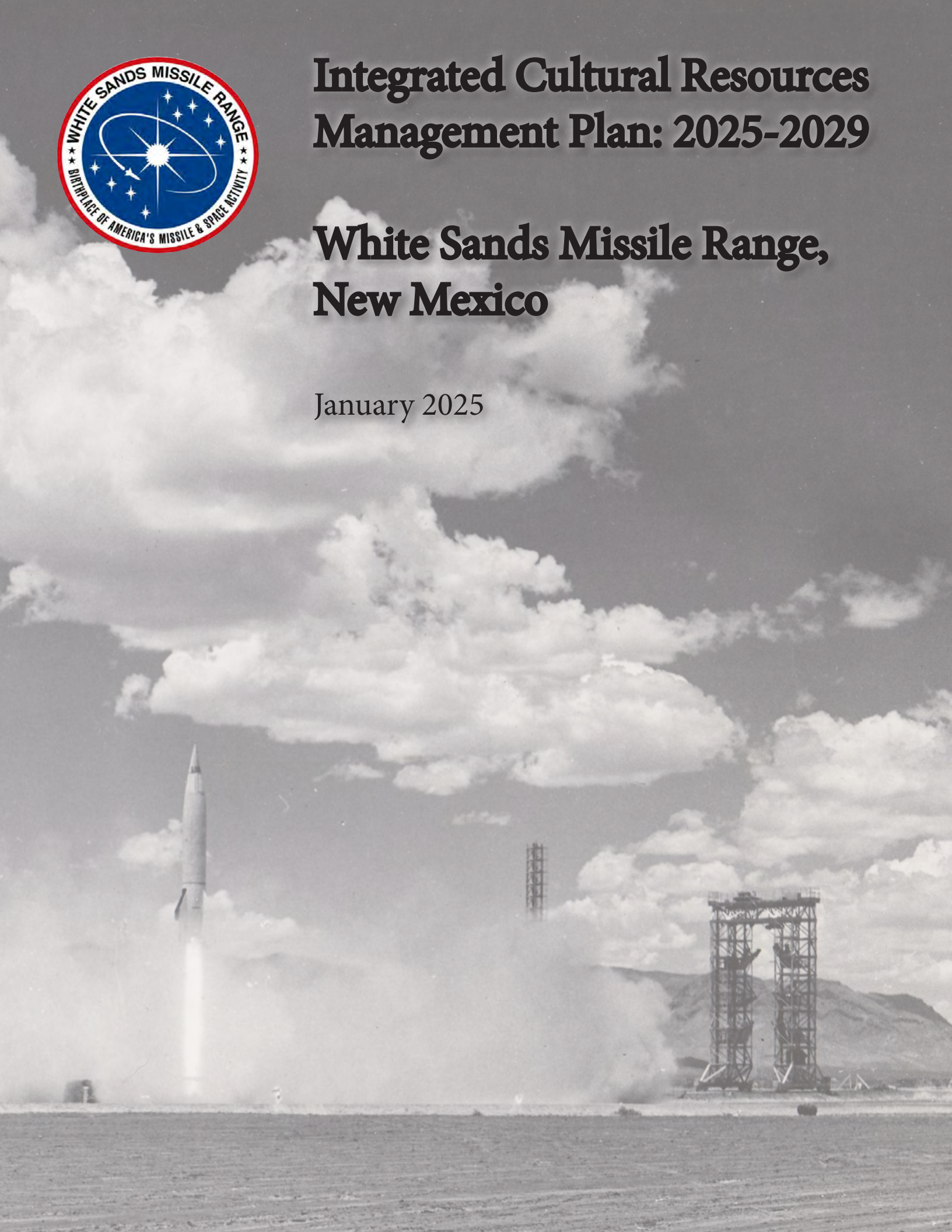
Integrated Cultural Resources Management Plan: 2025-2029

White Sands Missile Range, New Mexico

January 2025



Integrated Cultural Resources Management Plan: 2025-2029

White Sands Missile Range, New Mexico

January 2025

Cover image V-2 launch at LC-33 circa-1948, courtesy WSMR Museum Archives

INTEGRATED CULTURAL RESOURCES MANAGEMENT PLAN

This Integrated Cultural Resources Management Plan (ICRMP) meets the requirements of Army regulation 200-1, Environmental Protections and Enhancement (AR 200-1) and Department of Defense Instruction (DoDi) 4715.16, Cultural Resource Management. This plan updates the 2015-2019 ICRMP with required National Environmental Policy Act documentation (an Environmental Assessment). This ICRMP was developed in consultation with the New Mexico State Historic Preservation Officer and other stakeholders as required by DoDi 4715.16.

Donyeill A. Mozer COL, US Army

Garrison Commander, USAG-WSMR

20 Aug 25

Date

FOREWORD

This plan was prepared for the White Sands Missile Range Directorate of Public Works - Environmental Division, Conservation Branch by Epsilon Systems Solutions, Inc. Contributors included Dan Martinez, Archaeologist, Brad Beacham, Archaeologist, Nate Myers, Archaeologist/Historian, and Phillip Esser, Architectural Historian. Brigadier General Eric D. Little is the Commanding General of White Sands Missile Range; Colonel David Mitchell is the Garrison Commander; Brian D. Knight is the Chief of the Environmental Division; and Jim Bowman is the Conservation Branch Chief.

LIST OF ABBREVIATIONS

AAP:	Army Alternate Procedures
ACHP:	Advisory Council on Historic Preservation
AEC:	Army Environmental Command
AIRFA:	American Indian Religious Freedom Act
AMC:	Army Material Command
APE:	Area of Potential Effect
AR:	Army Regulation
ARMS:	Archaeological Records Management Section
ARPA:	Archeological Resources Protection Act
ATEC:	Army Test and Evaluation Command
ATV:	All-Terrain Vehicles
BLM:	Bureau of Land Management
BLP:	Blow-in-Place
BTI:	Building Technology Incorporated
CFR:	Code of Federal Regulations
COA:	Course of Action
CoN:	Certificate of Networthiness
CRM:	Cultural Resources Manager
DARCOM:	United States Army Material Development and Readiness Command
DoD:	Department of Defense
DoDI:	Department of Defense Instruction
DPW:	Directorate of Public Works
DTC:	Developmental Test Command
DTRA:	Defense Threat Reduction Agency
EA:	Environmental Assessment
EDM:	Electronic Distance Measurement

EIS:	Environmental Impact Statement
EO:	Executive Order
EOD:	Explosive Ordnance Disposal
EUL:	Enhanced-Use Leasing Initiative
FGDC:	Federal Geographic Data Commission
GC:	Garrison Commander
GIS:	Geographic Information System
GPS:	Global Positioning System
HABS:	Historic American Buildings Survey
HAER:	Historic American Engineering Record
HAFB:	Holloman Air Force Base
HBIF:	New Mexico Historic Building Inventory Form
HCPI:	New Mexico Historic Cultural Property Inventory Form
HPD:	Historic Preservation Division
HSR:	Human Systems Research
ICRMP:	Integrated Cultural Resources Management Plan
IK:	Indigenous Knowledge
IMCOM:	Installation Management Command
INCRMP:	Integrated Natural and Cultural Resources Management Plan
IO:	Isolated Occurrence
ITAM:	Integrated Training Area Management
LA:	New Mexico Laboratory of Anthropology
LINKS:	Local and Indigenous Knowledge Systems
MILCON:	Military Construction
MOA:	Memorandum of Agreement
MOU:	Memorandum of Understanding
MSL:	Mean Sea Level

MRTFB:	Major Range and Test Facility Base
NAGPRA:	Native American Graves Protection and Repatriation Act
NASA:	National Aeronautics and Space Administration
NDS:	National Defense Strategy
NEPA:	National Environmental Policy Act
NHPA:	National Historic Preservation Act
NHL:	National Historic Landmark
NMCRIS:	New Mexico Cultural Resource Information System
NMDGF:	New Mexico Department of Game and Fish
NMDOT:	New Mexico Department of Transportation
NPS:	National Park Service
NRHP:	National Register of Historic Places
NWR:	National Wildlife Reservation
OMRC:	Organ Mountain Riding Club
PA:	Programmatic Agreement
PAO:	Public Affairs Officer
PDF:	Portable Document Files
PFYC:	Potential Fossil Yield Classification
PMOA:	Programmatic Memorandum of Agreement
RCI:	Residential Communities Initiative
RDT&E:	Research, Development, Test, and Evaluation
RD-TS:	Research and Development Directorate Test and Assessment Department
RHPC:	Record of Historic Property Consideration
SDSFIE:	Spatial Data Standards for Facilities, Infrastructure, and Environment
SDZ:	Surface Danger Zone
SHPO:	State Historic Preservation Officer
SJA:	Staff Judge Advocate

SOP:	Standard Operating Procedure
TC:	Test Center
TC EOD:	Test Center Explosive Ordnance Disposal
TCP:	Traditional Cultural Property
TCPI:	Test Center Principal Investigator
TCSA:	Test Center Senior Archaeologist
THPO:	Tribal Historic Preservation Office
TRCI:	Property of Traditional Religious and Cultural Importance
US:	United States
USB:	Universal Serial Bus
USGS:	United States Geological Survey
UTM:	Universal Transverse Mercator
UXO:	Unexploded Ordnance
WGS:	World Geodetic System
WMD:	Weapons of Mass Destruction
WSDF:	White Sands Dune Field
WSMR:	White Sands Missile Range
WSPG:	White Sands Proving Ground
WSSH:	White Sands Space Harbor

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

1. EXECUTIVE SUMMARY

The executive summary provides an overview of the Integrated Cultural Resources Management Plan (ICRMP) for White Sands Missile Range (WSMR), New Mexico. This chapter summarizes each chapter in the ICRMP, explaining their purpose and how they relate to the cultural resources program, to provide an understanding of how the ICRMP works. The ICRMP has been prepared to meet requirements set by Army Regulation 200-1, Environmental Protection and Enhancement (AR 200-1) and Department of Defense Instruction (DoDI) 4715.16, Cultural Resource Management.

1.1 General Information

WSMR is a United States (US) Army installation that supports tri-service testing. WSMR is managed by the Army Installation Management Command (IMCOM), and its mission is to support test, evaluation, research, and assessment of military systems and commercial products. The major Army tenant organization at WSMR is the Developmental Test Command (DTC), which reports to the Army Test and Evaluation Command (ATEC). WSMR is also designated as a DoD Major Range and Test Facility Base (MRTFB). WSMR was first established in July 1945 through a combination of land purchases and condemnations (810,400 acres). Originally known as White Sands Proving Grounds (WSPG), the site supported critical testing for the nation's nuclear bomb program in the 1940s. The area was significantly expanded in 1952 through the withdrawal of approximately 1,350,500 acres. Other minor acquisitions since then have contributed to the current compilation of land within the installation boundary (WSMR 2009).

WSMR is the largest overland testing facility in the DoD, stretching across the northern Chihuahuan Desert in south-central New Mexico, between the cities of Las Cruces and Alamogordo. At over 2.2 million acres, the terrain consists of mountains, shrublands, alkali flats, gypsum dunes, and lava flows with an average elevation of approximately 4,000 feet (ft) above Mean Sea Level (MSL). This diverse landscape supports thousands of plants and animals. The cultural history of WSMR is as unique as the landscape, with prehistoric habitation beginning approximately 10,000 years ago and ending roughly 500 years ago. The arrival of the Spanish around AD 1581 marked the beginning of the historic period, which encompasses Euro-American settlement in the region and the creation of WSMR for military testing activities during World War II and the Cold War. Cultural resources documented at WSMR reflect this rich history and collectively form the present cultural landscape.

This ICRMP is based upon information assembled from historical, archaeological, ethnographic, architectural, and planning documents prepared by and for WSMR. The purpose of this ICRMP is to plan for the management of cultural resources in a way that supports and sustains the operational military mission of WSMR. Sustaining cultural resources, and compliance with associated laws, directly supports the military mission by sustaining the testing/training lands that our missions require. Additionally, the plan serves as a vehicle to streamline compliance with federal and state laws, regulations, and executive orders pertaining to the management of cultural resources. This ICRMP applies to lands within WSMR boundaries and does not apply to call-up areas or annex areas outside WSMR. The exception is Mendiburu Ranch, which is under WSMR resource management control.

The ICRMP outlines steps required to meet WSMR's legal obligations to provide for the stewardship of cultural resources, while enabling the accomplishment of the military mission. The ICRMP has been developed through cooperation with appropriate regulatory and other agencies. Major

partners in the implementation of this ICRMP are the New Mexico State Historic Preservation Office (SHPO), other federal and state agencies, Native American tribes, universities, contractors, non-governmental organizations, and private citizens. This plan will guide WSMR and its partners for the next five years and provide the foundation for adaptive resource management in the future. As a public document, it will support and perpetuate the military mission while fostering stewardship and goodwill for WSMR, the US Army, and the DoD.

1.1.1 ICRMP Organization

Chapter 1 summarizes the compliance requirements for WSMR, while providing an overview of WSMR's current cultural resource inventory efforts and ICRMP goals.

Chapter 2 describes the affected environment including WSMR's location, climate, geology, faunal and floral communities, water resources, and cultural resources. This chapter also discusses WSMR's mission statement, program responsibilities, user groups, and interested parties.

Chapter 3 provides an in-depth discussion of the cultural resource laws and regulations governing the management of cultural resources on federal lands, in addition to action items for WSMR to achieve compliance with the existing laws and regulations.

Chapter 4 describes Standard Operating Procedures (SOPs) for achieving compliance with the most prominent cultural resource laws and regulations.

Chapter 5 provides a summary of the cultural resources inventory on WSMR, inclusive of a literature review of significant studies since 2005 and a summary of published investigations.

Procedures for archaeological site protection measures are also discussed in this chapter.

Chapter 6 outlines procedures for implementing the ICRMP, including a discussion of the roles and responsibilities of the Garrison Commander (GC) and the Cultural Resource Manager (CRM). This chapter concludes with the ICRMP action plan, goals, and schedule.

Chapter 7 provides a list of the references cited in this document.

1.2 Legal Foundation and Methods for ICRMP

Pursuant to AR 200-1, the GC is responsible for compliance with cultural resource laws on WSMR. The GC will, through their appointed CRM, coordinate activities with this ICRMP. It is the CRM's responsibility to coordinate with users and interested parties to ensure compliance with cultural resource laws and regulations on WSMR. This section briefly summarizes the essential preservation laws significant to WSMR, while acknowledging other applicable preservation regulations, executive orders, and guidelines (Table 1-1). These laws and regulations establish the legal foundation for the ICRMP and form a basis for establishing the action plan for the ICRMP.

The National Historic Preservation Act (NHPA) establishes a national program for historic preservation. Regulations and guidelines in this Act include Federal agency responsibilities and consideration of effects of Federal undertakings on historic properties, as outlined in Section 110 and Section 106 of the NHPA, respectively. The Native American Graves Protection and Repatriation Act (NAGPRA) provides for the disposition of Native American human remains, associated and

unassociated funerary objects, and sacred objects and objects of cultural patrimony removed from Federal and tribal lands. NAGPRA requires consultation with Native American tribal entities with respect to disposition of cultural items discovered on Federal and tribal lands. The Archaeological Resources Protection Act (ARPA) protects archaeological resources that are 100 years of age or older on public lands. ARPA defines illegal activities and prescribes civil and criminal penalties for each infraction, establishes a permitting process for removal of archaeological resources from public lands, and provides for the confidentiality of archaeological site location information.

Analysis of the current cultural resources management program on WSMR indicates that a number of actions must be taken during the next five years to address concerns associated with each of the above laws. Action plans have been established to assist the GC in addressing these concerns and achieving compliance with the above laws.

Achieving and maintaining compliance with cultural resource laws requires an understanding of how to follow various cultural resources guidelines, carry out certain preservation activities, and meet specific requirements. Chapter 3, Legal Foundation and Methodology, provides guidance on how to implement the action plan provided in Chapter 6, Implementation of the ICRMP, and carry out preservation activities required by stipulations and SOPs provided in Chapter 4, Standard Operating Procedures. The CRM will use this guidance to ensure compliance with cultural resource laws and regulations.

1.3 ICRMP Goals and Objectives

DoDI 4715.16, Enclosure 6(1)(i), provides procedures for compliance with Federal laws, regulations, and executive orders requiring the protection and/or management of cultural resources with the least possible effect on military training and mission support activities. This ICRMP will direct the cultural resources program at WSMR to achieve the following goals:

- Comply with federal laws and regulations governing the treatment of cultural resources while causing the least disturbance to the military mission as required to support undertakings.
- Integrate cultural resources compliance requirements with other installation plans, including but not limited to the installation master plan, the facilities maintenance plan, training and range area management plans, natural resources management plans, mobilization and deployment plans, and information management plan.
- Maintain the historic fabric and character of buildings and landscapes contributing to WSMR's historic districts and landmarks.
- Pursue ways to avoid, minimize and/or mitigate adverse effects on historic properties while supporting military training and testing activities.
- Conduct data recoveries on National Register-eligible properties when avoidance is not feasible, per a project specific Memorandum of Agreement (MOA).

- Develop project manuals and handbooks outlining treatment of historic buildings, structures, and landscapes; and regular, systematic inventory and evaluation of these properties.

- Establish priorities based on the currently available information for the inventory and evaluation of cultural resources: (1) survey and National Register of Historic Places (NRHP) evaluation of archaeological sites for eligibility to the NRHP in areas where military training has or is expected to have the greatest impact; (2) evaluation of any site with "undetermined" eligibility; (3) identify mitigation methods for unavoidable adverse effects to historic properties.

- Prioritize the management of historic properties determined to be most at risk for adverse effects by the military mission.

- Establish a system of internal controls for the review of routine and mission-critical undertakings.

- Define and exempt from review undertakings that do not or are not likely to adversely effect cultural resources.

- Enforce federal laws prohibiting the vandalism or illegal collection of archaeological materials on WSMR and support that effort with the continued education of WSMR staff, contractors, and academic professionals through workshops and trainings (e.g., cultural sensitivity training, damage assessment workshops, site monitoring and condition assessment training).

- Implement the existing plan to ensure management of archaeological collections relevant to cultural resources at WSMR in compliance with 36 Code of Federal Regulations (CFR) Part 79.

- Ensure collections are available for research by professionals, interested Indian tribes, and other members of the public at the Fort Bliss curational facility during normal duty hours.

- Establish and implement a management plan for currently endangered paper collections relating to historic structures, archaeology, cultural landscapes, and objects on WSMR.

- Create and maintain cultural resource training opportunities for military and civilian personnel whose jobs or building occupations have the potential to impact cultural resources.

- Set realistic budgetary goals based on ongoing and future projects and available industry data.

- Ensure staff responsible for cultural resource management meet the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, (Federal Register Vol. 48, No. 190, pp. 44717-44742) and receive continued training.

- Consider outside interests, including but not limited to, local governments and public groups.

- Continue to engage Federally-recognized Tribes in the management of resources of interest to them.

- Through the implementation of this ICRMP, develop an innovative program that may serve as a model for other federal facilities; demonstrate the value of cultural resources management programs; and publicize and promote the commitment of WSMR to established programs.

The overarching purpose behind these management goals and objective is the integration of legal requirements for cultural resources management into the everyday operation of WSMR's military mission and support activities. This ICRMP incorporates guidelines, schedules, and SOPs into a single document to more efficiently fulfill management responsibilities.

1.4 Standard Operating Procedures (SOPs)

Most cultural resource management activities can be achieved using an established set of SOPs. The SOPs in Chapter 4 have been developed for such activities. Each SOP, or other guidance documents, identifies responsible parties, participants, and procedures. The GC is responsible for ensuring all military and nonmilitary organizations on WSMR coordinate their actions with the CRM to ensure compliance with the NHPA, NAGPRA, ARPA, and other applicable preservation laws outlined in Section 1.2. Twenty SOPs have been developed at WSMR per consultation between the WSMR Garrison Command, the Advisory Council on Historic Preservation (ACHP), and the New Mexico SHPO. Supplemental to these SOPs are seven appendices that address exempted undertakings, standard mitigation measures, and procedures for the identification and evaluation of properties. These SOPs and Appendices are provided below.

- SOP 1: Identifying Undertakings.

- SOP 2: Exempted Undertakings.

- SOP 3: Defining the APE.

- SOP 4: Identifying and Evaluating Historic Properties.

- SOP 5: Assessing Effects.

- SOP 6: Resolving Adverse Effects.

- SOP 7: Documenting Acceptable Loss.

- SOP 8: Reviewing and Monitoring through the National Environmental Policy Act (NEPA).
- SOP 9: Accidental Discovery of Historic Properties.
- SOP 10: Reporting Damage to Historic Properties.
- SOP 11: Public Involvement in the WSMR Cultural Resources Management Program.
- SOP 12: Dispute Resolution.
- SOP 13: Military Activities in Anticipation of Immediate Deployment, Mobilization or Armed Conflict.
- SOP 14: Cultural Resource Protection Measures for Missile Recovery and Unexploded Ordnance Activities.
- SOP 15: ARPA Compliance.
- SOP 16: NAGPRA Compliance.
- SOP 17: Paleontological Resources.
- SOP 18: Curatorial and Collection Management of Archaeological and Historical Collections and Associated Records.

1.5 Cultural Resources Inventory

The Historic Overview, presented in Chapter 2, provides a general summary of WSMR's cultural resource history and an overview of what cultural resources exist or may exist on the installation. Chapter 5, Cultural Resource Inventory, provides an overview of the investigations that have been completed thus far on the installation, in addition to the literature generated by the investigations, and the inventory of cultural resources resulting from such investigations. As of March 2020, there were over 7,773 archaeological sites and approximately 786 buildings and structures identified on WSMR. In addition, WSMR contains two National Historic Landmarks (NHLs), the Trinity Site and Launch Complex 33, and nine historic districts. Properties listed in the NRHP, determined eligible for listing in the NRHP, or remain undetermined for the NRHP are subject to the historic preservation laws and this ICRMP. Approximately 626,879 acres (28%) of WSMR has been inventoried by cultural resource professionals. Additional details regarding the cultural resources inventory are presented in Chapter 5, Cultural Resources Inventory.

1.6 ICRMP Implementation

To implement this ICRMP the GC will complete the following actions:

- Initiate a review of the ICRMP with interested parties.
- Sign the ICRMP after comments have been addressed.

After the ICRMP has been reviewed and approved, the GC will take the following actions to ensure implementation:

- Designate a government employee and subject matter expert in cultural resources as CRM (AR 200-01, 6-4(a)(3)) to ensure that:
    - Efforts to identify, evaluate, and treat historic properties consider the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (NPS 2020);
    - Such efforts are conducted under the supervision of personnel who meet applicable professional qualifications for undertaking such work (AR 200-1, 6-4(b)(5));
    - Provisions are made for the enforcement of cultural resource laws and regulations by professional trained personnel (DoDI 4715.16, Enclosure 6(2)(p));
- Continue to require installation staff, tenants, contractors, users, and interested parties to coordinate with the CRM early in the planning of projects and activities to ensure compliance with Section 106 of the NHPA and this ICRMP;
- Continue to prioritize funding and program funds for cultural resources compliance and management activities;
- Provide for the annual review of the ICRMP and initiate revision of the ICRMP if the annual review indicates a need for such revision.

The CRM will play an essential role in the implementation of this ICRMP. In this role, the CRM will coordinate compliance with cultural resource laws and Army regulations on behalf of the GC. The CRM will coordinate with users, interested parties and the public to ensure compliance with Sections 106, 110, 112 of the NHPA, NAGPRA, and ARPA. Additionally, the CRM will coordinate consultation with interested parties to address management concerns that affect the ability of WSMR to comply with cultural resource laws and regulations.

1.6.1 ICRMP Action Plan

The action plan for the ICRMP is presented in Chapter 6, Implementing the ICRMP. Costs associated with implementing the ICRMP are also found in Chapter 6.

2. GENERAL INFORMATION

This chapter provides essential background information for placing WSMR's cultural resources in their proper context by describing WSMR's location, physiography, and historic context. A summary of WSMR's mission statement, program responsibilities, and military tenants is also discussed, which provides a framework for understanding the key stakeholders and preservation philosophy guiding WSMR's cultural resources management program.

2.1 Location

WSMR spans approximately 40 miles from east to west, and 100 miles north to south, encompassing a land area of nearly 2.2 million acres in south-central New Mexico. This land areas includes portions of Doña Ana, Sierra, Socorro, Lincoln, and Otero counties. Fort Bliss, which is comprised of approximately 1.1 million acres, borders WSMR to the south and southeast. Holloman Air Force Base (HAFB), which consists of approximately 59,700 acres, is located along WSMR's eastern margin. White Sands National Park and the San Andres National Wildlife Refuge (NWR) are located entirely within WSMR's boundaries. Collectively WSMR, Fort Bliss, and HAFB provided nearly 3.4 million acres of contiguous land area to support DoD test and training missions.

The City of Las Cruces is approximately 15 miles southwest of WSMR; Alamogordo is about 34 miles east; and Albuquerque is about 100 miles north. The southern part of WSMR is bisected by US 70, which connects Las Cruces and Alamogordo. The Main Post of WSMR is located south of US 70 to the east of the Organ Mountains. WSMR holds leases and partner agreements with surrounding land owners on approximately 3.3 million acres. In these areas, known as call-up areas, WSMR is able to evacuate people temporarily during periodic hazardous test events, effectively doubling the size of the land area when required. Associated with the land area, restricted airspace overlies and extends beyond the WSMR land boundary. Together, WSMR, Fort Bliss, HAFB, and call-up areas provide nearly 6.6 million acres of contiguous land area to support DoD test and training missions (WSMR 2009) (Figure 2-1).

2.2 Geographic Overview

Understanding the geography of the region surrounding WSMR is critical for placing cultural resources in their broader environmental context. Knowledge of the environmental context, both past and present, is essential for understanding why prehistoric and historic peoples settled in this region. A summary of the region's geological history, physiography, soils, climate, faunal and floral resources, and water resources is presented in the following sections.

2.2.1 Physiography and Geologic History

WSMR lies within the Mexican Highland Section of the Basin and Range Physiographic Province, a northern extension of the Chihuahua Basin (Hawley 1986). This semi-arid area is characterized by linear and isolated fault block mountain ranges separated by internally drained basins and valleys. The landscape at WSMR is characterized by several prominent mountain ranges (The San Augustin, San Andres, Organ, and Oscura mountains) and two large basins (the Jornada del Muerto and Tularosa Basin). Other prominent geologic features include the Carrizozo lava flow, Armendaris lava flow, and minor mountain ranges, such as the Mockingbird and Little Burro mountains. Final-

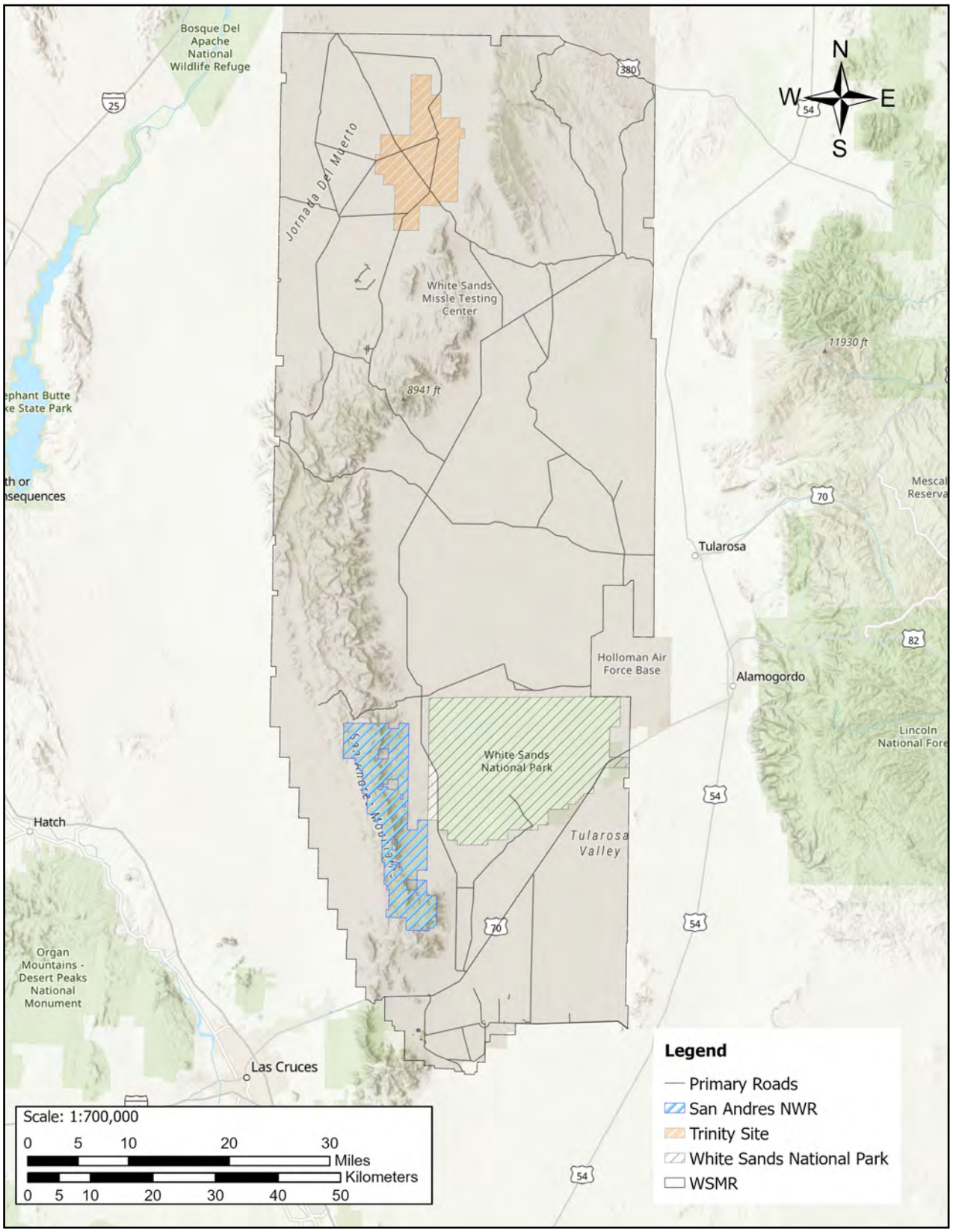


Figure 2-1. Location of WSMR and adjacent areas.

ly, gypsum sand dunes, which comprise the world's largest gypsum dune field, are located in the south-central portion of WSMR and extend onto White Sands National Park. Each of these prominent physiographic features are discussed in detail in the following sections.

Approximately 1.4 billion years of geologic history is represented at WSMR, which includes strata and formations ranging from the Proterozoic (Precambrian) to late Quaternary. This geologic history is complex and represented by a variety of prominent geological features across the landscape. This section primarily focuses on those prominent physiographic features located within the confines of WSMR, in addition to the smaller landforms associated with those features. A brief chronological geologic history is also presented to put these features and landforms into context. When appropriate, geological units are referenced with regards to the geological map of WSMR (Figure 2-2). Map unit definitions and approximate ages are provided in Table 2-1.

Proterozoic granitic and metamorphic rock representing the remains of ancient mountain or rift systems are the oldest rocks exposed on WSMR. These strata have been significantly altered and eroded by geological processes since they formed 1.3 to 1.4 billion years ago, making it difficult to determine the precise events leading to their formation. Proterozoic rocks, when exposed, generally consist of outcrops within the mountain ranges. Paleozoic rocks present throughout WSMR are primarily marine sedimentary strata, commonly observed in the fault-block mountain ranges along the eastern boundary of the installation. These strata represent alternating cycles of sea expansion, deposition, uplift, and erosion occurring over hundreds of millions of years (Seager 1981).

Strata dating to the Mesozoic are uncommon at WSMR, largely due to uplift and erosion during the Laramide orogeny, a period of mountain building throughout western North American which occurred at the end of the Mesozoic Era and continued into the Tertiary Period. Compressional tectonic forces, such as thrusting and folding, occurred during the early Tertiary, and contributed to the initial formation of the mountains on WSMR. The Bear Peak thrust and fold belt in the southern San Andres Mountains is one well-preserved example of this activity (Seager 1981). Tectonic processes later in the Tertiary resulted in substantial volcanic and intrusive activity in south-central New Mexico. The remains of the Organ Mountain batholith, along with the ash-flow tuffs and rhyolites characteristic of the Organ Mountains, provide the best evidence of this volcanic activity on WSMR (Seager 1981). Additional episodes of uplift and crustal extension associated with the Rio Grande Rift further contributed to the development of the north-south-trending fault-block mountain ranges on WSMR during the late Tertiary. These processes helped create the stark relief between the mountain uplands and the valley bottom observed today in the modern Tularosa Basin.

Tectonic and volcanic activity continued into the Quaternary Period, evidenced by faulted alluvial fans along the mountain fronts and basaltic lava flows in the basin, such as the Carrizozo Lava Flow. Periods of glaciation and interglaciation also occurred regularly throughout the Quaternary. These pluvial and interpluvial cycles, respectively, played a major role in sediment deposition and erosion within the individual basins throughout southern New Mexico. Erosion of the mountain fronts during the Tertiary and Quaternary led to the accumulation of thick unconsolidated sediments in the basin. This valley fill is estimated to range from 5,700 to 9,000 ft, and has largely obscured older Paleozoic rock on the basin floor (Healy et al. 1978). Continued infilling of the basin by streams running off the mountains during periods of increased moisture in the Pleistocene led to the development of large pluvial lakes, such as Lake Otero, in the Tularosa Basin (NPS 2012). Piedmont slopes, alluvial fans, and arroyos located along the mountain fronts throughout WSMR

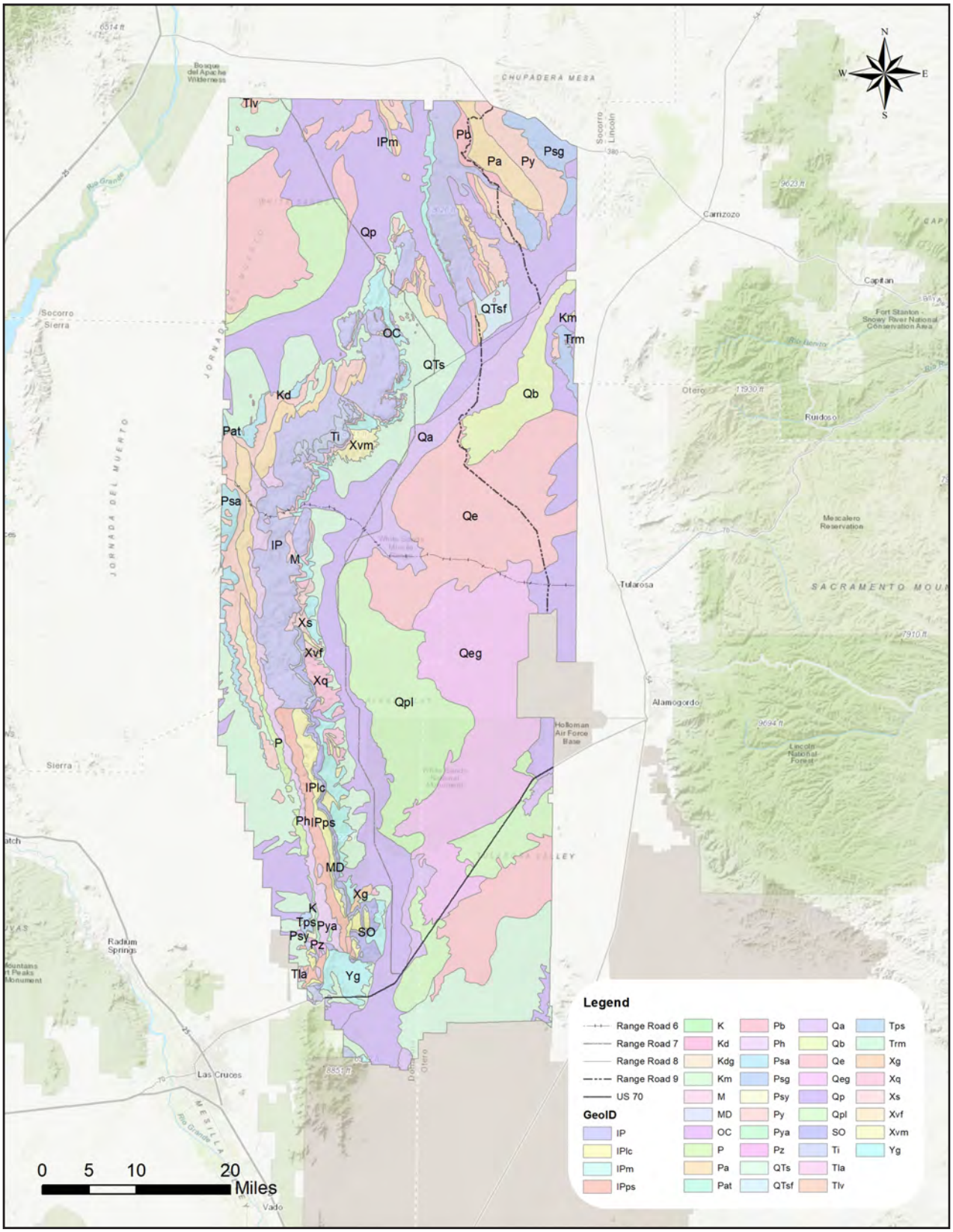


Figure 2-2. Geologic map of WSMR.

Table 2-1. Geologic Map Units.

Age	Map Unit Designation	Map Unit Description	PFYC*
Quaternary	**Qa**	Alluvium (Holocene to upper Pleistocene)	2
	Qpl	Lacustrine and playa deposits (Holocene)—Includes associated alluvial and eolian deposits of major lake basins	4-5
	Qp	Piedmont alluvial deposits (Holocene to lower Pleistocene)—Includes deposits of higher gradient tributaries bordering major stream valleys, alluvial veneers of the piedmont slope, and alluvial fans. May locally include uppermost Pliocene deposits	2
	Qe	Eolian deposits (Holocene to middle Pleistocene)	2
	Qeg	Gypsiferous eolian deposits (Holocene to middle Pleistocene)	2-3
	Qb	Basaltic to andesitic lava flows (Holocene to middle Pleistocene)—Flows south of Grants and west of Carrizozo are Holocene. Includes minor vent deposits	1
	QTs	Upper Santa Fe Group (middle Pleistocene to uppermost Miocene)— Includes Camp Rice and Palomas Formations	3-4
	QTsf	Santa Fe Group, undivided (middle Pleistocene to uppermost Oligocene)—Basin fill of the Rio Grande rift	3-4
Tertiary	**Tla**	Lower middle Tertiary andesitic to dacitic lavas and pyroclastic flow breccias (upper to middle Eocene, 33 – 43 Mega Annum [Ma]) — Includes Orejon Andesite, andesite of Telephone Canyon, and other units in southwestern, central, and northern New Mexico. Locally includes minor mafic lavas	1
	Tlv	Lower middle Tertiary volcanic rocks (lower Oligocene to upper Eocene, older than 31 Ma) — Mostly intermediate lavas of the lower Datil Group and intermediate volcaniclastic sediments of the lower Spears Group (Tla + Tvs). Locally includes ash-flow tuffs of the upper Datil Group (Tlrp)	1
	Ti	Tertiary intrusive rocks of intermediate to silicic composition (Pliocene to Eocene) — Includes monzonitic to granitic plutons, stocks, laccoliths, and porphyritic dikes in deeply eroded magmatic centers; and andesitic, dacitic, or rhyolitic plugs and dikes near cauldrons or stratovolcanoes. North-trending dikes near Capitan include some mafic diabase dikes	1
	TPS	Paleogene sedimentary units, includes Baca, Galisteo, El Rito, Blanco Basin, Hart Mine, Love Ranch, Lobo, Sanders Canyon, Skunk Ranch, Timberlake, and Cub Mountain Formations	1
Cretaceous	**K**	Cretaceous rocks, undivided	3-4
	Km	Mancos Shale (Cenomanian to Campanian)— Divided into upper and lower parts by Gallup Sandstone	3
	Kd	Dakota Sandstone (Cenomanian)	3
	Kdg	Upper and Lower Cretaceous rocks of east-central and northeast New Mexico, consists of Dakota Group, which includes Romeroville Sandstone (Cenomanian), Pajarito Shale, and Mesa Rica Sandstone (Albian); the underlying Tucumcari Shale (Albian) in Tucumcari area; and Glencairn Formation (Albian) in Union County	3
Triassic	**Trm**	Moenkopi Formation (middle Triassic)	3

Table 2-1. Geologic Map Units, Cont.

Age	Map Unit Designation	Map Unit Description	PFYC*
Paleozoic	**Pz**	Paleozoic rocks, undivided	3-4
	P	Permian rocks, undivided	3-4
	Pat	Artesia Group (Guadalupian)—Shelf facies forming broad south-southeast trending outcrop from Glorieta to Artesia area; includes Tansill, Yates, Seven Rivers, Queen and Grayburg Formations (Guadalupian). May locally include Moenkopi Formation (Triassic) at top	3
	Psa	San Andres Formation (Guadalupian in south, in part Leonardian to north)—Limestone and dolomite with minor shale	3
	Psg	San Andres Limestone and Glorieta Sandstone (Guadalupian and Leonardian)	3
	Py	Yeso Formation (Leonardian)—Sandstones, siltstones, anhydrite, gypsum, halite, and dolomite	3
	Pa	Abo Formation (Wolfcampian) — Red beds, arkosic at base, finer and more mature above; in Robledo Mountains the Abo may be considered a member of the Hueco Formation	4
	Psy	San Andres, Glorieta, and Yeso Formations, undivided	3
	Pya	Yeso and Abo Formations, undivided (lower Permian)	3-4
	Ph	Hueco Formation or Group (Wolfcampian) — Limestone unit restricted to south-central area. Pendejo Tongue of Hueco Formation divides Abo Formation into upper and lower parts in Sacramento Mountains	3
	Pb	Bursum Formation (lowermost Permian to uppermost Pennsylvanian) Shale, arkose, and limestone	3
	IP	Pennsylvanian rocks, undivided	3
	IPm	Madera Group (Pennsylvanian)— in Sacramento Mountains includes the non-Madera Holder, Beeman, and Gobbler Formations. May include strata lumped as Magdalena Group in a few areas	3
	IPps	Panther Seep Formation (Virgilian)—In Organ, Franklin, and San Andres Mountains	3
	IPlc	Lead Camp Formation (Atokan to Missourian) — In San Andres and Organ Mountains	3
	M	Mississippian rocks, undivided—; Lake Valley Limestone in south-central New Mexico	3
	MD	Mississippian and Devonian rocks, undivided—Includes Helms, Rancheria, Las Cruces, Lake Valley, and Caballero Formations and Escabrosa Group (Mississippian); Percha Shale, Contadero, Sly Gap, and Oñate Formations of south-central New Mexico, and Canutillo Formation of northern Franklin Mountains and Bishops Cap area (Devonian)	3
	SO	Silurian and Ordovician rocks, undivided	3
	OC	Ordovician and Cambrian rocks, undivided — Includes Montoya Formation (or Group), El Paso Formation, and Bliss Sandstone	3

Table 2-1. Geologic Map Units, Cont.

Age	Map Unit Designation	Map Unit Description	PFYC*
Proterozoic	**Yg**	Mesoproterozoic granitic plutonic rocks—Mainly 1.45–1.35 Giga Annum (Ga) megacrystic granites, generally weakly foliated except locally at their margins	1
	Xg	Paleoproterozoic granitic plutonic rocks—Variably foliated granites and granitic gneisses; 1.66–1.65 Ga in central and southern New Mexico	1
	Xq	Paleoproterozoic quartzite—Includes ~1.67 Ga quartzites in central New Mexico	1
	Xs	Paleoproterozoic metasedimentary rocks—Pelitic schist, quartz-muscovite schist, immature quartzite, and subordinate amphibolite	1
	Xvf	Paleoproterozoic rhyolite and felsic volcanic schist	1
	Xvm	Paleoproterozoic mafic metavolcanic rocks with subordinate felsic metavolcanic rocks—interpreted to be supracrustal part of juvenile volcanic arc basement	1

*Potential Fossil Yield Classification.

are landscape features associated with infilling processes during the Pleistocene. Drying of pluvial lakes at the onset of the Holocene eventually led to the formation of playas, dune fields, and other eolian landforms characteristic of the modern basin floor.

Mountain Ranges

Mountain ranges along the western portion of WSMR contain the oldest geologic strata on the installation. South to north, these ranges include the Organ, San Augustin, San Andres, Mockingbird, Little Burro, and Oscura mountains. These mountain ranges on WSMR have highly variable compositions and contain formations comprised of igneous, sedimentary, and metamorphic rock. Smaller landforms, such as valleys and canyons, are commonly observed within the interiors of these ranges, whereas canyons, piedmont slopes, alluvial fans, and arroyos typically comprise the mountain front. Uplifted fault scarps, often displacing alluvial fans and piedmont slopes several hundred feet in elevation, are also widespread along the mountain fronts.

A small portion of the Organ Mountains are located on WSMR, near the main post. These steep, angular mountains stretch approximately 85 miles north-south and have a maximum width of 42 miles east-west. The Organs are primarily composed of Tertiary igneous rock, but also include older Paleozoic sedimentary strata in some locations, displaced by tectonic uplift during the Tertiary. Intrusive granitic and monzonitic rock dominate the northern portion of the range and include prominent features such as the Needles, the highest point on the range at 9,012 ft (Seager 1981). These formations represent the remains of the ancient Organ batholith. Formations consisting of rhyolites, ash-flow tuffs, and other extrusive igneous rock make up the bulk of the mountain range south of the Needles. Quaternary piedmont alluvial deposits (Qp) flank either side of the range, and include the eastern alluvial fans located on WSMR. Other Quaternary age strata include the Camp Rice and Palomas Formations found within the Upper Santa Fe Group (Qts). Quaternary fault scarps observed on the eastern portion of the range have further displaced fan and piedmont deposits by several hundred feet (Seager 1981).

The San Augustin Mountains extend northward from San Augustin Pass to Quartzite Mountain, eventually merging with the San Andres Mountains. A small portion of this range is located on WSMR, along US 70. The most prominent feature of this small range is San Augustin Peak, approximately 7,020 ft in elevation. Most of the San Augustin Mountains are comprised of intrusive granitic and monzonitic rock which comprise the northern end of the Organ batholith formed during the Tertiary (Seager 1981). Older, metamorphosed Paleozoic rocks are located adjacent to the Organ batholith and form a series of west-dipping hogbacks and questas (Seager 1981). Quaternary age strata include the undivided Santa Fe Group (QTs) and Quaternary piedmont alluvial deposits (Qp) along the mountain front. The piedmont slope extends approximately 8 miles east-west from San Augustin Peak, reducing the Organ and San Augustin Mountains to a low ridge, approximately 1 to 3 miles wide, near San Augustin Pass (Seager 1981).

The San Andres Mountains are the most prominent mountain range on WSMR, extending roughly 80 miles along the western side of the Tularosa Basin. The San Andres range rises more than 5,079 ft above the basin's lowest point, and includes Salinas Peak, the highest point on WSMR with an elevation of 8,958 ft. Numerous small valleys transverse the range north-south, which are further divided into smaller east-west trending canyons. Larger east-west trending canyons, such as Rhodes Canyon, are located on the eastern and western flanks of the mountains and provide access to the interior valleys and canyon systems (Kottlowski 1955).

Formations dating to the Proterozoic to the Quaternary are present throughout the San Andres Mountains. Proterozoic rock includes outcrops of granite and gneiss (Xg) and metasedimentary rock (Xs). Proterozoic metavolcanics (Xvm) and granitic plutonic rock (Yg) are also located at the southern end of the range. Paleozoic sedimentary strata, represented by formations of limestone, sandstone, dolomite, gypsum, halite, siltstones, and shale, account for a majority of the geological units within the San Andres Mountains. Notable formations include the San Andres Formation (Psa), Abo Formation (Pa), Yeso Formation (Py), Lead Camp Formation (IPlc), and Panther Seep Formation (IPps). Tertiary intrusive rocks of indeterminate silicic composition (Ti) are located in the northern portion of the range. These Tertiary rocks include monzonitic to granitic plutons, stocks, laccoliths, and porphyritic dikes. Finally, Quaternary piedmont alluvial deposits (Qp) and alluvium (Qa) surround the eastern and western flanks of the range. Prominent formations within these units include the Camp Rice Formation within the Santa Fe Group.

Two smaller mountain ranges, the Mockingbird and Little Burro mountains, are located at the northernmost end of the San Andres Mountains. The Mockingbird Mountains have a maximum elevation of 6,506 ft, whereas the Little Burro Mountains have a maximum elevation of 7,373 ft (Bachman 1968). These mountain ranges largely consist of Proterozoic granitic plutonic rock (Yg) and Paleozoic granites and diorite found within the undivided Pennsylvanian rock unit (IP). Paleozoic sedimentary strata include formations found in the San Andres Mountains, such as the Abo (Pa) and Yeso formations (Py). Sandstone and dolomite associated with the Bliss, El Paso, and Montoya formations are also present in these ranges within the undivided Ordovician and Cambrian rock geological unit (OC) (Bachman 1968). Tertiary age strata, when present, includes intrusive granitic or monzonitic rock found in dikes and sills. Like the San Andres Mountains, the Mockingbird and Little Burro mountains are flanked by Quaternary piedmont alluvial deposits (Qp) and alluvium (Qa). Mockingbird Gap, a prominent pass connecting the Jornada del Muerto and Tularosa basins is located between these two ranges.

The Oscura Mountains are located to the northeast of the Mockingbird and Little Burro mountains, near the northeastern boundary of WSMR. Oscura Peak represents the highest point along this range, with a maximum elevation of 8,700 ft. Proterozoic granitic plutonic rock (Yg) are prominent throughout the western portion of the range, as are Paleozoic intrusive igneous rock, such as granite and diorite, found within the Pennsylvanian geological unit (IP). Paleozoic sandstone associated with the Bliss Formation is also present along the steep western escarpment of the Oscura Mountains (Bachman 1968). Additional Paleozoic sedimentary rock, such as shale, limestone, arkose, sandstone, gypsum, and halite, are commonly observed within the Bersum (Pb), Abo (Pa), Yeso (Py), and San Andres Formations (Psg). These formations gently dip northeast towards Chupadero Mesa (Bachman 1968). Like other mountain ranges, the Oscura range is flanked on either side by Quaternary piedmont alluvial deposits (Qp), which form alluvial fans along the mountain front. Quaternary rock association with the Santa Fe Group (QTsf). These unconsolidated deposits represent basin fill associated with the Rio Grande Rift.

Tularosa Basin

A majority of WSMR falls within the Tularosa Basin, a graben basin within the Basin and Range Province typical of southern New Mexico and west Texas. The basin covers approximately 6,500 square miles, stretching 150 miles north-south, with a maximum width of 60 miles east-west. The basin was formed by a series of regional uplifts and crustal extensions associated with the Rio Grande Rift. The basin is bounded by a series of steep, north-south-trending block-faulted mountains, including the San Andres, Oscura, and Organ mountains to the west and the Sacramento and Hueco Mountains to the east. Chupadero Mesa bounds the basin to the north, and the basin merges with the Hueco Bolson in the south near El Paso, Texas.

The Tularosa Basin contains a variety of unique geological features and landforms scattered throughout the basin floor. These features were formed through complex geological processes involving tectonic crustal extension, the deposition of fluvial and lacustrine sediments, soil formation on stabilized landforms, and the reworking of existing sediments through eolian processes. These processes have resulted in the formation of playas or other lacustrine landforms such as Lake Lucero, eolian landforms like the White Sands Dune Field (WSDF), and volcanic formations such as the Carrizozo Lava Flow.

The Tularosa Basin is a closed basin, meaning it does not have an outlet for draining surface water. Runoff from precipitation in the surrounding mountains collects in the basin, which resulted in the formation of numerous pluvial lakes during wetter conditions throughout the Pleistocene. Climatic changes during the Holocene caused many of these pluvial lakes, such as Lake Otero, to dry up, resulting in the formation of numerous playas, alkali flats, alluvial flats, and relict shorelines. These landforms are commonly observed within the Quaternary Lacustrine and Playa deposits (Qpl) geological unit throughout the basin floor.

A pluvial lake of significance to the geological history of the Tularosa Basin is Pleistocene Lake Otero, which is estimated to have encompassed an area of 750 kilometers $(km)^2$ during its high stand (Rachal et al. 2020). Prominent erosional scarps surrounding the alkali flat east of White Sands National Park have been interpreted to represent erosional shorelines of Lake Otero; other intact shorelines are more difficult to identify due to their erosion during the Holocene or burial by recent eolian deposits. Dating of known shoreline features throughout the basin suggest Lake Otero receded in a stepwise manner during the terminal Pleistocene and early Holocene (Rachal et al. 2020). As

the lake receded, lakebed sediments containing gypsum and other soluble evaporates were exposed and broken down into sand size particles by continual erosion (NPS 2012). This gypsum sand was eventually transported by the wind and deposited to form the WSDF during the mid-Holocene. Currently, a large alkali flat east of White Sands National Park represents the remains of Lake Otero. Lake Lucero is located in the southwest corner of this alkali flat and represents the lowest elevation in the Tularosa Basin. This dry playa occasionally fills with water following intense monsoon rains or seasonal runoff from the adjacent mountains.

Eolian landforms within the Tularosa Basin include hummocks, ridges, sand sheets, dunes, and interdunal areas. These landforms are scattered throughout the basin floor, primarily within the Quaternary eolian deposits (Qe) or Quaternary gypsiferous eolian deposits (Qeg) geological units. These units contain geomorphologically active landforms and inactive landforms dating to the Holocene and Pleistocene.

The WSDF comprises the world's largest gypsum dune field and covers an area of approximately 400-500 km^2. This active dune field is located in the south-central portion of the Tularosa Basin, a majority of which is located on WSMR (NPS 2012). These dunes were formed during the Holocene from gypsum rich lakebed sediments originating from Pleistocene Lake Otero. Exposed lakebed sediments containing gypsum were eventually broken down into sand size particles and transported by southwest to northeast-trending winds, which eventually accumulated to form the parabolic, barchonoid, transverse, and dome dune fields located within the WSDF (Rachal et al. 2020). The geomorphological processes which formed the WSDF are ongoing, with new gypsum sand deposited from the breakdown and removal of selenite crystals formed on the surface of Lake Lucero and Alkali Flat (NPS 2012).

The southern portion of the Tularosa Basin is covered by large eolian sand sheets and coppice dune fields comprised of siliceous quartz sand. Many of these dunes are comprised of historic blow sands representing a long and complex history of erosion, deposition, soil development, and landscape stability in the basin floor throughout the late Quaternary.

The siliceous quartz sand comprising many of these coppice dunes is derived from Pliocene-early Pleistocene sediments of the Camp Rice formation found within the Upper Santa Fe Group geological unit (QTs) (Blair et al. 1990). The Camp Rice formation includes sediments from the ancestral Rio Grande, which ran through the southern Tularosa Basin through Fillmore Pass approximately one to two million years ago. These fluvial sediments are referred to the Camp Rice fluvial facies. Around 800,000 BP the ancestral Rio Grande became entrenched in its floodplain, exposing the Camp Rice fluvial facies to weathering and soil formation, eventually resulting in the formation of the La Mesa geomorphic surface (Gile et al. 1981). The La Mesa surface contains some of the oldest soils in the region and is distinguished by its stage III calcic horizon or stage IV petrocalcic horizon, often referred to as caliche.

The La Mesa surface comprises one of four late Quaternary stratigraphic units identified by Blair et al. (1990) in the southern Tularosa Basin. These stratigraphic units are similar to other Quaternary deposits identified in the Jornada Basin (Gile et al. 1981; Monger 1993; Buck and Monger 1999). These units are interpreted to represent broad periods of eolian erosion and deposition, followed by periods of landscape stability and soil formation. The La Mesa surface, or Q1, represents the oldest unit, formed during the middle Pleistocene, approximately 50,000 to 250,000 BP. The Q2 unit represents a period of soil development during the terminal Pleistocene and early Holocene, ap-

proximately 15,000 to 9,000 BP. The Q3 unit represents a period of recent soil development during the Holocene, dating to approximately 7,000 to 100 BP. The Q3 unit is of particular importance to archaeologists at it often contains cultural material dating to the Early Archaic to El Paso phase of the Jornada Mogollon. Finally, the Q4 unit represents the historic sands that make up a majority of the coppice dunes and thin sand sheets observed on the surface. These historic sands lack significant evidence of soil formation, and have been suggested to have been deposited in the last 150 years (Blair et al. 1990).

The Tularosa Basin also contains many inactive eolian landforms, stabilized by vegetation, biological soil crusts, or other mineral crust. Notable examples include relict gypsum dunes identified in the Middle and North Range areas. These dunes are characterized by their well-cemented, whitish colored gypsum sand, a hardened gypsum horizon (gypcrete cap), and gypsum blister on the surfaces. The presence of a gypcrete cap suggests the surface of these dunes were exposed and weathered for a long time, whereas the blisters are often associated with older, more stable landforms formed on gypsiferous soils (Rachal 2019). While these attributes lend evidence to suggest these landforms are of significant age, no numerical age has been determined for these dunes on WSMR. However, research elsewhere in the Tularosa Basin by Monger et al. (2010) suggests these landforms date to the Pleistocene, approximately 20,000 BP or older. The source material for these dunes is likely the Paleolake Otero lakebed to the south (Rachal 2019).

The Carrizozo Lava Flow or *Malpais* is a large basaltic lava flow located in the north-central portion of WSMR. The Carrizozo flow is approximately 75 km long and covers an area of approximately 330 km^2, only a portion of which is on WSMR. The flow consists of two distinct basaltic flows originating from Little Black Peak northeast of WSMR. Cosmogenic dating of the flows using the chlorine-36 method indicate the flows occurred within 1,000 years of each other around 5,200 ±700 BP (Dunbar 1999). The flows are relatively young, geologically speaking, and represent one of the more recent episodes of volcanism in New Mexico. The flows have experienced minimal erosion since their formation and retain some pahoehoe ropey flow tops, smooth lava sheets, and other structures typical of basaltic lava flows (Dunbar 1999). The Carrizozo flow is represented by the Quaternary basaltic to andesitic lava flows (Qb) geological unit.

Jornada del Muerto Basin

A small section of the Jornada del Muerto Basin (Jornada Basin) is located in the northwest corner of WSMR. The basin is bounded to the east by Chupadera Mesa and the Oscura and San Andres Mountains, and by the Caballo and Cristobal mountains to the west. The southern end of the basin merges with the Mesilla Basin near Las Cruces, New Mexico. The basin is oriented north-south, roughly 160 miles in length with a maximum width of 20 miles. The Jornada Basin is a broad syncline, which dips to the south-southeast. Unlike the Tularosa Basin to the east, the Jornada Basin was not formed as part of the late Tertiary Rio Grande Rift extensional system (Land 2016). Infilling of the valley began during the Tertiary and consists of unconsolidated material eroded from the Oscura and San Andres mountains.

Like other basins in southern New Mexico, the Jornada Basin contains a variety of geological features and landforms. Playas and other lacustrine landforms are common throughout the basin, including Pleistocene Lake Trinity. Dunes and eolian landforms are common throughout the basin, as are piedmont slopes and alluvial fans associated with the mountain fronts. Finally, a small section of the Jornada del Muerto lava flow is located in the north-central portion of the basin. The following

paragraphs elaborate on each of these landforms within the confines of WSMR.

Pleistocene Lake Trinity resides in the northern portion of the basin and encompasses an area of approximately 200 km². Lake Trinity accounts for a majority of the basin controlled by WSMR. Shoreline features surrounding the lake suggest it receded in a manner similar to Lake Otero with the onset of a drier, warmer climate during the Terminal Pleistocene. Lake Trinity contains high proportions of gypsum, sulfate, and other soluble minerals likely derived from the dissolution of the Yeso Formation within the San Andres and Osura mountains, the runoff from which filled Lake Trinity throughout the Pleistocene (Neal et al. 1983). Currently, Lake Trinity is represented by large deposits of gypsum and sulfates, in addition to several barren playas at the southern end of the basin (Neal et al. 1983).

Rolling dunes elevated 9-15 meters (m) above the basin floor dominate the western portion of the basin on WSMR. The sediment source for these dunes is likely derived from the ancestral Rio Grande channel and floodplain deposits. Deflation of these deposits by strong southwesterly winds likely led to the formation of the dunes along the western shore of the Lake Trinity during the Holocene (Neal et al. 1983). The dunes are confined to the Quaternary eolian deposits geological unit (Qe) and include active and inactive dunes stabilized by vegetation. In addition to the dunes, piedmont slopes and alluvial fans flanking the San Andres and Oscura mountains are also common in the western portion of the basin. These landforms are characteristic of the Piedmont alluvial deposits (Qp) and Upper Santa Fe group (QTs) geological units.

A small portion of the Armendaris or Jornada del Muerto lava flow is located in the northwestern portion of WSMR. This lava flow covers an area of approximately 440 km² in the center of the basin. A small shield volcano is located at the center of the flow and is responsible for the gradual rise in elevation throughout the lava field. This volcano last erupted during the Pleistocene, approximately 760,000 BP and is represented by the basaltic to andesitic lava flows (Qb) geological unit (Crumpler 2020).

2.2.2 Soils

WSMR's unique geological history is reflected in the multitude of soils within the confines of the installation. Recent soil surveys by the National Resource Conservation Service (NRCS) identified and described 91 soil series at WSMR. The soil series is the lowest category in the soil classification system, and consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile (NRCS 2017). The following sections briefly summarize some attributes of several major soil series identified at WSMR within three prominent physiographic positions: 1) the basin floor; 2) mountain fronts; and 3) mountain uplands. A brief overview of the major soil orders represented at WSMR is also discussed, in addition to factors affecting soil vulnerability. For detailed information regarding individual soil series, the reader is referred to the *Supplement to the Soil Survey of White Sands Missile Range, New Mexico* (NRCS 2017) and *Soil Survey of White Sands Missile Range, New Mexico* (USDA Soil Conservation Service 1976).

Soils within the basin floor are located on a variety of eolian and lacustrine landforms. Eolian landforms include dunes, sand sheets, and interdunal areas, and are often formed from parent material consisting of gypsiferous, siliceous, or mixed eolian sand. Soils within these settings are well-to-excessively drained and situated on 0-20 percent slopes. Major soil series associated with

these landforms include the McNew-Copia complex, Aerobee-Slickcity complex, Peligro gypsiferous sandy loam, Lark-Transformer association, and the Talos-Copia- McNew complex. Soils associated with lacustrine landforms, such as alluvial flats, playas, relict lakebeds, and relict shorelines are usually formed from parent material such as gypsiferous lacustrine deposits, clayey alluvium, fine loamy alluvium, and mixed alluvium. These soils are poorly to well-drained and reside on 0-10 percent slopes. Prominent soil series associated with these landforms include the Aerobee-Slickcity complex, the Flake-Slatspring complex, Bigsalt-Najul complex, Gyplaya gypsiferous sand, and Llano-Ratscat complex (NRCS 2017).

Soils identified along the mountain fronts are typically associated with alluvial fans, fan remnants, piedmonts, and drainages. Parent material for these soils is mostly alluvium, which can range from fine-loamy to coarse gravelly alluvium. These soils are often well-drained and situated on 0-30 percent slopes. Notable soil series include the Nasa-Yesum complex, Agustin-Vado-Riverwash complex, Bodecker-Riverwash complex, Campana-Yesum complex, and Dona Ana-Chutum (NRCS 2017).

The mountain uplands are characterized by steep, rugged landforms such as mountains, hills, ridges, and escarpments. Parent material usually consists of alluvium, colluvium, or residuum derived from eroded bedrock outcrops, such as limestone, sandstone, or shale. Soils within these settings are well-to-excessively drained and form on 25-90 percent slopes. Prominent soil series include the Deama-Rock outcrop complex, the Deama-Penagua-Rock outcrop complex, the Gilland-Beach complex, and Elcor-Bissett Rock outcrop (NRCS 2017).

Soil series identified at WSMR belong to three major soil orders: 1) aridisols; 2) entisols; and 3) mollisols. Aridisols form in arid or semi-arid climates and are distinguished by well-developed pedogenic horizons formed under conditions of low moisture. The lack of moisture restricts the intensity of weathering processes and limits most soil development to the upper parts of the soils (NRCS 2020). Aridisols often accumulate calcium carbonate, gypsum, and other soluble minerals which are typically leached from the soils in more humid environments. At WSMR, aridsols often include petrocalcic or petrogypsic horizons, well-cemented hard pans commonly referred to as caliche (NRCS 2017). Entisols are soils displaying little to no evidence of pedogenic horizon development. These soils are common in areas of recently deposited parent material or in areas where erosion or deposition rates are faster than the rate of soil development. Landforms typically associated with entilsols include dunes, steep slopes, and flood plains (NRCS 2020; 2017). Mollisols are less common at WSMR. These soils have a dark colored surface horizon with a high content of organic matter. These fertile soils typically form under grasses in climates that have a moderate to pronounced seasonal moisture deficit (NRCS 2020).

Soils within WSMR are vulnerable to wind and water erosion, in addition to anthropogenic impacts. Wind erosion (deflation) is particularly damaging to soils not stabilized by vegetation and commonly occurs within the basin floor. Water erosion, evidenced by gullying, is prominent along the mountain front within alluvial fans, escarpments, and other landforms with significant relief. Sheetwash and the development of rills, other common forms of water erosion, are typically observed on low lying dunes and areas of lower relief throughout the basin floor. Anthropogonic impacts, such as construction or range testing, also have the potential to further disturb soils, which can exacerbate natural erosional processes.

2.2.3 Climate

The present climate of WSMR is characterized as semi-arid, typical of the Chihuahuan Desert (Muldavin et al. 2000b). The Chihuahuan Desert is generally colder and wetter than other warm desert regions because of its higher elevation (Dinerstein et al. 2000). Annual rainfall ranges from 8 – 13 inches. Annual mean temperatures range from 55 – 70° F and the growing season lasts 200 – 240 days (McNab and Avers 1994). Few intermittent streams and fewer rivers are present, and most originate in distant mountains. Playa lakes are common following rainy periods.

2.2.4 Faunal and Floral Communities

Ecological Setting

The present ecological setting of WSMR is classified as within the Chihuahuan Semi-desert Ecoregion, Bolson sub-section, Mexican Highlands section of the Basin and Range physiographic province, except for the extreme northeastern corner, which is classified as the Arizona-New Mexico Mountains Ecoregion. The Chihuahuan Desert landscape is a series of basins and mountain ranges, with a central highland that extends from Socorro south into Mexico (Dinerstein et al. 2000). Notable landforms include plains with low mountains with gentle slopes and local relief of 1,000 – 3,000 ft, plains with high hills and local relief of 1,000 – 3,000 ft, open high hills with a relief of 500 – 1,000 ft, and tablelands with moderate relief averaging 100 – 300 ft (McNab and Avers 1994). The northeastern corner, classified as Arizona-New Mexico Mountains ecoregion, includes major landforms of mountains, hills, plains, and scarps, and extends into the Sacramento-Manzano Mountains.

Floral Communities

Vegetation is a fundamental landscape attribute used for characterizing ecosystems, habitats, and management regimes. Within this ICRMP, ecosystems are generally classified according to their predominant plant communities. Across WSMR, three major classes occur: woodlands, shrublands, and grasslands, usually following an elevational gradient. A comprehensive vegetative analysis was completed by Muldavin et al. (2000) in which they further divided the three major classes into 52 alliances (e.g., Ponderosa Pine Alliance, *Pinus ponderosa*) comprised of 193 plant associations (e.g., Ponderosa Pine/Arizona Fescue Association, *Pinus ponderosa/Festuca arizonica*).

Chihuahuan Desert woodlands are classified at high elevation by ponderosa pine forests and woodlands with deciduous oak (*Quercus gambelii*) woodlands. Lower montane elevations are comprised of a combination of pinyon (*Pinus edulis*) and juniper woodlands, intermixed with evergreen oak (*Q. grisea* and *Q. turbinella*), mountain mahogany (*Cercocarpus montanus*), and wavy-leaf oak (*Q. undulata*) montane scrub (Muldavin et al. 2000). Interspersed among the woodlands are Montane Shrublands and Interior Chaparral, commonly on burned sites, or sites that are rocky with shallow soils. Shrublands become more prevalent southward through the San Andres Mountains. At lower elevation fringes, the woodlands extend onto alluvial fans and into interior valleys where they give way to grasslands and occasionally desert shrubland.

Chihuahuan Desert shrublands, the most widespread of the three major vegetation types, are found interspersed among desert grasslands of foothills and bajadas. Viscid acacia (*Acacia neomexicana*) communities occur on lower slopes of inner canyons and escarpments. Large stands of creosotebush (*Larrea tridentata*), acacia, and catclaw mimosa (*Mimosa aculeaticarpa var. biuncifera*) extend

away from mountain fronts. Undergrowth of desert scrub communities range from sparse to grassy and contain black grama (*Bouteloua eriopoda*), fluffgrass (*Erioneuron pulchellus*), and bush muhly (*Muhlenbergia porteri*) (Muldavin et al. 2000).

Lower elevation basin floors also exhibit extensive desert shrublands. Rolling sandy plains support sandsage (*Artemesia filifolia*) shrublands, and large alluvial flats are dominated by fourwing saltbush (*Atriplex canescens*) communities. In the southern Tularosa and southern Jornada basins, honey mesquite (*Prosopis glandulosa*), tarbush (*Flourensia cernua*), and creosotebush prevail. Lowland grasslands containing tobosagrass (*Hilaria mutica*) and alkali sacaton (*Sporobolus airoides*) intermix with lower elevation shrublands. Gypsum dunes and outcrops in basins support unique vegetation communities dominated by gypsum dropseed (*Sporobolus nealleyi*), gypsum grama (*B. brevista*), and hairy coldenia (*Tiquilia hispidissima*).

The grasslands of WSMR are extensive and occur throughout the foothills, escarpments and interior valleys of the mountain areas, and down onto the alluvial fan piedmonts to the basin floors. There are effectively three groups of plant associations related by structure and biogeographic provinces: the more mesic Plains–Mesa–Foothill Grasslands of hillslopes, mesas, and interior valleys dominated by species associated with the Great Plains province, and the more xerophytic Chihuahuan and Great Basin Desert Grasslands of the alluvial fan piedmonts, sandy plains and alluvial flats of the desert basins.

The Chihuahuan Desert is recognized for its high biodiversity among desert ecoregions. WSMR contains ungrazed grassland and riparian areas and virtually untouched montane vegetation communities. Grazing has been effectively banned for well over 50 years; as a result, WSMR has some of the highest quality grassland in the southwest (Muldavin et al. 2000). The diversity of habitats and the quality of vegetation communities found on WSMR provide environments supportive of great animal diversity. WSMR is, therefore, vitally important to the conservation and healthy functioning of various Chihuahuan Desert ecosystems.

In the Arizona-New Mexico Mountains ecoregion, vegetation is primarily composed of montane forest and woodlands, but this ecoregion is limited to the northeastern corner of WSMR. Waterways, springs, and basin bottoms, although few on WSMR, are dominated by such wetland species as American bullrush (*Scirpus americanus*), common reed (*Phragmites australis*), broadleaf cattail (*Typha latifolia*), and salt cedar an invasive species from Eurasia (Muldavin et al. 2000). Some of the plant species and names at WSMR change over time. For the most up-to-date list of WSMR plant species, the interested reader should refer to the 2023-2027 WSMR Integrated Natural Resources Management Plan (INRMP; WSMR 2023).

Fauna

This section provides a brief summary of terrestrial and aquatic habitat and wildlife which occur within WSMR. A more in-depth discussion and description of animal species present and survey activity on WSMR can also be found in the following documents, hereby incorporated via reference:

- The 2023-2027 INRMP (WSMR 2023) discusses the variety of species and habitats within WSMR and discusses management strategies.

- Amphibians and Reptiles of the WSMR (Burkett 2008, 2000) documents seven species of amphibians and 47 species of reptiles.
- Mammal Checklist of WSMR (2007a) documents 73 mammal species.
- Bird Checklist of WSMR (2007b) documents 291 bird species.
- Ecological Importance of "Waters of the United States" and Associated Wetlands to Wildlife developed by the U.S Army Engineer Research and Development Center (2004) describes wetland mammals, birds, herpetofauna, fish, and aquatic invertebrates and their preferred habitats.

Invertebrates

Invertebrate populations of WSMR are critical in the processes of pollination, seed dispersal, soil aeration, decomposition, and as a nutritional source for many vertebrate faunae (WSMR 2009). Few invertebrate surveys exist for WSMR, but studies conducted center around White Sands National Park. Frequent orders of insects found on WSMR include Coleoptera (beetles), Hemiptera (true bugs), Hymenoptera (ants, bees, and wasps), Lepidoptera (butterflies and moths), and Diptera (flies). A bee study to assess native bee biodiversity on WSMR was conducted between August 2003 and September 2005. This study documented 187 total bee species at WSMR (WSMR 2007c). Other common arthropod orders include Scholopenromorpha (centipedes), Pedipalpida (vinegaroons), Scorpionida (scorpions), and Araneida (spiders).

There are 23 documented species of land snails on WSMR, many occurring in the San Andres Mountains. The Tularosa springsnail (*Juturnia tularosae*), is endemic to WSMR, occurring within soft-sediment areas of Salt Creek. This species also is presumed to act as an intermediate host to a trematode, a parasite to the White Sands pupfish (Rogowski and Stockwell 2005). This species overlaps with pupfish habitat; however, it has a more restricted range than the pupfish occurring in locations of Salt Creek with moderate to lower salinity levels (Rogowski and Stockwell 2005). In areas of high salinity in Salt Creek, snail activity and survival are significantly reduced. A detailed list of all invertebrate species on WSMR is provided in the 2015 INCRMP Table 3.8.3a (WSMR 2015).

Amphibians and Reptiles

WSMR herpetofauna diversity is primarily comprised of snake and lizard species. Currently, there are seven species of amphibians and 47 species of reptiles, representing three orders and 12 families (Burkett 2000, 2008). There are 27 snake species, 19 lizard species, six toad species (three spadefoot toads and three true toads), one salamander species, and one turtle species. Burkett (2000) suggests that 10 additional species of reptiles and amphibians may occur on WSMR and are likely to be detected during future surveys. Burkett (2008) suggests that possible species may never be documented due to their secretive nature and scarcity including the New Mexico milksnake (*Lampropeltis triangulum*) and many-lined skink (*Plestiodon multivirgatus*). The non-native Mediterranean gecko (*Hemidactylus turcicus*) is actively expanding its range and discovery is expected within the Main Post (Burkett 2008). A detailed list of herpetofauna and their preferred habitat on WSMR can be found in the 2015 INCRMP Table 3.8.3e (WSMR 2015).

Fish

Only one fish species is native to WSMR, the White Sands pupfish (*Cyprinodon tularosa*). The White Sand pupfish is endemic to the Tularosa Basin, occurs in Salt Creek and Malpais Spring natively, and was introduced to Mound Spring on WSMR. Ranchers commonly stocked pupfish into tanks and other water impoundments for mosquito control (WSMR 2015). The pupfish is found in a range of microhabitats, ranging from deep spring ponds to shallow pools and calm spring runs. Microhabitats can exhibit considerable variability in salinity, ranging from fresh water to saltier than seawater (salinity of 50 ppt) (MacCarter 1996). These microhabitats for the pupfish often produce dense populations, but population numbers experience wide fluctuations based on natural climatic events and cycles (WSMR 2009). The White Sands pupfish is state-listed as threatened under the New Mexico Wildlife Conservation Act (BISON-M 2020) and is federally listed as under review (US Fish and Wildlife Service 2020).

Nonnative fish species include largemouth bass (*Micropterus salmoides*), mosquitofish (*Gambusia affinis*), goldfish (*Carassius auratus*), and sunfish (*Lepomis spp*.), which have been introduced into springs and ponds for mosquito control, but can pose a threat to native White Sands pupfish populations (WSMR 2009).

Birds

The habitats of WSMR support a relatively high diversity of avian species (291 documented species on WSMR vs. 500 species across New Mexico). The 291 documented species represent 17 orders, 55 families, and includes resident populations of raptors, game birds, and songbirds. More species occur during spring and fall due to seasonal migration. Over half of documented species (158) are present during summer, winter, or year-round. Ninety-nine species are transient, the rest are vagrants that only occur irregularly (WSMR 2015). Documentation for the breeding status (confirmed, highly probably, probably, or possible) of 114 birds on WSMR and a complete table of species can be found in the 2015 INCRMP Table 3.8.3f (WSMR 2015).

Mammals

There are 73 documented game and non-game mammal species on WSMR. Large herbivores include mule deer (*Odocoileus hemionus*), elk (*Cervis canadensis*), collared peccary (*Pecari tajacu*), pronghorn antelope (*Antilocapra americana*), and bighorn sheep (*Ovis Canadensis*). Nonnative species include feral horse (*Equus caballus*), oryx (*Oryx gazella*), and Barbary sheep (*Ammotragus lervia*). Common predator species include coyotes (*Canis latrans*), bobcats (*Lynx rufus*), mountain lions (*Felis concolor*), and badgers (*Taxidea taxus*).

Small mammals include three species of rabbits, one species of shrew (*Notiosorex crawfordi*), 31 species of rodents, and 17 species of bats. Rodents make up the most diverse order of mammals occurring on WSMR, representing five different families: Sciuridae (squirrels), Geomyidae (gophers), Heteromyidae (kangaroo rats and mice), Muridae (mice and rats), and Erethizontidae (porcupines). Two families represent bats: Vespertillionidae and Molossidae families. Most bat species at WSMR roost in caves, buildings, and a few are tree-roosting species (Defense Threat Reduction Agency 2007). A detailed list of mammals and their preferred habitat on WSMR can be found in the 2015 INCRMP Table 3.8.3g (WSMR 2015).

Threatened and Endangered Species

The high level of biodiversity and physical location on the edge of the Chihuahuan Desert range lend WSMR to a wide array of flora and fauna with the potential of becoming endangered or extinct. Species may become threatened or endangered as a result of a multitude of factors, including, but not limited to, habitat loss, human activity, environmental contaminants, predation, or disease. As such, WSMR maintains a proactive management approach and cooperative management agreements to maintain biological resources across the range.

Presently, there are 24 federally-listed endangered, threatened, experimental, or candidate species across WSMR and 20 listed migratory birds protected under the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act. Of the 24 species, 11 are listed as endangered, nine are federally listed as threatened, two are experimental populations, and two are candidate species (US Fish and Wildlife Service 2020). A greater discussion regarding management practices and decisions as well as details of each species can be found from the Information for Planning and Consultation (IPaC) tool on the US Fish and Wildlife Service's website and within the 2023-2027 INRMP (WSMR 2023). Many species have recently been down-listed from federal and/or state categories because surveys demonstrated that their populations statewide were in better standing than previously believed (WSMR 2015), and in some cases, species ranges were overly generalized (Muldavin et al. 2000). Some of the faunal species and names identified at WSMR change over time. For the most up-to-date list of WSMR faunal species, the interested reader should refer to the 2023-2027 WSMR INRMP (WSMR 2023).

2.2.5 Water Resources

Water occurs in all lithologic units across WSMR, but much of the water is of a poor quality, containing high concentrations of total dissolved solids. In the Tularosa and Jornada del Muerto basins, water exists in Tertiary to Quaternary unconsolidated basin-fill and alluvial deposits. These water sources locally provide large amounts of water for wells and springs, yet, the majority of groundwater recharge occurs in the adjacent mountain ranges. The mountains are largely impermeable, resulting in rainfall or snowmelt runoff infiltrating the alluvial basin-fill deposits along the bajadas of the mountains.

Surface water is mainly dependent on snow accumulation in the surrounding mountains. The majority of streams, ponds, lakes, and catchments are ephemeral. The only significant perennial stream is Salt Creek, and most perennial ponds are found near Mound Springs and Malpais Spring. No surface water on WSMR is considered potable (WSMR 2009).

Wetlands and riparian areas (approximately 725 acres) include springs, seeps in mountainous areas, and wetland marshes and creeks, mostly in the Malpais Spring and Brazel Lake areas. Although limited in extent, WSMR wetlands and riparian areas are crucial areas for fauna because they provide forage, water, and cover. These areas are intertwined with aquatic environments and associated invertebrates and fishes.

2.3 Historic Overview

By obtaining knowledge of the local culture history prior to conducting surveys, archaeologists are better able to identify and interpret findings. Understanding the material and spatial correlates of

different culture groups through time ensures that discoveries are placed within and interpreted in the proper context. Furthermore, cultural overviews allow the reader to appreciate the complexity of the cultural record for a specific geographic area. The cultural history of the southern Southwest, including southern New Mexico, can be divided into five general cultural periods, including: Paleoindian, Archaic, Formative, Proto-Historic, and Historic. These periods are distinguished on the basis of changing settlement patterns, subsistence strategies, technology, and social structure and interaction. The region in the vicinity of the project has been a focus of human occupation for millennia, with evidence of use dating to each of the major cultural periods. The following cultural-historical overview may be supplemented with regional treatments by Miller and Kenmotsu (2004), Murphy and Alexander (2015), Railey and Holmes (2002), and WSMR (2005).

2.3.1 Prehistoric (10,000 BC to AD 1540)

Paleoindian (10,000 to 6,000 BC)

The Paleoindian period is the earliest documented period of human occupation in the Americas, which occurred during the terminal Pleistocene period. Paleoindian adaptations are generally viewed as a tradition of small highly mobile bands with a specialized subsistence base focused on the hunting of large mammals such as mammoth and bison (Judge 1973). The Paleoindian period in this region is generally divided into Clovis, Folsom, and the late Paleoindian Plano and Cody Complexes. Some evidence of pre-Clovis occupation has also been claimed for the region, as well. Most Paleoindian finds are identified by the distinctive lanceolate projectile points associated with the period, which are cross-dated with chronometrically dated type sites or kill sites in the southwest and Great Plains (Miller and Kenmotsu 2004).

Pre-Clovis (pre-10,000 BC)

During the early 1990s, MacNeish excavated two rockshelters on the west side of Otero Mesa, east of Orogrande on Fort Bliss. One of these shelters, Pendejo Cave, yielded deep stratified deposits that ranged from Jornada Mogollon materials to extinct Pleistocene fauna. MacNeish based three pre-Clovis complexes on the Pendejo Cave finds, which were the North Mesa, MacGregor, and Orogrande complexes. The Orogrande complex was the oldest of the three, which MacNeish dated to pre-40,000 BP, which would have made it the oldest cultural remains in North America (WSMR 2005). The Orogrande complex was distinguished by the presence of pebble choppers with worked edges, Ayacucho unifacial projectile points, unifaces, and scraper plane choppers. However, the pre-Clovis claims for Pendejo Cave have proven to be controversial and generally not accepted among the regional archaeological community (Miller and Kenmotsu 2004).

Clovis Complex (10,000 BC to 9,000 BC)

The type site for the complex is located outside the town of Clovis, New Mexico, where a gravel quarry operation uncovered Clovis projectile points in association with extinct Pleistocene fauna. The Clovis Complex manifestations in southern and southwest New Mexico consist almost entirely of rare and isolated finds of the distinctive fluted lanceolate projectile points that are the hallmark of the period. This may be due to an issue of recognition, with Clovis lithic scatters lacking diagnostic tools perhaps going unrecognized during inventory efforts (Miller and Kenmotsu 2004). No absolute chronometric dates have been recorded in secure context with Clovis materials in the region (Miller and Kenmotsu 2004), with most Clovis manifestations consisting of isolated projectile points, or projectile points recovered from disturbed contexts in later sites.

Clovis sites have been documented in the Trinity Basin near Mockingbird Gap (WSMR 2005), near the southeastern corner of WSMR (Elyea 1988), in the south-central portion of WSMR (Laumbach 1985), and at Rhodes Canyon (Beckett 1983, Eidenbach 1983). Clovis manifestations were also reported from locations near Boles Wells and Tularosa Peak on Holloman Air Force Base (HAFB) property (Meyer and Eidenbach 1996). Based on the distribution of known sites, it has been suggested that Clovis was primarily an upland adaptation in the Tularosa Basin area (WSMR 2005). However, a Clovis component, likely a kill or processing site, was documented on the eastern shore of Lake Trinity (WSMR 2005)

These regional sites include two possible Clovis habitation sites. Beckett (1983) reported Clovis tools mixed with later Paleoindian materials at a location in Rhodes Canyon in the southern Tularosa Basin, but investigations were limited. The Mockingbird Gap site in the northern Tularosa Basin contained several possible living surfaces and approximately 100 whole and partial Clovis points (Weber and Agogino 1997), but the site has never been fully investigated or reported (Miller and Kenmotsu 2004). It is generally interpreted as an intermittent camp site rather than a kill or butchering site, which makes it unique among the documented sites in the region (WSMR 2005:B1-13).

As documented in southern New Mexico and other regions, the Clovis Complex consists of bifacially worked, fluted lanceolate projectile points with concave bases, transverse end scrapers, side scrapers, bifacial knives, gravers, perforators, and hammerstones. Blades and blade cores are also typically included as part of the Clovis tool kit (Collins 1999). A preference for fine-grained, homogenous, high-quality lithic raw materials in the manufacture of these tools is evident, with non-local materials indicating an extensive range. Clovis lithic tool kits exhibit an emphasis on curation and bifacial reduction, traits typical of highly mobile groups.

Folsom Complex (9,000 BC to 8,000 BC)

Folsom Complex manifestations are better-represented in southern New Mexico than those of the preceding Clovis Complex. Excavations of several Folsom components in the region have been undertaken, and numerous Folsom points and occupation sites have been recorded during inventory efforts. Substantial Folsom components have been recorded at Fillmore Pass on Fort Bliss outside El Paso, Boles Well in the Tularosa Basin, and the Padre Canyon sites in the Hueco Bolson (Miller and Kenmotsu 2004; WSMR 2005:B1-14).

Similar to Clovis, the Folsom complex is also distinguished by a distinctive fluted lanceolate projectile point. Folsom sites are particularly distinguished by large kill sites with extensive bone beds, such as the type site located near Folsom, New Mexico. Folsom occupations post-date the extinction of most species of Pleistocene megafauna, and appear to have specialized in the hunting of several extinct species of bison. Folsom occupations likely consisted of small, highly mobile groups, but the large kill sites documented for the complex indicate that a communal effort between groups may have been required.

Folsom points have proved to be popular with collectors, which has likely impacted the identification of Folsom sites and their apparent distribution across the landscape. Dennis Stanford of the Smithsonian Institution inspected a large private collection with more than 60 Folsom points and scrapers that were collected from the Tularosa Basin (WSMR 2005:B1-14). It is likely that due to the removal of the diagnostic projectile points, many Folsom sites are simply categorized as non-specific Paleoindian. A large cluster of such sites are found in the southeastern portion of

WSMR and extends into adjacent portions of Fort Bliss (WSMR 2005:B1-14). A review of 12 previously recorded Folsom sites in the Tularosa Basin by Amick and Stanford (1993) demonstrated that 10 of the 12 sites were located on the basin floor in association with playas, suggesting that this environment was a primary focus of Folsom adaptations. Among these are a cluster of identified Folsom sites associated with the southeastern shoreline of ancient Lake Trinity (WSMR 2005). Additional Folsom sites cluster in the northern San Andres and Oscura mountains, in the Pinon-Juniper and Juniper woodlands ecotone, suggesting that Folsom groups also utilized the mountain foothills in the Tularosa Basin (WSMR 2005 B1-15).

Folsom tool kits also show the same preference for high quality materials as seen in the Clovis complex. Based on the primary source locations of lithic raw materials and lithic assemblage content, Amick (1996) argued that Folsom groups in southern New Mexico had an extensive regional land use system that included the southern high plains.

Plano and Cody Complexes (Late Paleoindian Complexes- 8,500 BC to 6,000 BC)

The more diverse late Paleoindian tool traditions are collectively referred to as the Plano and Cody complexes (Wheat 1972). These complexes have type sites in the southern and northern Plains regions, and it appears that the focus of occupation during the late Paleoindian period was the plains rather than intermontane areas of New Mexico and the southwest. Similar to the Clovis period, late Paleoindian manifestations in southern and southwest New Mexico are largely limited to surface finds of diagnostic projectile points and substantial occupation sites are rare for the region. Isolated finds of Plano and Cody Complex tools are well-documented and relatively common in the Tularosa, Mesilla, and Hueco Bolsons.

Within the Tularosa Basin, Late Paleoindian complex sites tend to be associated with reliable water sources on the basin floor, hinting at a dryer climatic regime (WSMR 2005:B1-17). Many of these finds have been on basin landforms near playas or along the margins of the Rio Grande (Miller and Kenmtosu 2004:217). Paleoenvironmental reconstructions show that the environment was warmer and drier in the late Paleoindian period. The association of Cody and Plano manifestations with playa margins and major drainages probably reflects the continued tradition of big game hunting in the few well-watered locations where large game animals still congregated. One of the largest late Paleoindian sites in the region, LA 63880, is situated in the northern Tularosa Basin about 2 km from a playa (Miller and Kenmotsu 2004).

Diagnostic projectile points of the Plano and Cody complexes include Plainview, Agate Basin, Meserve, Golondrina, Angostura, Eden, Cody, and Scottsbluff point types (Miller and Kenmotsu 2004; WSMR 2005). Most of these points retain the lanceolate shape of earlier Paleoindian points but are not fluted. Technologically, these points usually exhibit collateral or transverse-parallel flaking, lateral thinning, basal constriction, and basal indentation (Wheat 1972). The preference for high-quality, fine grained cherts and chalcedonies is still represented in the raw material selection.

The early Holocene drying trend brought about the end of Paleoindian adaptations. Most late-dated Paleoindian sites are along the Rocky Mountain foothills or the Northern Plains, which suggests that late Paleoindian groups likely shifted out of the southwest to areas with climates more amenable to supporting large game animals. The changing environment required a more diversified subsistence base and greater emphasis on the exploitation of plant foods. These changes in subsistence base, settlement, and technology mark the beginning of the Archaic Period.

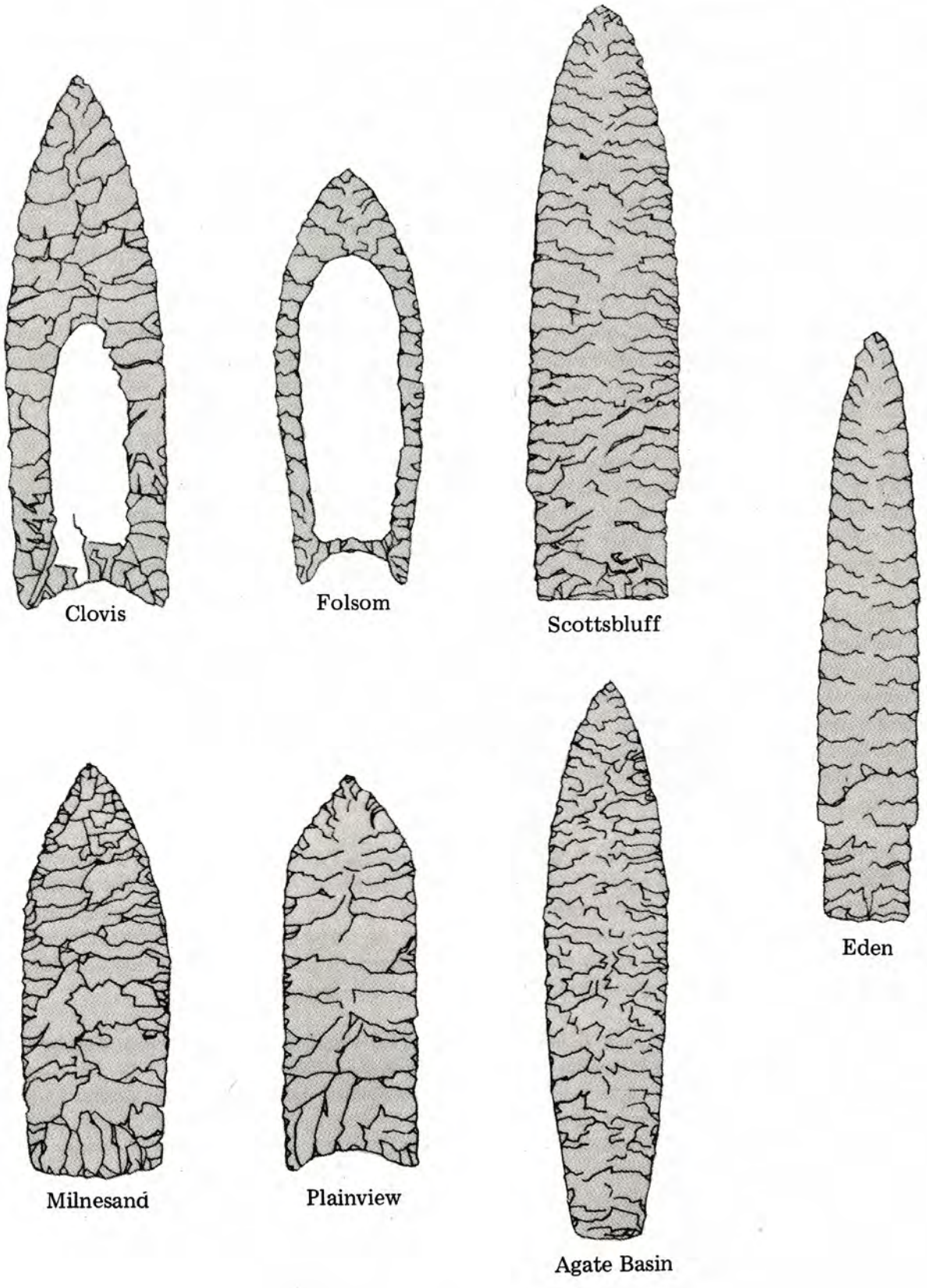


Figure 2-3. Typical Paleoindian projectile points (*adapted from Stuart and Gauthier 1981)*.

Archaic Period (6,000 BC to AD 200)

The Archaic Period follows the end of the Paleoindian Period and is distinguished by a more diversified subsistence base and a less formulaic lithic tool kit. Archaic period populations are generally not considered to have relied on horticulture or developed permanent or semi-permanent dwellings. Archaic populations are also widely accepted to be non-ceramic, with the development of ceramics being a key marker distinguishing Archaic from Formative Period occupations. Some of these distinguishing traits become less applicable during the Late Archaic. It is not agreed whether Archaic populations are an in-situ development from Paleoindian populations or represent the movement of new population groups into the southwest after the Paleoindian occupation moved onto the Great Plains (Stuart and Gauthier 1981; Irwin-Williams and Haynes 1970).

The Archaic Period in New Mexico and adjacent areas of the southwest is divided into four overlapping traditions. The western Archaic tradition is the Pinto-Amargosa of southern California and western Arizona. The southern tradition is the Cochise sequence developed by Sayles and Antevs (1941) for northern Chihuahua into central Arizona and New Mexico. The Oshara is the northern Archaic tradition as defined by Irwin-Williams, in northern New Mexico and southern Colorado. The southeast tradition is the Chihuahua tradition as developed by MacNeish and Beckett (1987) for northern Chihuahua and south-central New Mexico. These Archaic traditions are usually discussed in the wider framework of Early, Middle, and Late Archaic periods. The overview here will focus mostly on the Chihuahua Archaic tradition which is the most applicable for the project area.

Early Archaic (6,000 to 4,000/3,000 BC)

Early Archaic sites tend to have the least representation in the Archaic sequence, with Early Archaic finds being largely limited to surface discoveries of projectile points, limited deposits in rockshelter sites, and a few radiocarbon dates from thermal features or rockshelters (Miller and Kenmotsu 2004:220). Dating of Early Archaic finds also tends to rely on cross dating with projectile point forms of the Oshara tradition or central Texas Archaic traditions, with few secure radiocarbon dates from Early Archaic materials (Miller and Kenmotsu 2004:220).

Many of the existing radiocarbon dates for the Early Archaic have been found in deeply buried alluvial deposits on mountain flanks or deep rockshelter deposits. Such finds include several dates from buried thermal features at the Gardner Springs sites, as well as dates from Fresnal, Pendejo, and Todsen rockshelters. Limited Early Archaic dates have been recovered from basin interior locations, likely due to poor preservation (Miller and Kenmotsu 2004). This could, in part, be due to site formation processes. Recent research into the geomorphology of the Tularosa Basin suggests that these early sites were unlikely to be preserved due to slow surface accretion and fine-scale bioturbation by cicadas (Hall et al. 2010:1963-1964). Despite this, surface finds of Early Archaic projectile points are found across a wide variety of landforms, suggesting a high degree of mobility and a diversified subsistence base.

The Early Archaic Period encompasses the Gardner Springs phase (approximately 6,000 to 4,000 BC) of the Chihuahua tradition (MacNeish and Beckett 1987; MacNeish 1993). Typical of Early Archaic cultural complexes, the Gardner Springs phase also suffers underrepresentation in the archaeological record. The complex is defined at a few small sites containing a mixture of projectile points including Jay, Bat Cave, Aboloso, and Bajada points (MacNeish and Beckett 1987; Moore 1992).

Although specifics of Early Archaic material culture, subsistence, and technology are at this time under-documented, it is clear that the use of thermal features and heating stones became common during the period, implying a shift in subsistence practices from Paleoindian times (Miller and Kenmotsu 2004:221). The increased presence of groundstone implements also co-occurs with the use of thermal features in Early Archaic contexts (Beckett 1973; O'Laughlin and Martin 1992). Additionally, a shift in projectile point technology from the lanceolate shaped points of the Paleoindian period to stemmed points such as Jay, Bajada, and Uvalde occurs. Along with the adoption of stemmed point forms is a shift from the fine-grained materials associated with Paleoindian points to coarser igneous, metamorphic, and sedimentary materials. This change in materials is possibly a response to shifts in prey selection and hunting practices, or raw material access being limited to locally available materials (Miller and Kenmotsu 2004).

Middle Archaic (4,000/3,000 to 1,200 BC)

The Middle Archaic Period continued many of the technological and subsistence trends established during the Early Archaic. Radiocarbon dated Middle Archaic sites are more numerous than sites of the preceding Early Archaic Period, likely due to a gradual population increase through the 2,000-year long period. Contrary to dated Early Archaic contexts, many dated Middle Archaic contexts have been located in basin interior landforms, with only a few Middle Archaic dates recovered from rockshelter deposits (Miller and Kenmotsu 2004:223). Some Middle Archaic sites have been documented along terraces of the Rio Grande Valley and along sheltered drainages in mountain foothills as well (O'Laughlin 1980; Miller 2018:127,129). The increased presence of Middle Archaic sites may be related to a more intensive land usage pattern caused by a general drying trend documented during the period, or Middle Archaic populations taking advantage of a wider variety of environmental settings.

The Middle Archaic Period is represented by the Keystone phase of the Chihuahua tradition (MacNeish and Beckett 1987; MacNeish 1993). The Keystone phase was originally estimated to span the period from approximately 4,500 to 2,500 BC (MacNeish 1993). The Keystone phase of the Chihuahua Archaic tradition is much better represented in the archaeological record than the preceding Gardner Springs phase. The phase is associated with the Keystone Dam site, which is located on the Rio Grande floodplain in what is now northwest El Paso. Within excavated contexts, diagnostic projectile points for the Keystone phase are Pelona, Todsen, Amargosa, and Amalgre types. From surface contexts, diagnostic points include Langtry, Shumla, Trinity, and Bat Cave points (MacNeish and Beckett 1987; Moore 1992).

One of the most significant sites of the Middle Archaic Period in the southern southwest is the Keystone Dam site north of El Paso. Site 33, excavated as part of the Keystone Dam project, contains the earliest documented house structures in the region, dating from 2,500 BC to 1,800 BC (O'Laughlin 1980). The structures are interpreted as ephemeral "huts" of brush or jacal construction. The house remains consist of shallow (15 to 20 centimeters [cm] in depth) round depressions less than 2 m in diameter (Miller and Kenmotsu 2004:224). The Keystone Dam site is significant as it is one of the oldest known village sites in the Southwest, and perhaps the largest site containing Archaic period houses in the western US or northern Mexico. As noted by Miller and Kenmotsu (2004), it is of particular interest that these structures pre-date the earliest dates of domesticated cultigens in the region, which are generally assumed to have been adopted concurrently with structural habitations and semi-sedentary settlements.

Many elements of Middle Archaic lithic and thermal feature technology appear to be consistent with those of the Early Archaic Period, although this is at least partially due to insufficient samples to draw comparisons from. Projectile point forms do show distinctive shifts in the Middle Archaic Period, with increased regional patterning and variation occurring in Middle Archaic contexts (Mallouf 1985; Miller and Kenmotsu 2004:225). This phenomenon is visible in the proliferation of projectile point types recorded in association with the Keystone phase. Miller and Kenmotsu (2004:225) summarize this variety into two types of hafting configurations that are the most common during the Middle Archaic; contracting stems with flat, rounded, or pointed bases and expanding stems with concave bases. They also note that Middle Archaic projectile points tend to be demarcated by blade modifications such as beveling, serration, and extensive retouching (Miller and Kenmotsu 2004:225). Contracting stem projectile point forms become well-established around 2,500 BC and serve as a reliable diagnostic marker for the latter portion of the Middle Archaic (Miller 2018:130).

Burned rock middens (circular heaps of burned rock with a central depression) first appear in significant quantities during the Keystone phase, and numerous examples dating to the Middle Archaic are found in the sheltered valleys of the southern Sacramento Mountains and the alluvial fans of other mountain ranges (Miller 2018:129). Many of these features are associated with contracting stem projectile points. These features were likely used to bake succulents such as agave, yucca, sotol, and prickly pear, and possibly cholla buds. These succulents might have been baked not only as a food source, but also for the production of fermented mescal for communal gatherings (Miller 2018:129).

Late Archaic (1,200 BC to AD 200)

The Late Archaic Period represents a significant departure from the subsistence, settlement, and technological trends established during the preceding Archaic sequence. It is also substantially better represented in the archaeological record than either the Early or Middle Archaic periods. Occupational intensity is substantially higher during this period, with a major increase in the number of documented Late Archaic contexts and deposits. This occupational intensity is spread across almost all environmental zones with numerous Late Archaic sites located in basin interiors and substantial Late Archaic deposits in rockshelter locations. Late Archaic deposits are often the primary time interval represented in rock shelter deposits in the region, as seen at the Fresnal, Tornillo, Todsen, and La Cueva rockshelters (Miller and Kenmotsu 2004).

One of the most important finds dated to the Late Archaic is solid evidence for the use of domesticates. Middle Archaic dates for Maize De Ocho have been recovered from Bat Cave (approximately 2,500 BC) but the reliability of these early dates has been questioned by some scholars (Berry 1982; Upham et al. 1987). More reliable dates for the appearance of domesticates in the southwest comes from the direct dating of corn recovered from Fresnal and Tornillo rockshelters during the 1980s and 1990s (Carmichael 1982; Tagg 1996; Upham et al. 1987). A composite date of 2,030 BC to 830 BC was generated from a sample of eight corncobs recovered from Tornillo Rockshelter (Upham et al. 1987). An early date of 1,200 BC to 940 BC was generated from a corn sample from Fresnal Shelter, with other corn dates clustering around 1,200 BC to AD 600 (Tagg 1996). Wills (1988) estimates that maize was initially introduced in the period of 1,550 BC to 1,050 BC, which fits well with the dates recovered from the Fresnal and Tornillo rockshelters (Miller and Kenmotsu 2004). Dates from High Rolls Cave further established the presence of early cultigens in the region by around 1,250 BC (Lentz 2006; Miller 2018:132). Thus far, reliable dates for early cultigens have been almost exclusively recovered from upland rockshelter and cave settings. This might reflect that cultigens were

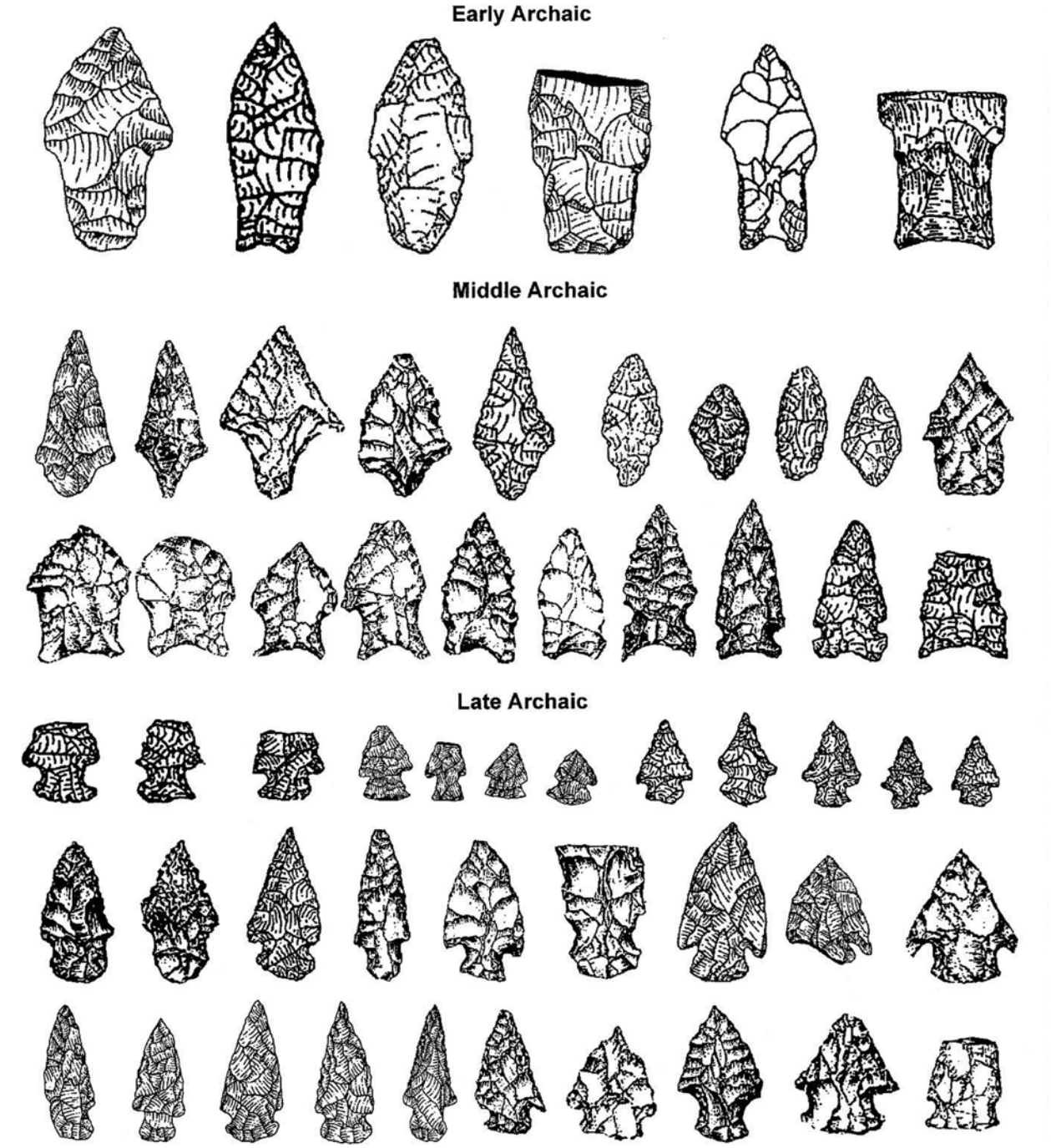


Figure 2-4. Representative drawing of Archaic projectile points, showing the shift from stemmed points, to concave base points, to Late Archaic side and corner notched styles (*adapted from Miller and Kenmotsu 2004)*.

adapted earlier in the more amenable upland environments or might simply be a by-product of poor preservation in lowland desert sites (Miller 2018:132). Early corn pollen was tentatively identified at the Keystone Dam site, with associated wood charcoal dates ranging from 3,400 BC to 1,200 BC (O'Laughlin 1980). However, due to the imprecise time period represented and lack of direct dated corn samples, this date range is not widely used (Miller and Kenmotsu 2004:226). Although the Late Archaic provides the first reliable evidence of cultigens in the southern Southwest, foraging still provided the bulk of subsistence, and the period "cannot be considered an agricultural or even a predominantly horticultural period" (Miller 2018:132).

Late Archaic projectile point technology shifts to corner and side notched forms. There is also a trend of decreasing point size during the latter portion of the period. An increase in the use of locally available raw materials is also noted during this time. This, in combination with other evidence of more intensive land use, may suggest a reduction in the territorial ranges available for use by Late Archaic groups (Miller and Kenmotsu 2004:229). The smaller projectile point size of the period may therefore reflect a shift to the harvesting of smaller game animals as a result of the local over-hunting of larger species.

The Late Archaic Period encompasses the Fresnal and Hueco phases of the Chihuahua Archaic tradition (MacNeish and Beckett 1987). The inception of the Fresnal phase (at 2,500 BC) of the Chihuahua Archaic tradition is based on the corn pollen dates at the Keystone Dam site (Upham and MacNeish 1993). However, this 2,500 BC date is likely imprecise as discussed above, and more recent regional summaries have revised the inception of the Fresnal phase to around 1,200 BC (Miller and Kenmotsu 2004; Miller 2018:132). Evidence from the Keystone Dam site indicates that seasonal camps were occupied along the Rio Grande during this period, and cultigens were incorporated into the seasonal round (MacNeish and Beckett 1987). Diagnostic projectile points of the phase include Fresnal, Augustin, Chiricahua, Nogales, Todsen, La Cueva, Maljamar, San Jose, and perhaps Pedernales points (Moore 1992:4).

Burned rock middens proliferate across the landscape during the Late Archaic. Ring middens began to appear in significant numbers during the Middle Archaic, but they occur across a wider variety of environmental zones during the Late Archaic. This suggests a more intensive and more widespread exploitation of succulents during this period (Miller and Kenmotsu 2004:229).

The middle portion of the Late Archaic period (800 BC to 350 BC) coincides with a remarkably diminished number of radiocarbon dates from several types of features, sites, and landforms (Miller 2018:133). The use of rockshelters, baking and storage pit features, and use of agricultural cultigens declined throughout this period. This interval was referred to as the Arenal phase, named after the El Arenal site, which is located near the southeastern edge of the Tularosa Basin (Miller 2007; Miller 2018:134). It does not appear that the Jornada region was abandoned during the Arenal phase, but rather that the population reverted back to a more mobile settlement pattern. Arenal phase sites are strangely rare in upland settings, and known settlements from the period are situated near playas. Environmental reconstruction for the period indicates that wetter conditions prevailed, which would have made lowland desert settings more amenable for a diversified subsistence base (Miller 2018:134-135).

The final portion of the Late Archaic was identified as the Hueco phase by Lehmer (1948). The phase had largely fell out of use in regional archaeology prior to being revived in the Chihuahua Archaic sequence by MacNeish and Beckett (1987). The Hueco phase is marked by an increasing

reliance on cultigens, especially maize, intensive settlement across all environmental zones, and population growth prior to the introduction of the bow and arrow and ceramics. Aside from these technological indicators, Hueco phase adaptations strongly resemble the settlement and subsistence patterns defined for the early Formative period (Miller 2018:135). Diagnostic points of the phase are a variety of corner and side-notched points, including San Pedro, Hatch, Hueco, and Fresnal points (Moore 1992:4).

Hueco phase sites show an increasing reliance on cultigens, and the period is marked by the first evidence of agriculture being pursued in lowland, desert settings. Social structure became markedly more complex during the Hueco phase, and the first villages with formal arrangements of houses and communal extramural areas appear during the Hueco phase (Miller 2018:136). Settlements have dozens of large storage pits and refuse pits, and the first formal storage structures, in the form of bell-shaped storage pits, also appear during the Hueco phase (Miller 2018:135). However, Hueco phase sites lack the larger communal structures found at later Formative period villages. Ideological and ritual concepts that carried into the Formative period were also likely established during the Hueco phase; ritual items recovered from Ceremonial Cave in the Hueco Mountains were radiocarbon dated to the period between 350 BC and 50 AD (Miller 2018:136).

Formative Period

The Formative Period is set apart from the Archaic Period by several important transitions in subsistence, material culture, and settlement patterns. Generally, the increased reliance on cultigens and agriculture and a concomitant decrease in mobility are key signatures of the period, as is the development of structural dwellings and adoption and use of ceramics. Although some of these traits have their roots in the Late Archaic Period (as seen in the pithouse structures at the Keystone Dam site and early dates of cultigens in the southwest), this suite of behavioral traits are much more prominent and extensively developed in the Formative Period. The Formative Period is classified within the Jornada Mogollon cultural sequence. The Jornada Mogollon culture was defined in the southern Rio Grande Valley by Lehmer (1948), and extends into west Texas, and across central and southern New Mexico. The Jornada Mogollon can overlap with the Mimbres Mogollon cultural sequence along the Rio Grande Valley and areas west.

The Jornada Mogollon

The Formative Period in south-central New Mexico is mainly characterized by the Jornada Mogollon cultural sequence as originally formulated by Lehmer (1948). This tripartite sequence consists of the Mesilla, Doña Ana, and El Paso phases. This basic sequence has been subject to some modification and revision over the years, but has remained largely intact. The Jornada Mogollon sequence has benefitted from a tremendous influx of new data generated by contract work over the last 20 years. Miller (2005) estimated that approximately 1,200 new absolute dates had been generated by compliance work in the Jornada Mogollon region since the 1990s. This has greatly improved both the temporal and geographic resolution of the Jornada Mogollon sequence.

Lehmer's original (1948) sequence placed the Mesilla phase in the period AD 900 to 1100, the Doña Ana phase in the period AD 1100 to 1200, and the terminal El Paso phase to between AD 1200 to 1400. Recent updates to the sequence based on more current and abundant chronometric data have revised the Mesilla phase to AD 200/400 to 1100, the Doña Ana phase to AD 1000 to AD 1250/1300, and the El Paso phase to AD 1250/1300 to 1450 (Miller and Kenmotsu 2004; Miller

2005). Terminological modifications to the basic sequence have also been proposed. Whalen (1978) included the Mesilla phase in an Early Formative or Pithouse Period, and included the Doña Ana phase and El Paso phase in a Late Formative or Pueblo Period. Due to classificatory difficulties, the Doña Ana phase has been argued to represent an overlap or gradual succession between the Mesilla and El Paso phases, rather than an independent phase (Mauldin 1993). It has therefore been labeled as the Transitional phase in some literature (per Miller and Kenmotsu 2004).

Murphy and Alexander (2015:79) note that projectile point types found at Jornada Mogollon sites consist of types from the Cienega and Livermore clusters as defined by Justice (2002). The Cienega cluster includes Tularosa Corner Notched, Tularosa Basal Notched, and Carlsbad types. The Livermore cluster consists of Guadalupe and Livermore types. General lithic technology of the Jornada Mogollon is mostly consistent with that of the earlier Archaic period, with no significant shifts in material preferences, technology, or types of tools (Murphy and Alexander 2015:80; Miller and Kenmotsu 2004). Jornada Mogollon lithic assemblages consist mostly of informal tools and expedient flake tools manufactured from locally available materials; black-banded and Rancheria chert are common raw materials, as is obsidian retrieved from Rio Grande gravels (Murphy and Alexander 2015:79-80).

Mesilla Phase (AD 200/400 to AD 1000)

The Mesilla phase is typically defined by the use of insubstantial pithouse architecture, the appearance of El Paso Brownware ceramics, and the use of cultigens. Non-local ceramics, particularly Mimbres whiteware, also appear in the latter portion of this period. The Mesilla phase is usually identified by the presence of El Paso Brown pottery which was originally postulated by Lehmer to have originated around AD 900; however, recent research and chronometric dates have revised its appearance to as early as AD 200 to 400 (Miller and Kenmotsu 2004; Miller 2005; Pertulla et al. 1995). The presence of pithouse architecture alone is not a reliable signature of the period as it is known to have been present during the Late Archaic at the Keystone Dam site (O'Laughlin 1980).

Ceramics in the Mesilla phase are dominated by El Paso Brownware, which is nearly ubiquitous on Mesilla phase sites. Some intrusive ceramics occur in low numbers on Mesilla phase sites. Alma Plain and San Francisco Red occur in some early assemblages and Mimbres whiteware is included in some later assemblages (Moore 1992; Whalen 1980). El Paso Brownware appears to be a very stable ceramic tradition throughout the Mesilla phase, with limited changes in vessel form or rim variation (Miller and Kenmotsu 2004). Whalen (1994) has observed technological changes in vessel construction between early and late Mesilla phase brownware vessels, most notably in temper size and abundance. These variations may have been driven by a need for increased thermal resistance. By measuring the temper type and abundance of El Paso Brownware sherds, Whalen (1994) proposed that these attributes could be used as a potential chronological marker.

Architecture in the early part of the Mesilla phase consists mostly of round pithouses which may or may not include interior features. These pithouses generally lack prepared or plastered floors, but may contain small unlined hearth features, postholes, and informal storage pits (Miller and Kenmotsu 2004). The pithouses were 3 to 5 m in diameter and were built as deep as 2 m below the surface. The round pithouses were constructed with wood beam roofs, similar to modern viga-latilla ceiling construction, and finished with mud daub. Entrances were either a roof entry or an excavated entry ramp (Murphy and Alexander 2015:82). During the latter portion of the Mesilla phase, square pithouses became the predominant architectural form and are generally more formalized than earlier

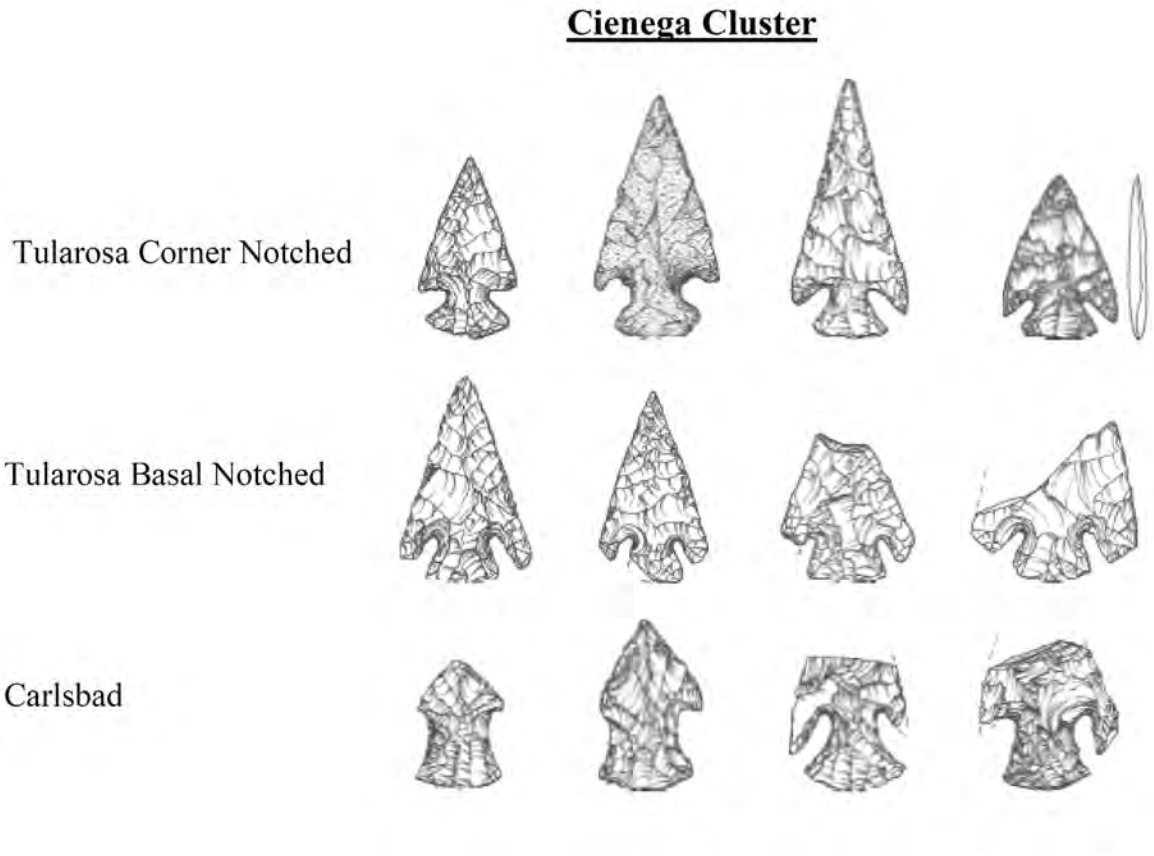


Figure 2-5. Cienega cluster points, including Tularosa Corner Notched, Tularosa Basal Notched, and Carlsbad projectile points (*adapted from Justice 2002)*.

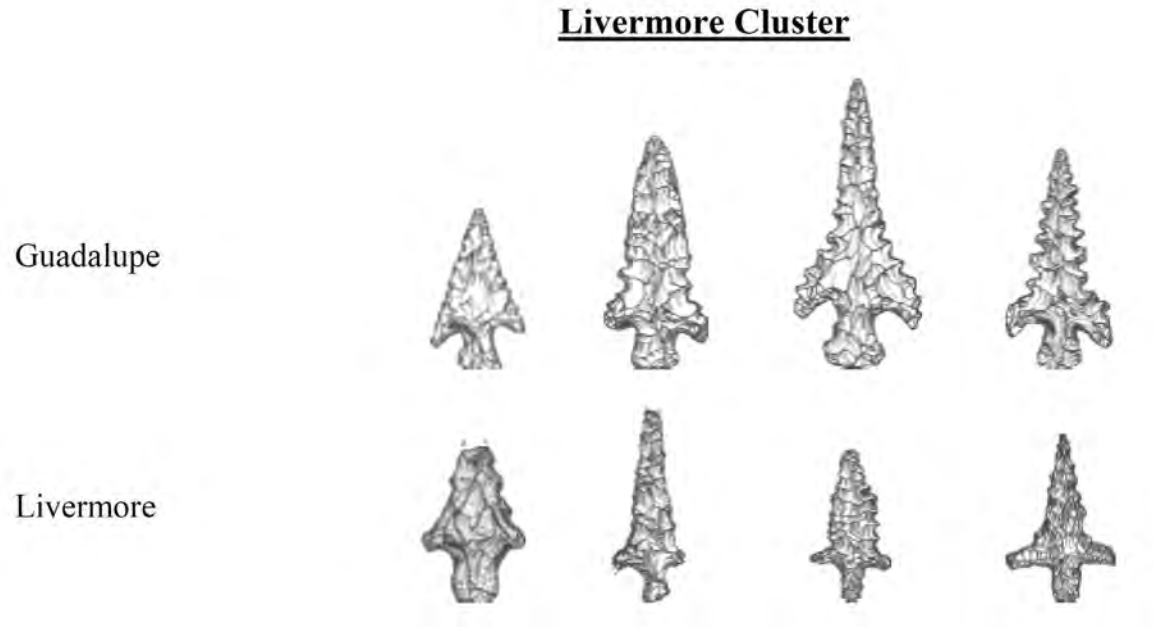


Figure 2-6. Livermore cluster points, including Guadalupe and Livermore projectile points (*adapted from Justice 2002)*.

round pithouses (Bullock 2000; Railey and Holmes 2002). Railey and Holmes (2002:36) state that square pithouses are mostly absent from the Tularosa and Hueco Bolsons during the Mesilla phase, and that the frequency of square pithouse structures in the Rio Grande Valley might reflect influence from the Mimbres area, where square pithouses were the dominant architectural form during the contemporaneous Three Circle phase (AD 850 to 1000). Pithouses located within basin floors also tend to be smaller than structures found within the Rio Grande Valley or basin margins (Railey and Holmes 2002:38).

Mesilla phase villages were possibly reoccupied seasonally as part of a mobile residential pattern, and investment in architecture was relatively minimal (Carmichael 1986). However, construction of an average Mesilla phase pithouse was not a trivial labor investment, likely representing several hundred man-hours (Murphy and Alexander 2015:82). Mesilla phase architecture can also include informal jacal or adobe surface structures, brush shelters, or ramadas. Extramural storage pits, trash sheets, and hearth features are also commonly found on Mesilla phase sites (Bullock 2000; Murphy and Alexander 2015:82).

The settlement pattern of the Mesilla phase appears to closely follow that of the preceding Archaic period, particularly during the earlier portion of the period (Moore 1992). Mesilla phase sites are more evenly distributed across all environmental zones than sites of succeeding phases. Mesilla phase sites are more likely to be found in basin interiors than sites of later periods, which tend to be located along basin margins and distal portions of alluvial fans. Within basin interiors, villages of the phase are often found in association with playa margins (Miller and Kenmotsu 2004; Murphy and Alexander 2015:81).

The settlement and subsistence model proposed for the Mesilla phase is one of semi-permanent settlements near major streams and perennial water sources, with a wide variety of short-term camps used to take advantage of seasonally available resources (Carmichael 1986; Hard 1983; Miller and Kenmotsu 2004). Seasonal hunting and gathering would peak during the wetter summer and fall months, with the majority of the population withdrawing to the semi-permanent camps near reliable water sources during the dry winter and spring months (Whalen 1986). Small scale horticulture would be practiced at these locations, which would make a gradually increasing contribution to subsistence. It is likely that there was a strong riverine component to Mesilla phase settlement; several Mesilla phase pithouse sites including Los Tules (type site for the Mesilla phase), Tortugas, and Roth are located along the Rio Grande Valley margins. However, evidence of this riverine settlement component has likely been destroyed by agricultural and urban development associated with the growth of Las Cruces and El Paso (Miller and Kenmotsu 2004). Other significant Mesilla phase sites are found along basin margins, near well-watered alluvial fans. The Turquoise Ridge site is one such example, and is located near the eastern edge of the Hueco Bolson. The site included multiple large, formal pithouses as well as storage pits, trash middens, and a possible ceremonial structure (Railey and Holmes 2002:39).

Doña Ana Phase (AD 1000 to AD 1250/1300)

The Doña Ana phase was originally defined by Lehmer (1948) as a transitional phase between the Mesilla and El Paso phases, and represents the pithouse to pueblo transition. However, it has been argued that the phase is actually an overlap between the Mesilla and El Paso phases and not a true independent phase (Mauldin 1993; Bullock 2000). As defined by Lehmer (1948), Doña Ana phase sites can contain both pithouse and pueblo architecture, and a mixture of ceramic types seen both

Figure 2-7. El Paso brownware jar (*image adapted from BLM ceramics guide)*.

in the terminal Mesilla and early El Paso phases. This hinders the identification of Doña Ana phase sites in the field and has caused some researchers to lump the phase with the El Paso phase (Mauldin 1993; Whalen 1978). The Doña Ana phase was originally proposed to date from AD 1100 to 1200, but has been revised to AD 1000 to AD 1250/1300 (Miller and Kenmotsu 2004).

Ceramics in the Doña Ana phase include decorated versions of El Paso brownware ceramics: El Paso Bichrome and early El Paso Polychrome. Intrusive ceramic types are more prevalent in Doña Ana phase ceramic assemblages. These intrusive types include Mimbres corrugated types and Mimbres Classic Black-on-white, Chupadero Black-on-white, Three Rivers Red-on-terracotta, and St. Johns Polychrome. El Paso Brownware continues to occur in Doña Ana phase assemblages, and is not strictly limited to the Mesilla phase (Railey and Holmes 2002:43; Bullock 2000; Moore 1992). It has also been demonstrated that El Paso Brownware vessel forms shifted around AD 1000 from predominantly neckless (*tecomate*) jar forms to necked jar forms (Miller and Kenmotsu 2004:253). This modification in vessel form may be a technological shift related to the more secure containment provided by necked vessels for the processing of corn (Hard and Nickels 1994).

During the Doña Ana phase, pithouse architecture still includes some round pithouses, but square pithouses become the predominant architectural form after AD 1100 (Railey and Holmes 2002:43). Also at this time, an architectural form described as "isolated rooms" begins to appear (Miller and Kenmotsu 2004:240). Isolated rooms are more formally constructed structures (compared to

earlier pithouses) that are square in shape, shallow in depth, and noncontiguous with other rooms or structures. They contain prepared caliche or plaster floors, and occasionally plastered walls. Floor features include collared hearths, occasional storage or burial pits, and sometimes stepped entryways. Two main support posts are usually located along a central axis (Railey and Holmes 2002:44; Miller and Kenmotsu 2004:239). Isolated rooms represent a substantial departure from pithouses in their formality and uniformity in construction. Dated isolated rooms make a substantial increase, more than 100%, around AD 1150 while pithouses decrease in frequency (Miller and Kenmotsu 2004:240). These rooms have been interpreted as antecedent to pueblo architecture (Batcho et al. 1985), but pueblo rooms are larger in size and contiguous in design. Actual pueblo architecture begins to appear at the end of the Doña Ana phase, at approximately AD 1250, at which time pithouses mostly cease to be constructed and the construction of isolated rooms declines (Miller and Kenmotsu 2004: 240-241). Other feature types, such as storage pits, trash middens, and thermal features, are consistent with those of the preceding Mesilla phase (Bullock 2000).

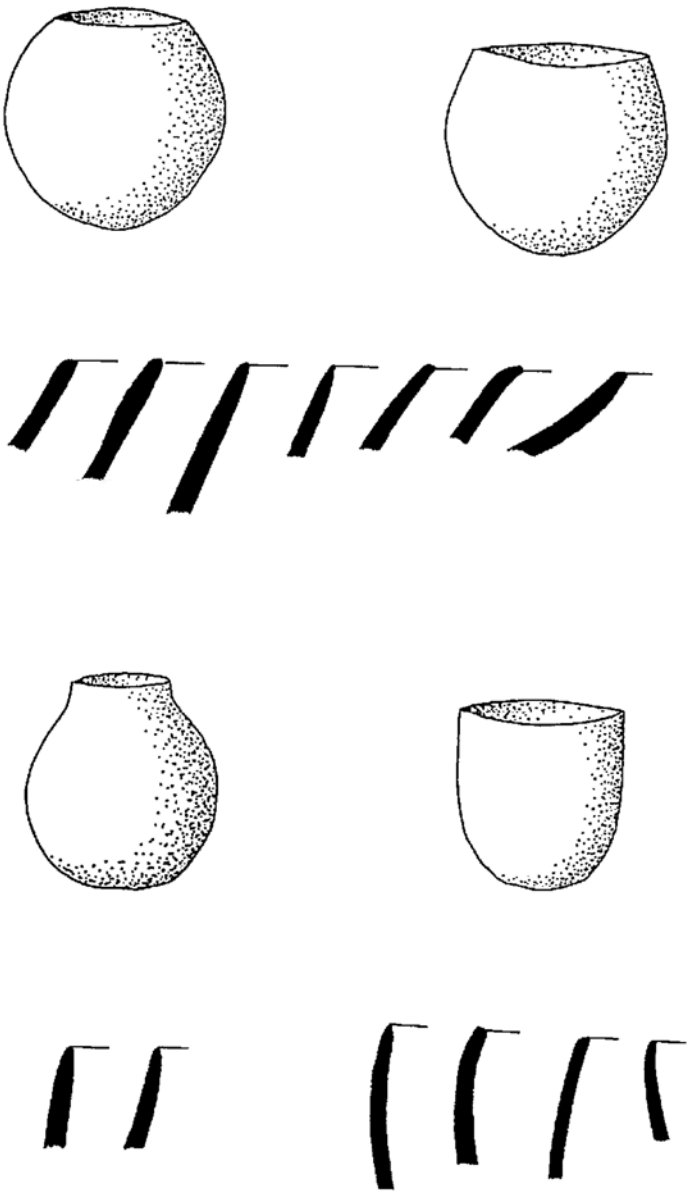


Figure 2-8. Typical El Paso brownware jar and rim forms (*adapted from Miller and Kenmotsu 2004*).

The increased level of formality in architecture and related increase in time and energy investment in construction suggests that a gradual decrease in mobility occurred during the Doña Ana phase. Mauldin (1994, 1995) examined radiocarbon dates from structures and thermal features in the Hueco Bolson and found that the use of interior basins substantially declined after AD 1000. Miller and Kenmotsu (2004) expanded this analysis by looking at trends in major feature types and topographic locations in the Mesilla, Hueco, and Tularosa Bolsons. They found that use of alluvial fan margins gradually increased during the latter portion of the Mesilla phase, and continued to increase during the Doña Ana phase. An abrupt decline in feature distribution in basin interiors occurs around AD 1000. A notable increase in the use of alluvial fans occurs around AD 1150, as settlements in close proxim-

ity to playas (at the alluvial fan/basin interface) increase in frequency. This trend continued throughout the Doña Ana phase, reaching an apex in the following El Paso phase (Railey and Holmes 2002:47; Miller and Kenmotsu 2004:246). It is noteworthy that these changes in settlement co-occur with changes in architecture (such as the appearance of isolated rooms around AD 1150) and together mark a shift in settlement and subsistence patterns from the preceding Mesilla phase.

Figure 2-9. El Paso brownware sherds (*adapted from Laumbach 2009)*.

It is believed that while exploitation of wild resources in basin interiors continued during the Doña Ana phase, residential use of basin interiors declined (Mauldin 1994, 1995). The exploitation of wild resources became more logistically organized as agricultural dependence and sedentism at basin margin sites increased. It is likely that the exploitation of wild resources in basin interiors actually increased during this period in response to the needs of growing populations, but this short-term logistical usage resulted in fewer datable features being constructed in basin interiors (Carmichael 1985; Mauldin 1994, 1995; Miller and Kenmotsu 2004:247). Oddly, few Doña Ana phase sites have been documented within the Rio Grande Valley, where significant sites of the preceding Mesilla phase were located. This has led some researchers to postulate that the center of the Jornada Mogollon cultural sphere shifted to the Hueco Bolson during the Doña Ana phase (Railey and Holmes 2002:49).

El Paso Phase (AD 1250 to AD 1450)

The El Paso phase is the terminal phase of the Jornada Mogollon sequence, and is marked by the construction of Pueblo-style architecture and likely the densest population levels of the sequence. It also represents the height of prehistoric social complexity in the Jornada region, with evidence of extensive trade, ceremonial architecture, and social stratification at sites of the phase. The El Paso phase was originally formulated by Lehmer to date from AD 1200 to 1400, but the phase has been slightly revised to AD 1250/1300 to AD 1450 (Miller and Kenmotsu 2004; Miller 2005). End dates for the phase are somewhat problematic, with some authors extending the terminal date to as late as AD 1475/1500 (Railey and Holmes 2002:49; Bullock 2000:6).

The ceramic assemblages of the phase are dominated by El Paso Polychrome. Undecorated El Paso Brownware and earlier varieties of decorated El Paso Brownware (such as El Paso Bichrome) are mostly replaced by El Paso Polychrome around AD 1250/1300. At this time vessel forms are dominated by necked jars with everted rims (Miller and Kenmotsu 2004:253). The wider variety of vessel forms and decorations seen in El Paso Polychrome (such as crenellated bowls) may have been part of ritual or ceremonial expression (Jackson and Thompson 2005; Legare and Legare 2010). Imported ceramics also increase in number during the El Paso phase, suggesting a wide-reach-

ing trade network. Ceramics from the Zuni area, Rio Grande pueblos, Sacramento Mountains, and Galisteo Basin in New Mexico; Salado and White Mountain areas in Arizona; and ceramics associated with Casa Grandes in northern Mexico all occur in assemblages of the phase (Railey and Holmes 2002:62; Bullock 2000). Common intrusive ceramic types include Chupadero Black-on-white, Three Rivers Red-on-terracotta, Lincoln Black-on-red, Gila Polychrome, Agua Fria Glaze-on-red, Ramos Polychrome, Heshotauthla Glaze-polychrome, Arenal Glaze-polychrome, St. Johns Polychrome, and Playas Red Incised (Lehmer 1948:81).

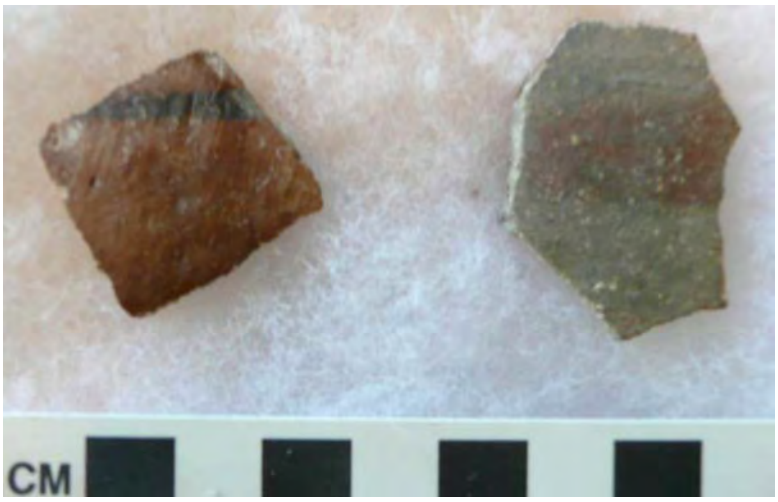


Figure 2-10. El Paso Bichrome sherds (*adapted from Laumbach 2009)*.

Prestige or ritual goods are also found in increased frequency at El Paso phase sites in comparison to earlier periods. As mentioned above, certain types of decorated ceramics were likely considered as ceremonial items, and turquoise, calcite, and shell from both the Gulf Coast and Pacific are found in association with El Paso phase deposits. Though usually found in limited quantities at El Paso phase sites, these goods likely played a significant role in social and ceremonial life (Railey and Holmes 2002:63). Several caches of ritual items have been documented in the region, indicating that controlled distribution of these goods may have been a significant part of the Jornada Mogollon social hierarchy. One such cache was the Bald Eagle Cache, which was found in the Sacramento Mountains and contained over 50,000 artifacts, including beads of marine shell, calcite, slate, and turquoise. A similar cache was discovered at Tobin Ranch northeast of El Paso in 1936. The Tobin Ranch cache consisted of seven ceramic vessels containing 7,477 shell ornaments (Railey and Holmes 2002:63).

Above-ground pueblo architecture is a hallmark of the El Paso phase, although isolated rooms still occur (Batcho et al. 1985; Railey and Holmes 2002:50). Construction is usually of adobe with common internal features including postholes, pits, and formal hearths. Foundations and lower walls were constructed of puddled adobe, but it is less clear if the upper walls were also of adobe construction; at least in some cases the upper walls were of more expedient jacal construction (Railey and Holmes 2002:56). Architectural layouts of El Paso phase settlements are variable, and often include multiple linear roomblocks with occasional isolated rooms mixed among the roomblocks, as seen at Hot Well Pueblo (Miller and Kenmotsu 2004:242;244). Marshall (1973) defined two types of roomblock arrangements: linear blocks and plaza-oriented blocks. The plaza-oriented arrangement is less common and only documented at a few larger El Paso phase sites of a hundred rooms or larger (Miller and Kenmotsu 2004; Railey and Holmes 2002:50). Linear blocks are often oriented east-to-west unless located near a water course, in which case they tend to align to the water course (Bullock 2000; Marshall 1973). Some “L” shaped structures have also been documented for the phase (Bullock 2000).

El Paso phase roomblocks often include a single large room which is interpreted as a specialized room with a ceremonial or communal function. The large rooms may be associated with a lineage or corporate group occupying a roomblock (Miller and Kenmotsu 2004:244). Ceremonial caches have also been recovered from the floors of these rooms (Legare and Legare 2010; Moore 1996). These rooms suggest a heightened level of community ritual or social hierarchy not evidenced in the archaeological record of preceding phases. Legare and Legare (2010) argue that these rooms are ceremonial edifices functionally equivalent to kivas.

Other features found on El Paso phase sites include storage pits and trash pits. Both storage pits and trash pits increase in quantity, size, and formality on El Paso phase settlements. This suggests an increased reliance on stored foods and a patterned disposal of trash typical of sedentary, agriculture-reliant populations. Thermal features declined substantially after about AD 1250/1300, which Miller and Kenmotsu (2004:251) argue represents a decrease in wild plant processing and increase in agricultural specialization and dependency during the El Paso phase.

Similar to the preceding Doña Ana phase, El Paso phase settlements tend to be located along the lower margins of alluvial fans, likely to take full advantage of run-off for agricultural production (Hard 1983; Carmichael 1986; Miller and Kenmotsu 2004). However, it has been noted that El Paso phase settlements tend to be located at slightly lower elevations on distal fan edges or along playa margins. In Miller and Kenmotsu's synthesis of dated features in the Mesilla, Tularosa, and Hueco Bolsons, it was observed that occupation of alluvial fans decreases during the El Paso phase, while occupations in the vicinity of playas at the lower edges of alluvial fans reach their apex (Miller and Kenmotsu 2004: 247). There is little evidence of features in basin interiors during this period, but El Paso phase ceramics and projectile points are still found in these locations. This indicates that while encampments or processing locations in basin interiors were limited, logistical procurement activities continued to occur. The limited distribution of settlements and feature locations during the El Paso phase indicates that sedentism and reliance on agricultural production defined subsistence patterns in this phase (Railey and Holmes 2002:49).

Evidence of an agriculturally based population in the Jornada Mogollon area ceases to be found after about AD 1400/1450. Whether the area was actually abandoned is debated. It has been argued that as agricultural production became untenable due to climatic change the Jornada Mogollon may have returned to wild resource procurement and a highly mobile subsistence strategy. This strategy would leave minimal indications in the archaeological record or possibly these sites would be misclassified as Archaic or early Mesilla phase sites.

2.3.2 Protohistoric

Following the El Paso phase, it appears that much of southern New Mexico was abandoned by agricultural populations, or at least the archaeological signature of remaining groups changed drastically. During this period of reorganization, it is usually postulated that the population of the region underwent a precipitous decline due to social or ecological collapse, and any surviving residents departed the area and were absorbed into developing population centers along the Rio Grande or in Sonora.

However, the southern New Mexico region may not have been totally abandoned during this period. Rather, local populations may have returned to a more diversified subsistence base and mobile settlement pattern that has a low visibility in the archaeological record. This economic and subsistence

Figure 2-11. El Paso Polychrome sherds (*adapted from Laumbach 2009)*.

pattern would resemble that of the Archaic or Early Mesilla phase (Upham 1984, 1988). At the time of the Spanish entrada, several groups were documented in the southern Rio Grande and northern Chihuahua area, including the Manso, Suma, Janos, Julimes, and Cholomes (Moore 1992; Wheaton and Reed 2009).

One of these groups, the Manso, has been extensively documented from Spanish records by the work of Beckett and Corbett (1992). The Manso occupied south-central New Mexico in the late 1500s and appear to be hunter-gatherers who built brush dwellings, but it is not clear from the records whether they manufactured their own ceramics. Beckett and Corbett (1992) argue that the Manso are the direct descendants of the Jornada Mogollon, and that the possible late terminal dates of Chupadero Black-on-white and Glaze A ceramics found on late El Paso phase sites could extend the El Paso phase dates close to the time of contact. This would decrease the chronological gap between the El Paso phase Jornada Mogollon and the early documentation of the Manso, increasing the likelihood that they were derived from the former Jornada Mogollon population.

Wheaton and Reed (2009) report the discovery of atypical brownware sherds at LA 129533 that they believe represent ceramic production by a late hunter-gatherer group. Though the sherds are associated with typical El Paso Brownware sherds, they varied from El Paso Brownware in both construction and chemical composition. Wheaton and Reed argue the site represents a transition

from a sedentary lifestyle back to a hunter-gatherer adaptation. However, radiocarbon dates from wood charcoal associated with the sherds range from AD 1310 to AD 1360 and AD 1390 to AD 1440, well within the accepted date range of the El Paso phase. Wheaton and Reed (2009:347) argue that LA 129533 represents an early occupation by a group transitioning back into hunter-gatherer adaptations that is possibly ancestral to the Manso.

Another site that may represent a Manso or Suma occupation is LA 26780, a multicomponent site located near the Doña Ana County Airport (Batcho 1987; Batcho et al. 1985). The site contains a high proportion of obsidian in its lithic assemblage, which is unusual for sites in the area, where obsidian sources are largely limited to secondary deposits included in the Rio Grande gravels. Obsidian sourcing revealed that none of the obsidian samples were derived from the Rio Grande gravels; rather, one sample was from Antelope Wells in the New Mexico "bootheel" and the remainder were from several sources in northern Chihuahua (Miller and Kenmotsu 2004:259). The artifact assemblage also included coarsely made and poorly fired brownware ceramics not typical of El Paso Brownware. Dates for the site included one hearth dated at AD 1420 to AD 1650 (Batcho 1987:7). However, other features at the site contained definite prehistoric artifact scatters and associated prehistoric dates, which creates interpretative issues for the site overall (Miller and Kenmotsu 2004:260). Similarly, Miller and Kenmotsu (2004:254) note that most post-AD 1450 dates in the region suffer some contextual and interpretative problems.

2.3.3 Historic (AD 1540 to Present Day)

Beginning in 1581, several Spanish entradas passed through the southern New Mexico region. These include the Rodriguez-Chamuscado, Espejo, and Oñate expeditions (Miller and Kenmotsu 2004:259). By the late 16th century, the caravan route of the *El Camino Real de Tierra Adentro* (The Royal Road to the Interior) or *Camino Real* was established, which traveled up the Rio Grande Valley between El Paso and the colonial capital of Santa Fe (Wilson et al. 1989). By the latter portion of the 1600s the Spanish had established missions and settlements along the Rio Grande Valley, but few are known archaeologically. One such location is the Mission de los Mansos, established in 1659 in what is now the city of Ciudad Juárez, a restored version of which still stands (Miller and Kenmotsu 2004:261).

Early Spanish exploration in western New Mexico consisted of several limited entradas. The first was the party of Marcos De Niza, a Franciscan Missionary, in 1539. The Coronado expedition followed roughly the same path in 1540. The next Spanish exploration of the region did not occur until 1697, when the Kino-Manje party passed through the area.

Spanish influence and settlement in southern New Mexico outside the Rio Grande Valley and the route of the Camino Real was limited. Although *parajes*, or stopping places, were located along the *Camino Real* in the Mesilla Valley, none of these are known to have been permanently settled during the Spanish Colonial period. The nearest major Spanish settlement was further south at the *El Paso Del Norte* (Juárez), where a garrison of Spanish troops was located (Owen 1999:6). Outside of Santa Fe and El Paso De Norte, the Spanish had limited control of New Mexico. The southern part of the state was the domain of the Apache, and by the early 1700s the Comanches had also established themselves as a serious threat to Spanish settlements, even raiding into Albuquerque in 1774 (Owen 1999:6; Simmons 1977:86).

Spanish land grants were largely issued in the northern portion of the state, with permanent settle-

ments extending only to the Belen area through the 18th century. The first documented Spanish settlement in the lower Rio Grande Valley occurred in the 1780s. This was the Santa Teresa land grant issued to Francisco Garcia, the military commandant of El Paso. Located on the west side of the river about 7 miles north of El Paso, the land grant was used for cattle and sheep grazing until it was abandoned in the 1820s due to Apache raids. It received limited usage for the next two decades until it was eventually resettled by Garcia's son (Bowden 1971). Other early land grant settlers, such as Juan Antonio Garcia de Noriega, who settled a grant in 1805, were also discouraged by encounters with the Apache and abandoned their settlements (Bowden 1971).

Mexican Period

The Mexican war for independence began in 1810, and after a protracted period of struggle, Mexico was recognized as an independent nation in 1821. The newly established Mexican government lifted trade restrictions, and soon the territory that is today New Mexico was experiencing a rapid influx of Anglo traders and merchants along the Santa Fe Trail. The Mexican government was also eager to establish Mexican settlements in New Mexico, in part to help maintain control of the territory. The settlements were expected to be largely self-sufficient, and to form citizen militias capable of defending the communities against Apache and Navajo raids. Any group of at least 100 individuals who committed to the requirements of making improvements and establishing a community could apply for a *cedulo* (grant) of land (Owen 1999:7).

The land grant system remained similar to that employed by the Spanish Colonial government, but the Mexican government issued grants on large tracts of land outside river valleys and also increased the number of grants overall. As a result, the total area of land grants issued by the Mexican government during the 1821 to 1846 period exceeded that granted during the entire 125 years of Spanish colonial rule (Bowden 1971).

An early settlement in the Mesilla Valley was led by John G. Heath, who settled a land grant in the vicinity of Brazito in 1823 (McFie 1903:22). Thirty Catholic families moved onto the grant, but turmoil within the Mexican government prevented soldiers from being assigned to the area and the settlers were unable to defend themselves against the Apache. The settlement was abandoned and the group returned to El Paso (Owen 1999:7).

Another attempt was made in 1839 when a group of 116 settlers from Juárez led by Don Jose Maria Costales petitioned for a land grant north of the unsuccessful Brazito site. The location was of the old paraje along the Camino Real known as Doña Ana, located at a bend in the Rio Grande. The Doña Ana Bend Colony Grant was awarded in 1840, and included more than 35,000 acres of land (McFie 1903; Owen 1999). Conditions for the grant included that a church, parsonage, and public buildings be constructed at the site. The settlers were unable to fund the journey north until 1843, when a group of only 33 settlers were led to the site by Bernabe Montoya. The community settled by these pioneers became the modern community of Doña Ana (McFie 1903; Owen 1999).

The Mexican-American War

During the 1830s, the Texas Revolution broke out, which ended with the establishment of the Republic of Texas. Mexico refused to recognize Texas as an independent nation, and sporadic border conflicts continued into the 1840s. Finally, the US annexed Texas as the 28th state in 1845. However, the location of the Texas border was still an unresolved issue, and the US recognized the border as

lying along the Rio Grande. Mexico disputed this, and relations between the two countries soon disintegrated. An underlying factor in the war was the "Manifest Destiny" expansionist policy of the Polk administration (Owen 1999:8).

The Mexican government of the 1840s was unstable and mired in chaos amid a series of coups and uprisings, with a succession of six different presidents between 1844 and 1847 (Velasco-Marquez 2015). Finally, a federal republican government was re-established in 1847, but was in a poor condition to bargain with the US on the annexation of Texas. However, the retention of its northern frontier states was a matter of national pride and Mexico continued to dispute the loss of its territory. Negotiations with the US to purchase lands along the Rio Grande broke down in 1846, resulting in the outbreak of the Mexican-American War.

Colonel Stephen Watts Kearny led the US military expedition into the Southwest. The expedition was composed largely of volunteers, numbering about 1,600 troops total. The Kearny expedition captured Santa Fe without encountering any resistance, and Kearny led the bulk of his forces further west (Owen 1999:8). The New Mexico command was left with Colonel Alexander Doniphan who led a force numbering approximately 850 down the Rio Grande to the south. Doniphan's soldiers were mostly untrained volunteers from Missouri; though they lacked traditional military discipline, under Doniphan they proved to be a capable fighting force. On Christmas Day 1846, Doniphan's forces repelled an advance of approximately 1,000 Mexican soldiers, the only battle of the Mexican-American War that was waged in New Mexico (Owen 1999:8). Doniphan's forces eventually moved on to capture Chihuahua City before returning home.

After US forces captured Mexico City in 1847, Mexico was forced to recognize that the war was lost and signed the Treaty of Guadalupe Hidalgo in 1848. The major consequence of the treaty was that the territories of New Mexico and Alta California were ceded to the United States, for which the Mexican government was paid 15 million dollars. The Territory of New Mexico became a US Territorial State in 1850 via congressional action, though it would be more than a half-century before it would become a full-fledged member of union.

The Gadsden Purchase

The Treaty of Guadalupe Hidalgo included several major faults that left southernmost New Mexico in a state of contested ownership. The core of the issue was that the Treaty of Guadalupe Hidalgo was based on the 1847 "Disturnell" map that incorrectly located the border. Updated surveys showed the map to be in error; however, both nations exploited the ambiguity and made claims to the southern strip of land that included the Mesilla Valley. The contested area of land, though narrow, extended across New Mexico and Arizona and encompassed many thousands of square miles of land (Simmons 1977:136).

There were also strong political motivations on the behalf of the US to acquire the additional territory. One such issue was that the area of southern New Mexico and Arizona was a prime transportation corridor, as evidenced by the throngs of migrants passing through on their way to the California Gold Rush. Although still years away, such a route would be ideal for a southern transcontinental railroad route, and such a route was strongly advocated by representatives from southern states (Owen 2005:34-35). The Mesilla Valley was a key geographic link in such a route, as it allowed the only reasonable passage across the Rio Grande.

The final major issue that emerged from the Treaty of Guadalupe Hidalgo was a provision that the US would prevent Indian raids into Mexico, particularly by the Apache. Of course, this provision was unrealistic and such attacks by the Apache still occurred. Mexico therefore demanded financial compensation for the attacks, which the US refused, as direct compensation was not stipulated in the treaty agreement (Department of State 2015).

These issues simmered for nearly five years following the Mexican-American War, keeping tensions high between the two governments. In 1853, the situation appeared to be approaching a crisis as Mexico began to evict Americans from their properties in the Mesilla Valley. The Territorial Governor of New Mexico insisted that the valley was part of the US Territory. The situation escalated when Mexico stationed troops in the Mesilla Valley, and US President Franklin Pierce sent James Gadsden, the newly appointed US Minister to Mexico, to negotiate with Mexican President Santa Anna. The goals of the negotiations were to settle the dispute by acquiring the lands needed for the southern transcontinental railroad and to settle the Mexican claims for compensation for Indian attacks (Department of State 2015).

The negotiations were undertaken throughout the fall months of 1853. Mexican President Santa Anna did not wish to sell any substantial amount of Mexican territory, but needed military funding against ongoing rebellions in Mexico. The initial version of the Treaty called for the US to pay 15 million dollars for approximately 45,000 square miles of territory across southern New Mexico. In addition to selling the desired lands, Mexico would abandon the claims for financial compensation against Indian raids. However, the final version of the Treaty eliminated the various provisions related to Indian raids and reduced the amount of acquired land to 29,670 square miles at a purchase price of 10 million dollars (Department of State 2015). The Gadsden Purchase Treaty was thus finalized on June 8, 1854, and on November 16, 1854 the American flag was raised over the town of Mesilla for the first time (Greenwood and Westerhoff 1985; Ritter and Holden 2014:80-81).

History of the Tularosa Basin before WSMR

After the region became part of the US, most of the regional settlement remained in the Mesilla Valley, while the neighboring Tularosa Basin remained a remote and sparsely settled area that was considered largely uninhabitable due to the constant threat posed by the Apache. Fort Stanton was established along the Rio Bonito in 1855 in order to provide settlers with protection against the Mescalero Apache, but even so, settlement away from the fort in the Tularosa Basin remained a risky affair.

However, by the 1860s, several factors conspired to change the uninhabited nature of the Tularosa Basin. The onset of the Civil War made New Mexico a subject of military interest among both the Union and Confederate armies, and several engagements were fought for control of the Territory. These conflicts eventually saw the Union victorious, and the military presence across the area continued following the end of the war. The establishment of a series of military outposts across the region somewhat ameliorated the Apache threat, and the perceived security encouraged settlers to move into the area between the Sacramento and San Andres mountains.

The earliest Territorial settlement in the Basin began even before the end of the Civil War. In the fall of 1862 Hispanic settlers fled the destruction wrought by the flooding of the Rio Grande in the Mesilla Valley and established a community at the mouth of Tularosa Creek at the western base of the Sacramento Mountains. This community, known as Tularosa, was carefully cultivated by its

Figure 2-12. The inaccurate Disturnell Map of 1847.

settlers and became a permanent oasis of civilization in the basin. By the early 1870s the Apache were largely contained on reservations, which mostly ended the threat of further raids from that quarter (Sonnichsen 1960:15). By the early 1880s, Anglo ranchers, mostly Texans, had discovered the Tularosa Basin, which at the time was especially verdant after several years of higher-than-average precipitation. The Texas cattle growers found in New Mexico a continuation of the open range grazing that was under assault by waves of post-war settlers and farmers in their native state, and these roving cattlemen rapidly established cattle ranching as an industry in the Tularosa Basin (Sonnichsen 1960).

The rise of cattle ranching in the late 19th century eventually led to "range-war" type conflicts that were experienced in New Mexico and elsewhere across the west. In the Tularosa Basin, this saga culminated in the disappearance of Albert Fountain and his son Henry on February 1, 1896. The site of the disappearance is located within WSMR, at a low ridge known as Chalk Hill, which Highway 70 now bisects near the Doña Ana/Otero County line (Eckles 2013:57). Although political rival Albert Bacon Fall and his associates, including prominent area rancher Oliver Lee, were suspected in the case, no convincing evidence tying them to the crime was ever found (Sonnichsen 1960). The Fountain case was a polarizing incident that encapsulated much of life in and around the Tularosa Basin at the close of the 19th century, and endures as a compelling mystery today.

The arrival of the railroad at the newly established railroad town of Alamogordo in 1898 brought the Tularosa Basin into wider contact with the rest of the nation, but after the conclusion of the turbulent events of the 1890s, the area remained little changed during the early years of the 20th century. The main economic activity continued to be cattle ranching, with ranchers relying on a mixture of their own private property and large grazing leases of federal lands in order to make a living in the sparsely vegetated Chihuahuan Desert landscape. The carrying capacity for grazing was calculated at only five or six cattle per 640 acres in some areas of the Tularosa Basin (Eckles 2013:67). With the capacity for grazing so minimal, it took many thousands of acres to make cattle grazing a feasible endeavor for ranching families in the area.

New Mexico became the 47th state of the US on January 6, 1912. Thomas Catron of Mesilla, and Albert Fall, who resided in Las Cruces, were elected as the first US Senators of the state, ensuring that southern New Mexico was well-represented. As a state, New Mexico began to benefit from infrastructural improvements, and a state highway system was well underway by the 1920s. The old trail between Alamogordo and Las Cruces through San Augustine Pass was replaced with US Highway 70 during the 1930s (Wallace 2004:118). However, the lives of the people in Tularosa Basin area were not much affected. The area remained much the same by the time White Sands National Park was established in 1933 to preserve the unique white gypsum dunes that formed from the winds blowing off the Lake Lucero playa in the basin interior.

The Great Depression and the Civilian Conservation Corps

The economic boom of the 1920s came to a disastrous end with the stock market crash of October 1929, which ushered in an international economic downturn that persisted for over a decade. The stock market crash wiped out many investors, which caused consumer confidence to plummet. In turn, most industrial sectors cut production and spending, which led to widespread worker layoffs and wage cuts. Many Americans were faced with repossessions and foreclosures. Nervous bank depositors demanded funds in cash, which caused a series of banking panics during the early 1930s. Numerous banks across the country had insufficient cash reserves and collapsed during these panics, furthering the financial destruction of what became known as the Great Depression. Matters were made worse by the Dustbowl of the 1930s, when drought conditions and unsustainable agricultural practices caused massive dust storms in the southern plains that wiped out many farmers, destroyed croplands, and killed livestock. The Dustbowl caused a mass migration of many plains farmers to cities in search of employment. The national unemployment rate, which was around three percent prior to the market crash in 1929, had risen to over 25 percent by 1933 (Paige 1985). Unemployment was particularly bad among the nation's youth; more than five million young men were unemployed, including many veterans of World War I (Goodfellow et al. 2009:11).

In order to stimulate the country's stagnant economy and address the massive unemployment rate, the incoming Roosevelt administration initiated a series of experimental social and economic programs known as the New Deal. These programs included employment and conservation programs including the Works Progress Administration (WPA), the Civilian Conservation Corps (CCC), and the Tennessee Valley Authority (TVA). Of these programs, the CCC was the most active across the public lands of the western states, including New Mexico.

Through the prompting of the Roosevelt administration, Congress passed the "Reforestation and Relief Bill" that provided the funding and authority for CCC on March 31, 1933 (Heller 2010). President Roosevelt then issued Executive Order 6101, which established the CCC as part of the na-

tionwide Emergency Conservation Work (ECW) agency, the director of which was labor leader Robert Fechner. Projects for the ECW were coordinated through an advisory council that included the Departments of War, Agriculture, Interior, and Labor (Heller 2010). Initially, the ECW managed the CCC as a chain of forest camps where young men were employed in conservation projects that aimed to protect the nation's forested lands. The program expanded through the 1930s to include flood and erosion control projects, transportation improvements, range development, wildlife aid, and the development of public recreational facilities, as well as projects related to disaster relief, historical restoration, and national defense (Goodfellow et al. 2009:11, 18).

Figure 2-13. Colonel Albert Fountain, who disappeared in 1896 within what would later become WSMR (*public domain image)*.

The physical maintenance of the CCC camps and its enrollees was the responsibility of the War Department, which included managing fiscal matters, health, supplies, shelter, transportation, and communication. The Department of the Interior managed CCC camps within national parks and Indian reservations, and managed projects in coordination with the Grazing Service, US Fish and Wildlife Service, Bureau of Reclamation, and General Land Office. The Department of Agriculture managed CCC programs through the US Forest Service and Soil Conservation Service and was responsible for CCC work completed on private lands and in state forests (Goodfellow et al. 2009:12).

Figure 2-14. Albert Bacon Fall during his tenure as senator (*public domain image)*.

The CCC was broken into nine administrative regions, which were based on Army administrative divisions. New Mexico was part of the Eighth Division, which also included the states of Texas, Oklahoma, Colorado, Arizona, and the portions of Wyoming outside of Yellowstone National Park. The Eighth Division headquarters was located at Fort Sam Houston in San Antonio, Texas (Goodfellow et al. 2009:14).

When the CCC was established, the program called for an initial enrollment of 250,000 young men by July 1933. CCC enrollees were selected by the Department of Labor in cooperation with state relief agencies, and the enrollees had to meet the requirements of being unemployed, unmarried, between the ages of 18 and 25, and from families already on state relief programs (Goodfellow et al. 2009:12). Additionally, 14,000 Native Americans were enrolled into the CCC to conduct conservation and stabilization work on reservation lands, and 24,000 Local Experienced Men (LEM) were also selected. The CCC LEM were older men with experience in trades such as carpentry and construction that supervised and trained younger workers. The selection was quickly expanded to include 24,000 WWI veterans, men in their 30s and 40s, which were mostly enrolled into their own

camps. By the end of July 1933, the CCC enrollment had grown to approximately 275,000 (Goodfellow et al. 2009:12).

CCC enrollees were first sent to Army conditioning camps where they were inducted and given physical examinations and aptitude tests. These camps were operated by Army officers reassigned from regular Army training camps and provided the new enrollees with their first exposure to the paramilitary style organization of the CCC. The enrollee's physical conditioning was improved through a five-day physical conditioning program after which they were sent out to their assigned CCC work camps (Goodfellow et al. 2009:12; Heller 2010:446). CCC workers had a six-month enrollment period and had the option of re-enlistment for another six months, up to a maximum of two years. The CCC enrollees worked 40-hour work weeks, for which they were paid $30 a month, $25 of which was sent home to their families. The remaining $5 could be spent by the worker on personal expenses, which were generally minimal since room, board, clothing, and tools were provided by the program (Goodfellow et al. 2009:12).

The CCC was very active in projects across New Mexico; by the end of 1942, the CCC had constructed a total of 1,111 bridges, 465 fire lookouts, 534 dams, 5,938 miles of fencing, 1,867 miles of phone line, 4,649 miles of road, and planted over four million trees across the state (USFS 2020). The CCC was also instrumental in the creation of New Mexico's network of state parks. New Mexico already possessed one National Park and eight National Monuments by the mid-1930s, but lacked any state parks due to lack of funding and manpower (Kammer 1994). Seizing on the opportunity to use Federal funding and CCC labor, Governor Clyde Tingley established a State Parks Commission and spearheaded efforts to build New Mexico's first state parks. Through the work of the CCC, New Mexico established Bottomless Lakes, Hyde, Elephant Butte, Conchas, and Santa Fe River State Parks, and lands were purchased for creation of additional future parks (Richardson 1966; Kammer 1994). The CCC also completed major projects at national parks in New Mexico, particularly at Bandelier National Monument, where the CCC constructed nearly all of the original park infrastructure (Kammer 1994).

Several CCC camps were located in Doña Ana and Otero counties, including locations near Alamogordo, Tularosa, Las Cruces, Orogrande, Radium Springs, Mayhill, and Ruidoso. A CCC camp was also established at White Sands National Park in September 1933 and remained in operation until June 1942 (USFS 2020). Many of these camps were likely re-used by different CCC projects and companies, and the same camp location was likely re-used by different companies and agencies. Camps were identified by several different methods, including the use of nicknames, company numbers, and agency designations, which can make tracking their identities and histories challenging. The military-type companies of the CCC were often on the move to other camps in the region or in other states; therefore, the designations of CCC camps changed frequently as different work programs and companies cycled through them (CCC Legacy 2021).

Many of the camps near Las Cruces and Alamogordo worked on grazing, soil conservation, and reclamation projects. While the CCC is probably best known for its work on Forest Service lands and in state and national parks, the agency also worked on many range improvement projects. As described in a DoD history of the CCC:

Figure 2-15. A CCC worker at the Peñasco CCC camp poses on the camp's sign (*photo by Ralph Cericola, courtesy Lincoln National Forest)*.

> Work for the Bureau of Reclamation involved repairing irrigation systems, building dams, clearing reservoir sites, excavating canals, and building other water control structures. For the Grazing Service, the CCC built water holes, reseeded burned lands, built roads and fences, completed surveys and made maps, and worked on control of insects and predatory animals. Fish and Wildlife Service work was comparable, including construction of water control features, planting cover vegetation, soil erosion control, construction of fire lookout towers and fences and firebreaks, and installation of phone lines [Goodfellow et al. 2009:19].

The CCC completed a number of projects within the boundaries of what would later become WSMR, mostly range improvement and road projects. Eckles (2013:72) describes how the huge "Red Tank" south of Range Road 12 was constructed by a CCC crew. Howard McDonald told him that the CCC crew that built Red Tank worked out of small "side camp" located north of his grandfather's place, which was in a drainage southeast of Mockingbird Gap. McDonald remembered that Red Tank always held water, and that as kids they would dip a can affixed to long piece of stiff wire deep into the tank to get the cool water near the bottom (Eckles 2013:72). Advocational historian David Soules discovered a letter regarding the CCC Mockingbird Gap campsite, which was addressed to the Department of the Interior's Division of Grazing, attention of Mr. Isom Newby in Albuquerque. The letter was dated July 28, 1938, and requested a larger generator so that the men could watch educational films at night. The letter mentioned that 25 men stayed in the camp under command of

Lieutenant King, and camp was considered a "side camp" from the main CCC camp at Carrizozo (Eckles 2013:72). The letter provided some additional details, stating that the existing generator was 350 watts, which was only enough for a few lightbulbs, so the camp used gas lanterns for lighting in several areas. The movie projector the camp wanted to use required 750 watts alone. The desired generator would provide enough power to install electrical lighting across the camp, and the letter even enumerated the proposed lighting system for the camp. According to the letter, the camp would require two 40-watt bulbs for the recreation hall; two 40-watt bulbs for the mess hall; one 40-watt bulb for the kitchen; six 25-watt bulbs for the barracks; one 25-watt bulb for the showers; one 25-watt bulb for the latrine; one 25-watt bulb for the Foreman's quarters; two 25-watt bulbs for the street; and one 40-watt bulb for the tool room (Eckles 2013:72).

The CCC also made improvements to the old route of New Mexico State Highway 52, which originally ran across the Tularosa Basin from the town of Tularosa, through Rhodes Canyon and Rhodes Pass in the San Andres Mountains, to Engle on the Jornada del Muerto. During its operation in the late 1920s and 1930s, the road was mostly dirt and gravel surfaced. The road continued on via NM 51 to Hot Springs, which is now Truth or Consequences (Eckles 2013:309). The CCC improvements consisted of stone retaining walls that supported the road along the canyon wall and stone headwalls for culverts along the road. Similar stone masonry culverts are found in Bosque Canyon (Eckles 2013:309). The modern alignment of the road through Rhodes Canyon has abandoned some segments of this old road for ease of maintenance, moving some sections to the canyon floor where it can be graded and maintained with earthmoving equipment. While they worked on the NM 52 alignment, the CCC workers were housed in a tent camp in Rhodes Canyon, which was located off the south side of the road northwest of Rock House Spring, which was west of the Potsy Potter home and gas pump (Eckles 2013:84, 309). This CCC camp has been recorded as LA 144346. The two stone pillars that once supported the gate into the camp are still visible today (Eckles 2013:84).

The CCC also developed a recreation area at Ropes Spring on the west edge of WSMR, located north of the NASA site and near the base of San Andres Peak (Eckles 2013:84). The Ropes Spring camp was supposedly a recreation area for CCC workers on leave. Ropes Springs usually has a flow of water in a shaded area of brush and trees. The CCC improved the area by building concrete picnic tables, each with its own fire grate and a water spigot. The water is supplied by a pipeline that connects to a storage tank located upslope from the picnic tables. Below the picnic area is a swimming pool that was probably filled using water from the same pipeline (Eckles 2013:84). The ruin of a large building is located above the picnic area with a center entry foyer area flanked by smaller rooms on both sides, perhaps a dining hall or a dormitory. South of these facilities is a large collapsed wood privy structure, along a with smaller privy of stone masonry construction. The smaller stone privy has roofline that somewhat resembles a castle parapet (Eckles 2013:84).

The work programs of the CCC shifted during the late 1930s and early 1940s. The ECW, the parent agency of the CCC, was officially renamed after its flagship program in 1937, which established the CCC as an official agency within the federal government. Throughout the remainder of its existence, the CCC placed a stronger emphasis on education and vocational training than the original ECW "forest camp" program (Goodfellow et al. 2009:11). By 1940, the US economy had begun to improve and defense spending had increased due to the portents of WWII. The unemployment rate had fallen, which diminished the need for New Deal programs such as the CCC. In 1939, Congress passed an act that funded the CCC through mid-1943, but dissatisfaction and desertion among the enrollees had increased (Goodfellow et al. 2009:14). In 1940, President Roosevelt issued

a limited national emergency after Germany invaded France, and the CCC quickly shifted towards defense-related projects. Military drill was instituted at camps, and enrollees received more course instruction in military-related tasks such as radio operation, aircraft maintenance, first-aid, construction, and demolition (Goodfellow et al. 2009; Heller 2010). After the surprise attack on Pearl Harbor on December 7, 1941, all CCC camps were dedicated to work on military projects. The CCC provided a "paramilitary pool" that significantly expedited the war mobilization. The recruitment and processing of CCC enrollees had prepared the Army for induction of wartime draftees, and provided junior officers with mobilization and leadership experience. The military also found that volunteers and draftees with CCC experience were well suited for leadership positions as noncommissioned officers. Even outside the military, the skills and work ethic of former CCC workers were valuable assets to the wartime work force (Heller 2010). America's entry into WWII essentially ended the CCC, and all conservation work off military reservations, with the exception of firefighting, was canceled as of January 1, 1942. Due to the ongoing war effort, Congress voted to end the CCC program on June 30, 1942 (Goodfellow et al. 2009:15).

With its open air space and reliably clear weather, the Tularosa Basin was an ideal place for training military pilots. The first flight training facility was already under development for the training of British pilots when the US entered the war in December 1941. The training school was subsequently re-directed into the Alamogordo Army Air Field and US bomber flight crews began training there in May 1942 (Kennedy 2009:19). The greatest conflict of the 20th century would bring many changes to the Tularosa Basin, and would also re-define concepts of offensive and defensive weapons for the remainder of the century.

The Establishment of White Sands Missile Range

Two independent developmental rocket programs required the Army to establish a sizeable overland test range in 1945. One program was domestic in origin and based in research conducted at California Institute of Technology (Caltech). The other was captured technology from the German rocket and missile program that made its way to the US at the end of WWII.

The Caltech rocket program started in 1936, when J. Frank Malina, a graduate student from the Caltech Guggenheim Aeronautical Laboratory (GALCIT), and a group of students under the guidance of Dr. Theodore von Karmen initiated research into rocket propulsion. The GALCIT group made steady progress, and in 1939 the group began work on Jet-Assisted Take-Off (JATO) units for aircraft. This early JATO work was first supported by the National Academy of Sciences, but as the war in Europe began to loom larger the Army Air Corps offered support for the JATO development (Carroll 1974:3). The emphasis on developing a workable JATO unit shifted the GALCIT group's focus away from liquid-propellant and towards long-burning solid propellant, whose simplicity and economy was required for the expendable JATO unit.

GALCIT successfully developed solid propellant JATOs for delivery to both the Navy and Army Air Corps. The commercial production of JATO units was not practical under the auspices of GALCIT, so in 1942 GALCIT project personnel founded Aerojet Engineering Corporation. Meanwhile, the completion of the JATO solid propellant work left GALCIT available for new projects, and news of the German missile program from Europe inspired Von Karmen to further the liquid propellant research. Von Karmen, J. Frank Malina, and Hsue-Shen Tsien prepared a memorandum outlining the proposed liquid-propellant work in 1944 (Carroll 1974:7). This memorandum was the first GALCIT document to use the title of Jet Propulsion Laboratory (JPL).

The JPL memo was a major turning point for US rocket and missile development. The German use of missiles in Europe was the major focus of the Army Ordnance Department Guided Missile Program and the JPL memo received a very positive reception by Army Colonel George W. Trichel of the Rocket Development Branch of the Army Ordnance Department, who developed a contract to expand the JPL liquid propellant research effort (Kennedy 2009:14; Miles 1961). This contract was the Army Ordnance-California Institute of Technology (ORDCIT) contract with Caltech, which was instrumental in the development of the liquid propellant Private test vehicle series. The Private A launches were conducted at Leach Springs, a location within Camp Irwin, California in early 1944. The next ORDCIT rocket, the Private F, was launched at the Hueco Range at Fort Bliss, Texas.

The next ORDCIT experimental prototype was the Corporal series, which was a larger and more powerful rocket that required a larger range in order to test it safely (Kennedy 2009:16; Miles 1961). Early scale model tests of the rocket were conducted in California, but the projected range of the full-size rocket required a larger overland test range. Concurrently, intelligence gained through the course of WWII further emphasized the need for enhanced missile testing facilities comparable to those used by Germany.

As hostilities drew to a close in Europe, the US was able to capture parts, equipment, and research materials from the German V-2 rocket program at Mittelwerk prior to the Russian advance into eastern Germany. Additionally, Werner von Braun, chief scientist of the German missile program, and key members of his staff surrendered to Allied forces on May 2, 1945 (Eidenbach et al. 1996).

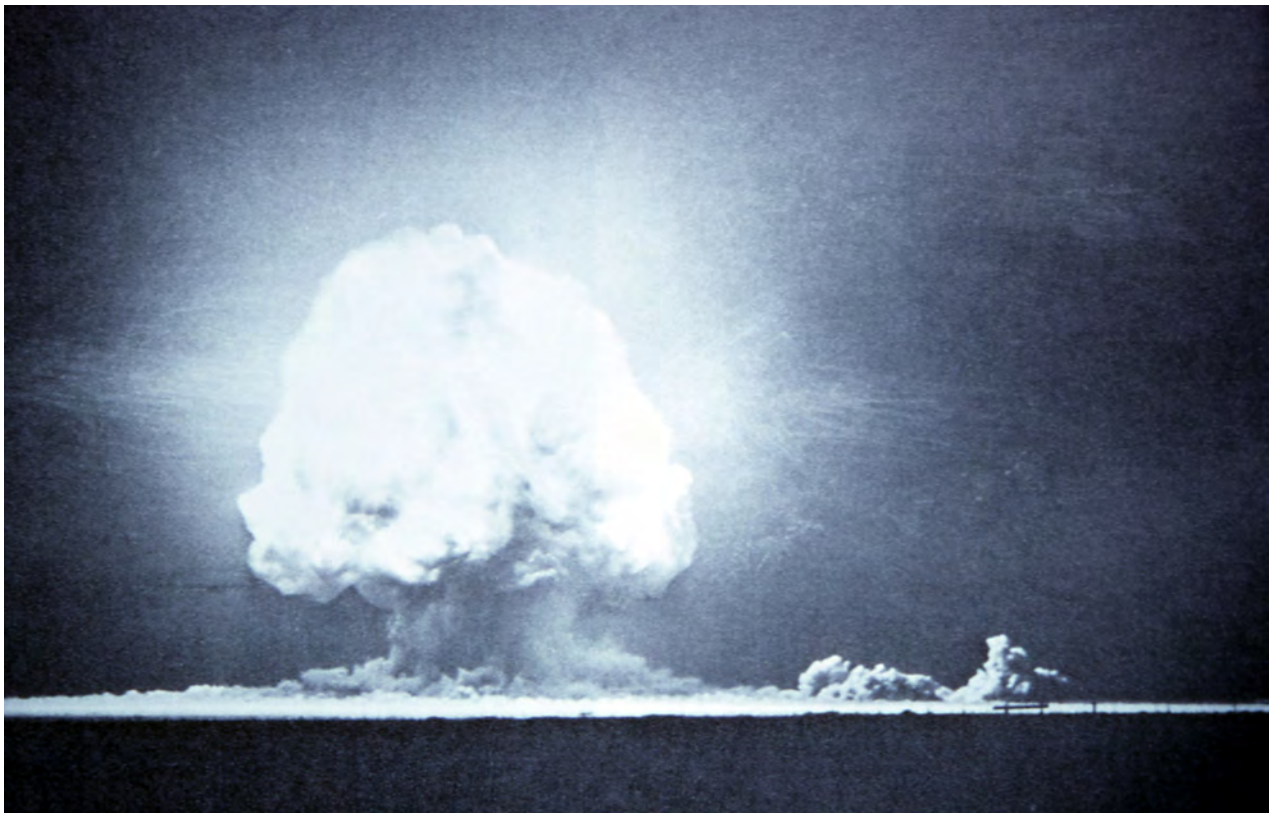


Figure 2-16. The flash and mushroom cloud of the world's first atomic bomb at the Trinity Site (*image from the New Mexico Air and Space Museum)*.

With both the parts and the minds behind the V-2 program in hand, the US now possessed the means to accelerate the rocket research the ORDCIT program had begun. In support of this, Project Hermes was established by the Army in 1944 as a parallel program to ORDCIT with General Electric (GE) selected as the prime contractor. Both programs required a suitable testing and proving ground; the Army began to search for an appropriate location for a new test range (Kennedy 2009).

The proposed proving ground required flat and open ground, a sparse population, and predominantly clear weather. Other preferred characteristics included surrounding hills or mountains for observation sites and natural barriers, access to railroad lines and utilities, and proximity to an established military post for support. The Tularosa Basin was identified as the best choice, possessing nearly all of the desired characteristics. The location was selected in February 1945 and named White Sands Proving Ground (WSPG) after the adjacent National Monument. Some of the land in the proposed proving ground was already under federal lease, and additional property was acquired from private landowners in the area via annual lease payments. The lease payments for the use of the ranchers' properties were used in lieu of outright purchase of their lands, as the range was conceived as being a temporary extension of the existing bombing ranges, and it was believed that the new missile mission would eventually be completed (Eckles 2013:87). This, of course, was not the case and the formation of the new proving ground effectively ended the ranching lifestyle in the Tularosa Basin which dated back to the 1870s. WSPG was formally established on July 9, 1945 — on July 16, 1945 the world's first atomic bomb was detonated at the Trinity

Figure 2-17. J. Frank Malina stands by the WAC Corporal launch tower at LC-33, 1945 (*US Army photo)*.

Site in the northern portion of the new range. The flash and rumble of the Trinity explosion was reported as far away as Silver City, New Mexico and El Paso, Texas (Sonnichsen 1960).

On September 26, 1945 the ORDCIT project launched a Tiny Tim rocket modified as a booster for the WAC Corporal at the newly established WSPG, the first rocket launched at the new range (Kennedy 2009:29). On October 11, 1945, the first fully fueled WAC Corporal launch reached an altitude of 235,000 ft, the altitude record for an American rocket at the time (Kennedy 2009:29). Meanwhile, the first of the captured V-2 materials were transported to the range and GE personnel working under Project Hermes began to sort, catalogue, clean, and assemble the various German missile components. Parts that were missing or damaged were fabricated as needed. The program progressed quickly, and the first American launch of a V-2 missile took place at WSPG on April 16, 1946 (Kennedy 2009:29).

WSPG grew slowly through the late 1940s in part due to post-WWII defense cuts, but experienced a period of accelerated growth during the 1950s. This was due in part due to increased defense spending in response to the Korean War, as well as the developing Cold War arms race with the Soviet Union. Renamed as White Sands Missile Range in 1958, the range experienced a peak period of activity during the early to mid-1960s, when it supported a wide range of test programs that included anti-tank systems, anti-aircraft systems, a variety of ICBM interceptor R&D programs, as well as supporting numerous research-driven upper atmospheric and space exploration programs.

Activity at WSMR slowed somewhat during the 1970s, due to a variety of factors. Arms limitation agreements diminished work in ICBM interceptors and related detection systems, the end of the Vietnam War marked a period of diminished defense spending, and the US manned space program entered its post-Apollo era. However, RDT&E efforts continued at WSMR, and several programs that became notable during the first Gulf War, such as the Patriot and MLRS, were initiated at WSMR during the 1970s.

The Strategic Defense Initiative (SDI) of the Reagan administration marked a period of renewed defense research and the last burst of Cold War activity at WSMR. The SDI sought to develop next-generation defense systems that would diminish the threat posed by nuclear warhead equipped ICBMs and alter the dynamic of mutually assured destruction that had defined most of the Cold War. The SDI program never produced a functional system, but proponents of the effort hold that it hastened the end of the Soviet Union by forcing it to invest in unproductive defense programs that overburdened its already stagnant economy (Lavin 1998:58; Salmon 2011:28; 32).

In DoD guidance, the year 1989 is generally acknowledged as the end of the Cold War period, when revolutions against the Communist regimes in Poland, Hungary, East Germany, Bulgaria, Czechoslovakia, and Romania initiated the dissolution of the Warsaw Pact and the Soviet Union. However, the Soviet Union was not officially dissolved until December 26, 1991. Even after the collapse of the Soviet Union in 1991, many SDI initiatives carried momentum into the post-Cold War era and became developmental programs at WSMR. Examples of these systems include the Theater High Altitude Area Defense (THAAD) missile, a modernized BMD system, and the Tactical High Energy Laser (THEL) System (Eckles 2013). Today, WSMR remains an important proving ground for the Army and other branches of service, and a significant source of employment for the neighboring communities of Las Cruces and Alamogordo.

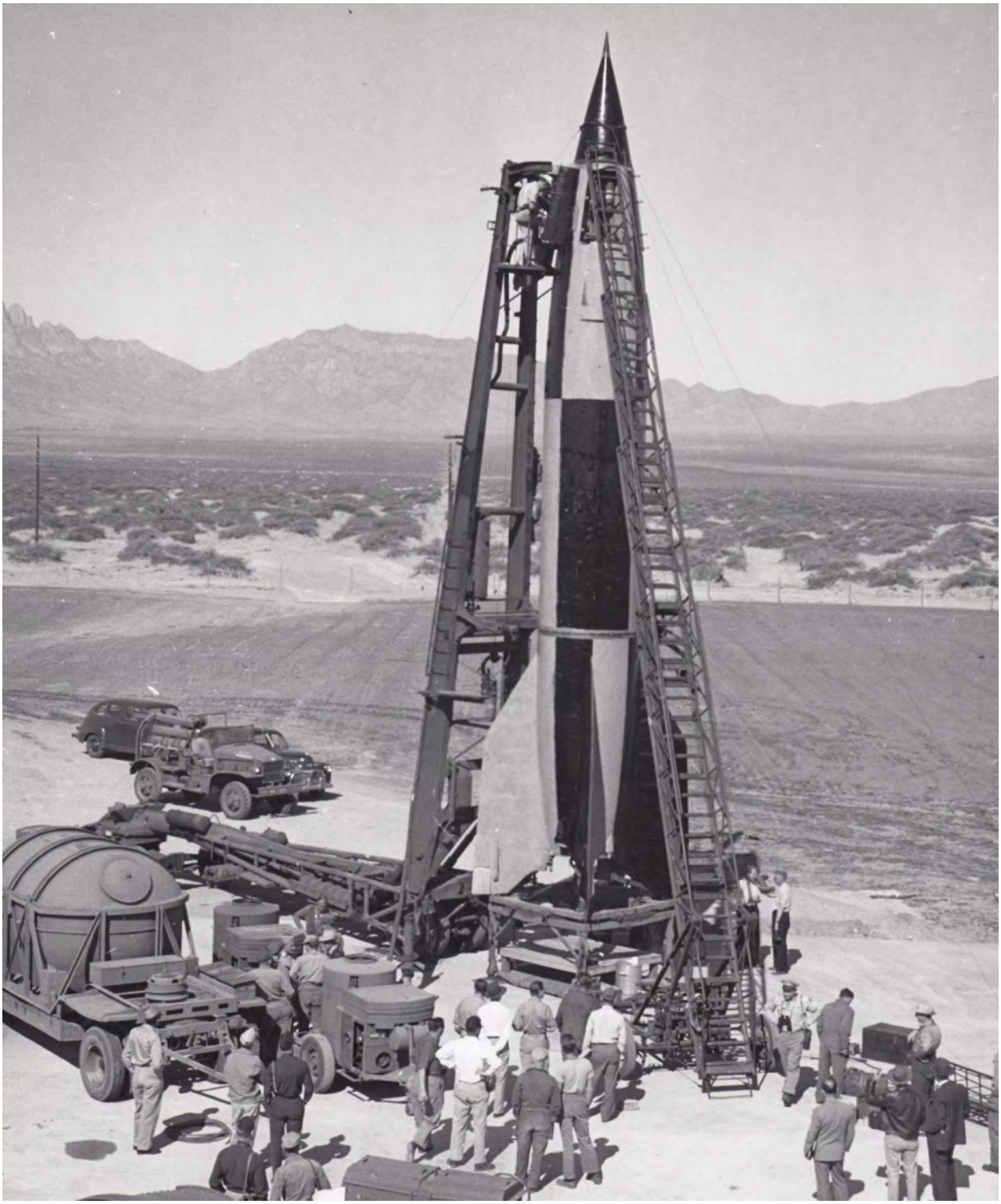


Figure 2-18. V-2 #2, the first actual American V-2 launch, on the launchpad at LC-33, April 1946 (*photo courtesy WSMR Museum Archives)*.

2.4 Mission Statement

WSMR is the DoD's largest, fully-instrumented, open-air range. The Range provides America's Armed Forces, allies, partners, and defense technology innovators with the world's premiere research, development, test, evaluation (RDT&E), experimentation, and training facilities to ensure our nation's defense readiness.

The mission of WSMR, as defined in Development Test Command (DTC) Regulation 10-6, is to "plan, conduct, analyze, and report the results of developmental tests, production tests, and other tests….to authorized customers within the DoD, outside the DoD, and to domestic and foreign governments and nongovernmental organizations" (WSMR 2009). DTC Regulation 10-6 lists the primary capabilities for which facility and technology investments will be made to maintain WSMR as a primary site for the following test programs:

- Aircraft systems-aircraft armaments fixed wing;
- Command, control, communications, computers, intelligence, surveillance, and reconnaissance;
- Directed energy weapons (high-powered microwave, lasers);
- Air/missile defense systems (surface and air-launched platforms);
- Missile/rockets (non-aviation, non-line of site);
- Systems of systems integration (Future Combat Systems, Brigade Combat team level);
- Electromagnetic environmental effects, electromagnetic interference and electromagnetic compatibility, and electromagnetic pulse; and
- Nuclear weapons effects.

2.4.1 Present Mission(s)

WSMR supports approximately 3,200 to 4,300 test events (or missions) annually (WSMR 2009). These include "Hot" missions, which are potentially hazardous and require the evacuation of personnel and all non-participants during the event. A majority of the missions are "Non-hot" missions, which include a wide variety of activities, such as ground checks, communication checks, aerial cable missions, soldier training, and unmanned aerial vehicle flights. For additional details regarding the present missions and range conditions see https://www.wsmr.army.mil/.

2.5 Mission Activities that may Affect Cultural Resources

Military missions have the potential to damage cultural resources through direct impacts (e.g., grading an archaeological site or demolishing a building) or indirect impacts (e.g., increased erosion at archaeological sites due to increased foot and/or vehicle traffic, or vibration effects to buildings from nearby construction activities). The following sections outline common mission activities that are likely to affect archaeological sites and historic architectural properties on WSMR.

2.5.1 Activities Likely to Affect Archaeological Sites

A majority of WSMR's cultural resources are located on or near the present ground surface and are therefore subjected to variety of surface and subsurface disturbances from activities. Common mission related activities which may adversely affect archeological sites include:

- Ground disturbance, including erosion, resulting from the construction, demolition, operation, and maintenance of facilities or training areas;
- Disturbance from ordnance impacts, missile testing, and ordnance recovery efforts;
- Disturbance from firefighting activities;
- Disturbance and damage from military maneuvers and training exercises; and
- Cumulative disturbance from recreation or training exercises which result in an increased number of personnel on the site, potentially accelerating erosion.

2.5.2 Activities Likely to Affect Architectural Properties

Facility and infrastructure construction and demolition are the principle activities that could impact historic architectural properties on WSMR. These activities include:

- Foundation or trench excavation, grading or filling, asphalt removal, heavy machinery movement, soil compaction, and renovation of historic buildings or facilities;
- The construction of new structures or additions to structures with designs that are not compatible with the existing historic properties, particularly properties located within the boundaries or viewshed of historic districts and/or landmarks;
- Vibration effects from construction and blasting, vehicle traffic, and aircraft overflights;
- Avoidance and/or neglect of historic buildings and structures resulting in deterioration and a loss of integrity, both of which are considered adverse effects under 36 CFR 800.5.[a][2][vi].

2.6 Program Responsibilities

WSMR is responsible for managing cultural resources on approximately 2.2 million acres in accordance with applicable Federal laws, regulations and guidelines as discussed in this ICRMP. AR200-1 "Environmental Protection and Enhancement" outlines responsibilities at all levels, in addition to specific cultural resource program goals and requirements. The CRM is responsible for coordinating compliance with cultural resources laws and regulations, and administering this ICRMP on behalf of the GC.

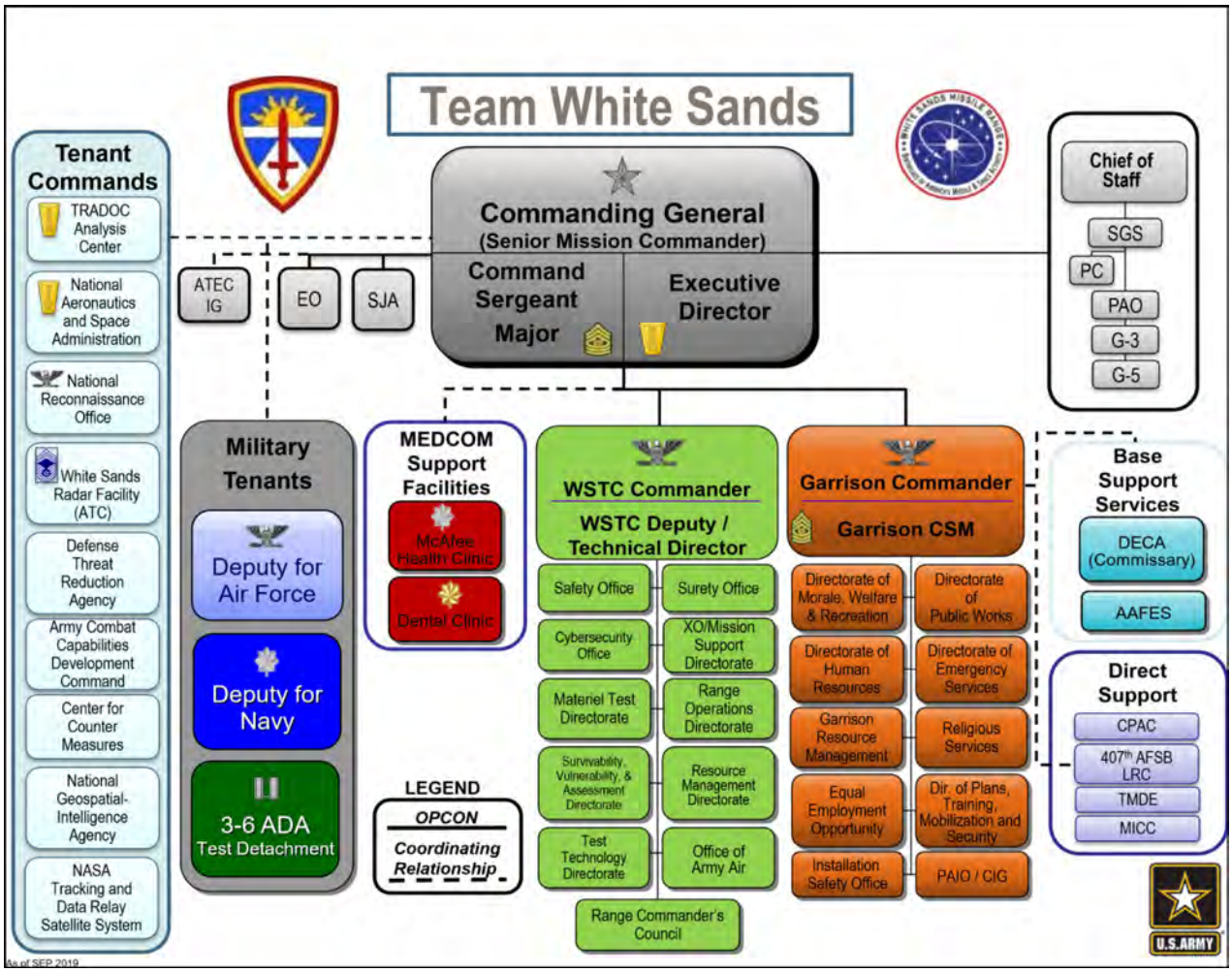


Figure 2-19. Team WSMR Command Structure.

2.7 Installation Organization

WSMR is comprised of several organizations, each with specific responsibilities, but together function as a team, *Team WSMR*, to give WSMR a unique set of capabilities. Figure 2-19 shows the organizational structure of these elements. The administrative infrastructure described below includes military, civilian, and contractor organizations, tenants, and customers on WSMR that are important to or have an interest in the ICRMP and its implementation. It is important to note that while all of these organizations have real or potential effects on WSMR's cultural resources and thus affect conservation management, the Conservation Branch of the Environmental Division is the organization primarily responsible for the development and implementation of this ICRMP. The involvement of other organizations in the ICRMP is indirect and coordinated by the Environmental Division.

The WSMR Chief of Staff and several tenant and support organizations report to the WSMR Technical Director. White Sands Test Center reports to the Commanding General. The WSMR Garrison Command is part of IMCOM-Readiness. IMCOM is now one of the major subordinate commands of the Army Materiel Command (AMC).

2.7.1 Commanding General

Leadership at WSMR is provided by the Commanding General, the Test Center Commander, and the GC. The Command Sergeant Major and the Executive Director work directly with the Commanding General, and the Chief of Staff reports to the Commanding General. The Test Center and Team WSMR members also report to the Commanding General. Day-to-day direction is provided under the auspices of Team WSMR, which is comprised of the leadership, the Deputies for Navy and Air Force, and members of primary organizations located at WSMR.

2.7.2 Garrison Commander

The GC is responsible for administration of many day-to-day and ongoing functions for the entire range, including administration, human resources, public works, resource management, planning, and infrastructure maintenance. The GC is also responsible for maintaining compliance with military requirements, including equal opportunity employment, range law enforcement/fire services, religious services, and legal services.

While the installation as a whole is responsible for implementation of and compliance with federal and DoD/Army executive orders, laws, and regulations, the ultimate responsibility rests with the GC who serves as approving official and signatory for this ICRMP. This office is responsible for helping to ensure that the ICRMP receives range wide dissemination and support.

There are nine directorates and offices under the administration of the GC. Those discussed below have responsibilities or are affected by aspects of the ICRMP.

Directorate of Public Works

The Directorate of Public Works (DPW) provides support services to include public works services, limited missile test support, and environmental conservation and compliance programs to Team WSMR elements and organizations.

The ***Operations and Maintenance Division*** provides support throughout WSMR for all facilities, roads, pavements, grounds, environmental, and electrical and water support including the full range of public works services; commercial and test mission support are also provided by this division.

The ***Environmental Division*** provides comprehensive customer support by ensuring employee and manager awareness of and compliance with environmental programs. The division provides leadership, management, and supervision of personnel and resources to ensure that all policies, procedures, plans, and programs support the WSMR mission and are in compliance with applicable environmental EOs, laws, regulations, policies, and guidance.

The ***Customer Support Branch*** is responsible for ensuring that environmental and safety considerations are a part of all WSMR activities and decision-making activities through the review and assessment of proponents' NEPA documentation. The branch provides training and awareness to ensure minimal risk to all people involved and to the environment as a whole. The branch is responsible for the planning, development, and execution of the Division's Information Technology Program.

The ***Compliance Branch*** oversees WSMR Environmental Compliance, Restoration, and Pollution Prevention programs. Branch responsibilities involve managing compliance with federal and state environmental laws and regulations regarding hazardous and toxic materials management, spill prevention and control, hazardous waste cleanup, and safe drinking water. Additionally, this branch manages a Pollution Prevention Program to ensure minimization of hazardous waste streams and other pollutants; it also manages WSMR's clean-up program. The branch is responsible for planning and reporting provisions of the Emergency Planning and Community Right-to-Know Act/ EO 12856 – A Joint Service Document, August 1994 that involves reporting releases of chemicals listed in the Emergency Planning and Community Right-to-Know Act Toxic Release Inventory at DoD facilities. Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, DoD facilities investigate and clean up releases of hazardous substances using Defense Environmental Restoration Account funds authorized by Congress.

The ***Conservation Branch*** administers the WSMR Cultural Resources Program, in accordance with federal, state, and local laws and regulations and EOs. In addition to developing, maintaining, and implementing the ICRMP, branch responsibilities include the management, enhancement, monitoring, protection, and restoration of various historical and archaeological resources. The branch serves as the liaison with the New Mexico Department of Game and Fish (NMDGF) and San Andres National Wildlife Refuge and provides consultation for the ESA, Migratory Bird Treaty Act, and Clean Water Act–Section 404.

The Branch is the principal installation advisor on environmental stewardship matters to ensure all test operators are aware of environmental stewardship responsibilities and conduct their activities accordingly, within all applicable guidelines and laws. It provides technical assistance, expertise, and monitoring on all operations to ensure compliance with environmental stewardship considerations. It provides environmental stewardship training and public awareness activities and oversight of conservation resource law enforcement. It is in charge of all cultural resource management logistics.

The Branch must be consulted for guidance on all issues related to cultural resource management. Implementation of cultural aspects of the ICRMP is the responsibility of the CRM who are government employees, qualified under the terms of 36 CFR 61. Implementation is ensured through effective coordination of procedures outlined in SOPs (See Chapter 4) into the daily operation of WSMR. CRMs serve as the point of contact for all program reviews, internal and external, related to cultural resource compliance with all outside agencies and internal directorates. Installation support, tenants, and contractors must coordinate all ground-disturbing and historic building actions with CRMs prior to implementation of any project.

Also involved with cultural resources management is the Native American Coordinator/CRM who manages consultations with recognized Native American tribes with an interest in the land now occupied by WSMR. Tasks may be delegated to a similarly qualified individual for specific actions.

Directorate of Morale, Welfare and Recreation

Among its responsibilities, the Directorate of Morale, Welfare and Recreation plans, organizes, and conducts recreation activities on WSMR. The directorate's programs do not include outdoor recreational activities other than those around the Main Post, such as golf, skeet, tennis, and others.

Directorate of Emergency Services

The Directorate of Emergency Services provides law enforcement, physical security, and fire support to the WSMR community. The ***White Sands Police Operations Division*** is responsible for coordinating daily operations of law enforcement patrols, physical security, and the Police Station. The directorate is responsible for enforcing state and federal laws and regulations, including those relating to WSMR security, access and control, cultural resources, and outdoor recreation. It is also responsible for maintaining a liaison with NMDGF Law Enforcement staff and, in coordination with and under the oversight of the Conservation Branch, for enforcing its regulations. The directorate controls access to restricted areas, patrols areas of security interest, provides ARPA enforcement, provides staff training for WSMR-specific resource identification, and administers the security badge, photo permit, and visitor control programs. ARPA training has been provided to some game wardens through the Federal Law Enforcement Training Center.

Directorate of Plans, Training, Mobilization and Security

The Directorate of Plans, Training, Mobilization and Security is the principal Garrison staff agency for all matters concerning security, plans, operations, antiterrorism/force protection, operations security, and emergency management. The ***Intelligence and Security Division*** administers Garrison security programs to include Security Education and Training, Personnel Security, and Information Security. The ***Plans and Operations Division*** prepares and coordinates operational, emergency, disaster, and force protection policies and directives. The ***Plans, Analysis, and Integration Division*** conducts analytical reviews, monitors Army base-line standards, captures and enables implementation of best business practices, and identifies, tracks, and orchestrates reporting of performance measures.

Directorate of Human Resources

The Directorate of Human Resources executes individual, family, and community support services and programs for Team White Sands. The directorate coordinates, recommends, and provides authoritative analysis, advice, and services, enabling commanders and directors to provide leadership in executing their military and civilian personnel management responsibilities.

Garrison Resource Management

Garrison Resource Management oversees resource allocations and all support activities, including budget formulation, control, and execution; accounting policy; funding manpower resources; developing installation support agreements; providing customer service for payroll; monitoring the government travel card program; and providing accountability to the public.

2.7.3 Cultural Resources Manager (CRM)

The CRM, designated by the GC and delegated authority under AR 200-1, is the cultural resource lead and the administrator of the ICRMP. The CRM acts on behalf of the GC to coordinate compliance with this ICRMP. The CRM must meet the qualifications under the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS 2020). Chapter 6, Implementing the ICRMP, identities the responsibilities of the CRM. The CRM is located in the DPW-Environmental Division. As the individual responsible for the administration of this ICRMP, the CRM coordinates with users and interested parties to ensure compliance with cultural resources laws and regulations on WSMR.

2.8 WSMR Tenants and Other WSMR Organizations

WSMR tenants have a role in implementing this ICRMP as it is their responsibility to meet or exceed compliance requirements and to abide by established land management policies in all of their activities on WSMR. WSMR has NHPA Section 106 authority over all operation, agencies, or branches operating on their property.

2.8.1 The Research and Analysis Center (TRAC)

The Research and Analysis Center (TRAC) conducts operations research and analysis to inform decisions about the most challenging issues facing the Army and the DoD. TRAC is a direct reporting unit to the Army Futures Command (AFC) and comprises four centers located throughout the United States. TRAC-White Sands Missile Range (TRAC-WSMR) is one of the four centers and is led by a civilian SES director. TRAC-WSMR is located at WSMR, New Mexico, and has historically conducted operations analysis from the individual Soldier to Brigade level. TRAC-WSMR develops and maintains scenarios to underpin Army concepts and requirements; develops, configures, manages, and applies models and simulations; and researches, develops, and shares new analytic methods and modeling. TRAC collaborates across a network of Army, DoD, and multinational partners to enable our Soldiers to win our nation's wars.

2.8.2 National Aeronautics and Space Administration (NASA)

Located on the southwest corner of the White Sands Missile Range is NASA's White Sands Test Facility (WSTF). WSTF maintains a key role in America's space program and space-related technology by conducting tests on materials and components required in today's innovative space vehicles and advancing the use of rocket engines that use nontoxic fuels through testing and evaluation.

An award-winning site, NASA's White Sands Test Facility is a diverse testing facility used in support of NASA, other government agencies, the US military and private industry. The facility is a remote component facility of the NASA Johnson Space Center in Houston.

Located on 28 square miles, the White Sands Test Facility is a self-contained and remote testing entity. The facility has five core test capabilities: rocket propulsion testing, hypervelocity impact testing, propellants and aerospace fluids testing, oxygen systems testing and composite pressure systems testing. NASA's White Sands Test Facility maintains a full-service facility for precision cleaning, repair and functional testing of fluid components. WSTF's Hardware Processing Component Services Section (CSS) is responsible for the disassembly, cleaning, maintenance, reassembly and testing of pressure relief and pressure safety valves in compliance with American National Standards Institute (ANSI) National Board Inspection Code (NBIC)/NB-23. After meeting the NBIC Part 3, Section 1 requirements, the WSTF Hardware Processing CSS is an approved "VR" certified facility holding the NBIC Certificate of Authorization and "VR" symbol stamp for the repair of pressure relief valves.

A key player in the space program since 1964, the test facility has created technical support capabilities for its customers, including chemistry and metallurgical laboratories, fabrication shops and clean rooms, which support the analysis, cleaning, refurbishment and calibration of equipment, hardware and test materials to stringent specifications. WSTF personnel have created safe system design and operations courses for oxygen, hydrogen, hypergolic propellants and other aerospace

fluids and provide numerous opportunities for training and technology transfers of this information to other government agencies and private industry. NASA and contractors are all Occupational Safety and Health Administration Voluntary Protection Program Stars, denoting commitment and excellence to a safe work environment.

The facility maintains and operates nine rocket engine system test stands, six with long-duration, high-altitude simulation systems. In addition to existing hypergolic propulsion systems, WSTF also operates propellant supply systems for liquid oxygen, liquid methane and other hydrocarbons to enable testing of environmentally friendly, nontoxic rocket engines and propulsion systems. Other capabilities include a high-energy blast facility, oxygen-enriched atmosphere test facilities and hypervelocity impact test facilities. The site's hypervelocity testing is invaluable to NASA's understanding of micrometeoroid and orbital debris impacts to spacecraft to ensure the safety of crew and cargo. WSTF is engaged in extensive testing efforts to evaluate the compatibility of materials being considered for use in aerospace applications, including flammability and ignition susceptibility in varied atmospheres, off-gassing and out-gassing, thermal stability and toxicity. WSTF is involved in the evaluation and test of composite pressure systems safety, damage tolerance and use-life evaluation.

2.8.3 White Sands Test Facility (WSTF)

The White Sands Test Facility (WSTF) maintains a key role in America's space program and space-related technology by conducting tests on materials and components required in today's innovative space vehicles and advancing the use of rocket engines that use nontoxic fuels through testing and evaluation.

2.8.4 ATEC Inspector General

The Office of the Inspector General, WSMR serves as the eyes, ears, voice and conscience of the Commander, and determines the state of discipline, efficiency, economy, morale, training, and readiness throughout the command, and provides assistance, on an area basis, to Commanders, Soldiers, Family Members, Civilian Employees, Retirees, and others who seek help with problems related to the US Army.

The Inspector General operates within the directives of the Commanding General in accordance with Army Regulation 20-1, Inspector General Activities and Procedures. The IG provides four functions of Assistance, Inspections, Investigations, and most importantly Teach and Train the command on a wide range of issues while maintaining the confidentiality of all concerned.

2.8.5 US Army Garrison

The US Army Garrison is a professional and disciplined team of experts that provides first-class customer service to our community, focused on our uniformed Military, their Families, the DOD Civilians, and our retirees, in order to build readiness today and into the future.

Director of Emergency Services (DES)

The Directorate of Emergency Services is committed to providing a law enforcement and fire protection workforce of professional, knowledgeable, service driven people working together and with our local, state, and federal partners to be the best emergency services unit possible.

Directorate of Family and Morale, Welfare and Recreation (DFMWR)

US Army Family and Morale, Welfare and Recreation (F&MWR) is committed to providing the WSMR community with quality of life programs to meet family, leisure and recreational needs. We believe that Soldiers and their families are entitled to the same quality of life as is afforded the Americans they are pledged to defend. Keeping an Army ready to fight and win takes more than hard work and training. Soldiers need a balance of work and play. US Army F&MWR is proud to have the unique opportunity to serve Army, Navy, Air Force, DoD, Contract personnel and their families through the F&MWR services provided at WSMR.

Directorate of Human Resources (DHR)

The mission of the Directorate of Human Resources is to maintain the readiness and resiliency of Soldiers, Families, and DoD Civilians by developing, coordinating, and delivering world-class services and support in the areas of military personnel, the Army Substance Abuse Program (ASAP), Administrative Services, the Army Continuing Education System (ACES), as well as providing development and training of the garrison civilian workforce through the Workforce Development (WFD) program.

Directorate of Plans, Training, Mobilization, and Security (DPTMS)

The Directorate of Plans, Training, Mobilization & Security executes Army G2 security programs, plans and executes the emergency management, antiterrorism, and deployment/redeployment programs, coordinates and tracks the execution of tasks and orders, and operates tactical training ranges and facilities in order to ensure WSMR retains the capability to train Soldiers and test equipment.

Directorate of Public Works (DPW)

The mission of the Directorate of Public Works is to provide base support services to include public works services, limited missile test support and environmental conservation/compliance programs to Team White Sands elements and organizations with specialties in:

- Master Planning
- Engineering services in design and construction
- Energy management
- Pollution prevention
- Environmental resource management
- Utility services
- Roads and grounds services
- Facility operations, maintenance and repair
- Housing service

Equal Employment Opportunity (EEO)

The mission of the Equal Employment Opportunity Program is to promote equal opportunity in employment for all employees and applicants for employment, and to contribute to a discrimination-free workplace that embraces diversity and inclusion. We implement, support, and educate the workforce about the laws and policies mandating equal opportunity for all individuals, irrespective of race, religion, color, sex, national origin, age, disability, genetic information, or reprisal (prior EEO activity). We proactively respond to the needs of the WSMR workforce and its leadership by promoting an inclusive and respectful work environment and fostering a professional culture that values diversity and productive conflict resolution in support of the WSMR mission. The EEO Office advises the Senior and Garrison Commanders on EEO and affirmative employment, processes EEO complaints filed by WSMR employees, assists employees and managers with requests for reasonable accommodation of disabling conditions, and provides EEO training to the WSMR workforce.

Garrison Safety Office (GSO)

Combined office with Installation Safety. The top priority of the Garrison Safety Office is to safeguard and protect service members, their families, civilian employees and Army property as well as to create the safest workplace and living environment possible.

407th Logistics Readiness Center (LRC)

The Logistics Readiness Center manages the development, coordination and supervision of logistic functions for the Installation, Senior Mission Commander, satellite and tenant activities. We direct operations of supply, transportation, maintenance, ammunition quality assurance, logistical planning, and other services and related matters. LRC advises the 407th AFSB, Garrison Commander, and Senior Mission Commander on matters pertaining to logistical support.

Plans, Analysis, and Integration Office (PAIO)

The Plans, Analysis, & Integration Office provides ongoing oversight of assigned programs; conducts analytical reviews; monitors Army baseline standards; captures and enables implementation of best business practices; identifies, tracks, and orchestrates reporting of performance measures; and integrates and optimizes use of technology. This office is the Garrison Commander's focal point for strategy and management planning for the installation.

Garrison Resource Management (GRM)

The Garrison Resource Management is here to provide professional analysis and advice regarding the budgetary and accounting records pertaining to Garrison resource (dollar and manpower) issues and to take (or advise) appropriate action to ensure appropriate use of public funds.

Religious Support Office (RSO)

The RSO provides comprehensive religious support for the spiritual and moral needs of Soldiers, other service members, family members, retirees, and authorized civilians.

2.8.6 National Reconnaissance Office (NRO)

The National Reconnaissance Office (NRO) develops and operates the world's most capable and innovative overhead reconnaissance systems to collect intelligence for U.S. national security, and to support disaster relief and humanitarian efforts. Headquartered in Chantilly, Virginia, NRO maintains ground stations at Buckley Space Force Base, Colorado; Fort Belvoir, Virginia; WSMR, New Mexico; as well as a presence in Australia and the United Kingdom. NRO has launch offices at Cape Canaveral Space Force Station, Florida, and Vandenberg Space Force Base, California.

The NRO was established in September 1961 as a classified agency in the Department of Defense. The existence of the NRO and its mission were declassified in September 1992. The first publicly acknowledged NRO satellite launch took place at Vandenberg Space Force Base in December 1996 on a Titan IV rocket. Today, NRO continues to launch from Vandenberg as well as Cape Canaveral Space Force Station, NASA's Wallops Flight Facility, and the Mahia Peninsula in New Zealand.

2.8.7 Defense Threat Reduction Agency (DTRA)

The Defense Threat Reduction Agency (DTRA) is a combat support agency that responds directly to Combatant Command needs and operational requests. DTRA enables the DoD, the US Government and international partners to counter and deter Weapons of Mass Destruction (WMD – chemical, biological, radiological, nuclear and high-yield explosives) and improvised threat networks. DTRA's strategic priorities are aligned with the priorities of the National Defense Strategy (NDS), the Nuclear Posture Review, and other strategic guidance documents which direct DoD to meet our national security goals through integrated deterrence, campaigning, and building enduring advantages. The DTRA Research and Development Directorate (RD) provides science, technology and capability development investments that maintain the US military's technological superiority in countering weapons of mass destruction & emerging threats, mitigate the risks of technical surprise and respond to the warfighter's urgent technical requirements. The RD Test and Assessment Department (RD-TS) provides objective evaluations of new capabilities through test and assessments. The DTRA assets to be able to do test and assessments include credible test beds, responsive test design, robust processes exercised over decades, test beds/structures to support full-spectrum counter-WMD testing and technology evaluation, nationally recognized subject matter experts, essential data capture and data analysis of results. RD-TS is located at DTRA Headquarters on Fort Belvoir, Virginia, and Kirtland Air Force Base, New Mexico, and maintains a variety of test beds and structures on WSMR.

2.8.8 Army Combat Capabilities Development Command (CCDC): Data & Analysis Center and Army Research Laboratory

The Army Combat Capabilities Development Command (CCDC): Data & Analysis Center and Army Research Laboratory (ARL) is the Army's primary source of fundamental and applied research. With more than 1,250 scientists and engineers, ARL is a key in-house repository of expertise in support of Army unique requirements. The laboratory's mission is to provide key technologies and analytical support to ensure the Army has decisive victory in future land warfare. Elements of two ARL organizations are located on WSMR: the Cybersecurity & Electromagnetic Protection Division (CEPD) of the Survivability/Lethality Analysis Directorate (SLAD) and the Computational and Information Sciences Directorate (CISD) Battlefield Environment (BE) Division.

CEPD's mission is to determine the Survivability, Lethality and Vulnerability (SLV) of all US Army missile defense systems, aviation systems and munitions demonstrations to the full spectrum of battlefield threats and atmospheric interactions throughout the system's life cycle. CEPD is the Army's lead organization for determining electronic warfare (EW) vulnerability and cyber operations vulnerability and survivability of US Army systems and provides technical support to other DoD activities. CEPD provides SLV and evaluation support to developers, decision-makers and the Army evaluator and provides technical judgments on complex SLV issues. CEPD researches, investigates and recommends counter-countermeasures for US Army systems to reduce their susceptibilities and vulnerabilities and to ensure optimum survivability and lethality in threat environments.

Since 1952, CEPD and its predecessor organizations have carried out missions on WSMR. Recent technological advances in cyber operations, electro-optics and directed energy provide new arenas for study, complementing work in the more traditional radio frequency and microwave areas. CEPD has employees on WSMR, New Mexico; Aberdeen Proving Ground, Maryland; and Ft. Hood, Texas.

2.8.9 Center for Countermeasures (CCM)

The Center for Countermeasures (CCM) is a joint activity that directs, coordinates, supports and conducts independent countermeasure/counter-countermeasure (CM/CCM) T&E activities of US and foreign weapons systems, subsystems, sensors and related components. The Center accomplishes this work in support of DOT&E, the Deputy Assistant Secretary of Defense for Developmental Test and Evaluation (DASD(DT&E), weapon systems developers and the services. The Center's testing and analyses directly support evaluations of the operational effectiveness and suitability of CM/CCM systems.

Specifically, the Center:

- Determines performance and limitations of missile warning and aircraft survivability equipment (ASE) used on rotary-wing and fixed-wing aircraft.
- Determines effectiveness of precision guided weapon (PGW) systems and subsystems when operating in an environment degraded by CMs.
- Develops and evaluates CM/CCM techniques and devices.
- Operates unique test equipment that supports testing across the DOD.
- Provides analyses and recommendations on CM/CCM effectiveness to Service Program Offices, DOT&E, DASD (DT&E) and the services.
- Supports service member exercises, training and pre-deployment activities.

The Center makes recommendations for improvements to system developers and decision-makers as well as to the OSD. These activities and recommendations contribute greatly to the production of robust ASE and CM-hardened US weapons systems and the improved capabilities necessary for these systems to function effectively in the increasingly hostile environments found on the modern asymmetrical battlefield. Fully mobile test teams from the Center are capable of operating under a wide variety of environmental CM/CCM test operations.

2.8.10 National Geospatial Intelligence Agency (NGA)

National Geospatial Intelligence Agency (NGA) mission at WSMR is to provide accurate and timely expert analysis of worldwide gravity, satellite and positional information including imagery and mapping control for navigation, safety, intelligence, positioning and targeting in support of national security objectives. NGA provides geodetic positions based on the World Geodetic System 1984 (WGS 84) and orthometric heights based on Earth Gravity Model of 2008 (EGM 08). The NGA range offices provide astro-geodetic deflections, geoid heights, gravity values, precise distances, true azimuths, astronomic positions, azimuths and geodetic control to accuracies of one part- per-million. Increased accuracies are achieved using state-of-the-art equipment and techniques to precisely locate the impact points of missile components and other test debris for flight safety, recovery, and post-test analysis. The quick responsiveness of the NGA range offices to customer requirements is key to keeping time-critical weapons tests on schedule. Our inability to provide this response would have huge impacts on systems testing as they rely solely on NGA survey data for accuracy and range safety.

2.8.11 NASA Tracking and Data Relay Satellite System (TDRSS)

The Tracking and Data Relay Satellite System (TDRSS) is NASA's network of specialized communications satellites in geosynchronous orbit that provide communication services to many NASA spacecraft. These satellites relay signals between spacecraft, including the International Space Station, and ground control stations on Earth. The TDRSS ground segment at WSMR is located next to NASA WSTF and consists of two functionally identical ground terminals collectively known as the White Sands Complex.

2.8.12 White Sands Test Center (WSTC)

The White Sands Test Center (WSTC) is responsible for planning and conducting tests at WSMR. The center command position is a board command-selected position from the assistant secretary of the Army for Acquisition, Logistics and Technology ASA at the colonel or GS-15 level. WSTC reports to the US Army Test and Evaluation Command.

An integral part of test operations, Army Air Flight Detachment operates six UH-60 Blackhawk helicopters and a C-12 King Air twin turboprop aircraft to support on- and off-range test customers. The fleet is used to search and recover critical test components. The UH-60s and the C-12 can be modified with various instrument packages, sensors and payloads to support test missions. All WSMR aircraft can be used as photo/chase platforms. Army Air Flight Detachment helicopters are also capable of external load operations.

2.8.13 Commissary (DECA)

The WSMR Commissary is part of the Defense Commissary Agency (DECA), headquartered at Fort Gregg-Adams, Virginia. DECA operates a worldwide chain of commissaries providing groceries in a safe and secure shopping environment to the most deserving customers – our military personnel, retirees and their families. The WSMR Commissary is located at 262 Picatinny Avenue.

2.8.14 Army and Air Force Exchange Service (AAFES)

The Army and Air Force Exchange Service (AAFES) provides quality goods and services at competitively low prices at 3,100+ locations worldwide and available 24-hours a day online. The Army & Air Force Exchange Service remains committed to increasing the value of the Exchange to its customers while continuing to give back to the military community. The WSMR Army Exchange Post is located in Building 260.

2.8.15 Civilian Personnel Advisory Center (CPAC)

The Civilian Personnel Advisory Center (CPAC) provides a variety of personnel products, services, advice and assistance to the employees, managers, and command staff at WSMR, including, but not limited to:

- Recruitment and Placement
- Position Classification
- Workforce Planning & Position Management
- Personnel Reporting
- Employee Benefits
- Employee Training & Development
- Management-Employee Relations
- Labor-Management Relations

2.8.16 407th Army Field Support Brigade (AFSB) Logistics Readiness Center

The 407th Army Field Support Brigade (AFSB) Logistics Readiness Center manages the development, coordination, and supervision of logistic functions for the Installation, Senior Mission Commander, satellite, and tenant activities. We direct operations of supply, transportation, maintenance, ammunition quality assurance, logistical planning, and other services and related matters. LRC advises the 407th AFSB, Garrison Commander, and Senior Mission Commander on matters pertaining to logistical support.

2.8.17 Test, Measurement and Diagnostic Equipment Support Center (TMDE)

The Test, Measurement and Diagnostic Equipment Support Center (TMDE) has the primary organizational responsibility of performing the test, measurement, and diagnostic equipment calibration and repair support mission for the Army, other DoD claimants, and thousands of industrial based customers.

2.8.18 Mission Installation Contracting Command (MICC)

The Mission Installation Contracting Command (MICC), White Sands Contracting Office is a full-service contracting office supporting the routine, unique and special needs of the WSMR testing community, its tenants and federal agencies external to the installation.

2.8.19 3-6 ADA Patriot Test Detachment

The 3-6 ADA Patriot Test Detachment provides expertise and knowledge support of Air and Missile Defense (AMD) programs to conduct developmental tests, flight tests, tactics, techniques, and procedures (TTP) development for all AMD modernization programs. The ADA Patriot Test Detachment provides support for Army and Joint experimentation and War Gaming and provides assistance in the development and refinement of TTP and provide subject matter expertise to support engineering and material development efforts.

2.8.20 McAfee Health / Dental Clinic

McAfee Health / Dental Clinic provides and coordinates timely, high quality healthcare in support of health readiness at the Army's largest open-air testing range and home of the Army's sole nuclear fast burst reactor at WSMR with a professional team delivering safe, accessible, valued and trusted medical services.

2.8.21 PEO Simulation Training and Instrumentation (PEO STRI)

The PEO Simulation Training and Instrumentation (PEO STRI) mission is to rapidly develop, deliver, and sustain testing, training, and information operations capabilities to enhance readiness across the operational spectrum.

2.8.22 Air Force 704th Test Group

Air Force operations at WSMR are primarily conducted by the 704th Test Group (TG). The mission of the 704th is to operate world-class test facilities for guidance and navigation system testing, high-speed sled track testing, radar signature measurements, aircraft survivability testing, landing gear testing and weapons system flight testing, as well as test and evaluation liaison for US Air Force Research and Development programs working with directed energy. The 704th TG commander also serves as WSMR Deputy for Air Force and is responsible for all Air Force test events at WSMR.

2.8.23 Air Force 49th Air Traffic Control

The Air Force 49th Operations Support Squadron is made up of seven flights including Weather, Aircrew Flight Equipment, Airfield Operations, White Sands Radar, Intelligence, Current Operations and Weapons and Tactics. These flights support the wing, tenant units, and Army's WSMR. The Weather Flight provides operational observing, forecasting, and staff weather support. The Airfield Operations Flight provides air traffic control and airfield management services for local and transient aircrews. Airmen and civilians control out to five nautical miles and up to 2.5K feet of airspace, manage 21 miles of runways, taxiways and aircraft aprons. The White Sands Radar Flight provides approach and range airspace control for WSMR and McGregor Range. In all, this flight controls airspace comprising over 30 percent of the state of New Mexico.

2.8.24 Naval Surface Warfare Center Port Hueneme Division WSMR

The Navy has been part of the test community at WSMR since 1946 when it arrived to participate in research and testing of captured German V-2 rockets.

During the 1940s and 1950s, the Navy continued to launch rockets for atmospheric research, and in the 1950s its responsibilities expanded from rocketry into the testing of surface-to-air missile defense systems. Its ongoing mission includes land-based testing of naval weapon systems missiles such as the electromagnetic railgun at its iconic USS Desert Ship that sits in a sea of sand. The USS Desert Ship is also designated LLS-1, for 'Land Locked Ship' number one.

Built in the 1950s to functionally duplicate the fire control requirements of a surface ship, the Desert Ship was originally used to test the Talos missile and now is primarily used for live fire testing of the Navy´s STANDARD Missile. The Desert Ship remains as one of two "Land-Locked Ships" operated by the U.S. Navy, the other being the USS Rancocas in New Jersey.

2.8.25 Space Force

The 15th Space Surveillance Squadron, Det. 1 of the US Space Force is a dedicated space surveillance unit in the northwest corner of the U.S. Army's WSMR, approximately 30 miles southeast of the town of Socorro, N.M. The detachment was the first operational site in the Ground-based Electro-Optical Deep Space Surveillance system. The primary mission of the detachment is to detect, track and identify all tasked space objects within its area of coverage. The unit usually provides data on deep space objects in the orbits from 3,000 to 22,000 miles, although it has a limited near-earth detection capability.

2.8.26 Air Force Research Labs

The Acoustic Research Complex (ARC) is a unique facility operated by the Air Force Research Laboratory (AFRL) on WSMR. The ARC facility is the first of its kind within DoD and the research community as a whole. It is used to help with the design, modification, and increasing combat survivability of current and future aircraft.

2.8.27 Air Force 781st Test Squadron

The National Radar Cross Section (RCS) Test Facility (NRTF) is the premier DoD facility for RCS testing. Formerly known as RATSCAT, which began measuring radar scattering in 1963, it is comprised of two complementary sites, Mainsite and RATSCAT Advanced Measurement System (RAMS). Assigned to the US Air Force's 781st Test Squadron, NRTF is located west of Holloman Air Force Base, New Mexico in a rolling gypsum region of WSMR. NRTF specializes in the RCS characterization of full-scale, aerodynamic vehicles and antenna radiation pattern development.

2.9 Other Defense Organizations

2.9.1 US Army Test and Evaluation Command

WSMR is a subordinate organization of the Army Test and Evaluation Command, which is a directly reporting unit under the Chief of Staff, Army. The General officer position is the senior commander on the installation and serves as the Commander of WSMR. The Integrated Training Area Management (ITAM) Program on WSMR is managed under the Army Test and Evaluation Command, Test Center Operations, Environmental Branch.

2.9.2 Installation Management Command (IMCOM)

The GC reports to the Commanding General of IMCOM-Readiness. IMCOM-Readiness is co-located with Forces Command at Fort Bragg, North Carolina. US Army Environmental Command is a subordinate command to IMCOM. US Army Environmental Command provides technical support to both IMCOM and to the office of Assistant Chief of Staff for Installation Management. Before the final ICRMP is signed by the GC, it must undergo IMCOM review.

2.9.3 US Air Force, Kirtland Air Force Base

Kirtland Air Force Base, located near Albuquerque, New Mexico, uses WSMR airspace for training and operates the following facilities on WSMR: National Radar Cross-Section Test Facility and its Advanced Measurement Site, Red Rio and Oscura bombing ranges, and Yonder site.

2.9.4. US Air Force, Holloman Air Force Base

Holloman Air Force Base (HAFB) is located adjacent to WSMR on its eastern boundary. HAFB cooperates with WSMR and funds and executes certain cultural resource projects on WSMR lands.

2.9.5 Fort Bliss, Texas

Fort Bliss and WSMR have an extensive common boundary and interact regularly in the conduct of their respective activities. Because historic resources and use areas frequently extend across agency boundaries, Fort Bliss and WSMR each have an interest in the cultural resources of the region.

WSMR has defined a new specialized area, the Southeast Multi-Use Area, located southeast of US 70, to support multiple use of both test and training off-road vehicle maneuvers (WSMR 2010).

2.9.6 New Mexico Army National Guard

The Army National Guard receives training on WSMR primarily through ranges on the northern installation that it uses and maintains

2.10 Interested Parties

2.10.1 Advisory Council for Historic Preservation (ACHP)

The ACHP has a consultation role in Section 106 NHPA compliance and may assist in preparing NHPA agreements or advising on NHPA compliance requirements. It has a review and comment role in the Section 106 process and issues notices of noncompliance (foreclosure) with the NHPA. In addition, when consulting parties disagree, the Council is asked to resolve any disagreement. The Council is included as a consulting party for all actions that have the potential to impact Trinity Site and Launch Complex 33 (LC33) National Historic Landmarks.

2.10.2 Bureau of Land Management (BLM)

The BLM manages some lands adjacent to WSMR. In a regional context, the BLM has an interest in WSMR's cultural resources. In addition, sites and use areas may extend across agency boundaries, requiring cooperative efforts between WSMR and BLM. Several areas of interest include improved law enforcement and partnering in fire management.

2.10.3 National Park Service (NPS)

White Sands National Park is situated in the southeastern portion of WSMR. Containing much of the world's largest gypsum dune field, the Park was established January 18, 1933, becoming a National Park on December 20, 2019. In a regional context, the NPS has an interest in WSMR's cultural resources. In addition, sites and use areas frequently extend across agency boundaries.

2.10.4 US Forest Service, Lincoln National Forest

The Lincoln National Forest was set aside as a Forest Reserve in 1902. It manages lands within the Sacramento, Capitan, and Guadalupe mountain ranges east of WSMR. This office assists WSMR with fire suppression, as requested by WSMR. In a regional context, the US Forest Service has an interest in WSMR's cultural resources because of its proximity to the missile range. WSMR also leases facilities, such as Alamo Peak and Sac Peak from the US Forest Service.

2.10.5 New Mexico State Historic Preservation Office (SHPO)

The SHPO is the state representative involved in consultation for Section 106 and other federal or state legislation. Agreements currently existing between WSMR and the SHPO include a PMOA, a MOUs outlining the sharing of data between New Mexico and WSMR, and control of Trinity Site and Launch Complex 33 (LC-33) NHLs. WSMR will seek funding for FY 26 to update the 1985 PMOA. This type of funding is authorized by Army funding guidance.

State and local cultural resources laws and regulations do not apply to Army property because there has been no waiver of sovereign immunity in this area. The Headquarters, Department of the Army Staff Judge Advocate will be consulted whenever a question arises concerning the applicability of a state or local law or regulation to the WSMR ICRMP. Several areas of interest include such items as using a cultural landscape approach to the management of cultural resources (*i.e.*, placing cultural resources in their natural setting), an interest in adequately inventorying and evaluating historic resources, and developing historic contexts for Cold War contributions at WSMR.

2.10.6 Mescalero Apache Tribe

Members of this Tribe include people of Chiricahua, Mescalero, and Lipan Apache groups. The Mescalero Apache Tribe was recognized by a final judgment of the Indian Claims Commission of the US Court of Claims as having aboriginally occupied an area encompassing all WSMR lands in the State of New Mexico. Both the Chiricahua and Mescalero groups have documented historic use of the area now covered by WSMR and are known to have sacred sites on missile range property

2.10.7 Pueblo of Isleta

This pueblo assimilated the Piro and Tompiro peoples, who historically used northern parts of what is now WSMR.

2.10.8 Ysleta del Sur

This Tribe was established in its present location by Isleta peoples (including some of the Piro and Tompiro) moving south during the Pueblo Revolt of 1680.

2.10.9 Universities

Researchers from many universities have been involved in cultural resources projects at WSMR. Below are some of the more active institutions.

New Mexico State University

New Mexico State University, Department of Anthropology and WSMR have an MOU to foster research and cooperative archaeological studies on the facility.

University of New Mexico

University of New Mexico, Office of Contract Archaeology, through the Cooperative Ecological Study Unit, are currently conducting archaeological site evaluations in the areas of Zumwalt Track, AltShist, Shist, Orogrande Training Area, and Yucca North Maneuver Area. The University has contributed to the understanding of WSMR cultural resources through studies, such as Seaman and Doleman (1986), Anschuetz et al. (1990), Doleman et al. (1991), and Kurota (2015).

Eastern New Mexico University

Eastern New Mexico University, located in Portales, has also contributed to cultural resources understanding through studies, such as Beckett (1973), Carmichael (1985), and Tainter (1981, 1985). Eastern New Mexico University held the archaeology contract for a number of years, performed numerous surveys on WSMR, and holds collections from WSMR.

University of Texas at El Paso

Researchers from the University of Texas at El Paso have performed a number of studies on WSMR. The University conducted a wind erosion patterns in coppice dune maneuver areas study for the ITAM program. Results of this study led to development of new and improvement of existing best management practices for planning where to place sites and other military activities as well as construction methods within duneland and shrubland vegetation types. The University also conducted an air quality study during 2009-2011.

2.10.10 Contractors and Cooperators

Cultural resources work is contracted with a wide range of archaeological firms representing a myriad of individual customers or project proponents or in support of various Conservation Branch projects. Several cooperators work in partnership with Conservation Branch under cooperative agreements. These include, but are not limited to Northwind Environmental Services, Eco Inc., New Mexico State University, Mescalero Apache THPO, Stout and Associates, and Williams Windmills, Inc.

2.10.11 Non-Governmental Groups

Because of the large size of WSMR and the diversity of its cultural resources, many nongovernmental conservation agencies and groups have interests in cultural resource issues on WSMR. Among such groups are the New Mexico Archaeological Council, New Mexico Museum of History and Natural Resources, and Smithsonian Museum.

3. LEGAL FOUNDATION AND METHODS FOR THE ICRMP

Per the guidance set forth in AR 200-1 and DoDI 4715.16, each installation is responsible for the preparation and implementation of an ICRMP. The legal foundation that underlies AR 200-1 are the Federal laws that pertain to cultural resources. The relevant Federal cultural resource laws applicable to WSMR are reviewed in this chapter. Following each review is a brief analysis of WSMR's current preservation programs responsible for compliance with the stated law. Preferred actions, referred to here as "Action Items," for ensuring compliance with each law are also provided with each legal summary. The Action Plan, provided in Chapter 6, Implementing the ICRMP, lists these action items in the order in which they should be carried out.

3.1 Federal Cultural Resources Laws (with Action Items)

3.1.1 National Historic Preservation Act of 1966 (as amended)

The NHPA was originally passed in 1966 and established a national program and guidelines for historic preservation. The NHPA, as amended in 2014 and codified in Title 54 of the United States Code (U.S.C.), directs the Secretary of the Interior to publish guidelines for a number of preservation policies. These include Federal agency responsibilities under the Act, consideration of the effects of Federal undertakings on cultural resources, curation of Federally-owned and administered artifacts, and documentation of cultural resources by private and public parties. These are presented in 54 U.S.C. 306101 through 306114 and Section 106 of the NHPA, respectively. Section 110 compliance follows the NHPA. Curation of Federally owned or administered archaeological collections is not part of the NHPA and is described in 36 CFR Part 79.

3.1.1.1 Title 54 U.S.C. (Formerly Section 110) of the National Historic Preservation Act

Title 54 U.S.C. outlines Federal agency responsibilities under the NHPA. The Department of the Army's AR 200-1 addresses agency responsibilities. For a complete understanding of agency responsibilities under NHPA, consult 54 U.S.C. in the NHPA and the NPS standards and guidelines for implementing Section 110.

3.1.1.2 54 U.S.C. 306101 (Formerly Section 110 [2][a][1])

The heads of all Federal agencies shall assume responsibility for preservation of historic properties for which they have ownership. Each federal agency shall use, to the maximum extent feasible, historic properties available to them.

> **ACTION ITEM 1:** WSMR will carry out maintenance, repair, new construction and renovation of historic properties in accordance with "The Secretary of the Interior's "*Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings*" (Grimmer 2017).

3.1.1.3 Title 54 U.S.C. 306102 (Formerly Section [2][a][2])

Each Federal agency shall establish a preservation program for the identification, evaluation, and nomination of historic properties to the NRHP, and protection of historic properties.

> **ACTION ITEM 2:** WSMR, in support of the Department of the Army's responsibilities under Title 54 U.S.C. 30102 (Formerly Section 110 [2][a][2]), will survey and inventory lands and real property under its management and evaluate identified properties for NRHP eligibility as required, driven by undertakings proposed by WSMR.

> **ACTION ITEM 3:** WSMR will protect identified historic properties through a series of measures: (1) review undertakings proposed at WSMR for their potential to adversely affect historic properties; (2) seek first to avoid any adverse effect, but if this is not possible due to the requirements of the undertaking, WSMR will pursue the most effective mitigation measure.

3.1.1.4 Title 54 U.S.C. 306103 (Formerly Section 110 [2][b])

Prior to demolition or substantial alteration, historic properties will be recorded and those records will be deposited with the agency (or some other appropriate agency) for future use and reference.

> **ACTION ITEM 4:** WSMR will record historic properties prior to any substantial alteration or demolition, per consultation with the New Mexico SHPO. Any related records created through these recordings will be stored in an approved curatorial facility.

3.1.1.5 Title 54 U.S.C. 306104 (Formerly Section 110[2][c])

The head of each Federal agency shall designate a preservation officer who shall be responsible for coordinating that agency's activities under the NHPA. The WSMR CRM is the responsible person on behalf of the GC for meeting the requirements of this ICRMP. Responsibilities may be delegated to appropriate qualified staff to address the cultural resource under consideration.

> **ACTION ITEM 5:** The GC shall designate a CRM until rescinded. During the duration of this ICRMP, the CRM will ensure that appropriate personnel meet the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS 2020).

3.1.1.6 Title 54 U.S.C. 306105 (Formerly Section 110[2][d])

All Federal agencies shall carry out agency programs and projects in accordance with the purpose and intent of the NHPA.

> **ACTION ITEM 6:** The cultural resources program shall consider the impact of proposed WSMR projects and activities on historic properties to ensure consistency with the requirements of the NHPA.

3.1.1.7 Title 54 U.S.C. 306106 (Formerly Section 110[2][e])

The Secretary of the Interior shall review and approve plans for transfer of surplus Federally-owned historic properties to ensure that prehistoric, historic, architectural, and culturally significant values will be preserved or enhanced.

> **ACTION ITEM 7:** WSMR shall ensure that any transfer of Federally-owned historic property follows the appropriate state and federal regulations (including but not limited to the NPS/GSA Historic Surplus Property Program).

3.1.1.8 Title 54 U.S.C. 306107 (Formerly Section 110 [2][f])

The heads of each Federal agency shall undertake planning and actions to minimize harm to any NHL and provide reasonable opportunity for the ACHP to comment on undertakings that directly and adversely affect NHLs.

Two NHLs are located at WSMR; the Trinity Site NHL and the Launch Complex 33 (LC-33) NHL. Management of the Trinity Site has also been addressed though a 1988 Memorandum of Understanding (MOU) between WSMR and the New Mexico SHPO (Appendix A). The MOU established the following parameters for management of the Trinity Site NHL:

- The MOU requires that WSMR maintain an inventory of all post-Trinity test structures, facilities, and other land modifications, as well as an inventory of all Trinity Site historic features.

- The MOU requires WSMR to consult with the New Mexico SHPO regarding all actions within the Trinity Site NHL that require an Environmental Assessment (EA) or Environmental Impact Statement (EIS).

- The MOU stipulates that the New Mexico SHPO be provided an opportunity to comment prior to the foreclosure of options to avoid, reduce, or otherwise mitigate effects of actions potentially affecting the Trinity Site NHL.

Finally, the agreement also requires that all future structures of temporary construction at the NHL will be removed after completion of the action that necessitated their construction. To this end, the MOU also establishes a Historic Zone and Limited Compatible Land Use Zone within the Trinity Site.

> **ACTION ITEM 8:** WSMR will avoid any actions that would be detrimental to the future maintenance and preservation of the LC-33 and Trinity Site NHLs. Per 36 CFR 800, the ACHP is included as a consulting party for all actions that have the potential to impact these NHLs. WSMR will manage the Trinity Site NHL in accordance with the terms of the 1988 MOU.

3.1.1.9 Title 54 U.S.C. 306109 (Formerly Section 110[2][g])

Each Federal agency may include the costs of preservation activities under this Act as eligible project costs.

ACTION ITEM 9: When applicable, WSMR will include costs and staff time required in proposed projects to adequately address historic property issues.

3.1.1.10 Title 54 U.S.C. 306110 (Formerly Section 110[2][h])

The Secretary of the Army shall establish an annual preservation awards program for recognition of outstanding contributions to historic preservation.

NO ACTION REQUIRED

3.1.1.11 Title 54 U.S.C. 306111 (Formerly Section 110[2][i])

Nothing in this Act shall be construed to require the preparation of an EIS where one would not be required under NEPA, and nothing in this Act shall be construed to provide an exemption from any requirement for the preparation of a statement under such Act.

NO ACTION REQUIRED

3.1.1.12 Title 54 U.S.C. 306112 (Formerly Section 110[2][j])

The Secretary of the Interior shall publish regulations under which requirements of this section may be waived in whole or in part in the event of a major natural disaster or an imminent threat to the national security.

ACTION ITEM 10: WSMR staff will monitor changes to the Act and 36 CFR Part 800.

3.1.1.13 Title 54 U.S.C. 306113 (Formerly Section 110[2][k])

Federal agencies shall not grant a loan, loan guarantee, permit, license, or other assistance to an applicant with the intent of avoiding Section 106 requirements, unless after consultation with the ACHP, determines that circumstances justify granting such assistance.

NO ACTION REQUIRED

3.1.1.14 Title 54 U.S.C. 306114 (Formerly Section 110[2][1])

With respect to any undertaking subject to Section 106 which adversely affects any historic property, and for which a Federal agency has not entered into an agreement pursuant to regulations issued by the ACHP, the head of such agency shall document that decision and may not delegate that responsibility.

NO ACTION REQUIRED

3.1.1.15 Section 106 of the National Historic Preservation Act

The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or Federally-assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure,

or object that is included in or eligible for inclusion in the National Register. The head of any such agency shall afford the ACHP established under Title II of the NHPA, a reasonable opportunity to comment with regard to such undertaking.

36 CFR Part 800.14(b) of the NHPA provides the opportunity for Federal agencies to streamline the Section 106 process through the development of a PA. PAs apply to a particular program, large or complex project, or class of undertakings that would require numerous individual requests for comment. Per this guidance, a Programmatic Memorandum of Agreement (PMOA) was established in 1985 between WSMR, the New Mexico SHPO, and the ACHP (see Appendix B) that expedited consultations and avoided delays to the WSMR mission. Under the terms of the agreement, routine actions with no adverse effects on cultural resources were allowed to continue with only notification of the New Mexico SHPO required. WSMR will seek funding for FY 26 to update the 1985 PMOA. This type of funding is authorized by Army funding guidance.

Finally, the ACHP and Federal Regulation 36 CFR Part 800.14(e) provides for the opportunity for Federal agencies to develop Program Comments to address a category of undertakings in lieu of conducting individual reviews. There are four Program Comments in effect that address historic property types found at WSMR:

(1) Program Comment on Capehart/Wherry Era Army Family Housing and Associated Landscapes (1949-1962): Provides for the ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance, new construction, demolition, deconstruction and salvage, remediation activities, and transfer, sale, lease, and closure of Cold War era (1946-1962) family housing without further Section 106 consideration.

(2) Program Comment for Cold War Era Unaccompanied Personnel Housing (1946-1974): Provides for the ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance, new construction, demolition, deconstruction and salvage, remediation activities, and transfer, sale, lease, and closure of Cold War era (1946-1974) barracks without further Section 106 consideration.

(3) Program Comment for Cold War Era (1939-1974) Ammunition Storage Facilities: Provides for the ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance, new construction, demolition, deconstruction and salvage, remediation activities, and transfer, sale, lease, and closure of WWII and Cold War era (1939-1974) ammunition storage facilities without further Section 106 consideration.

(4) Program Comment for WWII and Cold War Era (1939-1974) Army Ammunition Production Facilities and Plants for the ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance, new construction, demolition, deconstruction and salvage, remediation activities, and transfer, sale, lease, and closure of WWII and Cold War Era Army Ammunition Production Facilities and Plants without further Section 106 consideration. Currently, there are no facilities at WSMR that are covered by this Program Comment.

3.1.2 The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, as Revised in 2024

NAGPRA provides for the order of custody and the repatriation of Native American human remains and associated cultural items removed from Federal and tribal lands. Within NAGPRA, "cultural items" are defined as funerary objects, sacred objects, and objects of cultural patrimony according to the Native American traditional knowledge of a lineal descendant, Indian Tribe, or Native Hawaiian Organization (NHO). NAGPRA applies to cultural items possessed or managed by Federal agencies, and cultural items possessed or maintained by any institution or State or local government receiving Federal funds. Regulations to carry out NAGPRA are found at 43 CFR Part 10, "Native American Graves Protection and Repatriation Act Systematic Processes for Disposition or Repatriation of Native American Human Remains, Funerary Objects, Sacred Objects, and Objects of Cultural Patrimony." The Act requires consultation with lineal descendants, Tribes, or Native Hawaiian Organizations with respect to these remains and items.

Per the 2024 NAGPRA revisions effective as of January 12, 2024, Section 10.10 requires Federal agencies to complete, in consultation with Tribal entities, an inventory of all human remains and associated funerary objects in their possession or under their control. Under Section 10.9, Federal agencies are required to complete a summary of all unassociated funerary objects, sacred objects, or objects of cultural patrimony in their possession or under their control.

> **NO ACTION REQUIRED** (Section 10.9 and 10.10 reports have been completed under Army-wide NAGPRA program)

Responsibilities under NAGPRA continue after completion of Sections 10.9 and 10.10 requirements. Under Section 10.5, the excavation of human remains, funerary artifacts, sacred objects and objects of cultural patrimony during Section 106 review or the inadvertent discovery of these remains or items during an undertaking require that NAGPRA be addressed. The discovery of human remains and cultural items must be reported to Tribes via written documentation with 24 hours, and a response must be received within three days after the receipt of written documentation. Through consultation, a signed plan of action must be completed within 30 days.

Significant revisions have been made to the NAGPRA legislation since it was enacted, with revisions in 2010, 2015, and most recently in 2024. The 2024 revisions are the most significant in the history of the legislation and are mostly specific to strengthening the portions of the law that cover protection and repatriation, and are intended to expedite the repatriation of human remains and related cultural items. Summaries and overviews of the 2024 NAGPRA revisions and their impact are provided by Ream (2024) and the Society for American Archaeology ([SAA] 2024). The 2024 regulation is organized into four subparts that address (1) general information; (2) protection of human remains or cultural items by museum or federal agencies; (3) repatriation of human remains or cultural items on Federal or Tribal lands; and (4) operation and purview of the review committee.

Section 10.1 is an introduction to the 2024 regulations, and establishes to whom and what the law applies. This section also includes a new "Duty of Care" requirement for museums and Federal Agencies that requires them to consult with lineal descendants and Tribes on the care and preservation of human remains and cultural items in their custody. The same museums and agencies must also have written consent from lineal descendants and Tribes before exhibiting or allowing study of human remains and cultural items in their collections.

Section 10.2 provides definitions, including 15 that are new to the 2024 revisions. These clarify many ambiguities in the older versions of NAGPRA. The definitions also clarify the meaning of Federal funding, which includes indirect Federal assistance such as the use of Federal facilities, property, or services. The definition also establishes that private cultural resource management firms that received Covid-19 Paycheck Protection Program loans are now subject to NAGPRA compliance if they have any NAGPRA-related materials in their custody.

Section 10.3 of the 2024 revisions make meaningful changes to the process of determining cultural affiliation. The classification of "culturally unidentifiable" can no longer be used to defer the repatriation process. The guidelines allow cultural affiliation to now be established by reasonable connection, including acquisition history and geographical location. The determination of cultural affiliation does not require exhaustive study or additional research, and the 2024 revisions acknowledge that information gaps are to be expected. Native American traditional knowledge, referred to for the first time in the 2024 revisions, can also be used to establish cultural affiliation and is considered as other relevant information or expert opinion.

Section 10.5 provides guidelines for the excavation of human remains, funerary artifacts, sacred objects, and objects of cultural patrimony during Section 106 review or the inadvertent discovery of these remains or items during an undertaking. The discovery of human remains and cultural items must be reported to Tribes via written documentation with 24 hours, and a response must be received within three days after the receipt of written documentation. Through consultation, a signed plan of action must be completed within 30 days.

Section 10.4 covers general guidelines for the protection of human remains and cultural items on Federal or Tribal Lands. This section outlines what entities the law is applicable to, and clarifies that any permit, license, lease, right-of-way, or other authorization issued for an activity on Federal or Tribal land must include a requirement to comply with NAGPRA Subpart B. The Federal Agency involved is required to have a plan of action in place for discoveries and excavations of human remains and cultural items that has been written in consultation with relevant lineal descendants, Tribes, or NHOs. This plan of action can be part of a larger Comprehensive Agreement for all land management activities, provided that it consulted with interested Tribal parties.

Section 10.6 establishes standards for notification and reporting of excavation activities on Federal or Tribal lands. Permits, written authorization, and a plan of action are required for the excavation of human remains and cultural items on Federal or Tribal lands.

Section 10.7 covers the guidelines for the disposition of human remains. A priority for disposition must be determined no later than one year after the discovery or excavation of human remains. This section provides deadlines for the notification and reporting to lineal descendants, Tribes, or Native Hawaiian groups of the disposition of human remains. An institution or agency must report unclaimed human remains and cultural items annually beginning no later than January 13, 2025. Human remains or cultural items that remain unclaimed for one year can be transferred or reinterred 30 days (but no later than 90 days) after publication of a notice. This section also mandated a hard deadline of January 12, 2024 for Federal agencies to inform consulting lineal descendants, Tribes, or NHOs of property disposition with a written notice for those items removed and not completed before January 12, 2024.

Section 10.8 outlines general requirements for repatriation and updated standards of reporting for

relevant agencies and institutions. These guidelines apply to collections acquired before the passage of NAGPRA on November 16, 1990; collections acquired after this date must comply with an expedited repatriation schedule in Section 10.7. Notably, museums are required to report any Federal holding or collection in their custody no later than January 13, 2025 to the responsible Federal agency and NAGPRA Coordinator. The same reporting deadline applies to any holdings or collections not in the museum's custody but for which they have possession or control (for example, on loan to an academic institution).

Section 10.9 provides the process and requirements for the repatriation of unassociated funerary objects, sacred objects, or objects of cultural patrimony. Summaries of holdings that may contain these items must be completed, and consultation with interested parties must be initiated no later than 30 days after the summary is completed. Requests for repatriation received through consultation must be responded to no later than 90 days from receipt of the request. A notice of the intended repatriation must be submitted to the consulting parties and NAGPRA Coordinator no later than 30 days after responding to the initial repatriation request. A written repatriation statement should be provided after 30 days and no later than 90 days after the notice of repatriation is published. Section 10.9 also outlines the process for settling competing repatriation requests or disputed patrimony for the items in question.

Section 10.10 provides the process and requirements for repatriation of human remains and associated funeral objects in collections. These include completion or updating of an itemized inventory and initiation of consultation with interested parties. Notification of the completed inventory must be provided to interested parties no later than six months after completing or updating the inventory. In order to expedite the repatriation process, the new regulations stipulate that agencies and institutions must complete inventories and initiate consultation for the repatriation process no later than January 10, 2029.

Section 10.11 of the 2024 NAGPRA revisions establish a baseline civil penalty of $7,475 for each failure to comply with the regulations. Any person may file an allegation of non-compliance, and if substantiated a museum or agency can pay the penalty or take the allegation to hearing.

> **ACTION ITEM 11:** WSMR will incorporate and follow the guidelines established in the 2024 NAGPRA revisions regarding transferring control of human remains and associated funerary objects, especially from whose aboriginal lands the human remains and associated funerary objects were removed (as is most applicable on WSMR). Additionally, WSMR will incorporate and follow the guidelines of the 2024 NAGPRA revisions regarding procedures for the disposition of unclaimed human remains, funerary objects, sacred objects, or objects of cultural patrimony.

3.1.3 The Archaeological Resources Protection Act (ARPA) of 1979

The ARPA protects archaeological resources and sites on Federal and Tribal lands; violations of ARPA can result in criminal and/or civil penalties. Regulations for ARPA are found in 32 CFR Part 229, Protection of Archaeological Resources: Uniform Regulations. ARPA outlines illegal activities and prescribes civil and criminal penalties for each infraction, establishes a permitting process for removal of archaeological resources from public and Indian lands, and provides for the confidentiality of archaeological site location information (see Chapter 4, SOP #15 for ARPA compliance). AR 200-1 specifically identifies the GC to be the Federal agency official with management authority

over archaeological collections and associated records, includes a requirement for a permit to search for or collect from archaeological resources, allows curation of archaeological materials from Army lands in 36 CFR 79-compliant repositories, and upholds the protection from disclosure of the nature and location of archaeological resources.

ARPA prohibits a variety of activities from being conducted on archaeological sites without a permit: excavation, removal of items, damage, alteration, or defacing, or attempts to excavate, remove, damage, alter or deface. Other activities such as selling, purchasing, exchanging, transporting, receiving, or offering to sell, purchase, or exchange archaeological resources are also prohibited.

> **ACTION ITEM 12:** The CRM will coordinate with the GC to ensure that ARPA is integrated into the missions of applicable military and nonmilitary organizations on WSMR. The CRM will incorporate ARPA into training sponsored by the Environmental Division.

3.1.4 36 CFR Part 79 Curation of Federally-Owned and Administered Archaeological Collections

The Federal curation regulation, 36 CFR Part 79, Curation of Federally-Owned and Administered Archaeological Collections establish definitions, standards, procedures, and guidelines to be followed by Federal agencies to preserve collections of prehistoric and historic material remains, and associated records. The regulation outlines basic collections management procedures and standards, including access to and use of Federal collections. It presents general criteria for evaluating curatorial services provided by collection repositories and provides sample contract language that may be used by Federal agencies in procuring curation services.

Implementation of the requirements of 36 CFR 79 is left to each Federal agency. The United States Army's service-wide guidance for curation is found in AR 200-1. That regulation specifies that curation of archaeological items is to occur only in 36 CFR 79-compliant repositories and collection of archaeological materials is to be minimized to diagnostic artifacts and other significant and environmentally-sensitive material that will add important information to site interpretations.

WSMR's collections policy is to limit collections resulting from cultural resources investigations. Unless required for diagnostic purposes or for protection, artifacts identified during the course of cultural resources investigations are left *in situ*. Nevertheless, because an intensive program of archaeological survey and testing is implemented to support the WSMR mission, WSMR collections grow annually as a result of these studies.

WSMR collections are housed at the Fort Bliss Curation Facility, which meets or exceeds all federal requirements. Fort Bliss provides curation of WSMR's collections on a reimbursable basis based on the volume of artifacts and associated records. The Cultural Resources Program is responsible for most accessioning (i.e., labeling and processing of artifacts/documents for storage) and maintains a digital inventory of collections.

WSMR maintains its own specific SOP for collection and curation of archaeological and historical collections and associated records (see Chapter 4, SOP #20). Those procedures are also provided to any entity permitted to collect items from archaeological sites on WSMR; their submissions must strictly adhere to those guidelines.

ACTION ITEM 13: WSMR staff will provide long-term management and preservation of preexisting and new collections, as set forth in 36 CFR 79.

ACTION ITEM 14: WSMR will ensure that all associated records (including digital data) are curated and format migrated, as warranted.

3.1.5 The American Indian Religious Freedom Act (AIRFA) of 1978

The American Indian Religious Freedom Act (42 USC 1996) (AIRFA), as amended applies the First Amendment guarantee of religious freedom to Native Americans, establishing rights of Native Americans to have access to sites of religious importance and sacred sites, to use and possess sacred objects, and the right to participate in ceremonies and traditional rites. AIRFA defines a religious site as any place or area including, but not limited to, any geophysical or geographical area or feature:

- sacred to Native American Religion;
- where Native American practitioners are required by their religion to gather, harvest, or maintain natural substances or products for use during ceremonies, rituals, or for spiritual purposes; and
- that is utilized by Native American religious practitioners for ceremonies, rituals, or other spiritual practices.

A religious site may or may not contain physical remains, objects, or other elements that could identify it as an archeological site. AIRFA defines objects as specific items of use for religious practices that have spiritual or ritualistic importance. They may include sacred objects, non-sacred objects, and objects of cultural patrimony. AIRFA has no affirmative responsibility for Native American consultation; however, the intent of the AIRFA can be met only through the consultation process.

ACTION ITEM 15: WSMR will continue to provide access to sacred or religious sites for ceremonial use under AIRFA, contingent upon range testing activities due to safety concerns. Up range access will follow the safety and security protocols discussed in Chapter 4, SOP #18 (Up Range Access Control and Travel).

4. STANDARD OPERATING PROCEDURES

WSMR has developed SOPs to provide a more efficient structure for meeting the requirements of Section 106 and 110 of the NHPA (as amended) on a day-to-day basis. These SOPs provide more detail on the specific procedures for dealing with cultural resources at WSMR.

Following are the 20 SOPs implemented by WSMR. These SOPs are adapted from the former WSMR INCRMP (WSMR 2015) but have been updated for consistency with current regulations and procedures.

- SOP 1: Identifying Undertakings.
- SOP 2: Exempted Undertakings.
- SOP 3: Defining the APE.
- SOP 4: Identifying and Evaluating Historic Properties.
- SOP 5: Assessing Effects.
- SOP 6: Resolving Adverse Effects.
- SOP 7: Documenting Acceptable Loss.
- SOP 8: Reviewing and Monitoring through NEPA.
- SOP 9: Inadvertent Discovery of Historic Properties.
- SOP 10: Reporting Damage to Historic Properties.
- SOP 11: Public Involvement in the WSMR Cultural Resources Management Program.
- SOP 12: Dispute Resolution.
- SOP 13: Military Activities in Anticipation of Immediate Deployment, Mobilization or Armed Conflict.
- SOP 14: Cultural Resource Protection Measures for Missile Recovery and Unexploded Ordnance Activities.
- SOP 15: ARPA Compliance.
- SOP 16: NAGPRA Compliance.
- SOP 17: Paleontological Resources.
- SOP 18: Curatorial and Collection Management of Archaeological and Historical Collections and Associated Records.

In the SOPs the following terms apply.

- SHPO refers to the New Mexico SHPO.
- CRM refers to the designated WSMR cultural resources manager.

4.1 SOP #1: Identifying Undertakings

4.1.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.1.2 Objective

The objective of this SOP is to lay out a process to be followed to determine if an action is an undertaking subject to Section 106 review.

4.1.3 Policy

The WSMR GC is responsible for complying with all Federal and Army cultural resources legislation and regulations. The GC has assigned responsibility for the Cultural Resources Program at WSMR to the Environmental Division. The Cultural Resources Program serves as the WSMR Point of Contact for all external reviews related to cultural resources compliance issues with all outside agencies. It is WSMR policy to have the CRM review all undertakings for potential to affect historic properties. To this end, it is the responsibility of the CRM to identify which actions are undertakings as defined by 36 CFR Part 800 through following this SOP.

4.1.4 Implementing Procedures

An "undertaking" is defined as "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of Army, including those carried out by or on behalf of Army, those carried out in whole or in part with Army funds, and those requiring Army approval" [36 CFR Part 800.16(y)]. The CRM shall evaluate projects to determine if they meet this definition.

WSMR undertakings may take the form of projects, work orders, contractor actions, permits, leases, Army actions, and other activities as defined above. Undertakings may originate with the Directorate of Public Works & Logistics; Directorate of Plans, Training, Mobilization, and Security; infrastructure maintenance contractors; military construction (MILCON); project proponents; and other entities. If another DoD command or Federal agency is involved with WSMR in an undertaking, WSMR and the other agency may mutually agree that the other agency may be designated as the lead Federal agency. In such cases, undertakings will be reviewed by the lead agency in accordance with 36 CFR Part 800. In most instances, WSMR is considered the lead Federal agency and has Section 106 authority over all operations, agencies, and branches operating on its property.

Tenant organizations are responsible for coordination with WSMR to obtain up-to-date cultural resource information. Undertakings conducted by or for Army tenants with funding appropriated from

the tenant organization are the responsibility of the tenant; likewise, compliance with the guidelines put forth in the WSMR ICRMP is the responsibility of the tenant unless WSMR has assumed that responsibility on their behalf. Installation Support tenants and contractors must coordinate all activities with the Environmental Division prior to the implementation of a project.

4.1.5 Notification of Potential Undertakings

Initial formal contact should be with the Customer Support Branch at the Environmental Division. All documentation described in this SOP will be submitted as part of the National Environmental Policy Act (NEPA) process. Review of actions affecting cultural resources in compliance with NEPA does not replace compliance required under Section 106 of the NHPA, NAGPRA, or ARPA. Section 106 review may occur in conjunction with the NEPA review process, but it is a separate review process that requires coordination with the New Mexico SHPO, Federally recognized tribal governments, and other interested parties, as well as documentation prepared in accordance with SHPO standards. The CRM will inform the project manager of compliance requirements during consultation.

4.1.6 Activities Requiring Coordination with the Cultural Resources Program

The following activities require coordination with the Cultural Resources Program prior to the implementation of a project:

- All new construction;
- All building demolitions;
- Any ground-disturbing activity;
- All activities affecting properties at WSMR that are evaluated as historic or could be considered historic

4.1.7 Effects Analysis

Certain types of activities that do not have the potential to affect cultural resources do not require further Section 106 review. This determination can only be made by the CRM after reviewing details of the project and analyzing its potential effects. Some activities that involve no ground disturbance or that take place in previously disturbed areas might present no effect to cultural resources. On structures, some maintenance or repair actions using historically appropriate materials do not present a potential effect. Additionally, there are also undertakings that are specifically identified as exempt from the Section 106 process. See SOP #2 for a complete list of these exempted undertakings.

4.1.8 Further Action

The CRM will use the information provided by the proponent to determine whether the project or activity qualifies as an undertaking per 36 CFR Part 800.16(y), and if so, whether it has the potential to affect historic properties.

If the CRM classifies the project or activity as a Non-Undertaking, no further action is required.

If the CRM classifies the project or activity as an undertaking, proceed to SOP #3.

4.2 SOP #2: Exempted Undertakings

4.2.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.2.2 Objective

The objective of this SOP is to lay out a process to be followed to determine if an undertaking is exempted from further Section 106 review.

4.2.3 Policy

It is WSMR policy to consider health and safety issues as well as public interest in determining if undertakings may be exempted from Section 106 review. Army-wide exemptions are established by imminent threat to human health and safety in consultation with the ACHP. WSMR exemptions are established through what it perceives as the public's best interest in coordination with the SHPO, Tribal Historic Preservation Officer (THPO), and Tribal Governments (Tribes).

4.2.4 Implementing Procedures

After a project, activity, or program has been determined to be an undertaking, the CRM shall determine if the undertaking is one of the following categorical exclusions and exempted undertakings. The CRM has the sole authority to determine if a proposed undertaking falls into one of these categories. All proposed undertakings will continue to be coordinated with the CRM, and undertakings determined to fall under exempted undertakings will be documented by the CRM.

4.2.5 Army-Wide Exempted Undertakings

Consistent with Army-wide exemptions identified in the Army Alternate Procedures (AAP), WSMR recognizes exemptions to the Section 106 process where there is an imminent threat to human health and safety (Federal Register Vol. 69, No. 190, pp. 20576-25088). Parties subject to the ICRMP guidelines will recognize the following exemptions:

- In-place disposal of unexploded ordnance; or
- Disposal of ordnance in existing open burning/open detonation units; or
- Emergency response to releases of hazardous substances, pollutants, and contaminants; or
- Military activities in existing designated Surface Danger Zones (SDZs); SDZs are temporary in nature and only active during training activities. The exemption will apply to designated impact and/or dud areas with unexploded ordnances. SDZs are exempted only when active.

Undertakings addressed through a fully executed Nationwide Programmatic Agreement or other Program Alternative executed in accordance with 36 CFR Part 800.14, NHPA Section 106 regulations, an ACHP Program Comment or a MOA will be exempt. Presently there is one Nationwide Programmatic Agreement and three Program Comments in place that are relevant to WSMR historic properties.

- Nationwide Programmatic Agreement addressing World War II temporary buildings. Provides for the demolition of World War II temporary buildings without further Section 106 consultation. There is one building (Building 145-Post Chapel) that this applies to.

- Program Comment on Capehart/Wherry Era Army Family Housing and Associated Landscapes (1949-1962): Provides for the ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance, new construction, demolition, deconstruction and salvage, remediation activities, and transfer, sale, lease, and closure of Cold War era (1946-1962) family housing without further Section 106 consideration.

- Program Comment for Cold War Era Unaccompanied Personnel Housing (1946-1974): Provides for the ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance, new construction, demolition, deconstruction and salvage, remediation activities, and transfer, sale, lease, and closure of Cold War era (1946-1974) barracks without further Section 106 consideration.

- (3) Program Comment for Cold War Era (1939-1974) Ammunition Storage Facilities: Provides for the ongoing operations, maintenance and repair, rehabilitation, renovation, mothballing, cessation of maintenance, new construction, demolition, deconstruction and salvage, remediation activities, and transfer, sale, lease, and closure of WWII and Cold War era (1939-1974) ammunition storage facilities without further Section 106 consideration.

For work on buildings, all exempted work shall follow the *Secretary of the Interior's Standards for Rehabilitation (https://www.nps.gov/tps/standards/rehabilitation/rehab/stand.htm).*

4.2.6 WSMR Exempted Undertakings

Some areas of WSMR will be exempted from archeological and properties of traditional religious and cultural importance inventory requirements during the planning period because of low site potential (e.g., located on steep slopes offering no shelter, active arroyos bottoms, active flood plains, located in area disturbed to a depth below the cultural layer, etc.) or limited potential for mission impact (i.e. no or minimal ground disturbing activities).

Designated impact areas containing unexploded ordnance are off-limits to historic properties management. No access to these areas is allowed.

Non-ordnance contaminated areas may be identified on WSMR managed lands. Hazmat, restoration, and clean-up project teams will need to coordinate with the CRM to determine the need

and efficacy of survey for proposed undertakings in contaminated areas. Some contaminated areas may be off limits to ground-disturbing activities, including archeological surveys. Undertakings in contaminated areas, however, that do not pose an imminent threat are not exempted.

Decisions made through government-to-government consultation with Tribal Governments concerning management options on properties of religious, traditional, and cultural importance are not subject to Section 106 review by the New Mexico SHPO or the Advisory Council on Historic Preservation, except where such decisions may have an adverse effect on a historic property.

If an undertaking qualifies as an exempted undertaking, the CRM will document this on the Record of Historic Properties Consideration and the undertaking will receive no further consideration. If the undertaking does not qualify as an exempted undertaking, the CRM will review the undertaking and initiate the Section 106 process.

Activities on other areas across WSMR shall be exempted from project review because of the limited (or no) potential for cultural resources sites.

1. Steep slopes (greater than 30 percent)

2. Active arroyos bottoms

3. Active floodplains

4. Areas disturbed to a depth below the proposed undertaking

Site Work by Directorate of Public Works (DPW) personnel or contractors working for DPW

1. Replace in kind existing damaged landscaping and plant material with native and/or regional landscaping material. New replacement plantings, xeriscaping and ground cover shall meet the Installation Design Guide and shall maintain overall character of adjacent historic properties and historic view shed;

2. Repair or replace in kind existing streets, driveways, sidewalks and curbing. Undertaking includes stripping of pavement, spreading of new gravel on existing roads, and concrete formwork and curing;

3. Repair or replace existing water, sewer, natural gas, and communications lines in their present configuration, alignments and depth with no impact to character defining features. If a utility line passes through an archaeological site, an archaeological monitor may be required;

4. Traffic signs as required by law;

5. Repair or replace in kind existing building signs. Signs should be mounted in a way as to minimize physical damage to historic building materials. New sign installation shall maintain character of historic properties and not alter character defining features;

6. Temporary buildings or structures that will not have a life longer than five years and which have no significant ground disturbance associated with installation;

7. Undertakings that impact areas less than one square meter of ground disturbance and which are outside of sites eligible for the National Register;

8. Repair or replace in kind existing fencing and fence screens. Installation of perimeter security fencing and gates are acceptable provided surveys have not identified historic properties and character defining features are not altered; or

9. No, or minimal, ground disturbance, and ground disturbance within previously disturbed areas as long as new disturbance does not exceed dimensions of previous disturbance.

Additional Exempted Undertakings-Test Sites and Test Activities

1. Surface to surface missile launches from an established launch site or an area inventoried for historic properties where no historic properties exist to a known WSMR impact area. Some of the major missile launch sites include Launch Complexes 32 to 39, Launch Complex 50, WC 50, Mine Site, Pony Site, Chili Site, Brillo Site. Coker Site, Phil Site, Tula G Site, Shot Site and the Aerial Cable Range.

2. Surface to air missile launches with a launch from an established launch area or an area inventoried for historic properties where no historic properties exist. This type of mission includes launches from Fort Wingate (Launch Complex 94) where a target missile is launched and intercepted in WSMR airspace at various altitudes. If a surface to air mission uses a drone or missile as a target, recovery of the drone and/or missile (in the case of a miss) will be monitored by DPW Environmental Division archaeologists. Generally, when an intercept occurs, the missiles/drones are obliterated, leaving only small pieces of debris that is spread over many square miles. Little of this material is recovered. Some of the major missile launch sites include Launch Complexes 32 to 39, Launch Complex 50, WC 50, Mine Site, Pony Site, Chili Site, Brillo Site. Coker Site, Phil Site, Shot Site and the Aerial Cable Range.

3. Air to air missile launches-WSMR airspace is used for both testing of air to air weapons and for training of aircrews in air to air weapons firing. These missions usually take place north of US Highway 70 in the Tularosa Basin part of the installation. Frequently there is a need for recovery of targets and missiles. If a surface to air mission uses a drone as a target and the target is shot down, recovery of the drone and/or missile will be monitored by DPW Environmental Division archaeologists. Targets not hit by a weapon are generally returned by the operators to the take-off point.

4. Air operations conducted by the U.S. Air Force and foreign nation air forces where there is either no weapons release or weapons are released into an established impact area in an air to surface mode. This includes operations such as air to air radar tracking, air to air laser operations and other missions that have no impact on land.

Also included are air operations without weapons release at the Oscura and Red Rio bombing ranges, the Fairview Gunnery Range and the Slick City/Cardboard City target complex.

5. Laser operations and testing where lasers are propagated from a known, established site to a known, established target. This includes target vehicles that travel on known roads and trails where the vehicle does not leave the roadway.

6. Communications operations and testing where communications are propagated from a known, established site to a known, established target. This includes target vehicles that travel on known roads and trails where the vehicle does not leave the roadway.

7. Unmanned Aerial Vehicle/Unmanned Aerial Systems operations where UAV/UAS are launched, flown and recovered from a known, established site. Recovery of UAV/UAS by foot is also exempted. Recovery of the drone and/or missile will be monitored by DPW Environmental Division archaeologists on an as needed basis.

8. Vehicle testing and military vehicle land navigation missions on established roads and trails or testing at an established test site. This can include static testing of vehicles sited on concrete or gravel pads.

9. Artillery operations from a known, established site to a known, established target. The targets will always be one of the established WSMR impact areas. One of the most used artillery firing points is Arthur Site in the southern part of the range. Three firing boxes were established for the Excalibur system in the central part of WSMR. These boxes can support artillery live fire and limited maneuver.

10. Operations at the WSMR Small Arms Range Complex (SARC). Testing of optical and thermal sites is a frequent mission at the SARC. A shoot house is also located at the SARC. This facility and the small arms ranges are used for weapons qualifications by local and state law enforcement agencies, WSMR police, and military units. If test missions need additional land at this location, the Section 106 process will be initiated.

11. Radar testing and operations at established locations where radars are propagated from a known, established site to a known, established target. Radar tracking of vehicles moving along established roads and trails is exempted. Also exempted in aerial tracking of objects from radars at established sites.

12. Use of the Mountain Village, Yucca Village, Sierra, Otero, Thurgood Maneuver Areas by units for training events and use by test missions. These areas have been inventoried for historic properties. National Register eligible historic properties have been marked with Siebert Stakes and will be avoided by all vehicular traffic. Avoidance of eligible archaeological sites will be monitored by DPW Environmental Division personnel.

13. U.S. Air Force (and other services) operations at the Red Rio and Oscura bombing ranges and the Fairview Gunnery Range, including aerial gunnery, use of high explosive and inert weapons (bombs and missiles), Tactical Air Control training. Historic properties inventories have been conducted at both bombing ranges. National Register eligible archaeological sites have been marked and are avoided during USAF use of the ranges. Semi-annual monitoring of the archaeological sites will be conducted to ensure no impacts to eligible sites occur.

14. Use of the Zumwalt Test Track (ZTT) for weapons, radar, laser, and other testing. Typical operations at ZTT involve air to ground weapons testing. Historic properties inventories have been conducted at the test track. National Register eligible archaeological sites have been marked and are avoided during use of the track. If test missions need additional land at these locations, the Section 106 process will be initiated. If damage to a National Register eligible site occurs, WSMR will conduct a damage assessment and prepare a report for submission to the NM SHPO.

15. Use of the Electro Magnetic Resistance Emitting (EMRE) and Hazardous Test Area (HTA) sites. These sites are for electromagnetic testing and testing of hazardous materials. The test sites were established in the 1950s and are generally used for static testing of vehicles and equipment. All test sites at these locations have been inventoried for historic properties and these two test locations have no historic properties within the test sites. If test missions need additional land at these locations, the Section 106 process will be initiated.

16. Use of the White Sands Space Harbor for military testing and training and by other government agencies for missions.

17. Use of the Aerial Cable test site. This test site is composed of a Kevlar cable stretched between two mountain peaks. Test targets are attached to the cable and run along it to be targeted by various types of munitions. All launch and other test sites at these locations have been inventoried for historic properties and all test locations are free of them. If test missions need additional land at these locations, the Section 106 process will be initiated.

18. Use of the Permanent High Explosive Test (PHETS) site. This site is used to test penetration of munitions by aircraft and other large-scale tests. As this test site is located in the Trinity National Historic Landmark, use is governed by the 1988 MOU regarding operations with the landmark itself. If test missions need additional land at these locations, the Section 106 process will be initiated.

19. Use of the Capital Peak Test Site for high explosive and large munitions testing. Historic properties inventories have been completed and all National Register eligible sites are avoided during testing. If test missions need additional land at these locations, the Section 106 process will be initiated.

20. Use of the USAF Aeroacoustic Research Complex. Testing at this site is concerned with the acoustical signatures of aircraft. No ground disturbance occurs here. If test missions need additional land at these locations, the Section 106 process will be initiated.

21. Use of established, isolated locations for test vehicles such as optics equipment, radar and telemetry vans and trucks. There are many military sites that once housed optics, communications or radars which are berms or cleared areas. Most of these have concrete or gravel laid down. These occur both in the three WSMR mountain ranges and the Tularosa Basin floor. These locations are still usable for static testing of various military systems. Use of these locations for positioning test vehicles is exempted from Section 106 review provided no additional ground disturbance occurs.

Additional Exempted Undertakings-Natural Resources Activities

1. Maintenance work on existing features such as roads, fire lanes, fences, mowed areas, active disposal areas, manmade ditches, and ponds when no new ground disturbance is proposed.

2. Outdoor recreational programs including hunting, fishing, and mountain biking in accordance with WSMR and Army regulations, when there will be no ground-disturbance, including no off-road vehicular travel and when there are no known archaeological sites.

3. The following natural resources management activities are exempted: tree plantings, planting of decorative shrubs and flowers, maintenance of wildlife food and shrub plots and guzzlers in previously disturbed areas and where no archeological sites are present, improvement of existing dry stream crossings where the depth of the undertaking will not exceed the current disturbance and/or will not impact an intact soil layer with the potential to contain cultural materials.

4. Maintenance, removal, and replacement in kind of existing landscape and plant materials when keeping with the historic character when they are dead, dying, diseased (unsalvageable), and/or pose an imminent hazard to people or structures.

5. Deconstruction, demolition and all other undertakings occurring to buildings, structures, and landscapes that have been previously evaluated for NRHP eligibility and have been determined to be ineligible for inclusion in the NRHP in coordination with the appropriate SHPO, and which will not negatively impact existing historic properties or result in ground disturbance.

Additional Exempted Undertakings-Built Environment

1. Construction in areas where the APE of the construction project does not include historic properties and which do not require ground disturbance (such as storage buildings built on existing slabs or other non-ground-disturbing foundations, etc.).

2. Roofs - Repair in kind existing roof. If roof is deteriorated beyond repair, a compatible replacement roof is acceptable. Replacement roof(s) shall not alter overall appearance of exterior or diminish character defining features. Installation of new roofing, including white roofs or cool roofs, on a flat-roofed building with a parapet, such that the roofing material is not visible from any public right-of-way.

3. Exteriors - Repair or replace in kind existing materials that maintain character defining features: stucco, concrete, masonry, wood siding, trim, porch decking, porch rails, joists, columns, and stairs. Installation of materials such as netting, bird spikes or sonar equipment for the deterring of bird habitat and does not alter character defining features. Installation should be reversible and not result in physical damage.

4. Doors - Repair in kind existing historic door(s). If door is deteriorated beyond repair, a compatible replacement door is acceptable. Replacement door(s) shall match original design/configuration and shall not alter overall appearance of facade or diminish character defining features. Doors will typically be the same materials unless force protection or safety protocols require otherwise; installation of hardware to include dead bolts, door latches and locks, window latches, locks, hinges, and door peepholes, provided historic materials are not removed. New hardware shall be of a plain, contemporary design and made of the same material as existing historic hardware; repair in kind door screen(s). Door screen(s) shall be repaired in-kind prior to consideration of replacement. If replacement is necessary, screen shall be replaced in-kind with same material and thickness as existing screen.

5. Windows - Repair in kind existing damaged window components. If window components are deteriorated beyond repair, individual window component shall be replaced in-kind. Complete window replacement requires SHPO review; paint window components in-kind. Unpainted surfaces shall remain unpainted; adjustments of window counterweights including associated disassembly and reassembly; replace in kind existing broken window glazing. Replacement shall be clear glass with same thickness as broken glass; repair or replace in kind existing damaged window screens and storm windows; installation of hardware to include window latches, locks, hinges, provided character defining features are not removed. New hardware shall be of a plain contemporary design and made of the same material finish as remaining existing historic hardware.

6. Interiors - Repair or replacement of existing non-historic flooring, carpets, and blinds that does not alter character defining features; replacement or placement of window treatment such as mini-blinds and curtains; repair in kind damaged historic flooring. If flooring components are deteriorated beyond repair, individual flooring component shall be replaced in-kind. Replacement flooring shall match original design, color and material and shall not alter character defining features; installation of fire, smoke and security detectors; installation of new interior furniture/furnishing and information technology systems and equipment that does not alter or diminish character defining features; repair of structural and mechanical systems that are not visible and does not alter structural integrity or character defining features; repaint or refinish historic surfaces in kind. New paint color/finish shall match existing color

and texture and does not alter character defining features; removal and replacement of non-historic asbestos flooring and mastic and does not alter character defining features.

7. Electrical/Plumbing/HVAC - Repair or replacement of existing electrical, plumbing fixtures, wiring, lines and pipes and does not alter character defining features; repair or replacement of existing heating and cooling systems, ductwork and ventilation systems that are not considered character defining features and do not alter character defining features; repair or replacement of existing electrical, power, lighting and communication lines in their present configuration and alignments and depth and do not alter character defining features; upgrading existing electrical and plumbing components such as hot water heaters, existing wiring, lines and pipes that do not alter character defining features;

8. Conservation - Repair or installation of insulation in roofs, crawl spaces, ceiling, attics, walls, floors and around pipes and ducts that do not alter character defining features; repair or replacement of existing non-historic lighting systems that do not alter character defining features; installation of environmental monitoring units, such as those for water, air quality and electrical usage; energy audits and feasibility studies. Water conservation measures, such as installation of low-flow faucets, toilets, showerheads, urinals, or distribution device controls, provided that plumbing fixtures to be replaced are not original to the building; upgrading existing facility and infrastructure-related pumps and motors, including those water/wastewater facilities, to variable-speed or premium efficiency standards; hot water tank replacement that does not require a visible new supply or venting; and repairing plumbing systems in a manner that does not affect the interior or exterior of the building.

9. Maintenance - Maintenance and routine housekeeping that does not alter character defining features; removal of animals, birds, insects and their associated debris.

10. New Construction - New construction in areas that do not include historic properties or with the view shed of a historic district. New construction in or near a historic district and associated view shed shall be reviewed and approved by the CRM and/or CRM Staff and also reviewed by the SHPO.

4.3 SOP #3: Defining the Area of Potential Effect

4.3.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.3.2 Objective

The objective of this SOP is to present a process to be followed by WSMR to establish the appropriate APE of an undertaking.

4.3.3 Policy

It is WSMR policy to consider the direct and indirect effects an undertaking may have on historic properties; including visual impacts on properties that may be in the view shed of the undertaking. Prior to evaluating and identifying historic properties and assessing specific effects that an undertaking may have, WSMR will define the APE.

4.3.4 Implementing Procedures

Definition

36 CFR Part 800.16(d) defines the APE as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such historic properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." Guidance published by the ACHP states that the APE should include:

- All alternative locations for the undertaking;
- All locations where the undertaking may result in disturbance of the ground;
- All locations from which elements of the undertaking (e.g., structures or land disturbance) may be visible; and
- All locations where the activity may result in changes in traffic patterns, land use, public access, etc.

Establishing the APE

The size of the APE is determined on a case-by-case basis by the CRM and includes in its calculation the scale and nature of the undertaking. At a minimum, it should include all areas where ground-disturbing activities would take place. It should also

include areas affected by potential direct, indirect, and cumulative effects. The APE for interior work on buildings that do not have the potential to affect exteriors will be only the interior of that building.

WSMR will determine a project's APE using the following procedures:

- Categorize the undertaking (repair and maintenance, ground-disturbing activities, *etc*.);
- Determine whether the effects typically associated with this category of undertaking are the expected effects for this project;
- Determine where those effects might occur in relation to the project based on anticipated effect(s). The areas where effects might occur constitute the APE;
- CRM will consult with appropriate SHPO, THPO, and Tribe(s) if unsure of APE boundaries or suspects other information should be considered;
- Examine the APE to determine whether the proposed undertaking is likely to affect historic properties;
- Complete this process for all potential project locations;
- Include all APE definitions on a project map, including areas of direct and indirect effect; and
- Determine whether the scope and/or nature of the undertaking might result in additional or other effects.

4.3.5 Disagreements

Should WSMR, the SHPO, and other signatories disagree about the boundaries of the APE, they will use SOP #12 to attempt to resolve the dispute.

4.3.6 Further Action

- Document the APE in the Record of Historic Properties Consideration (RHPC); and
- Proceed to SOP #4: Identifying and Evaluating Historic Properties.

4.4 SOP #4: Identifying and Evaluating Historic Properties

4.4.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or inter-service support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.4.2 Objective

The objective of this SOP is to collect information about historic properties within the APE. After the APE has been defined, potential historic properties are identified and evaluated for eligibility for inclusion in the NRHP. Not all historic-age (typically 50 years of age or older) resources will necessarily qualify for inclusion in the NRHP. NRHP eligibility is a threshold that affects subsequent management actions for the resources. Properties do not have to be formally listed in the NRHP to meet this threshold. National Register eligibility can be determined by SHPO concurrence and/or Keeper of the National Register opinion.

4.4.3 Policy

It is WSMR policy to identify properties that are eligible for inclusion in the NRHP or that are identified as Properties of Traditional Religious and Cultural Importance (TRCI) by federally recognized Tribes and manage them to maintain the historic or cultural characteristics that qualify them for inclusion in the NRHP or important as TRCIs. All sites, until determined not eligible for NRHP listing, are considered TRCIs and are subject to the ICRMP guidelines. Additional standards, procedures, and guidelines for documenting historic properties are included in Appendix H.

4.4.4 Implementing Procedures

Identification

Identification studies typically include background research, field investigations, consultation, analysis, and documentation of findings. Prior to a project specific identification study, the CRM will conduct a pre-inventory analysis to determine whether additional investigation is necessary, and, if so, what type of inventory approach is appropriate.

Preliminary Analysis

The CRM will review the project area to establish whether the APE has been previously inventoried and to determine what types of historic properties are likely to be found in the APE. Background research should be conducted in preparation of survey as appropriate to the project.

Potential sources include, but are not limited to, installation files and maps; previous identification surveys; BLM files; New Mexico SHPO files; previously identified

historic contexts for the region; and local histories. Information may also be available from local governments, Native organizations and Tribal governments, universities, and public and private groups and institutions.

Resources for this review may also include, but are not limited to:

- The inventory and maps of WSMR historic properties held on the Geographic Information System (GIS) database at WSMR including planning level surveys, building inventories, maps of established historic districts and maps of archeological sites;

- Search of state site database systems, including the New Mexico Archaeological Records Management Section (ARMS).

- Any known properties of traditional religious and cultural importance. The CRM will also consider sources of Indigenous Knowledge (IK), or Local and Indigenous Knowledge Systems (LINKS) during the resource identification process.

Based on this review, the CRM will assess the information as follows:

- If the area has been investigated previously, assess the quality of any collection data. If the area has not been investigated, or if it has been investigated, but data quality is poor or conducted with old methodologies that are no longer valid by current state standards, further identification efforts will be required.

- Determine the need for additional identification based on Planning Level Survey data, predictive model results, and preliminary tribal consultation on potential properties of traditional religious and cultural significance. The CRM will determine whether the collective data provides a basis for decision-making without additional identification activities:

- Documentation of a decision not to proceed with further identification activities shall be included in the RHPC and made part of the project file; and

- The decision shall be documented in a letter report to the consulting parties; documentation shall include the basis for the decision.

Predictive Modeling

A GIS-based predicative model for site frequency across WSMR was completed in 2001, updated in 2012 (Heilen et al. 2012), and is available for preliminary analysis and planning. The predictive modeling system is based on the following five predictive factors:

- Topography: Variables of 1) slope – relative cost of moving across the landscape; 2) aspect – direction in which a slope is facing and terrain roughness; (3) shelter-degree to which topographic features afford shelter and cost distance to uplands.

- Soils: Based on United States Geological Survey (USGS) soil survey data such as organic matter content, available water capacity, bulk density, etc.
- Water: Landscape features that could have provided surface water resources after precipitation episodes, including 1) distance to artificial water tanks for storage; 2) distance to streams, drainages, and other elevation shifts relevant to flowing water.
- Vegetation: Data from gap analysis program and national land cover program.
- Social: Calculation of least cost path for water.

The predictive model is used for inaccessible survey locations at WSMR and allows survey efforts to focus on high-probability areas. The model was developed for areas within the basin interior and does not accurately model mountain slopes on the basin margins. Anecdotal evidence from large surveys has shown that the model does not necessarily accurately predict site densities or locations and, given its age, is probably in need of some further refinement.

Additional Studies

If additional identification studies are required, the appropriate tasks may include background research, field investigation, tribal consultation, analysis, and report preparation. The persons conducting identification studies and other historic properties activities shall meet the Secretary of the Interior's *Professional Qualification Standards* in the appropriate discipline under 36 CFR Part 61.

4.4.5 Survey

In general, there are two types of surveys: the reconnaissance survey and the intensive survey. The reconnaissance survey is a light inspection aimed at developing a general overview of an area's resources. The primary reason for a reconnaissance survey is to support background research in preparation of an intensive survey. The objective of an intensive survey is to identify completely and precisely all properties in a specified area based on a specific research design. It involves background research and a thorough inspection and documentation of all historic properties in an area. It should provide an inventory and necessary information to evaluate properties of eligibility for inclusion in the NRHP. The requirements and methods for conducting archeological surveys on WSMR are outlined below.

As part of the research process, the CRM should periodically contact the NPS or US Army Environmental Command (AEC) to determine whether any nationwide historic contexts have been developed that might apply to historic properties on WSMR. Similarly, the SHPO may have a statewide context against which the historic relevance of a resource can be weighed. WSMR has been proactive in developing historic contexts for resources on its installation that are specific to the history of the region and to the Army. This effort to address gaps in the literature for current and future reference will continue. However, Army funding practices do not provide for conducting historic context development beyond the borders of the installation. The CRM will consider other potential funding sources to assist in development of local and state context and will support efforts by others to develop these.

Requirements for Archeological Survey

A cultural resources professional with minimum qualifications as defined in 36 CFR Part 61 for archeology will supervise all archeological surveys. The CRM will provide general survey areas to the field archeologist who will:

- Determine the final survey area: Only areas with the potential to contain archeological sites in the project's APE will be surveyed. Areas that are already highly disturbed (e.g., improved areas, borrow pits, etc.) and areas inaccessible to military training or other WSMR undertakings (i.e., steep slopes) will be excluded. Areas that have been previously surveyed will also be excluded if existing data is determined by the CRM to be sufficient for the proposed project.
- Survey: The archaeologist will be responsible for conducting surveys and site evaluations according to the standards and procedures outlined in the following section.
- Submit report: A report will be submitted to the SHPO on the survey. Survey reports will include, but are not limited to:
    - A management summary.
    - Project description.
    - Project area description.
    - Previous work/sites.
    - Methods.
    - Results.
    - Recommendations.
    - References.

Archeological Survey Procedures

All cultural resource surveys undertaken on WSMR shall consist of comprehensive, intensive, pedestrian methods designed to identify those Historic Properties that can reasonably be detected from the surface or are exposed in profiles. The purpose of survey is to obtain accurate, descriptive field data, which are systematically collected and sufficiently detailed to assess the research potential of each site; to make evaluations for National Register eligibility; and to allow preparation of accurate data recovery plans and budget estimates. Historic properties shall include both prehistoric and historic (50 years or older) manifestations. Military debris such as bullets, cartridges, and small missile fragments shall not be recorded unless it constitutes a particular historic event or is specified in a delivery order. Historic remains shall also

be recorded, including wells, tanks, fences, machinery, and ground modifications from the historic period. Modern bottles, cans, and other trash will not be inventoried, but may be noted.

Intensity

The standard distance between surveyors shall be 15 m. Any deviations from this distance shall be justified, require prior approval by the archeological program managers, and be documented in the technical report. Obstacles that may obscure the discovery of historic properties (e.g., dense vegetation, recent alluvium, sedimentation) shall be noted and the approximate boundaries of the obstacle(s) or condition shall be indicated on the appropriate USGS quadrangle. Linear surveys shall cover a width determined appropriate by the CRM on each side of the linear undertaking being surveyed, not including previously disturbed graded or bulldozed areas.

4.4.6 Recordation

This section describes the standards and practices for recording archeological sites and isolated occurrences (IOs).

Site Documentation

Minimal data to be recorded include the general environmental setting, definition, and location of horizontal site boundaries; description of the location, number, and kinds of features visible from the surface; nature of artifact assemblages; density and frequency of artifacts; site integrity; potential for yielding chronometric samples (radiocarbon, dendrochronological, *etc*.); and paleoclimatological samples. The entire site boundary is also recorded, even if it exceeds the edge of the survey unit. Historic sites must have all relevant historic records searched as a way of adding documentary knowledge about the site. All archeological sites must have a Global Positioning System (GPS) differentially corrected, highly accurate location taken in the approximate center of the site. All site boundaries must be mapped with sub-meter accurate GPS. GPS files should be converted to ArcGIS shape file format for assimilation with the WSMR GIS dataset.

Site Definition Criteria

No quantified criteria are going to cover all possibilities. Therefore, the following general criteria will be used for defining a cultural resource site:

- The physical remains of past human activity that are at least 50 years old.
- At least five artifacts within a 20 m diameter area, except when all pieces appear to originate from a single source (e.g., one ceramic pot drop, one broken glass bottle, one deteriorated piece of sheet metal, etc.). The exception is discrete, single knapping episodes, which are treated as sites. Fire-cracked rock and burned caliche are not considered artifact types for purposes of this criterion, but may fall under the category of "undatable feature."

- One or more datable archeological features with at least one associated artifact.
- Two or more undatable archeological features.
- A single undatable feature with any associated artifacts. Ten pieces of fire-cracked rock and/or burned caliche in 1 square meter is the minimum criteria for fire-cracked rock and/or burned caliche to be assigned feature status without associated feature fill.
- In general, 30 meters will be the maximum distance between manifestations, beyond which the materials should be treated as spatially unrelated.

The CRM will allow the investigator to assign site status to other situations outside these criteria provided a logical and reasonable argument is made in consultation with the archeology program managers. Additionally, any IO must be completely recorded such that the data potential of that manifestation is exhausted. In the case of a single undatable feature, trowel tests must be conducted around the locus to ensure there is no associated stain or additional buried deposits. Additional documentation on the potential for subsurface deposits in that area must accompany any recording of a single undatable feature recorded as an IO. Additional information on the requirements of IO recording is discussed in a separate section below.

Forms

Data required for the New Mexico state forms for survey and sites shall be obtained for each project and site. Other additional data forms for infield analysis may be used at the investigator's discretion, with an archeological program manager's approval, or may be required by WSMR in the future. Data will be compatible with the ARMS systems. The investigator is responsible for completing a New Mexico Cultural Resource Information System (NMCRIS) form and obtaining the NMCRIS activity number and Laboratory of Anthropology (LA) numbers for New Mexico projects.

Features

All features (e.g., rooms, hearths, bins, depressions, middens, terraces, burned rock concentrations, fences, etc.) are recorded noting quantity of materials, size, shape, construction details, probable function, and any relationship to activity areas. Digital color photos should be taken of each feature. The feature location should be recorded with a sub-meter accurate GPS unit. When specified, profiles and plans views of each feature should be drawn. In cases of sites that include numerous examples of similar features that only vary in minor details, such as fire-cracked rock features or historic prospect pits, a single representative example may be drawn.

Artifacts

Sampling and density for large projects only (40 acres or more with surface collection as part of the project). The investigator shall confer with the CRM to design and implement an approved procedure for (1) estimating the density (or range in

density) of surface artifacts and (2) estimating total frequency of surface artifacts for each artifact group. This should be done on a project-by-project basis and previously approved methods are not automatically acceptable for other projects. Formal sampling procedures may include transects, quadrants, or other techniques, but the procedure shall be appropriate to the overall size and complexity of the site. To preserve the integrity of each site, artifacts shall be disturbed as little as possible during infield analysis and returned to their pre-analysis locations, unless they are collected.

- Recording artifacts. Artifacts shall be recorded using established WSMR procedures or the specific procedures established in the research design and/or work plan for that project. The CRM must approve any deviations in advance.

Site Maps

A sketch map shall be prepared that depicts, minimally, the relationship of the site to nearby physiographic features and identifying landmarks, the location of each visible feature, the shape and location of artifact sampling units, activity loci, the location of the site datum, site and provenience boundaries, location of test units (including probes, auger, and trowel tests) and locations of collected artifacts. All maps must have a scale, north arrow, recorder name, date, legend/key, and identification of source graphics (e.g., quadrangle name). If remote sensing techniques are used (e.g., magnetometer, ground penetrating radar, etc.) these areas must be delineated on the maps as well. The field number may be recorded on the field maps; however, LA numbers and WSMR site numbers shall be used on all final and published maps. The entire site boundary shall be recorded, even if it extends outside the survey area.

Site Depth

The investigator shall assess the potential of subsurface deposits at each site based on sound geoarcheological and/or geomorphologic argument. If the professional judgment is that a site is a surface manifestation only, a clear statement citing evidence supporting that judgment shall be provided. If the investigator believes a site contains subsurface deposits, a clear statement with supporting evidence shall be provided (e.g., strata visible in arroyo cut, results of auger tests, etc.). Auger tests, probes, trowel tests and other techniques of extremely limited nature that have minimal impact on the integrity of the site may be performed to serve as a basis for making a professional assessment of depth and extent of cultural deposits. These tests are considered a routine element of survey procedures distinct from a formal testing project. However, the archeological program managers must approve all subsurface testing strategies prior to the start of fieldwork.

Site Integrity

The investigator shall assess the present condition of each site including (1) identifying the kinds of post-depositional activities that have affected the site, (2) estimating the percentage of total site affected by each kind of disturbance, and (3) indicating

those portions of the site that remain intact. Investigators must identify all disturbance sources, man-made and natural. A thorough and accurate description of site integrity must be provided for each individual site investigated.

Chronometric Potential

For each prehistoric site, the investigator shall assess the potential for obtaining the following kinds of chronometric samples: (1) radiocarbon samples (how many, standard or AMS, and in what context); (2) dendrochronological samples (how many and from how many different features); (3) type seriation such as diagnostic artifacts (list kind and frequency); and (4) other techniques as appropriate.

Site/Project Location Maps

Each site and project shall be plotted on the appropriate USGS 7.5 minute quadrangle topographic map at 1:24000 scale. The actual boundary of each site, rather than a central point, shall be depicted, as shall the survey areas, features (hearths, fences, tanks, and other structures), IOs, and modern features (such as roads and power lines) within the project area. The complete site boundary shall be mapped, even if it falls outside the project area boundary. The complete project area must be plotted as well. When appropriate or requested by the archeological program managers, maps with background imagery should be provided. All locational data should be collected with a GPS, Electronic Distance Measurement (EDM) instrument, or other approved device using the Universal Transverse Mercator (UTM) coordinate system. Each site shall be identified in an appropriate GIS system.

Site Datum

A site datum will be placed during site recording unless otherwise indicated by the archeological program managers. In general, a datum should consist of a piece of steel reinforcing rod ("rebar") or other approved stake with an attached aluminum or other approved tag. The tag shall include the name of the contractor and/or investigator, date of placement, WSMR project number, and site number.

Isolated Occurrences

Isolated occurrences (IOs) must be recorded with sub-meter accurate GPS units and plotted on 1:24000 USGS quads as part of all survey reports. In instances where the distinction between an IO and a site is in question, the investigator shall consult with the CRM to determine the designation. Only diagnostic or unique artifacts may be collected unless special provisions have been made to accommodate a specific research interest. IOs must have enough attribute data recorded to exhaust the data potential of the material. IOs include artifacts/features from any cultural or temporal period where those manifestations do not qualify as a site under the current criteria.

4.4.7 Requirements for Surveys of Historic Buildings and Structures

A professional with minimum qualifications as defined in 36 CFR Part 61 for historian, architectural historian, or historical architect will supervise building and structure surveys. Survey requirements will vary depending on the scope and character of the undertaking. In many cases, previous inventory efforts will need to be revisited and updated, depending on the age and completeness of the earlier recording. Many recordings of buildings and structures completed during the 1990s are not compliant with current SHPO requirements and, at a minimum, should be recorded on current versions of the Historic Cultural Properties Inventory (HCPI) form. As of this writing, the Environmental Division has also prepared a WSMR-specific version of the HCPI form that facilitates documentation of DoD-type properties which can be used in place of the standard New Mexico HCPI form upon approval of the CRM. Another issue with many previous built environment recordings is that they focused on individual resources and did not adequately address the potential of historic districts. In many cases, a more expansive re-recording is required to better evaluate resource clusters as potential historic districts. One final consideration in regard to previous recordings is that many properties previously recorded in the 1990s or early 2000s are now 50 years of age or older. The potential historic significance of these properties or their associated programs has likely changed with the additional passage of time, and previously evaluated properties may require updated recommendations as a result.

Built Environment surveys, focused on the inventory of historic buildings, structures, and objects, may be conducted as needed as part of ongoing planning level survey work as well as to provide information on resources in an APE that are not sufficiently documented.

- Determine Appropriate Survey Requirements: The CRM will determine whether historic context material will need to be developed concurrently for the evaluation phase. The CRM will also consider if the APE has been previously surveyed and if that survey data is adequate for the present undertaking.

On-Site Recordation

Built environment inventories will combine site inspections with archival research. The inventory area will be determined in consultation with the CRM, and should be mostly comprehensive of a given facility, site, or complex. NPS guidance for identifying NRHP-eligible properties recognizes buildings, structures, and objects, as well as two additional types of resources that may include multiple resources; sites and districts. The NRHP is by necessity oriented towards recognizing "physically concrete properties that are relatively fixed in location" (NPS 1995:4). The selection of categories should be dictated by "common sense and reason" (NPS 1995:4) and the *NPS Bulletin 15* provides definitions for building, structure, and object as follows:

> A building, such as a house, barn, church, hotel, or similar construction, is created principally to shelter any form of human activity. "Building" may also refer to a historically and functionally related unit, such as a courthouse and jail or a house and barn [NPS 1995:4].

> The term "structure" is used to distinguish from building those functional constructions made usually for purposes other than creating human shelter [NPS 1995:4].
>
> The term "object" is used to distinguish from buildings and structures those constructions that are primarily artistic in nature or are relatively small in scale and simply constructed. Although it may be, by nature or design, movable, an object is associated with a specific setting or environment [NPS 1995:5].

Additionally, the NPS defines sites and districts as:

> A site is the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archaeological value regardless of the value of any existing structure [NPS 1995:5].
>
> A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development [NPS 1995:5].

Distinctive organizational cluster of buildings, structures, and objects are common at WSMR and often represent distinctive functional and administrative areas such as launch complexes, assembly areas, or instrumentation sites. Consideration of these resources as a larger group should be made as part of the recording process, which will allow these collections of resources to be evaluated as potential districts or sites. Specific guidelines on the evaluation process are provided in a separate section below.

On-site recording should include a written description of the property, planview map, and digital photographs of the property exterior and setting. Interior photography should also be taken if the building interior is accessible, unless forbidden by security concerns. Small infrastructural elements that are not consistent with the above definitions of buildings, structures, and objects might also be recorded if required by the WSMR CRM. These associated elements are often found in association with historic properties and can provide a more comprehensive understanding of the location's history, use, and infrastructure. These associated features can consist of instrumentation installations, water and wastewater features, electrical infrastructure features, launch support features, liquid propane tanks, and a variety of historic refuse dumps.

Background Research

Background research should be conducted as part of historic built environment inventory efforts. Background research can provide historical information about specific properties as well as provide information on the historic context of a property or location. Sources for this research include a number of DOD-sponsored guidance

and contextual documents, as well as several historical overviews of Cold War activities at WSMR. Archival resources unique to WSMR include the WSMR Museum Archives, a large repository of historic documents, photography, and videos located at the WSMR cantonment. The WSMR Museum Archives collections can be searched via an electronic database, and the physical collections are available by appointment. Another useful resource available through the WSMR Museum are annual firing records of the numerous missile systems and research rockets launched at WSMR throughout the Cold War. Additionally, a searchable electronic archive of the WSMR base newspaper, *Wind and Sands* (later renamed *The Missile Ranger*), is also a publicly available resource for research into the history of WSMR (see www.wsmrhistoric.com). The CRM can also provide current and historical WSMR property inventories that facilitate property identification and construction dates. The use of interviews and oral histories is also encouraged to provide additional information. Documentary research should be thorough enough to provide for the evaluation of any resources identified.

Documentation

A report documenting the survey will be prepared. The report will include, but not be, limited to the following:

- description and map of survey area(s);
- historical narrative;
- architectural description to the standard of the Historic American Buildings Survey (HABS) Level 4 documentation (as defined in the Secretary of the Interior 's Standards and Guidelines for Architectural and Engineering Documentation: HABS/HAER Standards, 1990), or equivalent Historic American Engineer Record (HAER) standards;
- photographs of all resources identified;
- list of sources consulted;
- evaluation of significance (as presented below); and
- maps will be digitized and submitted in a format compatible with ArcGIS. GIS data created in ArcGIS will be projected in the UTM coordinate system with NAD83 and corresponding UTM zone number. Metadata will accompany all GIS data and shall follow the Federal Geographic Data Commission's (FGDC) standards.
- In cases of militarily sensitive properties, photos and maps may be subject to internal review and restrictions.

- If no historic resources are identified within the APE of a proposed project the CRM will document the absence of resources and the means used to determine this absence in the project file. The project can then proceed without further consideration of historic resources. This finding will be documented in the RHPC and made part of the project file.

- If historic properties are identified in the APE, the CRM will determine if these are eligible for listing in the NRHP. This finding will be documented in the RHPC and made part of the project file.

4.4.8 Specific Requirements for Inventories of Traditional Cultural Properties (TCPs)

The NHPA and its implementing regulations in 36 CFR 800 refer to "properties of traditional religious and cultural significance" and "properties of traditional religious and cultural importance." These terms are essentially interchangeable and refer to geographic places that figure prominently in a particular group's cultural practices, beliefs, or values, when these are widely shared within the group, have been passed down through multiple generations, and have served to maintain the group's cultural identity for at least 50 years. These properties are very similar to Traditional Cultural Properties (TCPs), which are defined in *National Register Bulletin 38* as a site "eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." As TCP as come to be widely used in the historic preservation community, it is used in this document to refer to both TCPs and "properties of traditional religious and cultural importance." Besides meeting these definitions, TCPs must also meet one or more of the four NRHP Criteria for Eligibility and retain integrity (Parker and King 1992). The statement of significance describing why a TCP is eligible will be based on traditional knowledge, literature reviews, and archival records. Integrity is best determined by the Tribe recognizing the site's significance.

WSMR will consider TCPs in project planning. In respect of confidentiality issues, WSMR will only collect that information necessary to consider adverse effects in the planning process; this may or may not involve determining a site's eligibility for inclusion in the NRHP. Tribal Government consultation shall determine the level of identification effort that is merited. It should be noted that TCPs may include natural settings and do not necessarily need to contain culturally modified objects/sites to be considered in the planning process.

Confidentiality: Tribal Governments may determine that sharing information about a TCP is inappropriate. In such circumstances, consideration of adverse effects in the planning process is still possible. Tribal Governments may delineate a boundary around a significant site, which will be large enough to avoid inadvertent discovery of the property. When Army undertakings within the boundary are proposed, consultation with appropriate Tribal Governments will be initiated to discover whether the proposed project will affect the TCP. If the project will adversely affect the site, avoidance through project location modification will be explored. Where adverse effects cannot be avoided, consultation with Tribal Governments shall determine if there are measures to reduce adverse effects that can be agreed to by all parties.

4.4.9 Evaluation

Evaluation for eligibility is a judgment process based on established criteria and guidance found in NRHP guidance documents published by the NPS. The process relies on two key concepts: significance and integrity. Both of these thresholds must be met to establish NRHP eligibility. Understanding the historic context of a property allows reasonable judgments to be made about those thresholds. Because significance and integrity are subjective concepts, the NRHP has developed criteria for evaluation and definitions of integrity that this SOP must follow. These are provided in 36 CFR Part 60.4 and summarized below. While the same NRHP framework is used to evaluate historic resources, archeological resources, and TCPs, evaluations will emphasize the aspects appropriate to the type of resource under consideration.

Procedures for Evaluation

The procedures to be followed by the CRM for evaluating a cultural resource of any type are as follows:

Categorize the Resource

The CRM shall determine if the cultural resource is an archeological site, TCP, building, structure, landscape, object, district, or combination. If the property is a TCP, the guidance in Section 4.4.11 should be followed.

Establish the Historic Context of the Cultural Resource

- The CRM shall identify the theme(s), geographical limits, and chronological periods that provide a perspective from which to evaluate the cultural resource's significance;

- The CRM shall determine how the theme(s) within the context may be significant to the history of the local area, the state or the nation. Although it is desirable to understand local and state contexts that may apply to WSMR properties, funding does not always provide for conducting such studies off base. The CRM will consider other potential funding sources to conduct such studies and support local and state efforts to fill this gap. A theme is considered significant if scholarly research indicates that it is important in American or regional history;

- The CRM shall determine if the cultural resource type is important in illustrating the historic context. Contexts may be represented by a single cultural resource type or by a variety of types;

- The CRM shall determine how the cultural resource illustrates the historic context through specific historic associations, architectural or engineering values, or information potential; and

- The CRM shall determine whether the cultural resource possesses the physical features necessary to convey the aspects of prehistory or history with which it is associated.

Determine Whether the Cultural Resource is Significant under the NRHP Criteria

The CRM shall apply the following NRHP criteria for evaluation of eligibility for inclusion in the NRHP. If the historic property meets one or more of these criteria and retains integrity, the CRM shall proceed to a consideration of the property's integrity.

If the resource does not meet any of the criteria or does not retain integrity, the CRM shall determine that the resource is not eligible for inclusion in the NRHP; this determination will be stated in the RHPC and made part of the project file. In that case, no further action is required. Any Determination of Eligibility is subject to appropriate SHPO review.

National Register of Historic Places Criteria for Evaluation

Per 36 CFR Part 60.4, the quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A. that are associated with events that have made a significant contribution to the broad patterns of our history;. or

Under this criterion, an historic property must be associated with one or more events important in the historic context. To establish significance under this criterion:

- determine the nature and origin of the cultural resource; and
- identify the significant historic context with which it is associated; and
- evaluate the historic context(s); and
- evaluate the resource's history to determine whether it is associated with the historic context in any important way.

B. that are associated with the lives of persons significant in our past.; or

This criterion applies to historic properties associated with individuals whose activities are demonstrably important within a local, state, or national context. The cultural resource must illustrate the person's achievement. To determine an historic property's significance under this criterion:

- determine the importance of the individual; and
- ascertain the length and nature of the person's association with the resource and determine if there are other historic properties associated with the individual that more appropriately represent that person's contributions.

C. that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

This criterion applies to historic properties significant for their physical design or construction, including such elements as architecture, landscape architecture, engineering, and artwork. The historic property, to qualify, must:

- embody distinctive characteristics of a type, period, or method of construction; or
- represent the work of a master; or
- possess high artistic value; or
- represent a significant and distinguishable entity whose components may lack individual distinction.

D. that have yielded, or may be likely to yield, information important in prehistory or history.

This criterion applies to historic properties that have yielded, or may be likely to yield, information important to prehistory (pre-contact) or history (post-contact).

Determine if the Historic Property Represents a Type Usually Excluded from the National Register of Historic Places, and if so, meets any of the Criteria Considerations

36 CFR Part 60.4 normally excludes certain types of properties from NRHP eligibility. These include religious properties, properties that have been moved, birthplaces and graves, cemeteries, reconstructed properties and properties less than 50 years old. However, there are exceptions for these kinds of properties if they meet one of the four standard evaluation criteria described above and fall under one of the seven special Criteria Considerations. Before examining the Criteria Considerations, the CRM shall determine if the historic property meets one or more of the four NRHP Criteria for Evaluation and retains integrity, and document the finding in the RHPC.

- If the historic property meets one or more of the four Criteria for Eligibility, determine if the historic property is of a type that is usually excluded from the NRHP. If it does not meet one of these types, proceed to an evaluation of the property's integrity.
- If the historic property is a type cited in the Criteria Considerations, the CRM must determine if the historic property meets the special requirements stipulated for that type in the Criteria Considerations. If so, the CRM shall proceed to an evaluation of the property's integrity. If the historic property does not meet the

requirements, the CRM shall determine that the historic property is not eligible for the NRHP and document that determination in the RHPC. No further action is required for properties that are not eligible for inclusion in the NRHP.

Criteria Consideration G, properties that have achieved significance within the past 50 years, is the main criteria consideration that applies to historic properties on WSMR. It is recognized that some properties dating from the Cold War era (1946-1989) require evaluation under this consideration. The CRM will evaluate properties less than 50 years old from this period for their "exceptional importance" under Criteria A, B, C, and D to identify those that may be eligible for inclusion in the NRHP. Evaluation of Cold War era properties will be limited to exteriors only. Properties greater than 50 years old in this period will be evaluated for their significance under the four primary eligibility criteria.

Evaluate the Cultural Resource's Integrity

In addition to significance, an historic property must possess integrity to be eligible for the NRHP. Integrity is the ability of the resource to convey its significance; to reveal to the viewer the reason for its inclusion in the NRHP. Integrity is a subjective quality, but must be judged based on how the cultural resource's physical features relate to its significance. Seven aspects are used to define integrity. Some, if not all, should be present for the resource to retain its historic integrity: location, design, setting, materials, workmanship, feeling, and association. The CRM shall assess integrity as follows:

- Define the essential physical features that must be present for a cultural resource to convey its significance. Although not all the historic physical features need to be present, those that convey its historic identity are necessary, including those that define why and when the resource was significant. Under Criteria A and B, the resource must retain those features that made up its character or appearance during the period of its association with the important event, historical pattern, or person(s). Under Criterion C, the resource must retain most of the physical features that constitute that style or technique. Under Criterion D, integrity depends on the data requirements defined in the research design. The significant data contained in the historic resource must remain sufficiently intact to yield the expected important information under appropriate methodologies; and

- Determine whether the essential physical features are adequate to convey significance; and

- Determine whether the cultural resource needs to be compared with similar properties (historic and non-historic). A comparison may help determine what physical features are essential to historic properties of that type; and

- Determine, based on the significance and essential physical features, which aspects of integrity are essential to convey the significance of the resource and if they are present. For Criterion A and B, the presence of all seven aspects of

integrity are the ideal, however integrity of design and workmanship may not be as important or relevant. Under Criterion C, a cultural resource must have integrity of design, workmanship, and materials. Location and setting are important for those resources whose design is a reflection of their immediate environment. Integrity of setting can be an important consideration under Criterion D for evaluating the integrity of archaeological sites.

If the CRM determines that a cultural resource meets one or more of the four Criteria for Eligibility, its integrity must be evaluated. If the CRM determines that the resource retains integrity, the resource shall be determined eligible for the NRHP and the CRM shall document the finding in the RHPC and provide the SHPO with a 30-day review period for concurrence with that finding (36 CFR Part 800.5). Once SHPO concurrence is received, the CRM will proceed to SOP #5: Assessing Effects. If the CRM determines that the resource does not retain integrity, the resource is not eligible for inclusion in the NRHP. The CRM will document this finding in the RHPC and submit it to the SHPO for concurrence. Upon receipt of the documentation, the SHPO will respond within 30 days. (36 CFR Part 800.5). If the SHPO does not comment within that time, WSMR will assume concurrence and the undertaking may proceed. No further action is required for properties determined not eligible for inclusion in the NRHP.

4.4.10 Methods for Evaluation

In some cases, observations made during survey and recording may not be sufficient to determine the nature and extent of subsurface deposits or assess site integrity of archaeological deposits. In these cases, a formal testing program may be needed. The following outlines the general standards and procedures for subsurface testing on archeological sites:

Testing

WSMR may request formal limited subsurface tests (such as 1x1-m test units) or systematic auguring and/or shovel testing to assess subsurface deposits or aid in the design of site-specific data recovery plans. Tests should determine the extent and nature of subsurface deposits, including trash middens, artifact scatters, thermal features, or salvage of obviously endangered chronometric samples (e.g., a hearth eroding from the face of an arroyo bank). Information normally gathered in the survey stage, but absent, shall be obtained during testing. Tests should limit adverse effects to potentially eligible properties while maximizing significant data collection. If a site requires extensive tests to define data recovery efforts more accurately, the investigator should include these recommendations in the management section of their report. All units and tests must be screened through 1/4-inch mesh or 1/8-inch mesh as appropriate to the materials being discovered.

Test Data

Test units/locations, including auger and trowel tests, shall be plotted on site maps using sub-meter accurate GPS. When subsurface tests are performed, all soil hori-

zons and strata shall have written descriptions using standard scientific terms. Color descriptions shall be made in Munsell terminology. All excavated features shall be recorded using basic dimensions, orientation, and depth. Profile drawings and photographs (if possible) shall be made of at least one wall of each test pit and tested feature. Artifact descriptions, photography, and maps shall be as described under survey techniques. Upon completion of any test units, the area shall be restored as nearly as possible to conditions prior to excavation, except on specific instructions from the archeological program managers.

4.4.11 Determination of Eligibility for Inclusion in the National Register of Historic Places for TCPs

As previously discussed, it may not be necessary or appropriate to specifically identify and evaluate all TCPs for inclusion in the NRHP. However, when this is determined to be an appropriate measure, the following guidelines will be applied. The identification, evaluation, and management of TCPs require Tribal consultation and participation.

A TCP is defined in the *National Register Bulletin 38* as a site "eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." Besides meeting these definitions, TCPs must also meet one or more of the four NRHP Criteria for Eligibility and retain integrity (Parker and King 1992). The statement of significance describing why a site is eligible will be based on traditional knowledge, literature reviews and archival records. Integrity is best determined by the Tribe recognizing the site's significance.

TCPs do not need to be formally listed on the National Register for protection. The Army may recommend the property eligible for inclusion on the NRHP and manage it as if it listed. If such a property is determined eligible for inclusion in the NRHP, the appropriate THPO will be consulted for concurrence. THPOs represent tribal governments for actions on tribal lands. Consultation will be government-to-government and decisions are made at the Tribal Council level. All TCPs will continue to SOP #5 to address potential effects the undertaking may have on that property.

4.5 SOP #5: Assessing Effects

4.5.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army, by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.5.2 Objective

This SOP provides for the consideration of the effect of a project on historic properties as stipulated in 36 CFR Part 800. If the CRM determines that the proposed project or action constitutes an undertaking, and that historic properties are present within a project APE, the effect of the undertaking on those historic properties must be determined. Effect is defined under 36 CFR Part 800.16(i) as an alteration to the characteristics of a cultural resource that qualify it for listing in or eligible for listing in the NRHP. As stipulated in 36 CFR Part 800.4(d)(1), based upon the evaluation of effect the CRM will determine if there are No Historic Properties Affected or if Historic Properties are Affected.

4.5.3 Policy

It is WSMR policy to understand potential effects proposed undertakings may have on historic properties. WSMR will manage its historic properties to mitigate effects while meeting its mission requirements.

4.5.4 Implementation

No Historic Properties Affected

In accordance with 36 CFR Part 800.4(d)(1), if the CRM finds that either there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them as defined in 36 CFR Part 800.16(i), then the CRM will determine that there will be *no historic properties affected*. The CRM will document this finding in a RHPC, which will be made part of the project file, as well as in the NEPA documentation. No further action is required.

Historic Properties Affected

If the CRM finds that there are historic properties that may be affected by the undertaking, the CRM shall apply the criteria of adverse effect [36 CFR Part 800.5 (a)] to historic properties within the APE.

Definition

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location,

design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of an historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. [36 CFR Part 800.5(a)(1)]

Examples of Adverse Effects

Adverse effects on historic properties include, but are not limited to:

- Physical destruction of or damage to all or part of the property;
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR Part 68) and applicable guidelines;
- Removal of property from its historic location;
- Change of the character of the property's use or physical features within the property's setting that contribute to its historic significance;
- Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
- Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to a Native tribe; and
- Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions of conditions to ensure long-term preservation of the property's historic significance. [36 CFR Part 800.5(a)(2)]

Finding of No Adverse Effect

If the CRM finds that conditions can be applied to an undertaking to sustain a finding of 'No Adverse Effect' (36 CFR 800.5.b), SHPO and federally recognized tribal governments will be consulted. Should the finding be disputed, the dispute will be addressed pursuant to *External Disputes* under SOP #12. The CRM will document this finding in the RHPC and make it part of the project file as well as in the NEPA documentation. No further action is required.

Finding of Adverse Effect

If the CRM finds that the criteria of adverse effect applies to the undertaking, the finding will be documented in the RHPC and the procedures set forth in SOP #6 will be followed.

Reporting of No Historic Properties Affected and No Adverse Effect

Undertakings will be reviewed by the CRM and cultural resources professionals who meet the Secretary of the Interior's Professional Qualifications Standards (36 CFR Part 61) for their respective disciplines. When undertakings result in a finding of No Historic Properties Affected or No Adverse Effect on historic properties, the SHPO will be provided an opportunity to comment either through the NEPA process (see SOP #8) or project-specific consultation. If the SHPO does not concur with the CRM's finding, the dispute will be addressed in accordance with SOP #12. Further discussion of undertakings that will be reviewed by WSMR is presented in SOP #1. At the request of the SHPO and WSMR, the list of undertakings can be modified to include or delete items.

4.5.5 Emergency Actions

No requirement of this SOP shall delay immediate actions required in an emergency to protect health and human safety or avoid substantial loss of building fabric. Reasonable and prudent efforts, in coordination with the CRM, shall be made to avoid or reduce adverse effects to historic properties during the implementation of immediate emergency actions, documented in writing after the fact with documentation submitted to signatories within 30 days as notification of actions taken.

4.6 SOP #6: Resolving Adverse Effects

4.6.1 Applicability

This SOP applies to all organizations, properties, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.6.2 Introduction

ACHP implementing regulations provide the definition of adverse effect in 36 CFR Part 800.5: Assessment of Adverse Effects. An adverse effect occurs when an undertaking alters any characteristic that makes the property eligible for inclusion in the NRHP. An adverse effect will result in the diminishment of the property's integrity of location, design, setting, materials, workmanship, feeling, and/or association. This SOP defines WSMR policy in regards to adverse effects with the options of (1) how WSMR will attempt to avoid adverse effects, and (2) when avoidance is not possible, how WSMR will mitigate such effects.

4.6.3 Policy

It is WSMR policy to avoid adverse effects to historic properties under its management to the extent possible while meeting mission requirements. If adverse effects are found, WSMR will apply best management practices to consider all options to avoid or limit impacts to historic properties. If, after applying best management practices, avoidance is not an option, WSMR will address mitigation of the effect as provided for under 36 CFR Part 800.6: Resolution of Adverse Effects.

4.6.4 Implementation

Applying Best Management Practices

If the CRM, after applying assessment of adverse effects (36 CFR Part 800.5), determines a proposed undertaking will have an adverse effect on a historic property, they will consult with the undertaking's implementing organization to consider options for avoiding the effects. This consultation will explore the options available for meeting the mission's needs while maintaining the qualities of the historic property that make it eligible for inclusion in the NRHP. If the result of consultation is a change in the undertaking that eliminates adverse effects, the CRM will document this process in a RHPC, along with the changes made to the undertaking to bring it in compliance with a finding of "no adverse effect pursuant to 36 CFR Part 800.5(d)(1)," and submit it to NEPA. At a minimum, the CRM and implementing organization will consider the following options: (1) project cancellation, (2) project relocation to avoid impact to the historic property, (3) minimization of impact, and (4) project redesign to avoid adverse effect to the historic property. When an undertaking proposes the demolition of a historic building, the option of adaptive reuse of that building must also be considered. Other options identified during consultation may be considered.

Other Options

If, after considering alternative options, it is determined that the undertaking cannot avoid an adverse effect the CRM will apply mitigation measures identified in this SOP, the CRM will prepare a RHPC for submittal to NEPA and provide access to the RHPC as outlined below.

Consultation/Mitigation

If the CRM determines that mitigation measures identified in this SOP are not adequate for the level of effect on the historic property, a RHPC proposing appropriate mitigation measures will be prepared pursuant to and submitted to NEPA guidelines. If an environmental document is not prepared, the RHPC will be submitted to the SHPO, ACHP, THPO, Tribal Governments, and interested parties for consultation on mitigation measures. If the project requires an EA, the SHPO, ACHP, Tribal Governments, and interested parties will have an opportunity to comment in the preparation of the EA. If the project requires an EIS, consultation with the SHPO, ACHP and interested parties will be conducted to identify appropriate mitigation measures and made part of the Record of Decision (ROD). When appropriate and in consultation with the SHPO, off-site mitigation may be considered. If the CRM and SHPO cannot reach agreement on appropriate mitigation measures, SOP #12 provides guidance on resolving disagreements.

Buildings or Structures

In the event that a NRHP-eligible building or structure will be demolished, the Environmental Division will include documentation of the best example of that architectural/building or structure type at WSMR following HABS/HAER, (as applicable,) Level I or Level II standards as published in Federal Register Vol. 68, No. 139, as part of the mitigation of adverse effects. If HABS/HAER declines to receive the original documentation, digital photographic documentation will be carried out in place of conventional large format film photography. If no original drawings exist for the historic property type to be documented, new drawings will be prepared following HABS/HAER standards. The Environmental Division will maintain the original documentation with electronic copies provided to the SHPO. Interested parties will be provided copies upon written request. The CRM will relocate the WSMR collection of photographs and architectural and engineering drawings for the building to the permanent publicly accessible WSMR cultural resources archives.

The CRM will identify materials in the building/structure to be reused in the maintenance and repair of other historic buildings/structures on WSMR. Materials identified will be removed, protected, and reused as appropriate.

When the finding of adverse effect is limited to a single building that contributes to a historic district but that effect does not significantly diminish the NRHP eligibility of the historic district for inclusion in the NRHP (a finding of No Historic Properties Affected on the district level), the adversely affected building will be mitigated under

standard mitigation measures identified under this section. This mitigation will be referenced in the RHPC. When making a finding of effect for a contributing building in a district, cumulative effects to the district will be considered. If adverse effects to individual contributing elements have accumulated over time to a point where it threatens the NRHP eligibility of the historic district, then mitigation measures will address the historic district.

Other potential mitigation measures may also be considered such as off-site mitigation, development of public educational materials, spending of specific project mitigation money on preservation of a like property, etc. Other mitigation measures will be considered in consultation with the appropriate SHPO under the NEPA process as presented in SOP #8.

All actions taken under this SOP will be documented through the mitigation report and in the NEPA process as discussed in SOP #8.

Archaeology

If an archeological site is found to be eligible for inclusion in the NRHP in consultation with the SHPO, and will be adversely affected by a specific undertaking or as part of the ongoing land management plan, and avoidance is not possible, WSMR will develop an archaeological data recovery plan to mitigate adverse effects to archaeological sites eligible for the significant information they contain. The plan will be developed in accordance with the ACHP Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites, effective June 1, 1999, and through consultations with SHPO. The results of all such data recovery projects will be submitted to the SHPO and the ACHP upon completion. If the CRM determines that mitigation is not feasible, the CRM will follow SOP #7: Documenting Acceptable Loss.

4.7 SOP #7: Documenting Acceptable Loss

4.7.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.7.2 Policy

The applicability of this SOP to the WSMR decision-making process is conditioned by fulfillment of 36 CFR Part 800 and other SOPs. Unless these have been met, documenting acceptable loss cannot be undertaken. Prior to implementing this SOP, WSMR must document why treatment of adverse effects cannot be achieved. Use of this SOP by WSMR should be rare, as other mechanisms for compliance with Section 106 under the ICRMP guidelines will reduce the need to make acceptable loss determinations. A cost associated with mitigation is not justification for use of this SOP.

4.7.3 Implementation

The GC will make acceptable loss determinations, after consulting with the CRM. These determinations will be based on weighing the need to mitigate a historic property that will be adversely affected by an installation undertaking against public interest decisions. The following examples may be applicable under this SOP.

Properties of Traditional Religious and Cultural Importance

Avoidance of impacts altogether and protective measures are among the preferable mitigation measures for TRCIs. Mitigation measures for properties of this type, which are significant to a Native American tribe, must take into consideration the expertise and wishes of the Tribe. There may be cases where a Tribe, understanding the need for a particular installation undertaking and the adverse effects that will result, may decide that mitigation measures should not be undertaken out of respect for their values. In these cases, the Installation Commander, after consultation with the Tribe and in consideration of Tribe's views, may make a decision to forego undertaking standard mitigation measures for that property.

Historic Buildings

Avoidance of impacts altogether, renovation, reuse, and leasing or transfer are among the preferable mitigation measures for historic buildings. After consideration of these measures, WSMR determines that it is necessary to demolish a historic building, mitigation outlined in SOP #6 will be performed except under the following circumstance: for Army properties constructed using standardized plans, it may not be

in the public interest to further document an adequately documented property type. In this case, the GC may make a determination that no mitigation measures will be undertaken to treat adverse effects to a historic building scheduled to be demolished.

Archeological Sites

Archeological data recovery is time-consuming, and difficult to undertake, and should only be done when there is adequate justification to do so. Justification to conduct archeological data recovery is typically found in a research design or data recovery plan related to a specific archeological site. Data recovery at archeological sites should focus on gaining new information that will be useful to further understanding of past cultures, both for the public as well as archeologists, and to capture the significance of the property. This may include gathering information that can be used to verify or disprove current hypotheses regarding prehistory or history. It is the responsibility of archaeologists to adequately document the need for data recovery based on information collected to make a determination that the site is eligible for inclusion in the NRHP. In cases of repetitive site types that offer no new information not available at other sites or already obtained, the GC may make a determination that it is not in the public interest to conduct archeological data recovery.

4.7.4 Documentation

After reviewing all project information and the decisions made in carrying out the SOPs of the ICRMP, the CRM will make a recommendation to the GC on the need to proceed with documenting acceptable loss. A package documenting the process that led to selection of acceptable loss will be prepared by the CRM. This documentation will be submitted to relevant signatories. This documentation package will include:

- A letter from the GC stating the intent to document acceptable loss,
- A discussion of how WSMR applied the procedures of 36 CFR Part 800 and the ICRMP and the outcome of each of the steps of these procedures, and
- A rationale as to why treatment of adverse effects should not be considered.

The GC will afford 30 days for the SHPO, Tribal Governments, and ACHP to submit comments on the documentation. At the close of the review period, the GC, in consultation with the CRM, will consider these comments in making a final decision on the implementation of the project. The GC will notify the consulting parties and the ACHP in writing of the outcome of the review and the final decision made prior to implementing the undertaking.

4.8 SOP #8: Reviewing and Monitoring Through NEPA

4.8.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.8.2 Objectives

The New Mexico SHPO, federally recognized Tribes, and interested members of the public will continue to participate in the process of reviewing and commenting on WSMR undertakings with the potential to affect historic properties. Participation shall occur through the installation's public participation procedures as provided in 36 CFR Part 800.8: Coordination with NEPA, and, where no NEPA documentation is prepared, through the RHPC when addressed findings of eligibility or mitigation of Historic Properties Adversely Affected. The documentation used to reach findings of No Historic Properties Affected or No Adverse Effect will be available for review upon request.

NEPA, as amended, is a federal environmental statute that requires the Army to consider the effects of its proposed action on the quality of the human environment before it makes a decision to go forward with a specific course of action. Historic properties are considered elements of the human environment requiring consideration under NEPA. NEPA also directs the Army, in specified circumstances, to disclose environmental effects to the public, to seek the public's comment and to consider those comments before proceeding. The Army's NEPA procedures are published in the Code of Federal Regulations at 32 CFR Part 651.

4.8.3 Policy

The NEPA process can result in three types of review; Record of Environmental Consideration (REC), EA, and EIS. NEPA provides for Categorical Exclusion (CATEX) for undertakings that do not normally have a significant environmental impact. The Army's NEPA CATEXs follow the guidelines set forth in 32 CFR Part 651, and can only be used if the project can pass the screening criteria set forth in 32 CFR Part 651.29. A RHPC form will be prepared on all undertakings regardless of whether it is covered by a REC, EA, or EIS. If a finding of No Historic Properties Affected or No Historic Properties Adversely Effected is made for an undertaking, and only a REC is prepared as the NEPA documentation, this action will be reported in the associated NEPA documentation with the associated RHPC made available upon request. If an EA is prepared for the proposed undertaking, the RHPC will be made part of that document and released to the stakeholders for a 30-day comment period. If an EIS is prepared for an undertaking, the RHPC will be made part of the document and the stakeholders will be invited to participate in development of the EIS as appropriate. If there is a finding that Historic Properties Adversely Affected and no NEPA documentation is prepared, the RHPC and supporting documentation will be submitted to the stakeholders for a 30-day review. In all cases, comments received within the 30-day review period will be considered in the preparation of the final documentation prior to start of the undertaking.

4.8.4 Notification of NEPA Reviews

Notification for Actions for which an Environmental Assessment or Environmental Impact Statement is Prepared

WSMR shall maintain a list of parties with a demonstrated interest in management of historic properties on the installation. This list shall include, among others, the New Mexico SHPO, federally recognized Tribes, consulting parties and other interested parties.

When WSMR proposes an undertaking with the potential to adversely affect a historic property, the installation, if preparing an EA or EIS, shall use the NEPA process to notify consulting parties and provide an opportunity for their participation in the process. In particular:

- If the installation initiates a public scoping process prior to preparing the EA or EIS, it will specifically notify all consulting parties on the list referenced above and request their participation.

- The EA or draft EIS shall contain information regarding the installation's efforts and methods for identification and evaluation of historic properties, assessment of effects to such properties, and proposed mitigation. The installation shall provide interested parties with electronic access to the EA or draft EIS and request their review and comment. The notification shall direct the recipient to those portions of the document relevant to historic properties.

- The installation shall review and consider all comments submitted from interested parties before finalizing an EA or EIS. For comments received on a draft EIS, the installation will specifically respond to those comments in a final EIS as necessary.

Notification for Actions for which an Environmental Assessment or Environmental Impact Statement Is Not Prepared

The installation will prepare a RHPC for undertakings that have the potential to affect historic properties. If the installation proposes an undertaking that is likely to adversely affect a historic property without preparation of an EA or EIS, and thus no NEPA public participation, the installation shall make the RHPC available to the list of interested stakeholders. The RHPC will demonstrate the installation's compliance with the ICRMP and at a minimum, briefly describe the installation's efforts and methods for identification and evaluation of historic properties, assessment of effects to such properties, and proposed mitigation. If the RHPC includes a determination of eligibility for inclusion in the NRHP, the installation will provide the RHPC to the SHPO for a 30-day period to provide comment regarding concurrence or nonconcurrence. When a finding of eligibility addresses a property of Tribal interest the RHPC will be provided to the Tribal Governments for a 30-day review period.

The installation's CRM will maintain all RHPCs prepared under this SOP. Copies will be provided to consulting parties upon request.

4.8.5 Actions Normally Requiring an Environmental Assessment (EA)

The following actions normally require preparation of an EA:

- Special field training exercises or test activities on Army land of a nature or magnitude not within the annual installation training cycle.
- Military construction, including contracts for off-post construction.
- An installation pesticide, fungicide, herbicide, insecticide, and rodenticide use program.
- Changes to established installation land use that generates impacts on the environment.
- Proposed changes in doctrine or policy that may have a potential environmental impact.
- Acquisition or alteration of, or space for, a laboratory that will use hazardous chemicals, drugs, or biological or radioactive materials.
- New weapon systems development and acquisition, including the material acquisition, transition, and release process.
- Development of an installation master plan.
- Development of natural resource management plans (land, forest, fish, and wildlife).
- Proposals that may lead to accessing Army real property.
- Field activities on land not controlled by the military. This includes firing of weapons, missiles, or lasers over navigable waters of the United States, or extending 45 meters or more above ground level in the national airspace. It also includes joint air attack training that may require participating aircraft to exceed 250 knots at altitudes below 3,000 feet above ground level.
- Army National Guard/Operations and Maintenance projects that will impact environmental quality.
- Special field training exercises or test activities off Army or DoD property that extend into the national airspace (45 meters above the ground level).
- Changes to established airspace use that generates impacts on the environment or socioeconomic systems or creates a hazard to nonparticipants.

4.8.6 Actions Normally Requiring an Environmental Impact Statement (EIS)

The following actions normally require preparation of an EIS:

- Significant expansion of a military facility or installation.
- Construction of facilities that have a significant effect on wetlands, coastal zones, or other areas of critical environmental concern.
- The disposal of nuclear materials, munitions, explosives, industrial and military chemicals, and other hazardous or toxic substances that have the potential to cause significant environmental impact.
- Land acquisition, leasing, or other actions that may lead to significant changes in land use.
- Realignment or stationing of a brigade or larger.
- Training exercises conducted outside the boundaries of an existing military reservation where significant environmental damage might occur.
- Major changes in the mission or facilities either affecting environmentally sensitive resources or causing significant environmental impact.

4.9 SOP #9: Inadvertent Discovery of Historic Properties

4.9.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.9.2 Definition

"Historic Property", as defined by 36 CFR Part 800.16(l)(1), means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places as maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious or cultural importance to an Indian tribe and that meet the National Register criteria.

4.9.3 Objectives

The objectives of this SOP are to have procedures in place in the event of inadvertent discovery of archeological materials. This can apply to both previously recorded and new sites and to archeological sites in any part of WSMR.

4.9.4 Policy

Inadvertent Discovery of Archeological Materials

Historic period sites can be divided into two types: military and nonmilitary, and are usually characterized by one or more of the following artifact types: glass, ceramics, metal, bricks, and wood. Prehistoric period sites usually contain ceramics (usually brownwares, both decorated and undecorated), lithic artifacts (projectile points, scrapers, worked tools, flakes, cores, manos, and metates), bone (both burned and worked implements), and/or thermally-altered rock (including burned caliche). In addition, Native American burials can be encountered anywhere on WSMR. These will be indicated by the presence of bones, soil stains, and grave goods such as pottery, beads, and exotic hems.

- In the event of inadvertent discovery of archeological materials during a construction project or field training exercise in the maneuver areas, all work in the area affecting the materials must cease immediately.

- The conservation division chief and/or CRM must be notified immediately upon discovery of previously unknown archeological materials. The CRM will inspect the site where archeological materials have been discovered. Documentation of the disturbance will be made, including notes and photographs.

- The CRM will consult with the New Mexico SHPO and appropriate federally recognized Tribe on a course of action if the CRM determines the discovery may constitute an NRHP eligible property. Notification will be done within 48 hours of the discovery by fax and/or telephone. Within three (3) days, the CRM will follow this initial consultation with a letter detailing the disturbance, the location, and any necessary actions. The CRM will complete the NAGPRA process if Native American burials are encountered. A state site (LA) form will be prepared for the site(s) discovered.

- The SHPO will have 48 hours to respond.

- In the event that mitigation of the damage to a site is necessary, the archeological program managers will prepare a research design for fieldwork and submit it to the SHPO and appropriate federally recognized Tribes. The SHPO will have 10 days to respond. If there are no objections within the specified time, data recovery will proceed under the attached programmatic agreement.

Willful Destruction of Archeological Materials

The willful destruction of archeological materials is a violation of the Archeological Resources Protection Act (ARPA) of 1979 (as amended) and may result in a felony prosecution.

Native American Human Remains

In the event the find is or is suspected to be Native American human remains or funerary objects that are or may have been associated with human remains, or objects of cultural patrimony needed for continuing religious practices, the CRM will contact the appropriate Native American groups and comply with the requirements of NAGPRA, as applicable. WSMR will follow the NAGPRA protocols stipulated in the SOP #16.

4.10 SOP #10: Reporting Damage to Historic Properties

4.10.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.10.2 Objectives

The objectives of this SOP are (1) to ensure damage to historic properties (as defined in SOP #9) is reported so corrective actions may be developed to avoid future unintentional damage, (2) to identify organizations and individuals responsible for intentional damage so appropriate measures can be followed, and (3) to ensure that willful violations of federal law are reported to the range commander, WSMR provost marshal, the staff judge advocate, and the Installation Commander so appropriate action can be taken.

4.10.3 Introduction

Routine military training activities at WSMR and the operation and maintenance of WSMR facilities poses a risk of unintentional damage to properties that are or may be eligible for inclusion in the NRHP. Such damage may occur through the failure of the routine administrative controls provided in the WSMR ICRMP or through the failure of trainers or other personnel to confine ground-disturbing activities to the areas that have been cleared to avoid adverse effects.

Willful damage and violation of federal law is also possible. For determining reporting requirements under this SOP, damage is considered willful when the person responsible for, or who approved, the implementation of the action could have reasonably been expected to be aware of the law.

4.10.4 Policy

Funds programmed for the implementation of the ICRMP will not be diverted to repair or mitigate damage caused by failure to follow the provisions of the ICRMP.

4.10.5 Procedure

Archeological Sites

When a recorded site has been reported as damaged, the CRM will review the site records, visit the site, and make an initial determination of National Register eligibility of the site, if not already determined, and assess the damage to the site. An updated site form will be prepared and forwarded to the SHPO.

- Where the damage is slight, not an in-situ deposit, or not eligible for the National Register for other reasons, the CRM will document the incident and update the site form as needed.

- Where the damage is severe and the CRM recommends there is evidence the site had been found, or may have been found, eligible for the National Register before the damage, the CRM will prepare a RHPC documenting the circumstances of the damage, its extent and effect. This RHPC, with a transmittal letter signed by the WSMR Installation Commander, will be submitted for notification to the SHPO within 30 days after the CRM was made aware of the damage.

Tribal Cultural Properties

Properties with Tribal cultural values are identified and documented through consultation with lineal descendants and Tribes with ties to the area managed by WSMR. Examples of properties with Tribal cultural values are mountains, springs, and resource gathering areas. When a property with documented Tribal cultural values has been impacted in a manner contradictory to WSMR Policy or the ICRMP, the CRM will review the incident and prepare a report for the GC documenting the impact and recommending procedures (or modifications to existing procedures) that avoid future impacts.

- Tribes with ties to the impacted cultural property will be notified and consulted regarding WSMR's proposed methods to address damage to properties of traditional cultural value to which they have ties. The SHPO and relevant THPOs will be notified.

- The CRM will include documentation of the incident in the SHPO/THPO notification, taking care to ensure that information considered confidential by Native Americans is not made available to the public or any agency or organization the Native American individual or group does not specifically indicate should receive information.

Aboveground Properties (Including, but not Limited to Buildings, Bridges, Landscapes, Structures, Districts, Objects, and Traditional Cultural Properties Not Associated with Native Americans)

Recorded Properties

When an aboveground property that has previously been determined eligible for inclusion in or is listed in the NRHP or an unevaluated property that the CRM finds eligible has been impacted, the CRM will visit the property and make a determination of effect. When the aboveground property affected is 45 years of age or older and has not been previously evaluated for eligibility, the CRM with the assistance of a historian, architectural historian, ethnographer, folklorist, or landscape architect, as appropriate, will visit the property and make an initial determination of National Register eligibility and effect.

- Where damage is slight or does not affect features that contribute to the historic significance of the property, the CRM will make a determination of No Historic Properties Affected or No Adverse Effect, prepare a RHPC, and document the incident in the resource's HCPI form, if appropriate.

- Where the damage is severe and the CRM finds that the property has already been found eligible or may have been eligible for the NRHP before the damage, the CRM will prepare a report documenting the circumstances of the damage, its extent, and effect. This report will be submitted with a transmittal letter signed by the WSMR GC to the SHPO and Tribal Governments. Potential mitigation measures may be offered for consideration.

Unrecorded Properties

When new construction (or a modification to proposed construction that has not been reviewed in accordance with the ICRMP) is discovered within the historic district or within the viewshed of a historic property, the CRM will visit the site and make an initial evaluation of the impact the construction may have on the district.

- If the construction does not affect the features that contribute to the historic significance of the district or property, the CRM will make a determination of No Historic Properties Affected and will document the incident in the resource's HCPI form, if appropriate.

- Where construction is determined to have no adverse effect on historic properties, the installation historic architect will prepare a RHPC documenting the project and make the finding available to the SHPO.

4.11 SOP #11: Public Involvement in the WSMR Cultural Resources Management Program

4.11.1 Applicability

The WSMR CRM is responsible for carrying out the provisions of this SOP in cooperation with the public affairs officer. Other organizations are responsible for providing information regarding undertakings for which they are the proponent, user, or implementing organization.

4.11.2 Introduction

Various provisions of federal law, codified regulations and Army regulations require that interested members of the public have access to the decision-making processes and the results of historic preservation and environmental management undertaken at the public expense (36 CFR Part 800, AR 200-1).

This SOP outlines the minimum routine measures that WSMR will take to provide such access within the implementation of the WSMR ICRMP. Additional effort to determine public concerns may be required if WSMR proposes undertakings that the SHPO or the ACHP suggests have the potential to have an adverse effect on WSMR historic properties. In that case, the public and interested parties will be informed of action at WSMR that may affect historic properties consistent with the requirements of 36 CFR Part 800.8.

When compliance with NEPA requires either an environmental assessment or environmental impact statement, specific requirements of that law and its implementing regulation regarding public comment must be met concurrently with or in addition to those required by this SOP (AR 200-1). When WSMR includes wording in its NEPA notifications to the public specifically stating that comment is also being requested to meet the Army's responsibilities under the NHPA, the resulting public participation and comment will fulfill all requirements for public participation under the NHPA.

4.11.3 SHPO and ACHP Rights and Responsibilities

Nothing in this SOP or the ICRMP changes the right granted under federal law or regulation or separate agreement to the Army, for the SHPO or the ACHP to issue public notice, solicit public opinion, or hold, facilitate, or participate in public meetings relative to WSMR undertakings.

4.11.4 Policy

WSMR will make research reports prepared in conjunction with this plan available upon written request.

4.12 SOP #12: Dispute Resolution

4.12.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.12.2 Introduction

To manage historic properties under its cognizance and to ensure application of sound preservation practices, WSMR will retain a professional cultural resource expertise that meets the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (NPS 2020). Even so, disputes may arise in the application and interpretation of the National Register criteria for evaluation, Criteria of Effect and Adverse Effect, best management practices, etc. This SOP lays out WSMR policy on dispute resolution. It addresses both internal and external disputes.

4.12.3 Policy

It is WSMR policy to address all disputes in a professional manner and with the objective of reaching mutual agreement on dispute resolutions through meaningful consultation with objecting parties. Meaningful consultation needs to begin in the planning and preparation stages to limit disputes after implementation.

4.12.4 Implementation

Internal Disputes

Should an implementing organization object to an action recommended by the CRM under the ICRMP, the two will meet to discuss objections and consider potential ways to resolve the dispute in meeting both mission and legal requirements. If consultation fails to resolve the dispute, both parties will seek the Staff Judge Advocate's (SJA) opinion on applicability with cultural resource laws and regulations or applicability of the ICRMP for the disputed issue. Final dispute resolution, if necessary, will rest with the WSMR GC who will consider SJA's legal opinion in making a final decision.

External Disputes

Should the signatories object to any action carried out or proposed by WSMR with respect to implementation of the ICRMP, the objecting party will send its objection in writing to the WSMR CRM. The CRM will consult with the objecting party to resolve the objection. If the dispute cannot be resolved through this consultation process or if other parties are affected by the dispute, WSMR will consult with all

the appropriate project signatories. Should an interested party that is not a signatory object to any action, WSMR shall take the objection into account and document its consideration.

Area of Potential Effect

Should the SHPO, THPO, and/or Tribe object to WSMR's delineation of the APE, and after consultation the parties cannot reach concurrence, WSMR will request the opinion of the ACHP. All parties agree to accept the opinion of the ACHP as final.

Determinations of National Register Eligibility

If the objection between WSMR and SHPO, THPO, or Tribe concerns determinations of National Register eligibility, and if WSMR and the objecting parties cannot reach concurrence after consultation, the CRM will submit the determination of eligibility package originally submitted to the SHPO to the Keeper of the National Register for final determination. The submittal package to the Keeper will also include all correspondence and consultation between WSMR and SHPO addressing determinations of eligibility. The Keeper will respond to a request for formal determination of eligibility within 45 days of receipt of the request. If there is no response within the allotted time, it will be assumed by all parties that the Keeper concurs with WSMR's determination and coordination will proceed as specified in SOP #4.

Determination of Effects

If the objection between WSMR and the SHPO, Tribal Governments, concerns determinations of effect, and if the parties cannot reach concurrence after consultation, the CRM will submit the determination of effect to the ACHP for final determination. The submittal package to the ACHP will also include all correspondence/consultation between the CRM and SHPO, and/or Tribal Governments addressing the finding of effect. The ACHP will respond to the request for a formal determination of effect within 15 days of receipt of submittal. The ACHP may request an additional 15 days for response. Non-response by ACHP within 15 days of receipt of the submittal will constitute agreement with WSMR's finding of effect. Participating parties may request amendments to relevant SOPs in response to ACHP comments.

Other Disputes

For disputes relating to parts of the ICRMP other than findings of eligibility or effect and where agreement cannot be reached between WSMR and objecting parties, WSMR will forward all documentation relevant to the dispute along with its proposed resolution to the ACHP. ACHP will exercise one of the following options within 45 days of receipt of all pertinent documentation:

- Advise WSMR that ACHP concurs in the proposed final decision, whereupon WSMR will respond to the objection accordingly; or

- Provide WSMR with recommendations, which WSMR will take into account in reaching a final decision regarding its response to the objection; or

- Notify the Secretary of the Army that ACHP will comment pursuant to 36 CFR Part 800(7) (c), and proceed to comment. The resulting comment will be taken into account by WSMR according to 36 CFR Part 800(7)(c)(4) and Section 110(1) of the National Historic Preservation Act.

Should the ACHP not exercise one of the above options within 45 days of receipt of all pertinent documentation, all parties shall assume ACHP's agreement with WSMR's proposed response to the objection and proceed accordingly.

WSMR will take into account any ACHP recommendation or comment provided by this SOP with reference only to the subject of the objection; the installation's responsibility to implement other actions under the ICRMP that are not the subject of the objection will remain unchanged. Any procedural changes resulting from ACHP recommendations or comments will be incorporated into future versions of the ICRMP.

4.13 SOP #13: Military Activities in Anticipation of Immediate Deployment, Mobilization, or Armed Conflict

4.13.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.13.2 Objectives

The objectives of this SOP are to ensure the effects of military undertakings in anticipation of deployment, mobilization, or armed conflict on historic properties are considered and a reasonable effort is made to ensure that damage to historic properties is avoided.

4.13.3 Policy

The WSMR CRM or other appropriate cultural resources professional with appropriate security clearance will conduct a Section 106 review of undertakings required to support mobilization and training required in anticipation of immediate deployment, mobilization, or armed conflict. This policy only applies to training-related activities within areas previously surveyed.

4.13.4 Implementing Procedures

Implementing Organization

The implementing organization will include the CRM in planning activities when an undertaking includes ground-disturbing activities, modifications to or demolition of buildings or grounds 45 years of age or older, or the disposal of records connected with historic properties or unevaluated archeological sites or buildings 45 years of age or older.

Responsibilities of the Cultural Resources Manager

The CRM will ensure the implementing organization is aware of the potential adverse effects of all courses of action on historic properties under consideration and recommend ways to avoid and reduce adverse effects.

Responsibilities of the Implementing Organization

The implementing organization will follow the CRM's recommendations when practical.

- If the implementing organization cannot follow the CRM's recommendation, it will provide the CRM with a summary report detailing the decision-making process and why avoiding adverse effects was not practical. The implementing

organization will ensure that their next higher command is aware of the decision and include the report, along with recommendations for reducing adverse effects during future undertakings, in the after-action report.

- The CRM will include summary documentation of the undertaking(s) and its effects on historic properties in the after-action report. Projects funded will include as part of the deliverables a report describing the project.

4.14 SOP #14: Cultural Resource Protection Measures for Recovery of Test Mission Impacts

4.14.1 Purpose

This Cultural Resources SOP for Recovery of Test Mission Impacts within WSMR ensures compliance with Section 106 of the NHPA, the NAGPRA, as well as the relevant CFRs, executive orders, and US Army regulations. The intent of this Recovery SOP is to ensure sound principles of cultural resource stewardship are utilized when recovery actions are conducted within WSMR. All procedures adhere to the WSMR ICRMP, the 1987 WSMR historic preservation plan, and the current Programmatic Memorandum of Agreement between WSMR, the New Mexico SHPO, and the ACHP, and any revisions/updates to those documents.

4.14.2 Applicability

This Recovery SOP applies to all White Sands Test Center (TC) project proponents within all TC Directorates, as well as the U.S. Air Force, U.S. Navy, and all other government agencies and contractors that conduct test missions that may impact within WSMR. The responsibility for protecting historic properties while supporting test missions extends to all military personnel, Department of the Army civilians, and contractor staff. According to AR 200–1:i, "All Army organizations, regardless of their organizational level or chain of command, have environmental responsibilities as part of their functions; these environmental responsibilities must be incorporated into the planning, programming, budgeting, and execution of their respective missions."

4.14.3 Responsibilities

The TC project proponent is responsible for providing funding through a reimbursable Work Breakdown Structure charge code for cultural resource recovery support. Should any historic properties be impacted by test mission and/or recovery activites, further cultural evaluation may be required (i.e., document and map impacts within cultural sites and/or document subsurface cultural remains identified during recovery activities). The TC project proponent is responsible for funding any post-recovery evaluation(s) and/or damage assessment(s) as well as any additional archaeological work determined necessary after consultation with the NM SHPO.The TC project proponent may also be responsible for funding task orders for additional recovery actions and support, if required.

The WSMR CRM at the Garrison DPW Environmental Division has the management authority for archaeological sites on WSMR and is responsible for consulting with the NM SHPO, tribes, etc. All actions performed under this Recovery SOP will be in consultation and agreement with the WSMR CRM.

The TC Senior Archaeologist (TCSA) oversees all recovery efforts and is responsible for coordinating with the Test Officer for each program, as well as with TC Explosive Ordnance Disposal (TC EOD) personnel. The TCSA is also responsible for consulting with the WSMR CRM to determine an appropriate Course of Action (COA) for the safe recovery of test mission materials while limiting adverse effects to the natural and cultural environment. In some circumstances, consultation with the WSMR CRM may not be feasible prior to recovery due to safety and/or security concerns. In these situations, the TCSA is responsible for making decisions in consultation with field personnel regarding the consideration of impacts to cultural resources. All actions during recovery activities

are to be documented for consultation with the WSMR CRM post-recovery. All decisions will be based on ethical and professional judgement, adhering to the guidance of the WSMR ICRMP. All TC archaeologists meet the Secretary of the Interior's Professional Qualification Standards in Archaeology (Secretary of the Interior, Federal Register, Vol. 48 No. 190).

TC Principal Investigator (TCPI) is responsible for overseeing all fieldwork conducted by TC archaeologists related to recovery including archaeological survey, monitoring, archaeological site recording, evaluation, and damage assessments. Additionally, the TCPI produces cultural resource reports describing these actions for submittal to the TCSA and WSMR CRM. All reports include a recommendation for determination of effect to historic properties and a recommendation of eligibility for inclusion to the NRHP if applicable. The TCPI is responsible for uploading all state archaeology forms and GIS shapefiles of survey areas and site boundaries to the New Mexico Historic Preservation Division (HPD) NMCRIS database.

4.14.4 Unexploded Ordnance Safety Protocol and Historic Properties

If it is determined by TC EOD that it is not safe to conduct an archaeological survey of the impact area prior to recovery and/or Unexploded Ordnance (UXO) demolition, then an after-action inspection will be conducted. If the after-action assessment finds that cultural resources have been impacted, the TCSA will consult with the WSMR CRM to determine the appropriate COA to document impacts to cultural resources, that may include a damage assessment.

4.14.5 Procedures

The procedures stated in this Recovery SOP follow all SOPs within the 1987 historic preservation plan and the WSMR ICRMP. The procedures are subject to change upon future revisions, new programmatic agreements, or any other binding document(s) that directly affect the management of cultural resources on WSMR.

To maintain flexibility and limit damage to historic properties, several recovery options are available depending on various logistical issues that may arise during the recovery process (e.g., impact location, weather conditions, landscape characteristics, etc.). Recovery procedures may include All-Terrain Vehicles (ATV), helicopter, heavy equipment (i.e., backhoe/roll-off trailer), and Blow-in-Place (BLP) detonation.

White Sands Test Center Coordination Protocol

Communication

WSMR Range Control/Flight Safety personnel will contact the TCSA and TC EOD with the nominal impact coordinates.

Coordination/Consultation

Upon receiving the nominal impact location(s) the TCSA will inform the WSMR CRM that an impact has occurred and the consultation process for the recovery action begins. The TCSA and TCPI coordinate with TC EOD to begin the logistical planning process for the recovery action.

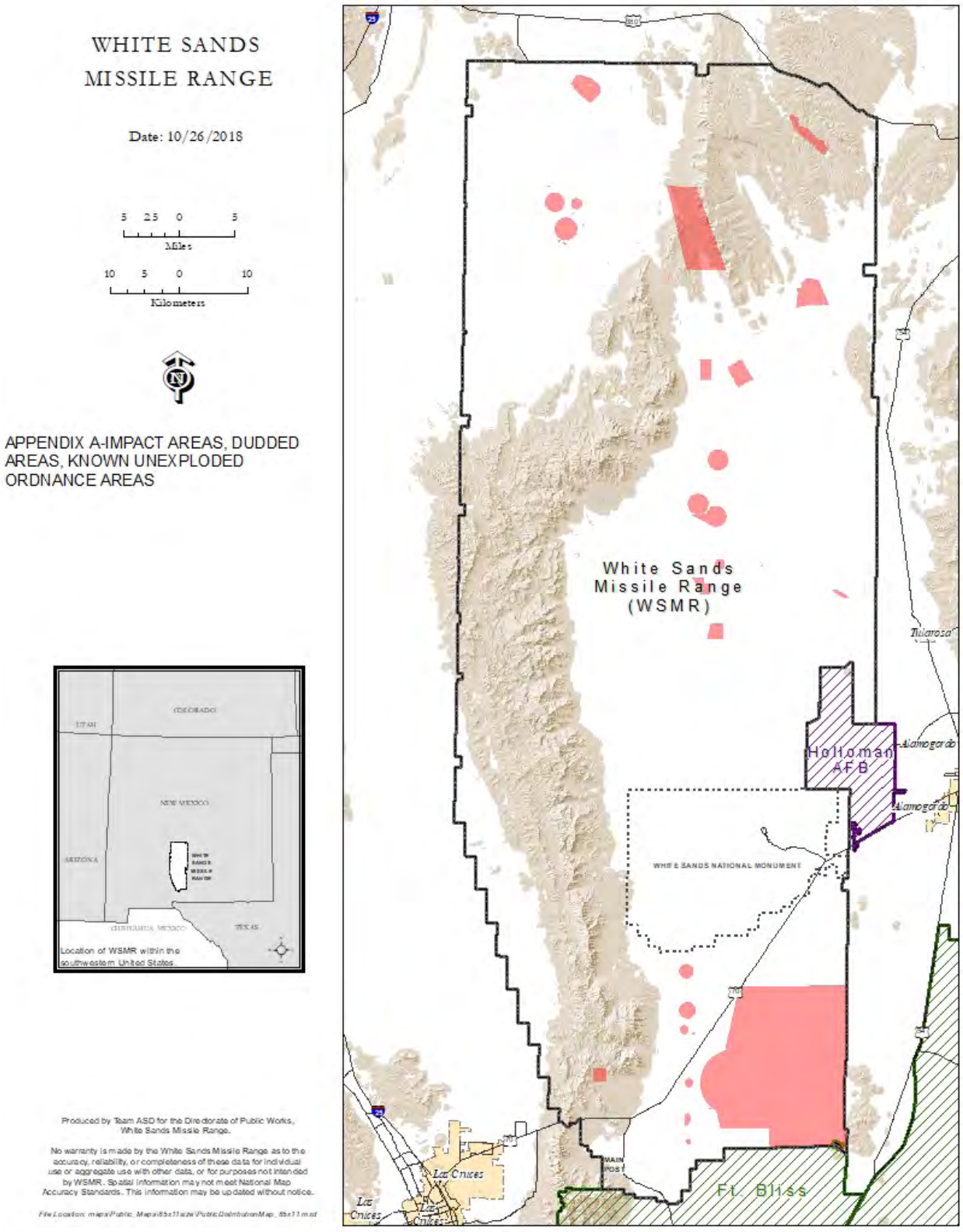


Figure 4-1. Established Impact Areas on WSMR.

Impact Recovery Protocol

Response

The TCSA and/or the TCPI will accompany TC EOD on the initial reconniassance to identify the impact location by ATV, or by helicopter. GPS support will be provided by the in-field archaeologist to accurately document the impact location on the ground.

Upon identification of the impact location, the TCPI will review existing GIS database files provided by the Garrison Environmental Division and will conduct a records search of the NMCRIS database to determine if the impact occurred within a previously surveyed area and/or within a previously documented archaeological site.

Location

If the previous records search reveals the impact location is within a previously surveyed area with no sites in the vicinity and there is clear access to the impact, then TC EOD can recover the test item (including the utilization of heavy equipment) with no further cultural resource support required.

If the impact location is within an area that has not been previously surveyed, within a known site, or there are known archaeological sites in the vicinity, then TC archaeologists will support the recovery.

Confirmation

If the previous records search reveals that the impact location is within an area that has not been previously surveyed for cultural resources, TC archaeologists will conduct an intensive survey of the required access route, and an area around the impact to determine if any archaeological sites are present. If any sites are encountered during survey of the access route, TC archaeologists will survey a reroute option in order to avoid them.

Depending on TC project proponent's need, the security classification of the test article, and the safety considerations based on TC EOD's protocols, same-day recovery may be required. In this case, TC EOD will coordinate with the TCSA or TCPI to plan for real-time support during mission launch. TC archaeologists will stage with TC EOD and accompany/escort them during recovery efforts.

Archaeological Survey/Monitoring and Heavy Mechanical Equipment Subsurface Excavation

Survey

If TC EOD determine that heavy mechanical equipment (e.g., backhoe, bobcat, vehicles, roll-off trailers, etc.) is required for recovery, TC archaeologists will survey and clearly define the access route to the impact location prior to any heavy mechanical equipment use to ensure archaeological sites are avoided.

Monitoring

In the event heavy mechanical equipment is required for recovery, TC archaeologists will monitor all excavation activities to minimize impacts to any potential subsurface cultural deposits and ensure proper documentation if applicable.

Not Eligible Site

If an impact lands within a previously documented archaeological site that has been determined not eligible for inclusion in the NRHP, activities within the site requiring subsurface excavation (including heavy equipment) may proceed, and no additional fieldwork/documentation will be required.

Eligible Site

If an impact lands within an archaeological site that has been determined eligible for inclusion in the NRHP, activities within the site requiring subsurface excavation (including heavy equipment) may proceed; however, TC archaeologists will provide direction to TC EOD on how best to avoid and minimize impacts to cultural resources. Precautionary monitoring and documentation will also be conducted in this circumstance. Upon completion of recovery activities, the TCSA will consult the WSMR CRM to determine the appropriate COA for evaluating the impacts to the eligible site that may include a damage assessment.

Undetermined Site

If debris lands within an archaeological site that has an undetermined eligibility designation for inclusion in the NRHP, recovery activities within the site requiring subsurface excavation (including heavy equipment) may proceed; however, TC archaeologists will provide direction to TC EOD on how best to avoid and minimize impacts to cultural resources. Precautionary monitoring and documentation will also be conducted in this circumstance. Upon completion of recovery activities, the TCSA will consult the WSMR CRM to determine the appropriate COA for evaluating the impacts to the undetermined site that may include a site evaluation and damage assessment.

New Site Discovery

If debris lands within a newly discovered archaeological site, recovery activities within the site requiring subsurface excavation (including heavy equipment) may proceed; however, TC archaeologists will provide direction to TC EOD on how best to avoid and minimize impacts to cultural resources. Precautionary monitoring and documentation will also be conducted in this circumstance. Upon completion of recovery activities, the TCSA will consult the WSMR CRM to determine the appropriate COA for evaluating the impacts to the newly discovered site that include site documentation and may include a damage assessment.

4.14.6 Archaeological Survey

In the event an impact occurs within an area that has not been previously surveyed, TC archaeologists will conduct a complete survey that will systematically inspect the impact area for cultural resources to accurately identify any archaeological sites that might be located within access routes or impact locations. All surveys will be pedestrian and conducted only when lighting, surface cover, and weather conditions permit effective viewing of the ground surface.

Archaeological Survey

An intensive survey systematically inspects an area for cultural resources to accurately document archaeological sites by collecting pertinent field data that is necessary to provide unambiguous NRHP eligibility recommendations for consultation between the WSMR CRM and the NM SHPO. This is to provide the WSMR CRM with detailed recommendations for consultation with the NM SHPO on determinations of eligibility for archaeological sites to be nominated to the NRHP.

Linear Survey

Linear surveys (access routes) shall cover a 15-meter corridor, not including previously disturbed graded or bulldozed areas. Survey of access routes to debris impacts will be a minimum of 15-meter wide, unless recovery efforts require extra maneuverability, in which case additional transects will be surveyed.

Impact Location Survey

Upon identification of an impact location, and prior to recovery actions, TC archaeologists will conduct a survey around the impact. The survey area will encompass the impact location and any additional area needed to complete the recovery. Based on this survey, TC archaeologists will monitor and direct TC EOD as how to best minimize impacts to cultural resources.

4.14.7 Damage Assessment Protocol

In the event of inadvertent impacts on cultural resources, an archaeological damage assessment may be required to ascertain the nature and extent that such impacts have on historic properties. This assessment entails the following procedure, in compliance with the WSMR ICRMP: Chapter 4.10 SOP #10, *Reporting Damage to Historic Properties*:

a. Informing the WSMR CRM to have a findings consultation with the NM SHPO.

b. NRHP site eligibility evaluation.

c. Field documentation of the damage incurred. Dependent upon these findings, a mitigation, and data recovery plan, along with the preparation of a Memorandum of Agreement, may be required between the WSMR CRM and the NM SHPO. This is in pursuant to the NHPA and 36 CFR 800.

Damage Assessment

TC archaeologists will conduct a field assessment to include an examination of the impacted cultural resources. This process includes documentation of the damage, measurements, mapping, and photography.

Damage Assessment Report

The TCPI will provide a damage assessment report to the TCSA and WSMR CRM for review and consultation with the NM SHPO. The report will include identification of the resource by formal site number, detailed documentation of the damage that occurred, an recommendation for eligibility in the NRHP, and management recommendations. For informational purposes, the WSMR CRM will also provided the damage assessment report to the NM SHPO.

4.14.8 Archaeological Site Documentation and NRHP Evaluation

The TCPI will compile all pertinent field data necessary to provide detailed and unambiguous NRHP eligibility recommendations to the WSMR CRM for consultation with the NM SHPO. Site and IO documentation and evaluation will follow the protocols outlined in the WSMR ICRMP: Chapter 4.4 SOP #4.

Archaeological Site Documentation

Information collected must be sufficient to complete the required Cultural Resource forms and to meet detailed reporting requirements. The excerpt from the WSMR ICRMP *Site Definition Criteria* provides the following information: No quantified criteria are going to cover all possibilities. Therefore, the following general criteria will be used for defining a cultural resource site:

- The physical remains of past human activity that are at least 50 years old.
- At least five artifacts within a 20 m diameter area, except when all pieces appear to originate from a single source (e.g., one ceramic pot drop, one broken glass bottle, one deteriorated piece of sheet metal, etc.). The exception is discrete, single knapping episodes, which are treated as sites. Fire-cracked rock and burned caliche are not considered artifact types for purposes of this criterion, but may fall under the category of "undatable feature."
- One or more datable archeological features with at least one associated artifact.
- Two or more undatable archeological features.
- A single undatable feature with any associated artifacts. Ten pieces of fire-cracked rock and/or burned caliche in 1 square meter is the minimum criteria for fire-cracked rock and/or burned caliche to be assigned feature status without associated feature fill.

- In general, 30 meters will be the maximum distance between manifestations, beyond which the materials should be treated as spatially unrelated.

The WSMR CRM will allow the investigator to assign site status to other situations outside these criteria provided a logical and reasonable argument is made in consultation with the archeology program managers. Additionally, any IO must be completely recorded such that the data potential of that manifestation is exhausted. In the case of a single undatable feature, trowel tests must be conducted around the locus to ensure there is no associated stain or additional buried deposits. Additional documentation on the potential for subsurface deposits in that area must accompany any recording of a single undatable feature recorded as an IO.

Documentation

The TCPI will use the following procedures, in accordance with the WSMR ICRMP: Chapter 4.4.6 *Recordation*, to document prehistoric and historic archaeological sites encountered:

a. Completion of a New Mexico LA site form.

b. Artifact Analysis.

c. Feature identification.

d. Site boundary determination.

e. Site depth determination.

f. GPS mapping.

g. Subsurface testing.

h. Collection of diagnostic artifacts if present.

j. Photography.

k. Impact/disturbance analysis.

NRHP Eligibility Evaluation

As part of the site documentation and reporting process, each of the sites recorded will be evaluated for its eligibility for listing in the NRHP following the eligibility criteria for evaluation established in CFR 60.4: *National Register criteria for evaluation*. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

a. that are associated with events that have made a significant contribution to the broad patterns of our history; or

b. that are associated with the lives of persons significant in our past; or

c. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d. that have yielded, or may be likely to yield, information important in prehistory or history.

4.14.9 Archaeological Survey Reports

The TCPI will submit a report to the TCSA and WSMR CRM for review. Upon review and comment, the WSMR CRM will forward the report to the NM SHPO and request concurrence on determinations of effect and eligibility. The report will contain a clear and concise section documenting and describing the results of the recovery action.

Report Content

The information submitted to the TCSA and WSMR CRM will include a technical report, GIS project shapefiles and site maps, as well as all pertinent State of New Mexico cultural resource forms (i.e., LA and HCPI forms). The technical report will include:

Introduction

a. Narrative description of the undertaking, including nature and extent of any land-modifying recovery activity.

b. Narrative description of the impact area, including the legal description(s), description of topography, drainage, elevation, and vegetation, as appropriate.

c. Description of previous surveys and recorded sites within or immediately adjacent to the recovery area.

Description of Recovery Activity

a. Inclusive dates of fieldwork.

b. Names and designations of all field personnel.

c. Survey intensity, 100 percent, or limited survey, and transect interval used.

Description of Findings

a. Summary of recovery results.

b. Description of all sites and isolated occurrences encountered.

c. Monitoring results.

Evaluation

a. Evaluation of National Register eligibility, or potential eligibility.

b. If sites are formally evaluated (36 CFR 63), statement of research or information context in which sites have been evaluated.

Management Recommendations

a. Statement of effects to historic properties.

b. Discussion of avoidance methods for eligible sites.

c. Discussion of possible mitigation measures if sites were impacted.

4.14.10 GPS Field Data Collection, GIS Database Management, and Mapping

Field data will be collected using GPS devices, loaded with data collection software and specialized data collection dictionaries.

a. Data will be recorded in the World Geodetic System Datum 1984 (WGS 84) and UTM Coordinates (Zone 13 North).

b. Site boundaries will be generated as systematic polygons based on collected data; however, if there are landform anomalies or other special circumstances, some deviation from this process may be necessary, under the discretion and professional judgement of the TCPI. (Note: If linear sites are encountered, a centerline will be used as a frame of reference to create a buffer with the appropriate width.)

c. Site datum, notable artifacts, and/or features will be recorded as point files. Other internal site characteristics (natural features and other distinguishing characteristics) may be mapped in the form of lines, polygons, or point files as necessary.

All GIS data collected will adhere to a Certificate of Networthiness (CoN), as appropriate for the licenses being used. GIS data will be stored on government networks and all appropriate security protocols will be adhered to including:

(a) Be compliant with WSMR's versions of Esri data collection software.

(b) Follow a Universal Serial Bus (USB) Trimble GPS connection authorization form.

(c) All spatial data will conform to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE).

4.14.11 NAGPRA Protocol

In the event of the inadvertent discovery of human remains during recovery actions, the TCPI or TCSA will complete the following procedures:

a. Stop any recovery activity that would result in further disturbance of the human remains and immediately take steps necessary to secure and protect including, but not limited to, stabilization or covering, as appropriate.

b. Immediately notify the WSMR CRM that human remains have been encountered to determine the appropriate course of action.

c. Within 24 hours, notify and initiate consultation with appropriate Tribes and THPOs.

4.15 SOP #15: Archeological Resources Protection Act (ARPA) Compliance

4.15.1 Applicability

ARPA protects archeological resources and sites on Federal and Indian lands. ARPA outlines illegal activities involving archeological resources and prescribes civil and criminal penalties for each, establishes a permitting process that outlines specific conditions for removal of archeological resources from Federal or Indian lands, and provides for the confidentiality of archeological data. For purposes of this regulation, the GC is considered the Federal land manager responsible for compliance. The CRM, acting on behalf of the GC, is responsible for coordinating with WSMR security personnel for the enforcement of ARPA policies.

4.15.2 Permitting Process

The Chief of the Conservation Branch issues these on a project-specific, semi-annual, or annual basis, as appropriate. The CRM tracks all activities carried out under ARPA permits. A copy of WSMR's ARPA permit is available in Appendix C.

Applications for permits will be processed through the WSMR Cultural Resources Program. ARPA permit applicants must provide sufficient information in their permit applications to establish their qualifications, description of the proposed action, and timetables for the project. Investigations proposed for lands under WSMR control or for projects sponsored by WSMR are initiated by submittal of the project data and ARPA submittal form. The CRM will review the application for completeness and will initiate consultation with the SHPO/THPO, if necessary. Testing and excavation projects normally will require NAGPRA and Tribal consultation unless the site is a historic ranching, mining, or military site. Consultations will occur for all projects with possible effect on cultural resources of interest to the Tribes. ARPA permits are not required for contracted work if the contract provides the same information as required by the permit. Additionally, ARPA permits are not required if WSMR-sponsored projects are undertaken directly by WSMR staff.

Permits for archaeological salvage operations are issued on a project basis. Ongoing missile testing with impact within established impact areas does not generally require further permits. For additional information on cultural resource permits, location of archeological sites, or other historical properties on WSMR lands, please contact the **WSMR Environmental Division: (575) 678-2225**.

The CRM will ensure that ARPA permits:

- Comply with the requirements of 32 CFR 229 (ARPA) and with 43 CFR 10 (NAGPRA),
- Require adherence to the Secretary of the Interior's *Professional Qualification Standards* (36 CFR 61) and *Standards and Guidelines for Archeology and Historic Preservation* (NPS 2020).
- Are issued only after any concerns of interested Tribes are addressed in accordance with NHPA, NAGRPA, and AIRFA. WSMR will ensure that documentation of consultation with culturally affiliated Indian tribes is prepared and maintained as part of the record of each permit.

- Require that artifacts and associated records be permanently curated in a curation facility that meets requirements of 36 CFR 79.

4.15.3 Enforcement of ARPA Permits

The CRM will monitor permitted activities to ensure that terms and conditions of issued permits are being met; and if not, permits may be revoked. The CRM shall certify that conditions of permits have or have not been met within 30 days of final deliverable dates and notify the proponent and the investigator by e-mail. Conditions not met within 90 days of the due date, unless an extension is granted by the Chief of the Conservation Branch, shall cause the CRM to refuse the permit holder further approval for projects on WSMR, and consultation may be delayed.

The following stipulations will also be enforced:

- The use of metal detectors to locate archeological resources is prohibited on Army installations, except when used by Army personnel, contractors, volunteers, or permit holders in association with official cultural resource management activities or pursuant to a permit issued under ARPA.

- Collection of cultural resources is prohibited on WSMR, except under terms of an ARPA permit or by qualified CRM-sanctioned archeological and historical researchers.

- Removing artifacts from their find spot by WSMR employees or visitors is prohibited and illegal. Archeological resources, objects of antiquity, and significant scientific data from federal installations belong to the installation, except where NAGPRA requires repatriation to a lineal descendant or Indian tribe. All artifacts collected from US Government land remain the property of the Government. Investigators shall label all artifact/sample containers as: **"Property of US Government (White Sands Missile Range)"** while artifacts are in their possession.

4.16 SOP #16: Native American Graves Protection and Repatriation Act (NAGPRA) Compliance

4.16.1 Applicability

NAGPRA was enacted in 1990 and ensures protection and the rightful disposition of Native American cultural items that are discovered on Federal or Indian lands. The *cultural items* referenced under NAGPRA are legally defined as Native American human remains, associated funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony. Implementing regulations are found in 43 CFR Part 10. NAGPRA regulations apply to existing collections that contain cultural items, as well as to newly discovered items.

4.16.2 Responsible Parties

The WSMR GC has responsibility for ensuring compliance with NAGPRA; the CRM is responsible for implementing NAGPRA compliance actions, including tribal consultation. The CRM will coordinate with appropriate personnel to facilitate compliance with NAGPRA. The project proponent for any action must coordinate with the CRM to ensure that the initial project review includes consideration of requirements of NAGPRA.

4.16.3 Procedures

Procedures for the intentional archeological excavation of NAGPRA cultural items and human remains are stipulated in NAGPRA Section 3(c) and 43 CFR 10.3. In these instances, the initial project review by the CRM will include review of possible NAGPRA compliance issues and will begin necessary notification and consultation procedures, which are to be carried out by the CRM, in consultation with Tribal authorities and the SHPO/THPO, if necessary.

In accordance with NAGPRA, human remains and cultural objects must be identified, if possible, as to lineal descendants or culturally affiliated contemporary tribes and must be repatriated if claims are justified by a preponderance of evidence. This section outlines procedures to be followed in the event of an inadvertent discovery of Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony. It also outlines procedures for planning an excavation that has a high probability for the discovery of Native American human remains and cultural objects, as well as procedures for managing treatment and disposition of Native American human remains and cultural objects.

4.16.4 Notifications

Inadvertent Discovery

In the event of the inadvertent discovery of human remains or cultural items on WSMR lands, the CRM or a representative of the CRM will accomplish the following procedures.

- Stop any activity that would result in further disturbance of the human remains or cultural items and immediately take any steps necessary to further secure and protect the human remains or cultural items, including, but not limited to, stabilization or covering, as appropriate.

- Document in writing that an inadvertent discovery has been made.

- Immediately notify the Tribal authority by telephone, followed by written notice by certified mail. The notice will describe the nature and condition of items discovered, their general location, and circumstances surrounding their discovery.

A written plan of action or treatment plan shall be developed by the CRM in consultation with the Tribal authority regarding treatment and disposition of human remains or cultural items. The written plan of action will be consistent with NAGPRA and specific procedures set forth therein. WSMR will submit to the Tribal authority a signed copy of the plan, in accordance with sections 10.3 and 10.5(c) of NAGPRA (43 CFR 10).

In accordance with Section 3(d) of NAGPRA and its implementing regulations (43 CFR 10), an activity that resulted in the inadvertent discovery may resume thirty (30) days after CRM receives confirmation that the Tribe has been notified of the discovery. The activity also may be resumed at any time after provisions of the joint written treatment plan have been fulfilled or as otherwise permitted by law.

Intentional Excavation

During the planning stages for excavation of a site known to contain items covered under NAGPRA jurisdiction, the CRM will perform the following procedures.

- Notify the Tribal authority in writing at least 30 days prior to any planned activity, such as construction or archeological excavation, that has reasonable potential to result in discovery of Native American human remains or cultural items. The notice will describe the planned activity, its general location, basis for the determination that human remains or cultural items may be present, and the basis for determining likely custody pursuant to Section 10.6 of NAGPRA.

- Submit to the Tribal authority a signed, written plan of action per sections 10.3(b) and 10.5(e) of NAGPRA and procedures set forth therein. The plan will be developed in consultation with the Tribal authority regarding treatment and disposition of human remains or cultural items.

4.16.5 Treatment of Human Remains or Cultural Items

In the event that human remains or cultural items are discovered as a result either of a planned excavation or inadvertent discovery, unless otherwise agreed in writing between the Tribe and WSMR, their treatment will be as follows.

- Human remains and cultural items will be treated with dignity and respect at all times.

- WSMR will leave Native American human remains and cultural items intact in place, without further disturbance, separation, or removal, if possible.

- WSMR will take immediate steps, as necessary, to protect discovered human remains or cultural items, including any appropriate stabilization or covering. Reasonable steps will be taken to ensure restricted access and confidentiality of the site of discovery by excluding access to the general public and news media.

- Human remains or cultural items that are noted on the ground surface or within a site that cannot be protected, stabilized, or covered immediately will be collected or excavated. Pending a determination of final disposition, these items will be removed to the secure curation facility located at WSMR. Location and circumstances surrounding the discovery of human remains or cultural items may be documented through photographs or maps. At the time of collection, human remains or cultural items may be placed in paper or plastic bags labeled with information on the location and circumstances of their discovery.

- Human remains or cultural items will be exposed to the extent necessary to attempt determination of cultural affiliation, antiquity, the number of individuals represented, age, sex, stature, and any pathologies or evident trauma. If remains or cultural items cannot reasonably be protected from further disturbance *in situ*, they will be removed to the secure curation facility at WSMR, pending their final disposition.

- Tribal representatives will be afforded the opportunity to be present during excavation and treatment of human remains or cultural items.

- All excavations will be conducted in accordance with requirements of ARPA and other relevant Federal, State, Army, and DoD policies and procedures. Excavations will be undertaken only under supervision of an archeologist meeting standards specified in the Secretary of the Interior's *Profession Qualification Standards* (36 CFR 61).

- Measurements, observations, and photographs of human remains or cultural items may be recorded; however, under no circumstances will any destructive testing take place without the express written consent of the Tribe. A qualified bio-anthropologist or archeologist may examine human remains to determine cultural affiliation, antiquity, number of individuals represented, age, sex, and stature and to identify any evidence of trauma or pathology.

- No human remains or cultural items will be put on public display in any manner or photographed, except for documentation purposes or with written consent of the Tribe. No photograph of human remains or cultural items will be distributed or published without written consent of the Tribe.

- Information regarding Native American traditional cultural properties will be kept strictly confidential and will be protected from public disclosure to the fullest extent allowed by law.

Within 90 days of re-interment or other disposition of the human remains or cultural materials,

WSMR will complete a final report on the discovery, treatment, and disposition of human remains and cultural items. A copy of the report will be sent to both the Tribe and the SHPO.

4.16.6 Disposition of Human Remains or Cultural Items

Section 3 of NAGPRA mandates that Native American human remains or cultural items that are excavated or identified on Federal lands after November 16, 1990 will be transferred to the custody of one of the following individuals or groups, in this order:

- lineal descendants,
- the Tribe on whose Tribal lands such remains or objects were discovered,
- the Tribe most closely affiliated with the remains or objects, or
- the Tribe recognized by a final judgment of the Indian Claims Commission or the US Court of Claims as having aboriginally occupied the Federal land on which such remains or objects were discovered.

In consultation with Tribal authorities, the CRM will take appropriate steps to identify lineal descendants or establish the likely cultural affiliation of any human remains or cultural items inadvertently discovered or identified during intentional excavation after November 16, 1990. Lineal descendants and cultural affiliation will be identified using procedures outlined in Section 10.14 of NAGPRA's implementing regulations. Custody of any such human remains or cultural items will be established in accordance with NAGPRA Section 3(a) and its implementing regulations (43 C.F.R. § 10).

- If the cultural affiliation of human remains or cultural items is determined, custody of such material will be made available for transfer to the affiliated Tribe, subject to notification provisions and limitations outlined in NAGPRA implementing regulations.
- If no cultural affiliation can be identified for human remains or cultural items found on WSMR lands, custody of human remains or cultural items will be offered to the Mescalero Apache Tribe pursuant to NAGPRA Section 3(a)(2)(C)(1), by virtue of the Mescalero Apache Tribe's claim of aboriginal occupancy of the area. This occupancy was verified by final judgment of the Indian Claims Commission of the US Court of Claims.

WSMR will initiate public notice procedures outlined in 43 CFR 10.6(c) after determination of custody is completed. The CRM will publish general notices of the proposed disposition of human remains or cultural items in a newspaper of general circulation in the area of discovery, or if necessary, in areas where potentially affiliated groups currently reside. Notices will provide information about the nature and presumed affiliation of the human remains or cultural items and will solicit additional claims of affiliation. The CRM will provide a copy of each published newspaper notice to Tribal authorities and to the Department of the Interior's Departmental Consulting Archeologist. The notice will be published a minimum of two (2) times, at least one (1) week apart. No transfer of human remains or cultural items will take place until at least thirty (30) days after publication of the second notice to allow time for any claimant to appear. If additional claimants do appear and

WSMR cannot clearly determine appropriate custody, WSMR will not transfer custody of the items until the proper recipient is determined.

Upon transfer of legal custody of any such human remains or cultural items, WSMR will offer options set forth below. However, the custodian or Tribe, which need not follow any following options, will decide the ultimate disposition of remains or cultural items.

- If it is determined that human remains or cultural items can be reasonably protected from further disturbance, they may be left in place, covered with earth and stabilized. The Tribe will have the opportunity to carry out ceremonies, rituals, or other observances attendant upon re-interment of the remains.

- If human remains or cultural items cannot reasonably be protected from further disturbance at the point of discovery, they may be re-interred on WSMR lands as close to their original location as possible to assure their protection or in another location chosen by the Tribe but subject to the WSMR approval.

- The specific location of human remains or cultural items will be reported to WSMR and to the Tribe. The specific location of human remains or cultural items will be withheld from public disclosure and protected to the fullest extent allowed by federal law. Consistent with provisions of the NHPA (16 U.S.C. § 470, *et seq*.), as amended, the original location and the re-interment of the remains will be withheld from public disclosure.

- If requested in writing by the Tribe, WSMR will enter into a MOA to care for any human remains or cultural items discovered as a result of an inadvertent discovery or intentional excavation. Any human remains or cultural items will be provided curation at WSMR under the terms of a loan agreement to be established in accordance with both reasonable requests of the Tribe and federal standards for curation.

- The Tribe will be permitted reasonable access to re-interment areas and curation facilities for the purpose of conducting ceremonies, rituals, or other observances as permitted under statute and regulation.

4.16.7 Unclaimed Native American Human Remains or Cultural Items

If Native American human remains or cultural items discovered or excavated on WSMR lands are not claimed by anyone pursuant to the process described above, disposition of such human remains or cultural items will be in accordance with regulations promulgated by the Secretary of the Interior in consultation with the review committee established under NAGPRA Section 8, Native American groups, representatives of museums, and the scientific community.

4.16.8 Disputes

If other claimants should appear where multiple requests for custody of human remains or cultural items are made, WSMR will retain any human remains or cultural items until the proper recipient is determined, either by agreement or the NAGPRA Review Committee.

4.17 SOP #17: Paleontological Resources

4.17.1 Applicability

Paleontological resources are scientifically significant fossilized remains, specimens, deposits, and other data from prehistoric, non-human life. The Archeological and Historic Preservation Act of 1974 specifically provides for survey and recovery of scientifically significant data that may be irreparably lost as a result of any terrain alteration from any Federal construction projects, or Federally-licensed project, activity, or program.

4.17.2 Responsible Parties

The CRM is responsible for management of paleontological resources on WSMR. Accordingly, management of paleontological locales and collections is incorporated into the WSMR ICRMP.

4.17.3 Procedures

The following standards will be used for treatment of paleontological resources. Additional details, including the background of Paleontological resources on WSMR, can be found in the Paleontological Resource Management Plan (Appendix D).

- The discovery of unknown sites and locations will be treated in the same manner as the inadvertent discovery of archaeological sites, the process for which is described in CRM SOP #9.

- Known paleontological resources will be addressed in any NEPA documentation prepared for actions that may impact or cause irreparable loss or destruction of such resources.

- Collection and removal of paleontological resources shall be prohibited on WSMR, except for professionally collected samples that: (1) are to be curated in museums or university collections; (2) provide data for academic studies conducted by museums, academic institutions, or government agencies; or (3) are for recovery as mitigation of a proposed adverse effect.

- Such collection activities shall be requested in writing to the Cultural Resources Program and approved by the CRM after being reviewed for NEPA concerns. The request shall specify: the area of study; type(s) of fossil(s) to be collected; location(s) where fossils will be stored or exhibited; manner in which the fossils may be accessed for academic study by interested parties; method of collection; dates of activity; and quantity of fossils required to address the research goal.

- Proponents who propose activities that adversely impact paleontological resources shall be required to mitigate the activity, either by removing the adverse effect or by funding a recovery program. If recovery is required, the CRM shall prepare a recovery plan and after receipt of funding, oversee the recovery of a sufficient sample of fossils to characterize the deposit.

- Professional survey and recovery activities may be programmed in the Environmental Program Requirements report for studies to further scientific research.
- Members of the Conservation Branch or its contractors shall consult and coordinate with the CRM when paleontological specimens, deposits, and remains are suspected or known to occur in an archeological context. Those paleontological resources found in an archeological context are considered as an archeological resource under ARPA.

4.18 SOP #18: Curatorial and Collection Management of Archaeological and Historical Collections and Associated Records

4.18.1 Applicability

This SOP applies to all organizations, property, and activities under the control of the Department of the Army and located within the boundaries of WSMR or other contiguous land under WSMR control. It also includes activities undertaken on behalf of the Army or with consent of the Army, or as a result of consent of the Army by contract lease, or interservice support agreement or other instrument to which WSMR, the United States Army, or the DoD is a party, within WSMR or other contiguous land under WSMR control.

4.18.2 Objectives

The objectives of this SOP are to ensure that:

1) archaeological and historic collections, inclusive of artifacts, samples, and their associated records (e.g., reports, photographs, drawings, etc.), are curated in accordance with the guidelines established in 36 CFR 79, *Curation of Federally Owned and Administered Collections*, and 48 FR 44716, *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines,* and other governing Federal regulations as they related to Federally-owned and administered collections and;

2) data and other information collected during cultural resources investigations continue to be shared with the New Mexico SHPO, THPOs, and other qualified professional archaeologists and historians as outlined in the 2020 *Intergovernmental Agreement Between Garrison Commander, US Army Garrison White Sands, White Sands Missile Range, New Mexico and The New Mexico State Historic Preservation Officer Concerning Automation and Management of Cultural Resource Information (Data Sharing Agreement)*.

4.18.3 Policy

WSMR's collections policy is to limit collections resulting from cultural resources investigations. Unless required for diagnostic purposes or for protections, artifacts identified during the course of cultural resources investigations are left *in situ.* Nevertheless, because an intensive program of archaeological survey and testing is implemented to support the WSMR mission, WSMR collections grow annually as a result of these studies.

WSMR is responsible for curating collections and their associated records in accordance with 36 CFR 79 and 48 FR 44716. These regulations establish four general criteria for curation of federally-owned archaeological collections.

- Curation facilities must have adequate space, facilities, and professional personnel.

- Archaeological specimens must be maintained so that their information values are not lost through deterioration, and records must be maintained to archival standards.
- Curated collections must be accessible to qualified researchers within a reasonable time of having been required.
- Collections must be available for interpretive purposes, subject to reasonable security precautions.

WSMR collections are housed at the Fort Bliss Curation Facility, which meets or exceeds all federal requirements. Fort Bliss provides curation of WSMR's collection on a reimbursable basis based on the volume of artifacts and associated records. The Cultural Resources Program maintains a digital inventory of collections.

WSMR's data management policy is to continue sharing spatial data and other pertinent information with the New Mexico SHPO through NMCRIS as outlined in the 2020 Data Sharing Agreement.

4.18.4 Curation Procedures

Archaeological and historical collections originating from WSMR are ultimately curated at the Fort Bliss curation facility; however, collections adhere to the curation procedures established by WSMR. The WSMR collections are housed at Fort Bliss using a WSMR specific catalog system. The WSMR procedures for curation are outlined in *WSMR Deliverables and Curation Guidelines* (Appendix E).

4.18.5 Data Management

The 2020 *Intergovernmental Agreement Between Garrison Commander, US Army Garrison White Sands, White Sands Missile Range, New Mexico and The New Mexico State Historic Preservation Officer Concerning Automation and Management of Cultural Resource Information (Data Sharing Agreement)* is the basis for WSMR's management of cultural resources data (Appendix F). Rather than stipulating management requirements like a NHPA agreement document, the 2020 Data Sharing Agreement is essentially a service agreement that allows WSMR cultural resources data to be integrated with the New Mexico ARMS, formerly known as the Laboratory of Anthropology. ARMS is within New Mexico HPD's responsible for maintaining the State's inventory of sites and surveyed areas, issuing classification numbers for sites and investigations, and establishing standards for cultural resources investigations. Most of these functions are built into NMCRIS, the most advanced on-line cultural resources database among the nation's SHPOs.

NMCRIS ensures cultural resources data for WSMR are compatible with that from across the state of New Mexico and allow for more efficient report preparation and review. The current version of the system also allows WSMR to share GIS data through NMCRIS. The 2020 Data Sharing Agreement also requires that information developed and disseminated through NMCRIS will be made subject by both parties to such restrictions of accessibility to ensure that its disclosure will not create risk of harm to cultural resources or the site at which such resources are located, consistent with provisions of New Mexico Public Law 96-95. Information obtained from NMCRIS by WSMR is subject to the same provisions of confidentiality, and investigators or project personnel may be required to sign non-disclosure agreements.

CRMs are responsible for reviewing all cultural resources investigations prepared for WSMR and process appropriate forms and reports with ARMS. The Cultural Resources Program maintains tracking files for all investigations and sites recorded on WSMR. Information on site locations and survey areas is maintained in the Conservation Branch GIS in addition to NMCRIS.

Confidentiality Policy

ARPA, Section 304 of the NHPA, and EO 13007 contain provisions for the protection of sensitive information regarding the location and nature of archaeological sites, historic properties/Traditional Cultural Properties (TCPs), and sacred sites. DoDI 4715.16 (Enclosure 3, 3.) states, [w]*hen an installation determines that the disclosure of information on the location or character of cultural resources may create a substantial risk of harm, theft, or destruction of such resources, invasion of privacy, trespass on Government property, interference with the military mission, and/or interference with the rights guaranteed to tribal groups under section 1996 of title 42, U.S.C., the installation shall ensure that documents and other data provided to the public do not disclose such information. Information may be provided to other agencies and parties in accordance with the confidentiality provisions of section 470w-3 of* [title 16, U.S.C.] *and part 229 of title 32, CFR.*

The Cultural Resources Program provides for the confidentiality of sensitive cultural resources. Information that would allow archeological and historical sites to be located is not released to other WSMR elements or the public. Location information is released only to qualified professional archeologists and historians who have a need to know, as well as to the New Mexico SHPO and THPOs.

Resources associated with a Tribe with standing at WSMR and deemed by the Tribe to require special confidentiality have significantly tighter security procedures than other properties. Locations of places deemed sensitive by Tribes are protected from disclosure to all but Conservation Branch personnel who use the data to help protect these resources.

In reports produced for public distribution, specific site location data is omitted from text and illustrations. Sites are shown only at 1:250,000 scale or less accuracy. Copies intended for public release contain maps showing the survey area, but not sites and isolated occurrences (IOs), and do not contain map coordinates of any cultural resources except military era buildings.

4.19 SOP #19: Spill Responses

4.19.1 Purpose

Section 106 of the NHPA requires all federal agencies (including WSMR) to take into account the effects of their undertakings on historic properties and afford the ACHP a reasonable opportunity to comment. This SOP addresses the appropriate response for treating cultural resources while responding to an environmental spill release impact, ranging from remediating spill releases to emergencies that represent immediate threats to life or property.

4.19.2 Background

Some environmental protection measures, such as clean-up after a spill release, have the potential to affect historic properties on WSMR. In addition to the potential adverse effects outlined in Section 106 of the NHPA, spill response and environmental remediation may result in subsurface disturbance, and may therefore have an adverse effect on other cultural resource sites that would normally be addressed under common authorities, such as:

- Archaeological and Historical Preservation Act (16 USC 469);
- ARPA (16 USC 470aa-470ll);
- NAGPRA (25 USC 3001); and
- AIRFA (42 USC 1996)

Initial consultation with the CRM will aid in identifying the presence of cultural resource sites and avoid or minimize inadvertent damage during a spill response.

4.19.3 Procedure

The procedures for addressing adverse effects to historic properties during spill response and environmental remediation activities will be dictated by the immediacy of the required action. Immediate rescue and salvage operations associated with an essential or immediate response to a disaster or emergency are exempt from Section 106, as cited in 36 CFR Part 800.12(d). Under these circumstances, the project proponent shall notify the CRM of the operations so that the activities and its adverse effects can be documented for ARPA and other purposes.

Jim Bowman

Chief. Conservation Branch

Cultural Resources Manager

Directorate of Public Works

Environmental Division

Building 163, Springfield Ave.

ATTN: AMIM-WSP-E

White Sands Missile Range, NM 88002

Phone: (575) 678-7925

Email: james.e.bowman68.civ@army.mil

Any activities not requiring immediate emergency response shall follow the procedures stated below:

- WSMR project proponents should consult with the CRM to identify Section 106 and other cultural resource responsibilities as early as possible in the planning process. Scoping, identification, and assessment of the undertaking's potential effect on historic properties should be considered prior to initiating remediation or non-emergency spill response activities and follow the Section 106 consultation process.

- As a proactive protective measure, project planners, engineers, DPW personnel, military personnel, tenants and any other individuals involved in potential ground disturbing activities at the installation (including remediation and spill release response) should be informed of the types of cultural resources present at WSMR. Additionally, these individuals should be briefed on the provisions of this SOP.

- In the event that a spill, not treated as an emergency rescue and salvage operation or life-threatening situation, occurs within a location of known cultural resources, the CRM should be consulted as to the procedures to be followed for treatment of the threatened resources.

- Ground-disturbing activities, if they are involved in the initial spill or subsequent remediation, will be halted in the immediate area of the site or discovery. "Immediate area" is a context-specific measure; 100 feet is adequate in most situations, although special attention should be given to the possible extension of a new find beyond this buffer zone.

- WSMR Cultural Resources Program personnel should visit and assess the location of the discovery within 24 hours of notification of the spill. This short time frame is necessary so that other environmental concerns surrounding the spill can be addressed quickly. The services of appropriate technical experts (e.g., Archaeologists, Human Osteologists, Forensic Anthropologists) should be considered to participate in the field visit, if necessary.

- Upon the instruction of the CRM, and in consultation with the appropriate experts for dealing with spill releases, the cultural resources should be stabilized and protected from further disturbance in order to avoid a potential ARPA violation.

5. CULTURAL RESOURCES INVENTORY

Chapter 2, Historic Overview provides an understanding of what cultural resources might be present on WSMR. This chapter provides and overview of the significant work that has been done on the Range, literature generated by this work, and an inventory of cultural resources identified from the work. While there are unique resources at WSMR, such as the Trinity Site NHL, there are no there are no known cultural resource areas of critical or special concern or unique cultural resource issues. There is not a specific long-term plan to inventory unsurveyed portions of WSMR; however, cultural resource inventories are ongoing related to military needs based on the mission and consultation with TC personnel.

5.1 Predictive Models

Despite robust survey efforts since the 1980s much of WSMR has not been inventoried due to the sheer size of the installation. However, survey efforts have provided enough data to establish a baseline of expected resource types and locations on WSMR. These baseline data have contributed to the development and refinement of archaeological predictive models, which provide the CRM with a valuable tool for project planning and resource management. A predictive model for a large portion of WSMR's interior was prepared by Statistical Research Inc. (SRI) in 2012 (Heilen et al. 2012). The model was initially developed for the neighboring Fort Bliss, and adapted for use at WSMR using WSMR's site location data. The model incorporated variables of topography, soils, water resources, vegetation, and known site data to develop predictive models of site locations as well as models of site significance, i.e., the likelihood of sites possessing sufficient data potential to be eligible under NRHP Evaluation Criterion D. Outputs of the predictive model varied depending on the variables applied and how they were weighted, as well as the site significance (Heilen et al. 2012). The SRI predictive model is available in GIS format from WSMR Environmental Division, Conservation Branch. An example of one of the predictive model outputs is shown in Figure 5-1. This is the "All Sites Model" which predicts the probability (or 'sensitivity') of all sites, regardless of age or significance. The report prepared as part of the SRI predictive modeling effort (Heilen et al. 2012) is included in Appendix I. Future inventories will undoubtedly aid in the development of more refined predictive models while continuing to support the military mission at WSMR.

5.2 Literature Review

5.2.1 Summary of Investigations

The WSMR cultural resource database contains listings of 1,181 published cultural resources investigations, inclusive of cultural resources inventories, NRHP evaluation and testing projects, data recoveries, oral histories, and historic architectural investigations (Appendix G). Cultural resources inventories (archaeological surveys) account for a majority of these investigations and have covered approximately 29% (629,051 acres) of WSMR (Figure 5-2). Inventories have been conducted by universities, state and federal agencies, private individuals, and cultural resources contractors, and have ranged from less than one acre to several square miles in size. To date, nearly all the areas south of US 70 have been inventoried. Large sections of the Middle Range area north of White Sands Space Harbor (WSSH) and south of the Carrizozo Lava Flow (Malpais) have been the focus of numerous inventories. Portions of Holloman AFB have also been inventoried. In the North Range

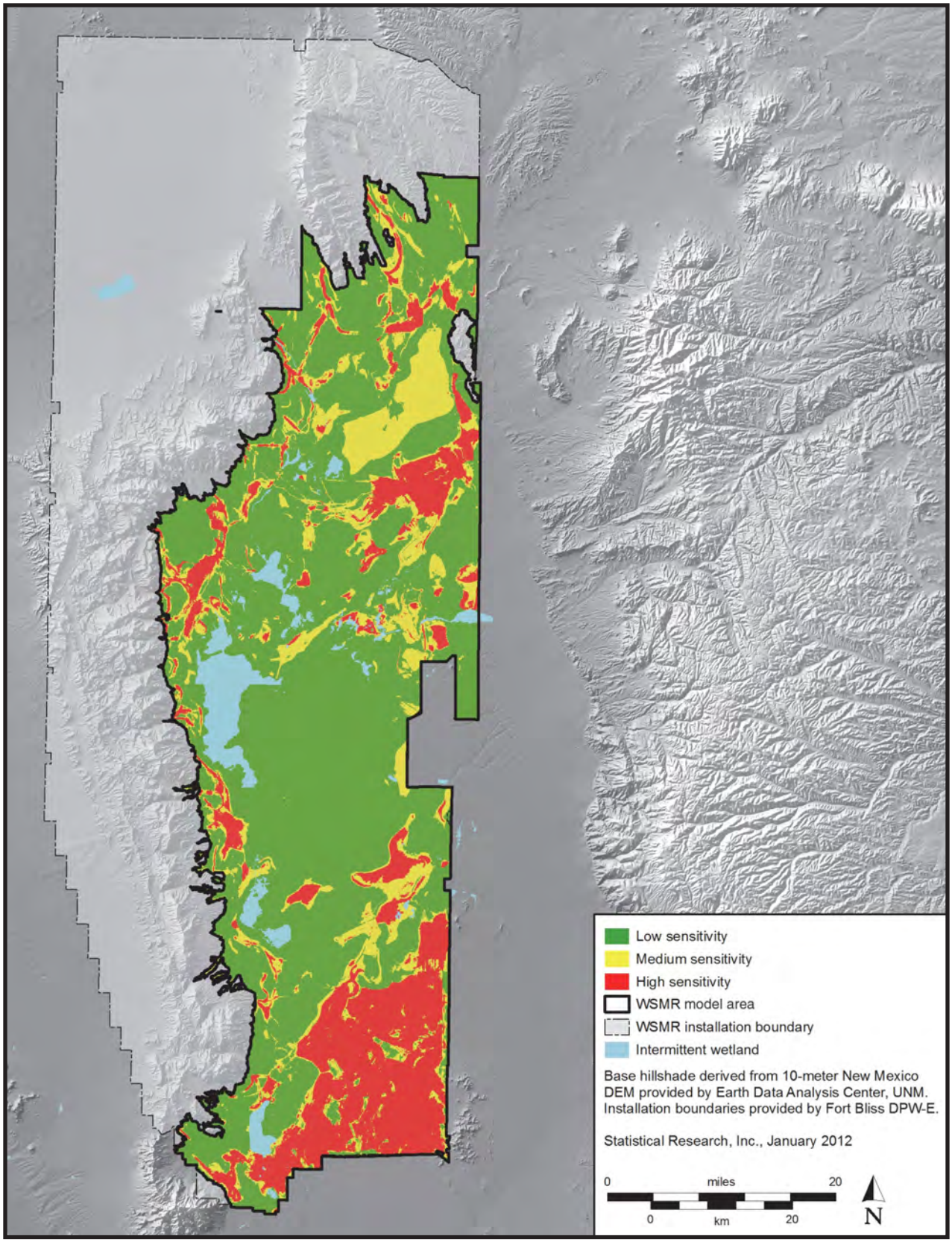


Figure 5-1. Example map from SRI predictive model using the All Sites Model *(from Heilen et al. 2012)*.

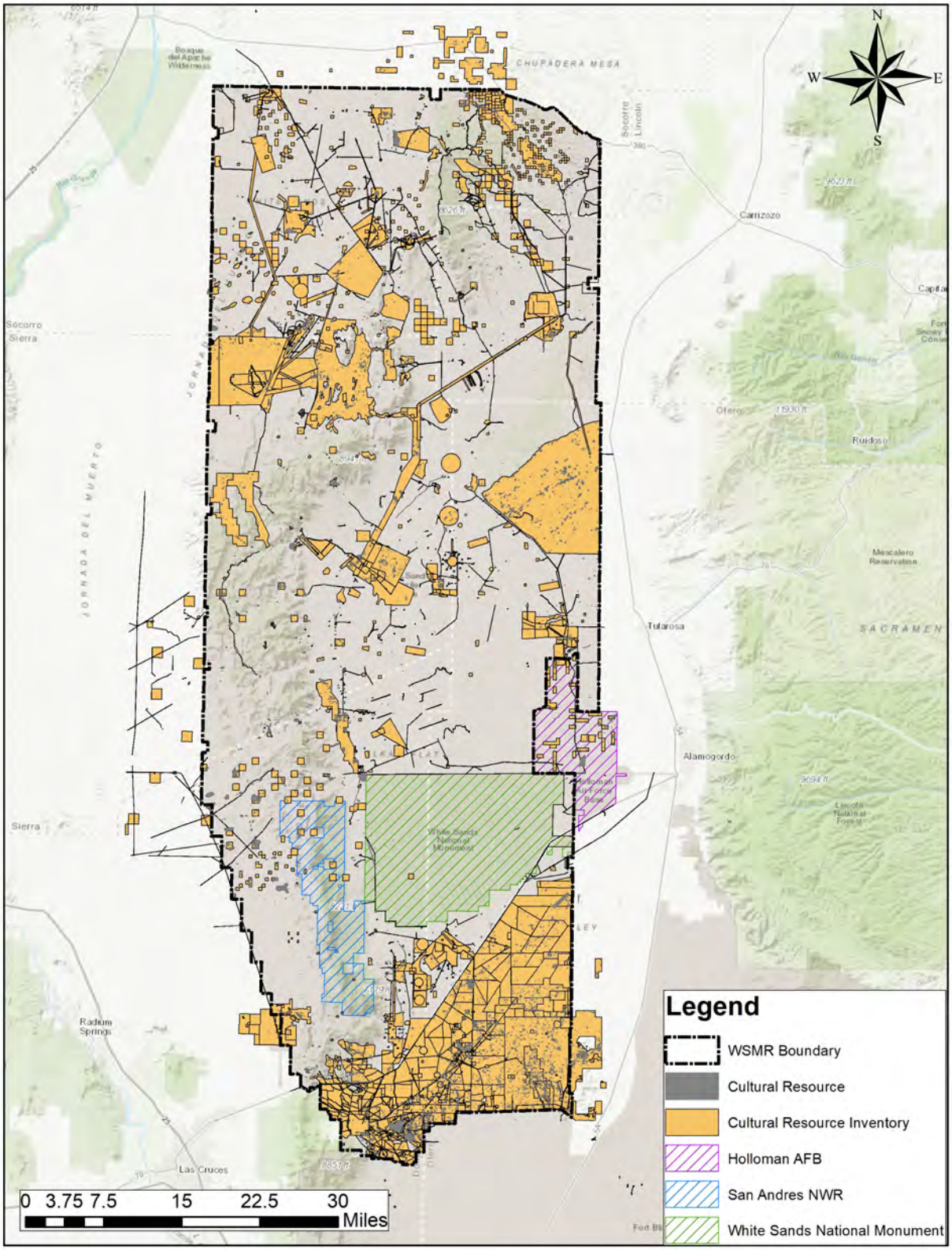


Figure 5-2. Previously surveyed areas and identified cultural resources on WSMR.

area, portions of the Jornada del Muerto Basin, and adjacent Oscura and San Andres Mountains have been subjected to multiple inventories. Section 5.1.2 provides a synthesis of significant archaeological investigations on WSMR since 2005.

In addition to archaeological investigations, numerous architectural and historical investigations have been conducted at WSMR. These investigations include surveys of Cold War related structures and facilities; HABS/HAER documentation of structures related to the V2 Missile Complex, Trinity Site, and Launch Complex 33; preparation of historic monographs and oral histories on Cold War and historic ranch occupations; and research and documentation of select resources for nomination to the National Register. Section 5.2.3 summarizes the prominent architectural and historical investigations that have been conducted on the post since the 1980s.

5.2.2 Synthesis of Select Archaeological Investigations Since 2005

The following section summarizes the significant investigations completed at WSMR from 2005 to the present, inclusive of cultural resource inventories, NRHP site evaluations, and data recoveries. The reports referenced in this section do not represent the entirety of cultural resource investigations completed across WSMR during this time frame; rather they are those determined to be highly significant by WSMR cultural resource staff. The volume of data produced by these investigations is immense, most notably data recovery excavations near WSMR main post (Sale and Silberberg 2009; Sale et al. 2011; Ward and Vierra 2010) and the Jarilla Mountains (Kurota 2015). While key findings and trends are summarized here, the reader is encouraged to read the reports referenced in this section for more detailed information.

5.2.2.1 Cultural Resource Inventories / NRHP Site Evaluations

Cultural resource inventories included in this summary resulted in the inventory of approximately 84,175 acres and documentation of 1,276 archaeological sites (Table 5-1). Most of these investigations consisted of discontinuous survey parcels located in the South Range area, with less acreage covered in the Middle and North Range areas. A majority of the archaeological sites documented during these investigations were newly discovered resources; site updates, though few, were required in some instances where previously recorded resources fell within survey boundaries. Site density varies significantly across WSMR and is largely contingent on local topographic and/or geomorphic setting and distance to resources (e.g., water, shelter, lithic material, etc.). In general, inventory efforts indicate site density is highest in the southern portion of WSMR.

Site re-evaluations resulted in the update of 1,047 sites, primarily in the South Range area (Table 5-2). Most of these sites were originally recorded during the Border Star 85 Survey (Seamen et al. 1988), the Ground Based Free Electron Laser Integration Experiment (GBFEL-TIE) survey (Anschuetz et al. 1990), and other smaller cultural resource inventories conducted in the 1980s and 1990s. While these early investigations recorded a vast amount of resources and expanded our knowledge of the regional prehistory, the NRHP eligibility of many resources remained undetermined. To remedy this situation, WSMR contracted Ecological Communications Corporation (EComm) for several large re-evaluation projects. EComm personnel reviewed the available site records, re-visited each site location, recorded the cultural material observed at each locale, and assessed the geomorphic integrity of each site using the Holocene stratigraphic sequence defined by Blair et al. (1990). EComm staff also conducted limited shovel testing at most sites to further evaluate their subsurface potential (Silberberg and Swain 2009; Trierweiler et al. 2008).

Table 5-1. Summary of Cultural Resources Inventories Included in the Literature Review.

Contractor	Citation	WSMR Report Number	Total Acres	Identified/ Revisited Sites	Location	Site Density
Ecosystem Management, Inc.	EMI 2005	493	27,368	471	South Range	1:58 acres
AmaTerra Environmental, Inc.	Sale et al. 2014	721	2,700	54	Middle Range	1:50 acres
AmaTerra Environmental, Inc.	Sale et al. 2015	722	1,600	31	North Range	1:51 acres
R. Christopher Goodwin and Associates	Taylor-Montoya et al. 2018	660 and 832	21,981	315	Middle and South Range	1:70 acres
R. Christopher Goodwin and Associates	Taylor-Montoya and Rude 2019	775	14,751	79	North Range	1:186 acres
Ecological Communications Corporation	Trierweiler and Swain 2009	532	15,775	326	South Range	1:48 acres

Table 5-2. Summary of Re-evaluations Included in Literature Review

Contractor	Citation	WSMR Report Number	Evaluated Sites	Final Number of Sites	Location
Ecological Communications Corporation	Silberberg and Swain 2009	549	703	117	South Range
Ecological Communications Corporation	Trierweiler et al. 2007	531	133	107	South Range
Ecological Communications Corporation	Trierweiler et al. 2008	538	200	135	South Range
AmaTerra Environmental, Inc.	Silberberg et al. 2019	932	11	11	North Range

Re-evaluation work by EComm resulted in a substantial reduction in the total number of sites for management purposes in the South Range, from 1,036 resources to 359. This reduction primarily stemmed from three factors: 1) EComm used the then-current criteria to define sites, which differed from previous investigations; 2) the surface distribution of artifacts warranted the combination of one or more previously recorded site under a single LA number; and 3) previously recorded sites could not be relocated using the available data. In a few instances, duplicate site records also reduced the total number of sites investigated.

To avoid redundancy, the findings of inventory and re-evaluation efforts are reported in the following sections. These sections summarize the cultural material and features observed at documented sites, in addition to common site types and cultural/temporal affiliations reported in the investigations. Research themes or trends of significance are also discussed in this section.

Cultural Material

Prehistoric cultural material observed during inventory and re-evaluation efforts include flaked stone, ground stone, and ceramic assemblages. Lithic material, diagnostic projectile points, and ceramics documented during these investigations do not differ greatly from those reported for the Jornada region (Miller and Kenmotsu 2004) or in previous versions of the ICRMP (WSMR 2005; 2015). Historic materials largely consist of cans, bottles, and other domestic debris dating to the late 19th to mid-20th centuries. As the historic materials represent mass manufactured goods with well-established date ranges and descriptions, this section focuses exclusively on prehistoric material.

Lithic material comprising debitage and flaked stone tool assemblages includes chert, limestone, siltstone, rhyolite, dolomite, basalt, quartzite, chalcedony, quartz, and obsidian. Chert is the most common material type reported in all investigations and includes local materials sourced to the San Andres and Jarilla mountains. Non-local, high-quality cherts are also noted by several researchers, often suspected to represent Paleoindian or Early Archaic components (EMI 2006:10). High quality material, regardless of the source, is preferred for formal flake tools (e.g., bifaces, drills, projectile points), whereas coarse grain material is more frequently used for expedient tools (EMI 2006:10). Ground stone tools are commonly manufactured from sandstone, limestone, schist, vesicular basalt, quartzite, and granite. Many of these materials are locally available in the Organ and San Andres mountains.

Projectile points representative of Paleoindian to Formative cultural/temporal affiliations are well-documented across WSMR. The points listed here do not represent the entire spectrum of types reported in the literature; rather, they include those most frequently reported. Miller and Graves (2019) have recently highlighted the challenges faced with updating the chronology and type designations for the over 200-point types reported in the Jornada region. While disagreements may exist in the temporal designations for some of the points listed below, re-assigning temporal designations is beyond the scope of this ICRMP.

Folsom, and late Paleoindian points, such as Eden, Midland, and Planview are the most common Paleoindian points reported, although they occur in low frequencies. Early Archaic points regularly include Jay and Bajada types. Commonly observed Middle Archaic points include San José, Pelona, Augustin, Shumala, Todsen, Armagosa, Chiricahua, and Gypsum. Late Archaic points consist of San Pedro, Fresnal, Hueco, Pendejo, Datil, Livermore, and Guadalupe points. Formative period

projectile points largely consist of Tularosa Corner Notched, Harrel, Pueblo Side Notched, and other varieties of small triangular shaped points.

Ceramic assemblages largely consist of El Paso Brownware and its decorated varieties (e.g., El Paso Bichrome and El Paso Polychrome), most notably in the southern portion of WSMR. Northern Jornada brownwares (Jornada Brown and Corona Plain) are also reported, but more frequently in the Middle and North Range areas (Sale et al. 2014, 2015). Other well documented Northern Jornada ceramics include Chupadero Black-on-white and Three Rivers Red-on-Terracotta, though the latter less frequently.

Intrusive ceramics attributed to the Mimbres-Mogollon, Casa Grandes, Salado, and Rio Abajo ceramic traditions are reported across WSMR. Mimbres-Mogollon ceramics are by far the most common and widespread with Mimbres Black-on-white (variety not often noted) and Alma Plain accounting for the majority of types observed. Playas Red is the most frequent Casas Grandes type observed throughout the range, whereas Casas Grandes polychromes tend to occur at larger residential complexes in the South Range area (EMI 2006:72, 455). Gila polychrome and other probable Salado ceramics are also noted in the South Range area, often accompanied by Casas Grandes and Mimbres-Mogollon ceramics (EMI 2006:92, 455). Ceramics associated with the Rio Abajo tradition are noted in assemblages across the range, including sites in the North and Middle Range areas (Sale et al. 2014, 2015). Common types include Socorro Black-on-white, San Marcial Black-on-white, and Red Mesa Black-on-white.

Features

A wide range of prehistoric and historic features are reported in the reviewed literature. Prehistoric features include thermal features, middens, room blocks, mounds, depressions, rockshelters, and rock alignments. Historic features are related exclusively to mining, ranching, and military sites. Common historic features include shafts, adits, prospecting pits, ranches, water tanks, windmills, concrete pads, and military testing/training features.

Thermal features are the most abundant prehistoric feature type documented throughout the range, and commonly include fire-cracked-rock (FCR) concentrations, hearths, and carbon stains. Of these features, FCR concentrations are the most common type reported in the reviewed literature. These features can range from less than one meter to several meters in diameter and may contain hundreds of pieces FCR, some of which may be repurposed ground stone. EMI (2006:634) suggest simple, flat FCR concentrations documented throughout the range are associated with limited baking/roasting episodes of succulents or other vegetal material, which are more common than the well-developed ring middens characteristic of long-term, multiple use episodes. Other researchers suggest FCR concentrations may represent the remains of deflated hearths or burned ground stone tools. Carbon or charcoal staining is sometimes observed in association with features, but this is typically not the norm.

Carbon stains often range from less than 1 m to several meters in maximum dimension. FCR can be associated with stains, in addition to fired gypsum in areas with gypsiferous soils (Taylor-Montoya 2019). These features are usually interpreted to represent deflated hearths, roasting pits, or other thermal features associated with cooking activities. However, recent excavations at LA 51225 (Quail Run), LA 62136 (Casas Vecinas), and LA 62143 (Huesos Quemados) suggest larger stains can also represent burned structures (Kurota 2015:310; Sale and Silberberg 2009).

Limited trowel testing has been conducted on some thermal features to assess their subsurface potential; however, the vast majority remain untested. Those surface features which have been tested have often produced mixed results regarding the recovery of datable material and subsistence remains. For example, Silberberg et al. (2019) obtained several AMS radiocarbon dates from thermal features in the Otero Maneuver area, the ages of which generally agreed with diagnostics observed on the surface. However, no macrobotanical or faunal remains are reported in association with these features. In contrast, Kurota (2015) excavated several FCR concentrations in the South Range area; all of which failed to identify material suitable for radiocarbon dating or macrobotanial analysis. However, researchers were able to obtain a Thermoluminescence age for the features, which generally agreed with diagnostics observed on the surface (Kurota 2015). These observations suggest surface thermal features have the potential to retain some data, however, this is largely dependent on the degree of erosion.

The criteria, if any, used to define these features can vary significantly between contractors (Kurota 2015:586), making comparisons between investigations challenging. For example, AmaTerra and EComm have established density and size thresholds, 10 or more elements with a size of 25 millimeters (1 inch) or greater within a 1-m diameter area, for distinguishing FCR features from background scatters of FCR (Sale et al. 2014, 2015; Silberberg and Swain 2009:351). Other investigations are less specific with their feature definitions, suggesting they are determined on a case by case basis subject to the judgment of the supervisory archaeologist.

Features typical of long-term habitation, such as room blocks, mounds, middens, and depressions (i.e., pithouses) are less frequently reported in the literature. Room blocks range from single rooms to multi-room blocks, at least one of which at site LA 151046 is "L" shaped and associated with a plaza (EMI 2006:164). Room blocks reported in the literature have only been found in the South Range (EMI 2006). Mounds, likely representing puddled adobe walls, are commonly observed alongside room blocks, as are well-defined middens. Middens can also occur in locations without surface structural remains; however their presence has led researchers to suspect that structures or other features may be present subsurface (Silberberg and Swain 2009:350).

Rockshelters and rock alignments are reported in the northern portion of the range, along the western edges of the Carrizozo Lava Flow (Malpais). Rockshelters are often associated with bedrock metates, mortars, grinding slicks, and cultural material suggestive of use throughout the Archaic and Formative periods (Sale et al. 2015:121). While untested, several rockshelters are reported to have sufficient geomorphic integrity and high potential to yield additional data; LA 179525 is an excellent example (Sale et al. 2015:108). Rock alignments include walls, linear alignments, enclosed circles, and "C" or "V" shaped alignments, all of which are constructed out of local basalt cobbles and boulders (Figure 5-3). The exact function of these features remains unknown, especially in the absence of any cultural material. However, researchers suggest alignments on prehistoric sites could represent structural remains or shrines (Sale et al. 2015:90), whereas stacked wall alignments lacking any cultural material are suspected to represent the remains of historic corrals (Sale et al. 2015:90, 114). Notable prehistoric sites with rock alignments include LA 179518, which contains multiple alignments along with a ceramic assemblage suggestive of a mixed Jornada Mogollon/Anasazi cultural affiliation (Sale et al. 2015:91).

Figure 5-3. Circular structure documented at LA 179518, facing north *(from Sale et al. 2015:91)*.

Site Types

Inventory and re-evaluation efforts have resulted in the documentation of numerous prehistoric and historic site types. Prehistoric campsites, encampments, and resource processing/extraction locales are commonly documented across the range, whereas habitation or residential sites are less frequently reported. Historic sites are predominately related to late 19th to mid-20th century mining, ranching, and military testing activities.

A majority of the prehistoric sites are characterized in the literature as encampments or campsites (EMI 2006; Taylor-Montoya et al. 2018; Taylor-Montoya and Rude 2019). These sites typically have a low to moderate density scatter of artifacts inclusive of debitage, FCR, flaked and ground stone tools, or ceramics. One or more thermal feature is not uncommon at many of these sites. In general, these sites are interpreted to be short-term or seasonal occupations, many of which have been re-occupied on a semi-continuous basis. Evidence to support this assessment comes from the identification of diagnostic artifacts attributed to one or more temporal periods in site assemblages and the presence of large metates at some locations. These metates are too large to be regularly transported and most likely represent "site furniture" left in place by groups returning to the same

location on a regular basis (Taylor-Montoya et al. 2018:135). Campsites can range from under 1 acre to over 10 acres in size. Resource processing and extraction locales share many characteristics with encampments or camps, but generally have a less diverse artifact and feature assemblage, and are smaller in size (less than 1 acre).

Prehistoric residential complexes or habitation sites are less frequently encountered when compared to other site types. Late Formative period residential complexes typically have multiple features, including a mound, midden, or room block. In addition to these features, residential complexes often contain a diverse ceramic assemblage, inclusive of intrusive ceramics such as Mimbres Black-on-white or Casas Grandes polychromes (EMI 2006). Large El Paso phase residential complexes are almost exclusively documented in the South Range area (EMI 2006; Silberberg and Swain 2009). For example, EMI (2006:40) documented approximately two dozen sites with well-defined middens, mounds, and in some instances, room blocks during their inventory. Prominent examples include LA 32078 (Adobe Well Pueblo), LA 150931, LA 151046, LA 151032, and LA 150925 (EMI 2006: 58, 89, 164, 232, 454).

Historic mining sites commonly occur in the eastern portion of the range, within the Organ, San Andres, and Oscura mountains (Taylor-Montoya et al. 2018:39). A majority of mining sites are exploratory in nature, consisting of one or more simple features (e.g., prospect pits, trenches, or cuts). Large mining sites generally have multiple features inclusive of shafts, adits, prospecting pits, and occasional structure remnants or tent pads. Significant mining sites are often associated with prominent individuals or events in the region's history, as documented through historic records. The Mormon Mine (LA 121716) and Mockingbird Mine (LA 172040) are two examples of significant mining sites updated during recent investigations (Taylor-Montoya et al. 2018; Taylor-Montoya and Rude 2019). For additional details regarding prominent mines, mining districts, and the history of mining on WSMR the reader is referred to Taylor-Montoya et al. 2018.

Ranching sites consist of simple features, such as water tanks, windmills, and corrals, but also include more elaborate ranch complexes containing habitation structures in addition to the aforementioned features. The Felipé Lucero Ranch (LA 58857), Lena Cox Ranch (LA 108145), Hal Cox Ranch (LA 108144), Letherman Well (LA 144177), Tinaja Sheep Camp (LA 140117), and an unnamed ranch site (LA 182371) are examples of the significant late 19th century to early 20th century ranching sites documented during recent investigations (Taylor-Montoya et al. 2018:156; Taylor Montoya and Rude 2019:358) (Figure 5-4).

Historic military sites are primarily related to Cold War era testing, but also include WWII era aviation markers, bombing targets, and concrete blockhouses (Trierweiler and Swain 2009:318). Cold War era sites are primarily instrumentation stations with features consisting of concrete pads, earthen berms, utility boxes, and other simple features used to support instrumentation equipment. Prefabricated, metal-clad, portable buildings resting on wooden foundations are sometimes associated with these sites (Taylor-Montoya and Rude 2019:66). Cold War era sites also consist of inoperative vehicles or equipment used as targets (Trierweiler and Swain 2009). For a detailed regarding significant Cold War era historic sites and architectural resources, see Section 5.1.3.

Isolated trash dumps with material dating to the early to mid-20th century are noted throughout WSMR. These sites generally date to the military occupation of the landscape, but can also be associated with mining and ranching activities. Artifacts commonly observed at these sites include bottle glass, cans, and other debris dating to the early to mid-20th century (AD 1900 to 1960). These sites, by their nature, offer little to no data potential (Taylor-Montoya and Rude 2019:389).

Figure 5-4. Overview of site LA 140117 *(Tinaja Sheep Camp)*, view to the south *(from Taylor-Montoya and Rude 2019:360)*.

Cultural/Temporal Affiliation

Cultural/temporal affiliations assigned to prehistoric components range from Paleoindian to Jornada Mogollon, though a majority of sites are listed as Unknown Prehistoric due to the lack of diagnostics. Sites with a Formative period (Jornada Mogollon) or Late Archaic component occur in high frequencies throughout the range, which is not surprising given the prevalence of these temporal periods in the Jornada region (Miller and Kenmotsu 2004). Middle Archaic, Early Archaic, and Paleoindian components are less frequently reported.

Of note is the identification of several sites with assemblages suggestive of Protohistoric occupations. Sale et al. (2015:125) describe three potential Protohistoric sites (LA 179504, LA 179509, and LA 179519) in the North Range area along the western edge of the Malpais. LA 179504 has the most data potential of the three, as it contains a well-developed ring midden with two low-fired brownware sherds protruding from the interior wall. Sale et al. (2015:125) suggest these sherds share attributes similar to other Protohistoric ceramics of probable Athapascan origin documented within the Tularosa Basin.

Historic sites are all primarily attributed to the late 19th to mid-20th century use of WSMR by Euro-Americans for ranching, mining, and finally military testing/training activities. No sites dating to the Spanish or Mexican occupation of the area is reported in the literature. Of note is one possible Apache site (LA 150892) documented by EMI (2006:208) in the South Range area. The site consists of lithic artifacts associated with several pieces of worked glass and a cut metal object.

Site Re-use and tool recycling

Many site assemblages contain diagnostic artifacts attributed to one or more cultural/temporal affiliation, which have often been attributed to site re-use or tool recycling. While site re-use indicates favorable locations were re-occupied throughout prehistory, tool recycling suggests researchers should exercise caution when determining cultural/temporal affiliation based on surface diagnostics alone. The reviewed literature highlights some challenges faced when dealing with re-use and tool recycling for inventory and re-evaluation projects.

Site re-use often results in mixed assemblages, making technological interpretations for specific occupations challenging, as later occupations tend to obscure earlier ones. This is best exemplified at Archaic and Formative period sites, which have evidence of bifacial manufacture, dart points, and ceramics in one assemblage, which often mask subtle differences between the two (EMI 2006:634). Cultural overprinting during the Formative period is well-documented in the regional archaeological record (Miller and Kenmotsu 2004) and the reviewed investigations suggest it is fairly common throughout WSMR. Overprinting is most noticeable in the southern portion of WSMR which was extensively occupied during the Formative period (EMI 2006; Silberberg and Swain 2009:344). This extensive occupation has likely obliterated earlier components, making their detection difficult in-lieu of diagnostic artifacts.

Despite the challenges presented by overprinting, several investigations have conducted detailed analysis of lithic raw materials in an attempt to detect earlier occupations (EMI 2006). This is based on the premise that Late Archaic and Formative period groups relied more heavily on locally available materials, whereas earlier groups (e.g., Paleoindian) utilized a wider range of materials, with a preference for high-quality, non-local material. For example, EMI (2006:130, 131, 172) used a lithic diversity index to identify probable Paleoindian components at several sites despite the lack of diagnostics. Adoption of this technique by future investigations may prove useful for identifying earlier components in mixed assemblages.

Tool recycling or scavenging is a common element discussed in the literature (Sale et al. 2015; Silberberg and Swain 2009) and reported at several sites in the North Range area (Sale et al. 2015:74, 76). Evidence for tool recycling is often based on the presence of a Paleoindian-style projectile point (or other early diagnostic) found within an assemblage lacks the technological signature characteristic of that occupation. Recycling is more commonly observed on Formative period sites, but can occur in all temporal periods.

Landforms

Inventory and evaluation efforts included survey parcels and sites located in a wide range of topographic settings inclusive of the piedmont slope, foothills, basin floor, and the edge of the Malpais. Within these settings, sites are reported to occur on playa margins, bajada slopes, alluvial plains, ridge tops, low rises, dunes, sand sheets, and blowouts. A review of the literature suggests ridge

tops, low rises, dunes, and sand sheets warrant further discussion.

Several investigations observed a tendency for substantial prehistoric sites to be strategically located on elevated landforms (e.g., low rises or dunal ridges) often located near playa margins or intermittent catchment\ponding basins on the basin floor (Silberberg and Swain 2009:348; Sale et al. 2014:147). Despite their elevated nature, many of these landforms are difficult to detect remotely, and do not readily appear on aerial imagery or 7.5-minute series USGS topo maps. Given the frequency in which sites are reported on these landforms, they likely played a significant role in regional settlement patterns, the full extent of which has yet to be determined (Sale et al. 2014:148). Additional inventories within the basin floor may help clarify which landforms are likely to contain significant sites, furthering our knowledge of settlement patterns and improving our predictive modeling capabilities.

Expansive sand sheets and coppice dune fields in the southern portion of the range are known to contain a substantial number of sites, most of which date to the Formative period (EMI 2006; Trierweiler et al. 2007; Trierweiler et al. 2008). Sites located in these settings are in a geomorphically active landscape and subject to burial and re-exposure by eolian processes. This often results in different artifact and feature assemblages reported for each site visit, which may partially explain the discrepancies reported by recent re-evaluation efforts and original recordings (Trierweiler et al. 2007, 2008; Silberberg and Swain 2009). Additionally, researchers have found it challenging to define site boundaries and isolated occurrences in these settings, where the cultural material is more akin to a cultural landscape (EMI 2006:455).

Geomorphic Integrity

Researchers working throughout WSMR have relied on the identification of the late Quaternary eolian stratigraphic units defined by Blair et al. (1990) or Monger (1993) to assess the geomorphic integrity and subsurface potential of archaeological sites. When evaluating sites, investigators have focused on the presence of either the Q3 deposit (Blair et al. 1990) or Organ deposits (Monger 1993), which are known to contain cultural material from the Archaic to Formative periods. The presence of these deposits was based on surface observations or shovel tests (EMI 2006; Silberberg and Swain 2009; Trierweiler et al. 2007, 2008; Trierweiler and Swain 2009). In many cases, archaeologists recommended sites as eligible to the NRHP if an intact Q3 or Organ II/I deposit was suspected to be present, arguing the site had the potential to yield additional data. However, due to the limited testing imposed on these investigations, determining whether the deposits contained a substantial subsurface cultural deposit could not often be verified.

5.2.2.2 Data Recoveries

Data recovery excavations at three sites on the eastern alluvial fans of the Organ Mountains (LA 32078, LA 51225, and LA 147117), five sites on the basin floor west of the Jarilla Mountains (LA 62372, LA 62410, LA 62673, LA 64062, and LA 64034) and three sites on the western alluvial fan of the Jarilla Mountains (LA 62127, LA 62136, and LA 62143) have provided a wealth of data related to Late Archaic and Formative period occupations in the southern Tularosa Basin (Table 5-3). These sites share many commonalties with regards to chronology, residential structures, season(s) of occupation, modes of abandonment, material culture, and subsistence practices. Despite the similarities, investigations also identified many characteristics not typically observed in the archaeological record for similar sites in the Jornada area. In the following sections, the similarities and differences of each site are further discussed.

Table 5-3. Data Recoveries Discussed in the Literature Review.

Investigator	Citation	WSMR Report No.	Location	Site Number / Name
Ecological Communication Corporation	Sale and Silberberg 2009	554	South Range – eastern alluvial fans of Organ Mountains	LA 51225 (Quail Run)
Zia Engineering and Environmental, Inc.	Sale et al. 2011	595	South Range – eastern alluvial fans of Organ Mountains	LA 32078 (Lizard Village)
Office of Contract Archaeology – University of New Mexico	Kurota 2015	805	South Range – edge of the basin floor and western alluvial fans of Jarilla Mountains	LA 62372 LA 62410 LA 62673 LA 64062 LA 64042 LA 62127 LA 62136 (Casas Vecinas) LA 62143 (Huesos Quemados)
Statistical Research, Inc.	Ward and Vierra 2010	589	South Range – eastern alluvial fans of Organ Mountains	LA 147117

Chronology

The reviewed sites are primarily attributed to the Late Archaic and Formative periods based on AMS radiocarbon, optically stimulated luminescence (OSL), and thermoluminescence (TL) dates, in addition to diagnostic projectile points and ceramic artifacts. TL and radiocarbon dates obtained from thermal features and ceramics from five sites on the basin floor (LA 62372, LA 62410, LA 62673, LA 64062, and LA 64034) and one site on an alluvial fan (LA 62127) indicate these locales were likely logistical sites occupied on a re-occurring basis throughout the Middle Archaic to El Paso phase. In contrast, residential sites documented during excavations (Quail Run, Lizard Village, Casa Vecinas, Hueso Quemados, and LA 147117) are all attributed to the Formative period (Table 5-4). Aside from Doña Ana and El Paso Phase occupations at Quail Run, all substantial Formative period occupations are associated with the Mesilla Phase. AMS radiocarbon dates obtained from features at the residential sites suggest they were occupied on multiple occasions.

Table 5-4. Excavated Residential Sites with Formative Period Components.

Investigator	Site Number/Name	Occupation Date (s)	Dating Method(s)	Phase of Occupation
EComm	LA 51225 (Quail Run)	~AD 1150, AD 1250-1350	AMS Radiocarbon, OSL, Ceramics	Doña Ana and El Paso
Zia Engineering and Environmental, Inc.	LA 32078 (Lizard Village)	AD 550 – 1000, primary occupation between AD 780 and 870.	AMS Radiocarbon, Ceramics	Mesilla
Office of Contract Archaeology – University of New Mexico	LA 62136 (Casas Vecinas)	2150 BC – AD 990	AMS Radiocarbon, Ceramics	Late Archaic, Mesilla
Office of Contract Archaeology – University of New Mexico	LA 62143 (Huesos Quemados)	AD 660 – AD 990	AMS Radiocarbon, Ceramics	Mesilla
Statistical Research, Inc.	LA 147117	AD 500s to AD 900s	AMS Radiocarbon, Ceramics	Mesilla

Thermal Features

OCA archaeologists excavated an abundance of thermal features during their investigation which led to the identification of five feature types: 1) hearths; 2) hearths with angular FCR; 3) hearths with curvilinear FCR; 4) deep cylindrical pits; and 5) paired pits. Radiocarbon dates associated with these features suggest they may be temporally sensitive to either the Archaic or Formative periods.

Hearths are associated with all occupations; however, Kurota (2015:604-605) suggests hearths with angular FCR are more typical of the Mesilla phase, whereas hearths with curvilinear FCR are associated with the Archaic period. These differences are thought to coincide with distinct cooking methods; curvilinear FCR is associated with boiling activities, whereas angular FCR is more typical of roasting activities (Kurota 2015:604). Hearths with angular FCR are more typical of the Mesilla phase; hearths with curvilinear FCR is associated with the Archaic.

Deep cylindrical pits are characterized by an absence of FCR and their cylindrical morphology. Radiocarbon dates suggest these features are attributed to the Middle and Late Archaic (Kurota 2015:607). These pits are suspected to have been used for the roasting of succulents or other slowly cooked foods. They have been identified in other studies in the region and may often be characterized as roasting pits.

Paired pits consist of two pits containing charcoal stained sediment or ash in close proximity to each other. Kurota (2015:608) interpret one pit to represent a hearth or cooking feature, the other was used for processing food after cooking. The later pit was subsequently filled with discarded material from the hearth, presumably in preparation for another cooking episode. These pits are relatively shallow, 10 to 20 cm deep, and often contain little to no FCR. Based on radiocarbon dates, these features are generally associated with the Archaic (Figure 5-5).

Residential Structures

Residential structures documented during excavations include pithouses and/or brush structures spanning all phases of the Formative period. The structures share many similarities with those previously documented in the region, but also have distinct qualities which set them apart from other excavated structures in the Jornada area.

Figure 5-5. Example of a paired pit excavated at LA 62127 *(from Kurota 2015:605)*.

Pithouses include three Doña Ana phase pithouses at Quail Run and seven Mesilla phase pithouses at Lizard Village. At Quail Run, pithouses are square shaped and much larger than those reported at other excavated Doña Ana phase sites, measuring 5 m (N-S) x 4.5 m (E-W). Despite their larger size, these pithouses have many informal characteristics, such as unprepared hearths and floors. Hearths are all placed in the east-central portion of the structure, opposed to centrally aligned hearths typically observed in other Doña Ana phase pithouses. Other notable differences, include east-facing entryways and clustering of pithouses in a parallel alignment, attributes not reported at other excavated pithouses (Sale and Silberberg 2009:126).

Pithouses at Lizard Village are characterized by vertical walls, east-facing entries, and internal features, such as storage pits, hearths, and post holes. Pithouse are circular shaped, with an average diameter of 2.75 m. Pithouse depth, however, is highly variable with shallower pithouses averaging 65 cm in depth and deeper pithouses averaging 110 cm in depth. The latter pithouses are among the deepest reported in the Jornada region for a Mesilla phase component (Sale et al. 2011:8-4).

Brush structures are the most common residential structure reported in the reviewed literature. These structures have considerable variability in form, ranging from informally constructed lean-to shelters to more formalized huts. Informal brush structures, include the ramadas and lean-to shelters documented by Kurota (2015:618) at Casas Vecinas and Huesos Quemados (Figure 5-6). These features are characterized by a few perimeter post holes supporting a lightweight superstructure and few, if any, internal features. Other informal brush structures include wikiups documented at LA 147117 and Quail Run (Sale and Silberberg 2009:50). These structures are roughly circular to irregularly shaped, 2 to 3 m in diameter, and 20 to 50 cm in depth. These features lack postholes or superstructure remains, suggesting they were made from a lightweight, portable material (Ward and Vierra 2010:176). In general, the wikiups share characteristics typical of the hut structures described by Miller and Kenmotsu (2004:239). While commonly observed at Mesilla phase sites, the wikiups at Quail Run are associated with the El Paso phase occupation of the site. This unusual occurrence could represent an overlooked component of the El Paso settlement system (e.g., seasonal occupation of the alluvial fans), which may go undetected given the ephemeral nature of these features (Sale and Silberberg 2009:154).

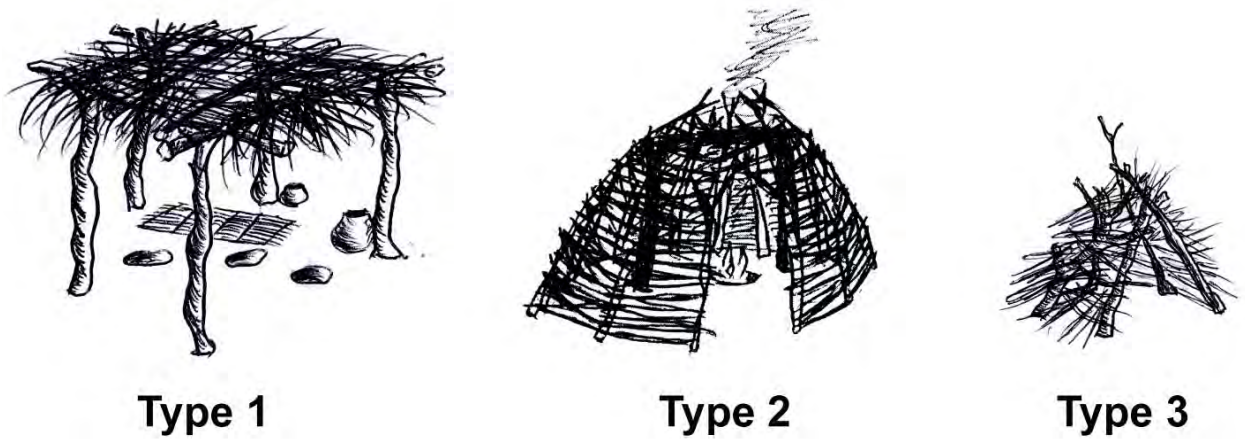


Figure 5-6. Stylized illustration of three types of Late Mesilla phase structures at Casas Vecinas and Huesos Quemados: 1) Ramadas; 2) Brush Huts; and 3) Lean-to-shelter *(from Kurota 2015:618)*.

Formalized brush structures include Kurota's (2015:618) Type 2 structures at Huesos Quemados and Casas Vicinas and the huts reported from Lizard Village. Type 2 structures contain at least one internal roof support post and a large number of perimeter post holes placed at regular intervals of 30 to 50 cm (Kurota 2015:614). The roof support posts are believed to have held a horizontal beam or vega to create a frame on which the perimeter posts rested (Kurota 2015:615; Figure 5-7). Internal features, such as hearths, are commonly associated with these features. Huts at Lizard Village may also contain internal hearths and multiple perimeter posts, but are distinguished by their large size. For example, the average hut size at Lizard Village is 3.4 m with a depth of 60 cm, which are some of the deepest reported for Mesilla phase (Sale et al. 2011:8-3).

Overall, differences in size, depth, and construction suggest varying levels of labor were expended in the construction of brush structures. Several researchers suggest these differences may correspond with different seasonal occupations or structure function (e.g., family vs. individual dwelling) (Kurota 2015:618; Sale et al. 2011:8-4). While this review is limited to only a handful of sites, data collected during excavations indicates there is significant variability in structure form, notably during the Mesilla phase. Furthermore, the presence of formalized brush structures lends evidence to suggest these features may have been better suited for long-term occupations than previously expected, challenging our current perceptions of huts as small, ephemeral structures characteristic of highly mobile populations (Miller and Kenmotsu 2004:239; Sale et al. 2011:9-2).

Season(s) of Occupation

Structural remains, features, and assemblage data suggest the Organ Mountain sites, Huesos Quemados, and Casas Vecinas were occupied during multiple seasons, including summer and winter occupations. The presence of informal brush structures shelters is believed to coincide with a warm season occupation. Sale and Silberberg (2009:154) and Kurota (2015:613) argue these ephemeral structures would have provided inadequate protection for a cold season occupation, suggesting they were used during the late spring to late fall. Macrobotanical and faunal remains recovered from LA 147117 and Quail Run lend evidence to support this interpretation (Sale and Silberberg 2009:153; Ward and Vierra 2010:177).

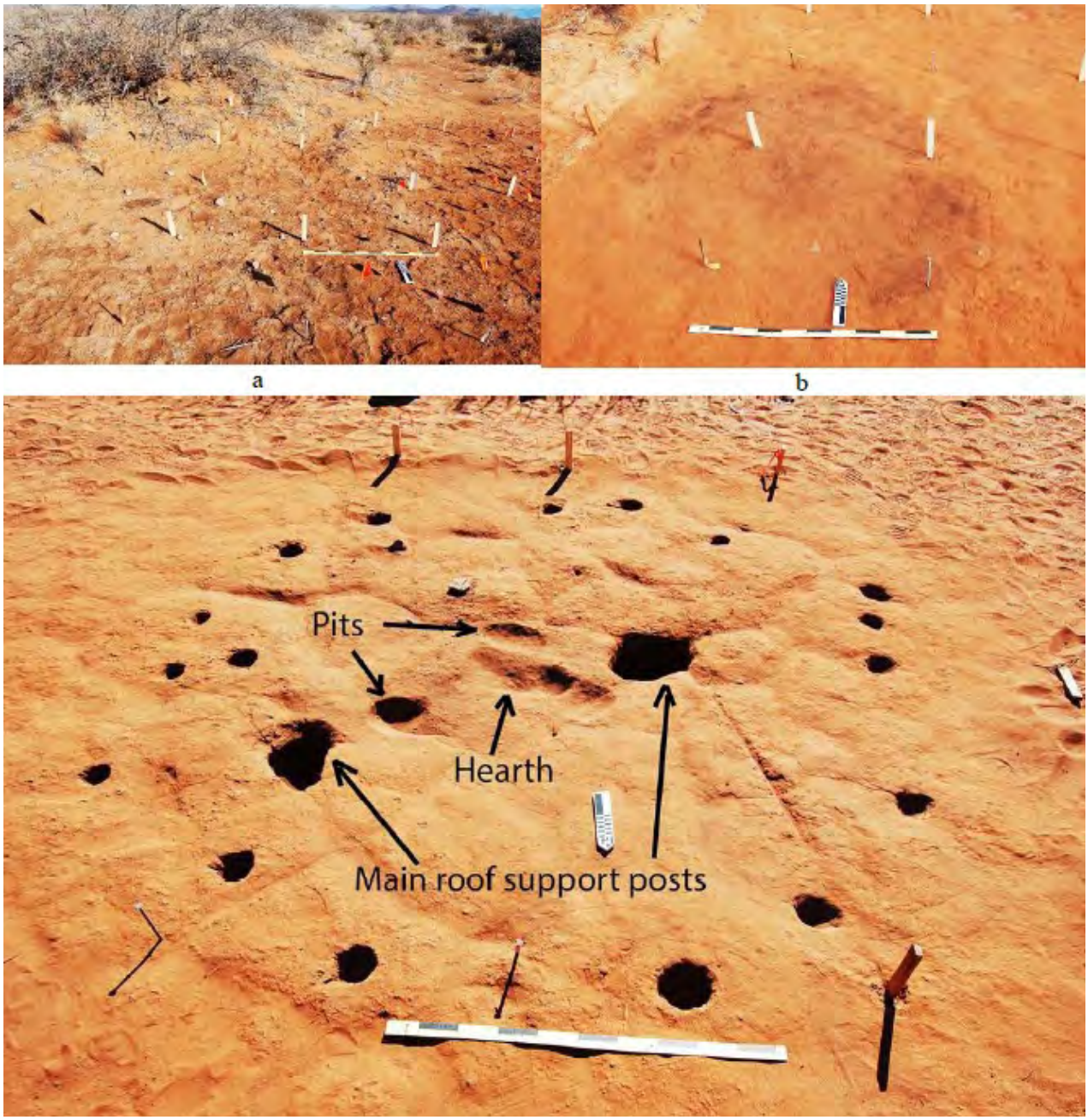


Figure 5-7. Casas Vecinas Structure 25 overview: *(a)* surface manifestation prior to excavation, view north; *(b)* exposed burned structure outline after removal of eolian sediment, view south; and *(c)* post-excavation overview looking south *(from Kurota 2015:226)*.

Evidence for cold season occupations include deep pithouses, robust brush structures, storage features, and ceramic assemblages. For example, pithouses at Quail Run are large, tightly clustered, and have east facing entryways, attributes atypical of other Doña Ana phase pithouses. Sale and Silberberg (2009:154) suggest the site layout and unique pithouse attributes may have minimized the damage (and heat loss) caused by downslope winds originating from Organ Mountains to the west, which are known to occur throughout the late fall to early spring. Type 2 brush structures documented at Casas Vecinas, and Huesos Quemados are more robust than those typically observed

elsewhere, suggesting they may have been used during the cold season by family units (Kurota 2015:616; Sale et al. 2011:8-10). Internal hearth features and storage pits documented at these sites lend additional evidence to support a cold weather occupation.

Huts and pithouses documented at Lizard Village are deeper than those reported by Miller and Kenmotsu (2004:239) for Mesilla phase occupations, which lend evidence to support a cold weather occupation. Researchers suspect huts preceded pithouse construction; however, an evaluation of radiocarbon dates and the depositional history of the site failed to identify a clear separation between the two structure types (Sale et al. 2011:8-13). The co-occurrence of both structure types could be related to different seasonal occupations during the two or three Mesilla phase occupations suspected to be represented at the site (e.g., winter and summer occupations). Alternatively, huts and pithouses could have been occupied simultaneously, with each structure type being occupied according to the weather or other favorable conditions (Sale et al. 2011:9-4). In addition, the ceramic assemblage at Lizard Village includes a high volume of large vessels suitable for storage and extended cooking, attributes preferable for the winter (Sale et al. 2011:8-2).

Overall, data recovered from the Organ Mountain sites, Casas Vecinas, and Huesos Quemados indicate these sites were occupied on a reoccurring basis throughout the Formative period. Occupations occurred at different seasons throughout the year, presumably to access seasonally available resources. Several sites, such as Lizard Village and Casas Vecinas, contain both cold and warm season structures, which could have been in use during the same time based on overlapping radiocarbon dates (Kurota 2015:599; Sale et al. 2011:7-11).

Abandonment

Analysis of feature floor assemblages and structural remains indicate planned and rapid abandonment strategies were employed at the reviewed sites. Planned abandonment is evident at all sites based on the lack of substantial structural remains and floor assemblages in Doña Ana pithouses at Quail Run, pithouses and huts at Lizard Village, and brush structures at LA 147117, Casas Vecinas, and Huesos Quemados.

The most substantial evidence supporting planned abandonment comes from a pit feature (Feature 6) at Quail Run. Here researchers documented nonfunctional and broken ceramics, pigments, stone bowls, and other items placed in the pit in an organized fashion. This includes placement of ceramics in upright positions or stacked at varying elevations (Sale and Silberberg 2009:39; Figure 5-8). These observations led researchers to suspect the pit played a role in the ceremonial closing of the site. Closing ceremonies are known to occur amongst contemporary Pueblo groups and the items documented in the pit have been observed in ritual contexts elsewhere in the region (Sale and Silberberg 2009:141, 149).

Evidence for ritual closing is also present at Lizard Village and Casas Vecinas. At Lizard Village, researchers recovered worked sherds near the floor of several pithouses and huts, an unusual pattern thought to be the result of ritual abandonment (Sale et al. 2011:8-12). At Casas Vecinas, researchers documented a slab metate placed over a hearth in one of the brush structures. This metate, in addition to the lack of floor artifacts and near complete burning of the structure, led researchers to conclude it had likely been ritually closed (Kurota 2015:631).

Evidence for rapid abandonment can be found within several brush structures at Quail Run, Casas

Figure 5-8. Ceramic stacking evident in Feature 6 at Quail Run *(from Sale and Silverburg 2009:141)*.

Vecinas, and Lizard Village. For example, at Quail Run burned El Paso phase brush structures contained usable tools and ceramics on the occupational surfaces. These observations led researchers to suspect they were rapidly abandoned, possibly due to a fire based on the proximity of brush structures to hearths (Sale and Silberberg 2009:148). At Casas Vecinas, Kurota (2015:631) identified two partially burned structures interpreted to be the result of rapid abandonment based on the degree of burning.

The most unique evidence for rapid abandonment comes from Lizard Village. Here, researchers identified three hut structures with evidence of burning and usable tools on their occupational surfaces, characteristics typical of rapid abandonment. In addition to the burned structures, a burial containing the remains of two individuals, an adult and adolescent, was also documented at the site. Within the adolescent burial, Sale et al. (2011:5-3) identified a penetrating fracture to the skull, suggestive of perimortem violence. Based on this evidence of violence, Sale et al. (2011:8-11) postulate that rapid abandonment may have resulted from intentional destruction by an adversarial group.

Cultural Material

Analysis of the lithic and ceramic assemblages identified several patterns among the sites included in the literature review, including lithic raw material selection, lithic technological orientation, groundstone use, and ceramic assemblages.

Flaked stone assemblages at Lizard Village, Quail Run, and LA 147117 have attributes typically

associated with expedient core technology, a technological focus thought to coincide with increased sedentism during the Formative period (Parry and Kelly 1987). Flake stone assemblages at these sites have high proportions of core reduction flakes, expedient flake tools, and cores, most of which are manufactured from local material. Only Quail Run has any substantial evidence of bifacial reduction and formal tool manufacture/maintenance. Interesting, this is attributed solely to the El Paso phase occupation of the site and suspected to coincide with projectile point manufacture (Sale and Silberberg 2009:66), a relatively rare occurrence for habitation sites (Miller and Kenmotsu 2004:255).

Sites near the Jarilla Mountains also have flaked stone assemblages characteristic of expedient core technology; however, the assemblages are thought to represent two different activities. The five sites located on the basin floor have assemblages more suggestive of logistical use, where material procurement, initial tool production, and resource processing were likely activities (Kurota et a. 2015:620). In contrast, the three sites located on the alluvial fans are more indicative of residential use, with a wide range of activities inferred from the remains, including later stage tool production (Kurota 2015:471).

Groundstone assemblages largely consist of informal tools manufactured from locally available material. The use of local material is not surprising given the proximity of the sites to the Organ and Jarilla mountains, which are known to contain an abundance of material suitable for groundstone implements. Unshaped manos, slab metates, and basin metates account for a majority of the groundstone documented at these sites, which are suggestive of generalized grinding activities associated with the processing of wild foods (Kurota 2015:623; Sale and Silberberg 2009:86; Ward and Vierra 2010:153). Lizard Village deviates slightly from this trend, with a higher proportion of two hand manos and metates, suggesting an increased use of corn (Sale et al. 2011:8-6). Groundstone tools documented along the Organ Mountain alluvial fans also have a high percentage of tool re-use and burning, which is suspected to coincide with reoccupation of the sites by later inhabitants during the Formative period (Sale and Silberberg 2009:85).

Undecorated El Paso Brown ceramics dominate the ceramic assemblages at all sites, occurring exclusively at Lizard Village (Sale et al. 2011). Decorated ceramics, if present often included El Paso Bichrome or Polychrome, Mimbres Black-on-white, and Chupadero Black-on-white. Of the excavated sites, Quail Run contains the most diverse ceramic assemblage with wares attributed to the Doña Ana and El Paso Phase occupations.

Of note is the presence of modified sherds at sites with residential structures, which include all three Organ Mountain sites, Casas Vecinas, and Huesos Quemados. Modified sherds include oval shaped scrapers and scoops believed to have served a variety of functions, including ceramic manufacture. Perforated sherd discs were also noted in the assemblage at Lizard Village, Casas Vecinas, and Huesos Quemados which may have coincided with textile production (Kurota 2015:513; Sale et al. 2011:6-57).

Subsistence

Macrobotanical and faunal remains recovered at each site indicate Formative period occupants generally focused on the exploitation of wild flora and fauna, with less emphasis given to domesticated cultigens. The prominence of wild foods is not surprising given these sites were occupied seasonally and located in areas with access to several environmental zones containing a variety of resources

(e.g., mountain uplands, alluvial fans, and the basin floor). Common plant remains include taxa with seeds, leaves, and fruits such as cheno-am, goosefoot, sunflower, juniper, mesquite, and prickly pear (Kurota 2015:564; Ward and Vierra 2010:162; Sale and Silberberg 2009:C-34). The presence of domesticates, such as corn (Zea mays), beans, and cotton were found exclusively at sites in the Organ Mountains; no domesticates were documented at sites near the Jarilla Mountains (Kurota 2015:582). The presence of domesticates suggest limited horticulture was practiced at sites in the Organ Mountains, but was heavily supplemented by wild foods.

Faunal remains largely consist of rabbit and other small mammals, likely procured through garden hunting or communal drives. Rabbit remains are heavily fragmented in the respective assemblages, suggesting bones were crushed and cooked to make a stew or gruel like food. Processing and cooking rabbits in this manner would have maximized nutritional returns and bone grease yield while offsetting the protein starvation caused by eating extremely lean meat (Kurota 2015:561; Sale et al. 2010:6-61; Ward and Vierra 2010:171). Large game, such as antelope, big horn sheep, and deer, are reported from the Organ Mountain sites, but their numbers are more suggestive of a supplementary role in the diet. However, use of large game is much higher at Quail Run and Lizard Village when compared to other Formative period sites on the basin floor, suggesting groups living along the alluvial fans likely had more opportunities to harvest large game (Sale and Silberberg 2009:159; Sale et al. 2011:8-8).

While wild foods account for a majority of the recovered materials, unusually high frequencies of domesticated remains at Lizard Village require further discussion. Sale et al. (2011:6-58) report high frequencies of corn and cotton recovered from several contexts, including huts and pithouses. Corn was identified in seven of the eight total light fraction (flotation) samples analyzed, resulting in a corn ubiquity value of 88 percent. Mesilla phase occupations usually produce corn ubiquity values around 10 percent (Miller and Kenmotsu 2004:249), making Lizard Village one of the highest values ever reported for a Mesilla phase component in the Jornada region (Sale et al. 2011:8-12). In addition, Sale et al. (2011:6-57) suspect cotton recovered from the site may be representative of textile production based on the presence of perforated sherd discs (e.g., spindle whorls) in the assemblage. While no textiles were recovered to validate this claim beyond a reasonable doubt, the preponderance of evidence strongly supports textile production.

Summary

Excavation of the five sites on the basin floor have provided insight on the types of features and cultural material characteristic of logistical sites on the basin floor. While the assemblages at these sites are not as robust as residential sites, the placement of these sites and the cultural material they contain can shed light on how Archaic and Formative period groups utilized the basin floor as part of a larger seasonal round.

Excavations at Lizard Village, Quail Run, and LA 147117 indicate the alluvial fans on the eastern side of the Organ Mountains played an important role in the regional settlement patterns throughout the Formative period. Excavation of Casas Vecinas and Huesos Quemados suggest the alluvial fans on the western side of the Jarilla Mountains were also favorable locations for Formative period occupations. Faunal and floral remains indicate these locations were a highly productive environment for a variety of wild resources, whereas the lithic assemblages suggest the area contained an abundance of locally available toolstone. In addition, the area may also have provided opportunities for limited horticulture and access to other topographic zones, such as the mountain uplands or basin floor.

These favorable qualities attracted Formative period (and likely earlier) groups to these areas on a recurring basis, evidenced by multiple occupations at each site. Occupations appear to be seasonally oriented, presumably to take advantage of seasonally available resources throughout the year, including the winter and summer months. While seasonally occupied, several documented residential structures indicate a substantial amount of labor was invested in their construction, some of which lack direct correlates in the archaeological record (Sale and Silberberg 2009; Sale et al. 2011).

Finally, excavations at these sites provide a cautionary tale regarding surface finds and subsurface potential. When initially recorded, many of the sites represented mundane lithic and ceramic scatters, as they generally lacked clear evidence of features or structures. However, limited testing, via auger probes or test units, can identify anthrosols, features, or other clues to suggest substantial buried deposits are present. It is important to note that nearly all the features documented in these investigations were discovered via subsurface testing or trenching, and in some instances, geophysical investigations at Quail Run (Sale and Silberberg 2009:163).

5.2.3 Summary of Historic Architectural Investigations

In addition to archeological sites, cultural resources at WSMR are comprised of historical and architectural resources. These built environment resources typically span the mid-19th century through the Cold War era. Research on these resources has entailed survey and detailed recordation.

Histories of WSPG and WSMR were created almost from the beginning of the installation. Base histories were compiled that included information on buildings and structures. A variety of histories, including those of the US Navy Detachment were recorded up through the 1970s, though none were dedicated to buildings and structures.

The earliest and most comprehensive inventory, evaluation, management recommendations, and NRHP recommendations for historic resources at WSMR is the 1984 historic properties study prepared by Building Technology Incorporated (BTI) for the United States Army Materiel Development and Readiness Command (DARCOM) to fulfill their responsibilities under the NHPA (Buchanan et al. 1984). This study includes buildings, structures, and sites associated with ranching and mining activities in the area, the Trinity test site, early development of the military-era, early to mid-Cold War era at WSMR, and the Green River Test Site in Utah. In addition to the wide-ranging coverage, the study included HABS/HAER photography and extensive as-built drawings (Buchanan et al. 1984).

Ranching constitutes the first period of substantive European-American settlement patterns in the Tularosa Basin. The results of historical and oral historical research into the ranches, trails, mines, and other features are associated with many of the historical archeological sites in the inventory. The first extensive survey of extant ranching properties was undertaken as part of the 1984 BTI study which captured 79 buildings, structures, and sites associated with ranching and mining activities in the area that is now part of WSMR. Individual NPS inventory forms were created for each site (Buchanan et al. 1984).

The first dedicated study directed at WSMR ranching properties was completed in 1989 (Eidenbach 1989). Then, during the early 1990s, the Ranching Legacy Project incorporated interviews with several families about their lives between 1900 and 1940. Nineteen individuals from 17 families were interviewed on topics that included ranch development, physical descriptions of the ranches

and range, discussion of livestock and their care, and the families' daily life (Ackerly et al. 1993). The project resulted in a technical report (Ackerly et al. 1993) and the publication of two popular history volumes. The first volume focused on aspects of daily ranch life (Eidenbach and Morgan 1994) and the second volume focused on aspects of rural education (Eidenbach and Hart 1994). Additionally, ranching and mining sites were inventoried in a five-volume series (Russell 1997-2001). Additional ranching and mining surveys have been undertaken over the decades, many of which carried components of both archaeology and the built environment (Trierweiler et al. 2004; Trierweiler et al. 2005).

During the mid-1990s a more expansive contextual document explored the historic properties associated with the development of WSMR's rocket, missile, and instrumentation systems that critical to the nation's Cold War defenses between 1942 and 1964 (Eidenbach et al. 1996). The publication was a demonstration project for the DoD Legacy Resource Management Program exploring the Cold War historic theme at the national level of importance. In addition to the buildings that supported testing activities, the study expands the historic context including the individual programs and the social component of the built environment at WSMR (Eidenbach et al. 1996).

In the 1990s Human Systems Research Inc. (HSR) was contracted by WSMR to inventory and evaluate many military-era properties for NRHP eligibility in the form of New Mexico Historic Building Inventory Forms (HBIF). Few of the recordations with NRHP recommendations were accompanied by historic contexts with which to properly make recommendations for NRHP eligibility, though Eidenbach et al. (1996) was referenced as the historic context on which recommendations were based in consultations with SHPO. If nothing else, the recordations captured a large number of buildings in drawings, photography and property record research. The only report produced by HSR for an individual site was for the WSMR Hotel Site which was recommended "potentially" NRHP-eligible but did not receive SHPO consultation (Kirkpatrick 1994). Interspersed with building history, HSR also produced a social history document for the early years of WSMR, the first modern historic context that focused on the community aspect of the military installation (Boehm 1997).

In 1998, the first NRHP historic district at WSMR was recommended, the result of an agreement with the SHPO to prepare a preservation plan for historic buildings in the Post Headquarters area as partial mitigation for the demolition of four historic structures. WSMR contracted with the Technical Center of Expertise for Preservation of Structures and Buildings, US Army Corps of Engineers, Seattle District, who prepared the building inventory and eligibility determinations for what would become the Main Post Historic District. The original historic district boundaries included Buildings 300 and 301, Range Control, as well as numerous wood-frame WWII era temporary buildings, all but one of which were demolished in the following 15 years. A single report was prepared for the Technical Area buildings and structures in the historic district, which focused on a reinforced concrete structure designed to safely observe V-2 rocket engine testing (Ellison 2002). A revised historic district study for the Main Post area was completed in 2020, which recommended re-drawn boundaries and changed the name of the historic district to reflect the cooperative nature of the Army and Navy's relationship at the station (Korfmacher et al. 2020).

The extant resources remaining at Trinity, the site of the first atomic test, began to be inventoried in earnest starting in the 1980s through the efforts of the aforementioned 1984 BTI study (Buchanan et al. 1984). Major sites associated with the NHL include Ground Zero; Jumbo; camera, instrumentation, and personnel bunkers to the north, west, and south of Ground Zero; the MacDonald Ranch,

2 miles to the southeast of Ground Zero; and Base Camp, 9 miles to the south of Ground Zero. A number of studies encapsulated components of the built environment for the test site including Merlan (1997), Merlan (2001), and Rieder and Lawson (1995).

Probably the most extensive recordation, documentation, and rehabilitation efforts at Trinity have been applied to the former George McDonald Ranch House, the site where the plutonium core was prepared for the first atomic bomb test. Beginning in the 1980s the ranch house was recorded by the NPS and underwent a complete rehabilitation. BTI's 1984 documentation provided detailed HABS/HAER documentation which included site maps, plan and elevation drawings, and details (Buchanan et al. 1984). In recent years the house has again become the subject of ongoing stabilization and rehabilitation.

As NASA's Space Shuttle Program came to an end in 2011, the White Sands Space Harbor (WSSH), facilities built as part of an emergency landing strip for the Shuttle in the early 1980s was slated for closure. A 2012 inventory and evaluation project recommended the runways and associated buildings and structures as a historic district (Reed and Jones 2012). Mitigation provided by NASA included a HABS/HAER recordation and relocation of the observation stand to the White Sands Missile Park in exchange for the loss of demolished structures.

While not published as a report, in 2012, 13 HCPI forms were prepared to document the horse stables and ancillary buildings at the Organ Mountain Riding Club (OMRC), southeast of the WSMR Cantonment (Eisenhour 2012). These forms included a historic context in which to properly evaluate the resources for NRHP eligibility. This was undertaken in preparation of planned demolitions of the vacant site.

Federal agencies, SHPOs, and historic resource consultants have evolved and become more sophisticated in the last four decades and the quality and standardization of historic resource inventory and NRHP eligibility studies have improved over time. In the second decade of this century WSMR assigned dedicated staff to manage the built environment component. This has resulted in a new generation of work products that combine historic contexts with in-depth research into the programs that produced individual resources and groups of resources. Combined with extensive analysis into the resources, their evolution over time, and their physical integrity, consultants have produced denser historic contexts to offer better informed NRHP eligibility recommendations.

More recent reports prepared over the last decade include the mitigation document prepared for the former Range Control Center Buildings 300 and 301 (Eisenhour et al. 2013), an inventory and evaluation of the Green River Test Site in Utah (Feit et al. 2014), and an evaluation of the Mule Peak Site in the Lincoln National Forest (Jenks et al. 2015). All three sites were mitigated under MOAs in exchange for the loss of demolished structures. In addition to the above-mentioned HABS Level II documentation for the loss of Buildings 300 and 301, interpretive signage and displays were created for the loss of the Green River resources, and the historic T-4 tracking telescope at Mule Peak was rehabilitated and relocated to the White Sands Missile Park.

This was followed by an inventory and evaluation of the WC-50 Site (Jenks and Cuba 2015), and a historic context for cinetheodolites and other optical tracking instruments at WSMR (Korfmacher 2015). Concurrent with the second study were multiple HCPI Forms prepared to document HAFB Askania Shelters constructed on WSMR, two of which were slated for demolition. This project also included HABS/HAER Level II black and white photography (Korfmacher 2015).

In early 2015, the US Navy Detachment proposed an adaptive reuse of the historic blockhouse at Launch Complex 35. As part of an agreement for the interior alterations, the Navy funded preparation of a report that offered guidance for retaining the Navy Blockhouse's character-defining historic fabric, while still allowing the needed renovations to be completed (US Army 2015).

Studies addressing more specific sites followed, including inventory and evaluation reports for the WSMR Small Missile Range (Myers et al. 2016a); RAM and RAMPART Sites (Moyer and Korfmacher 2016); Talos Defense Unit (Myers et al. 2016b); and C-Station (Moyer et al. 2017). Several of these evaluation efforts resulted in the recommendation of historic districts. In 2017, two additional historic contexts were undertaken, including a contextual document for AN/FPS-16 radar facilities (Myers et al. 2017) and a context for astrodome instrumentation shelters (Esser 2017).

Additional inventory and evaluation efforts have focused on the Cold War era launch complexes at WSMR, which are primarily located along Nike Avenue. These inventory and evaluation reports have covered LC-35 (Myers and Esser 2017a); LC-50 (Myers and Esser 2017b); LC-32 (Myers et al. 2018), and LC-33 (Myers and Esser 2020a). Additional inventory and evaluation reports for LC-37 and LC-38 are in preparation as of this writing.

Additional inventory and NRHP evaluations have recently been completed for the former Atmospheric Science Lab's Meteor Trail Radar Site (Myers and Esser 2019); 300K Static Test Stand (Myers and Esser 2020b); Army Missile Assembly Area (Myers and Esser 2020c); and Special Weapons Assembly Facility (SWAF) Number 4 (Myers and Esser 2020d). Related to the SWAF 4 inventory, a broader historic context was prepared for assembly buildings at WSMR (Myers and Esser 2020e).

The first project to address building conditions and treatment was the 1984 BTI study which included a Preservation Recommendations section. Based on then Army regulations regarding historic properties, the recommendations were high level and did not include any materials conservation approaches. In 1987, a WSMR historic preservation plan was created to codify procedures, a part of the Army's shift towards a more formalized cultural resource compliance process (Eidenbach and Burton 1987). This document included WSMRs first PMOA to implement the plan and procedures. Additional site-specific reports geared towards preservation were prepared for ranch buildings associated with the Trinity Site (Slater 1997); the Greer Ranch (LA 116340) (Connelley 2000); and Rock House Spring House (LA104049) (Connelley 2001). In 2014, a more comprehensive study that was inclusive of most of the historic ranch houses at WSMR was completed (Porter et al. 2014).

Other forms of literature on the built environment of WSMR have been created over the decades. These include property documentation in the form of HCPIs, informational brochures, historical monographs on buildings and sites prepared for Section 106 mitigation agreements, teaching aids, and site-specific interpretive signage.

5.3 Archaeological Sites

Based on the data available in the WSMR GIS database, 7,773 archaeological sites of all periods have been documented on WSMR, inclusive of 6,393 prehistoric sites and 1,380 historic sites (Table 5-5). Sites are known to occur in all of the topographic zones encompassed by WSMR.

Of the 6,393 prehistoric archaeological sites, 3,659 have been determined or recommended eligible

Table 5-5. Summary of Archaeological Sites and Their NRHP Eligibility Status.

Period	Cultural/Temporal Affiliation	NRHP Eligible	NRHP Not Eligible	Unevaluated	Total
Prehistoric	Paleoindian	78	6	14	98
	Archaic	656	267	109	1,032
	Formative	1,493	505	282	2,280
	Unknown Prehistoric	1,422	782	765	2,969
	Protohistoric	11	3	0	14
Historic	Euro-American	699	457	214	1,370
	Historic Apache	10	0	0	10
	Totals	4,369	2,020	1,384	7,773

for listing in the NRHP, 1561 sites have been determined or recommended not eligible for listing in the NRHP, and 1,170 sites have not been evaluated for NRHP eligibility. Of the 1,380 historic sites, 709 have been determined or recommended eligible for listing in the NRHP, 457 have been determined or recommended not eligible for listing in the NRHP, and 214 sites have not been evaluated for NRHP eligibility. Three sites have a multi-component or "mixed" designation and include one site eligible for listing in the NRHP and two sites not eligible for listing in the NRHP.

Based on either absolute dating techniques (e.g., radiocarbon, thermoluminescence, etc.), relative dating techniques (e.g., type seriation, diagnostic artifacts, etc.), or types of features, structures, or artifact assemblages, prehistoric sites are assigned a temporal affiliation. Most prehistoric archaeological sites lack diagnostic artifacts or datable material and are categorized as unknown prehistoric, followed in decreasing frequency of sites with a Formative, Archaic, Paleoindian, or Protohistoric temporal affiliation. Most historic archaeological sites have a temporal affiliation of Euro-American, suggesting they are either associated with ranching or military training/testing activities. A small number of sites have an Apache temporal affiliation.

The WSMR site database has been compiled over several decades by numerous researchers employing different classification schemes to assign temporal affiliation. For example, Formative period sites have been described using Lehmer's (1948) Jornada Mogollon classification scheme (e.g., Mesilla, Doña Ana, El Paso phases) and variations of Kidder's (1927) Pecos classification system (e.g., Pueblo I-IV, etc.). While similar, the use of different temporal classification systems has the potential to introduce discrepancies or errors into the database, which is not uncommon for a database of this size and age. While discrepancies may exist, the totals represented above accurately represent the expected frequencies of cultural/temporal affiliations on WSMR based on data summarized in the Historic Context (Section 2.3).

5.4 Historic Architecture

Historic architecture includes buildings and structures on WSMR. These resources can include standalone buildings, but are commonly built in conjunction with other buildings or structures to comprise a larger launch complex and other training/test facility. As of March 2020, a total of 768 historic architectural resources have been documented on WSMR. Historic architectural resources

Table 5-6. List of National Register Eligible Historic Districts on WSMR.

NRHP Eligible Historic Districts	Period(s) of Significance
Small Missile Range Historic District	1953 to 1989
Army Navy Cantonment Historic District	1946 to 1989
RAM/RAMPART Historic District	1963 to 1973
C-Station Historic District	1947 to 1966
Launch Complex 33 Historic District	1945 to 1954
Launch Complex 35 Historic District	1946 to 1966
Launch Complex 50 Historic District	1965 to 1970
300,000 Pound Static Test Stand Historic District	1954 to 1965
Army Missile Assembly Area Historic District	1953 to 1989
Special Weapons Assembly Facility (SWAF) Number 4 Historic District	1960 to 1989

include two NHLs: the Trinity Site and the Army Launch Area at Launch Complex 33. Historic architectural resources also include 10 NRHP eligible Historic Districts (Table 5-6).

5.4.1 National Historic Landmarks and NRHP Eligible Historic Districts

Two WSMR properties are listed on both the New Mexico State Register (SR) and the NRHP: the Trinity Site (NRHP Number 66000493; SR Number 30) and Launch Complex 33 (NRHP Number 85003541; SR Number 580).

The Trinity Site, the location of the world's first nuclear detonation, was declared an NHL in 1975. The 51,500-acre landmark includes the base camp, where the scientists and support staff lived; ground zero, the site of the bomb explosion; and the McDonald ranch house, where the plutonium core to the bomb was assembled. In 1988, WSMR and the New Mexico SHPO agreed to a MOU to establish parameters for management of the Trinity Site NHL (Appendix A). The provisions of this MOU require WSMR to:

- Maintain an inventory of all post-Trinity test structures, facilities and other land modifications as well as an inventory of all Trinity historic features;
- Consult with the New Mexico SHPO regarding all actions within Trinity Site NHL which require and EA or an EIS;
- Afford the New Mexico SHPO the opportunity to comment prior to the foreclosure of options to avoid, reduce, or otherwise mitigate effects of action with the NHL.

In addition, the MOU stipulates that all future structures at the site will be temporary and will be removed following the completion of the action which necessitated their construction. The agreement also establishes a Historic Zone and Limited Compatible Land Use Zone within Trinity Site. The

agreement reflects Section 106 requirements in effect in 1988. Additional consultation requirements were included in the revised 36 CFR 800. To comply with these regulations, the ACHP is now included as a consulting party for all actions which have the potential to impact the NHL.

Launch Complex 33 (LC-33) is the country's first major rocket launch facility and began operations in 1945. The complex includes the Army blockhouse, V-2 assembly building, gantry, and ancillary structures which supported testing of captured German V-2 rockets. Over 100 V-2 rockets were launched from the site, which paved the way for the next generation of rockets and eventually space exploration. Due to its major contributions to the country's rocket/missile program and space program, LC-33 was designated an NHL in 1985. LC-33 is still an active test site, though some historic structures, such as the Army blockhouse and gantry, are no longer in use.

5.5 Cultural Resources Protection Measures

5.5.1 Archaeological Site Protection Measures

There are two general options for the protection of known archaeological sites that would be impacted by mission activities: protection and mitigation. Protection can be achieved indirectly through avoidance or actively through physical site protection or monitoring. Mitigation procedures consist of data recovery and documentation prior to site destruction.

- Avoidance: In instances where proposed project areas contain archaeological sites eligible or unevaluated for the NRHP, the project area can be relocated to avoid impacts. Avoidance is easily facilitated during the planning stages when an area is being chosen for a project by simply relocating the project to a previously surveyed area not containing eligible sites. In instances where eligible sites are identified during a cultural resource inventory in support of a specific project, the project parameters can be adjusted to avoid the resource.

- Site Protection: When avoidance is not possible, physical site protection can be employed to protect sites from adverse effects. Physically placing sites off-limits with protective signage or fencing (e.g., Siebert Stakes) is a common form of site protection. Physical site protection requires site monitoring during the installation of signage or fencing, and periodically until the undertaking has been completed.

- Monitoring: Monitoring can be a form of protection and mitigation. Monitoring to implement site protection may occur when mission activities occur near an archaeological site where the site boundaries are unknown, or in geomorphic settings which have a high probability for containing buried cultural resources. Monitoring can also be a form of mitigation when mission or construction activities are limited in scope and impact a portion of the site. Monitoring for the replacement of a water pipeline within an archaeological site is one example.

- Data Recovery: Mitigation in the form of data recovery is conducted as a last resort when a site, or portion of a site, cannot be avoided or physically protected from undertakings. Data recovery consists of excavation and documentation. Excavation

must be conducted by a professional archaeologist meeting the Secretary of the Interior's Professional Qualification Standards (NPS 2020), in addition to requirements stipulated by ARPA.

    - Data Recovery must seek to further archaeological knowledge in the public interest.

    - Excavated materials remain the property of the US, and such materials and copies of associated documentation will receive curation at an adequate facility (see Appendices E and F for curation guidelines).

    - Activities associated with excavation must be consistent with other management plans (e.g., natural resources) applicable to the area concerned.

- In addition, protection extends to inadvertent discoveries found during an undertaking will require immediate notification of the Conservation Branch, unless a plan pre-approved by the Conservation Branch is in place. The preferred method of treatment will be avoidance. When that is not possible, the site will be delineated, and a data recovery plan will be formulated in consultation with the SHPO and interested tribal organizations.

Training exercises and testing may require prior survey and inventory. Off-road travel is limited to foot traffic and low impact vehicles unless the area has been surveyed and determined free of cultural resources. Large-scale, cross-country exercises require complete survey and either avoidance or mitigation of effects agreed to with SHPO prior to the exercise. Small training exercises may require monitoring timed to coincide with unit set-up to ensure avoidance of resources. A post-training site visit is required to document impacts on the training site. Any damages will be reported, within the requirements for maintaining security on location and training description. Any areas in which targets are established or live firing takes place require prior archaeological survey.

All work orders are screened for the potential to adversely affect cultural resources and are reviewed by archaeological and architectural staff. GIS data and/or site visits determine whether or not survey work is required, whether any eligible properties are within the footprint, and if eligible properties do exist, whether they can be avoided or some type of mitigation will be required. The work order review processes is completed with either a "no historic properties," or "no adverse effects" finding or, if adverse effects are anticipated, the mitigation or avoidance measures are proposed. The goal in all cases is to meet the particular mission while protecting the resource.

5.5.2 Historic Architecture Protection Measures

When it is determined that a proposed undertaking will impact a NRHP eligible architectural property, steps must be taken to either mitigate the adverse effects or preserve the property. Treatment options should provide for the protection of an architectural property's significant features and characteristics. The Secretary of the Interior outlines several treatment options for protection (NPS 2020):

- Rehabilitation: Returning a property to a state of utility while maintaining its historic integrity.

- Restoration: Accurately recovering the form and details of a property and its setting as it appeared at a particular period of time.
- Preservation: Application of measures to sustain existing form and integrity.
- Stabilization: Application of measures to re-establish a weather-resistant enclosure and the structural stability of the resource.
- Mothballing: Removal of a resource from active use and protecting it from deterioration.
- Maintenance: Preventing deterioration through regular treatment.
- Repair: Fixing an element of the resource that has deteriorated or is broken.

If the protection of an architectural property is not feasible, documentation can be implemented as a mitigation procedure if stipulated in a Section 106 agreement document. Documentation of properties is performed so that information will not be lost as a result of proposed alteration or demolition. Minimum standards are defined in the Secretary of the Interior's *Standards and Guidelines: Archaeology and Historic Preservation* (NPS 2020).

Most commonly, mitigative documentation is prepared according to standards established by HABS/HAER. Both programs establish a comprehensive procedure for the documentation of buildings, sites, structures, and objects significant to American history through the creation and maintenance of an archive within the US Library of Congress.

HABS documentation may be prepared and submitted on the following three levels:

- Level I: Includes a full set of field-measured drawings along with maps, large-format black and white photographs of the interior and exterior, written historic and description accounts, evaluation of significance, and a list of sources. This is the most in-depth and labor intensive.
- Level II: Includes originals or as-built drawings not measured in the field, but other accompanying materials are the same as those required for Level I.
- Level III: Consists of a sketch site plan and large-format black and white photos of the interior and exterior. A written historical account and evaluation of significance is also required.

Documentation is submitted in archivally-stable formats and must be reviewed and accepted by Historic American Buildings Survey.

In addition to evaluating treatment options and building documentation, Army policy requires the preparation of an economic analysis for any NRHP-eligible architectural property being considered for mitigation to show alternatives considered for disposition, to include adaptive re-use. The analysis should include such factors as maintenance costs, utility costs, and replacement costs in cost estimates. The economic analysis envisioned is not a decision document but rather a tool to assist CRMs in making management decisions. Cost is only one factor involved in the decision process,

and the installation is by no means required to adopt the management alternative of least cost.

The economic analysis should, at a minimum, provide the following information on each property proposed for disposal or demolition:

- a property condition assessment,
- a description of management alternatives considered,
- cost estimates for each alternative, and
- a statement of the agency's decision, i.e., preferred alternative, with regard to disposition of the property.

Alternatives considered should include demolition, no action, and options for adaptive re-use of the property. The economic analysis subsequently may be used as a supporting document in the Section 106 consultation process.

5.5.3 Tribal Resources

Management alternatives for tribal resources are determined in consultation with the respective Native American tribal organization. In most cases avoidance will be the preferred management option. When avoidance is not possible, physical protection measures may be appropriate. As opposed to other cultural resources, it is often not possible to mitigate TCPs or sacred sites due to their uniqueness.

6. IMPLEMENTING THE ICRMP

This ICRMP was prepared with a goal of 100% implementation. The following sections describe the personnel and funding needed to implement the laws, regulations, and SOPs applicable to this ICRMP as described in the preceding chapters.

6.1 The Garrison Commander's Role

AR 200-1, Section 1-24 places responsibility for compliance with historic preservation laws and regulations on the GC. As such, the GC will implement this ICRMP. Prior to implementing this ICRMP, the GC must complete the following actions:

- Direct the preparation of an EA to support the implementation of this ICRMP and initiate a public review of the ICRMP in accordance with NEPA and AR 200-1.
- Initiate an IMCOM review of the ICRMP in accordance with AR 200-1.
- Sign the ICRMP after IMCOM and public comments have been addressed.

The GC must take the following actions to implement this ICRMP:

- Designate a full time professional CRM who meets the Secretary of the Interior's *Professional Qualification Standards* (NPS 2020) for archaeology or historic preservation, and task this individual to implement and coordinate the ICRMP.
- Ensure the CRM and their staff receive adequate, ongoing training in cultural resources laws, regulations, and practices.
- Establish procedures which require installation staff, tenants, contractors, users and to coordinate with the CRM early during project planning to ensure compliance with Section 106 of the NHPA and the ICRMP guidelines.
- Appoint a Tribal Liaison through which all tribal consultation will be conducted.
- Establish funding priorities and program funds for cultural resources compliance and management activities.
- Provide an annual review of the ICRMP and initiate revision of the ICRMP if the annual review indicates a need for such revision.

6.1.1 Annual Review of the ICRMP

This ICRMP will undergo an annual review to determine its effectiveness, make necessary adjustments, and incorporate changes in the cultural resources management program. This review is initiated by the GC and coordinated by the CRM. The product of this review should be a report on the cultural resources management program at WSMR. The report will provide a summary of the preservation activities completed and in progress, the progress in implementing the ICRMP Action Plan, difficulties encountered in performing these activities, revisions proposed to the ICRMP, and any historic properties added to the inventory.

6.2 Cultural Resources Manager's Role

As the cultural resources program lead, the CRM will play the primary role in implementing this ICRMP. The CRM's responsibilities will adhere to the Action Items outlined in Chapter 3 (Legal Foundations and Methods for the ICRMP) and the SOPs discussed in Chapter 4 (Standard Operating Procedures). These responsibilities generally fall into five (5) categories outlined below:

6.2.1 NHPA Title 54 U.S.C. 306101 through 306114 (Formerly Section 110)

- Ensure that maintenance, repair, renovation of historic properties, and new construction are carried out in accordance with The Secretary of the Interior's *Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstruction Historic Buildings* (NPS 2020).

- Coordinate a review of WSMR policies and procedures to ensure compliance with NHPA title 54 U.S.C 306101 through 306114.

- Coordinate the development and implementation of a cultural resources survey plan at WSMR.

- Pursue funding to meet Title 54 U.S.C. 306101 through 306114 requirements.

6.2.2 NHPA Section 106

- Coordinate with installation staff, tenants, users, contractors, and interest parties early during the planning phase of projects and activities to ensure compliance with the ICRMP guidelines and NHPA Section 106.

- Coordinate the integration of cultural resources review into the NEPA review process.

- Pursue funding to meet Section 106 requirements.

- Annually review the ICRMP for compliance with Section 106.

6.2.3 Consultation with Native Americans

- Coordinate consultation with Federally-recognized Native American tribal entities on a government-to-government basis as required by EO 13084 and the DoD's American Indian and Alaska Native Policy.

6.2.4 Cultural Resources Education Program

- Submit funding requirements for a cultural resources education program.

6.2.5 Management Responsibilities

- Provide an opportunity for CRM staff to participate in historic preservation courses as funding is available.

- Ensure that individuals carrying out maintenance activities on historic properties follow the Secretary of the Interior's *Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstruction Historic Buildings* (NPS 2020). Integrate the ICRMP into all tenant agreements to ensure compliance with appropriate preservation laws.

- Pursuant to ARPA, ensure that individuals performing crime scene investigations and archaeological damage assessments meet the Secretary of the Interior's *Professional Qualification Standards* (NPS 2020).

6.3 ICRMP Action Plan

6.3.1 ICRMP Goals

During the life of this ICRMP, the following goals will direct the cultural resources program at WSMR:

- Integrate historic preservation compliance requirements with planning and military testing, construction, maintenance, real property management, land use decisions, training, and other undertakings.

- Establish procedures for compliance with Federal laws, regulations, and executive orders requiring the protection and/or management of cultural resources with the least possible effect on military testing and mission support activities.

- Maintain the historic fabric and character of buildings and historic districts contributing to WSMR historic districts, as well as individually eligible properties.

- Minimize and/or mitigate adverse effects on all cultural resources on WSMR meeting criteria for listing or listed on the National Register in concert with the execution of military testing and support activities.

- Conduct data recoveries on National Register eligible properties pursuant to SHPO consultation and project specific MOAs.

- Set priorities based on currently available information for the inventory and evaluation of cultural resources and establish a procedure for revising those priorities: (1) survey and NRHP evaluation of archaeological sites for eligibility to the National Register in all areas where military testing will have the greatest impact; (2) evaluation of any site with "undetermined" eligibility; and (3) ongoing data recovery of sites in areas expected to receive the greatest impact. This plan can incorporate the use of remote sensing, geographic information systems data, and predictive modeling.

- Give top priority to management of properties most at risk for adverse effects by the military mission.

- Enforce Federal laws prohibiting the vandalism of cultural resources or illegal collection of archaeological materials on WSMR and strengthen that effort with continued training and additional staff (as funding is available).

- Implement the existing plan to ensure management of archaeological collections relevant to cultural resources at WSMR in compliance with 36 CFR Part 79.

- Make collections available for research by professionals, interested Native Americans, and other members of the public at the Fort Bliss curatorial facility during normal duty hours.

- Maintain historic preservation training opportunities for military and civilian personnel whose jobs or building occupancies have an influence on cultural resources.

- Establish realistic budgetary goals.

- Ensure staff *responsible for cultural resource management meet the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, (Federal Register* Vol. 48, No. 190, pp. 44717-44742) and receive continuing training.

- Through the implementation of this **ICRMP,** develop an innovative program that demonstrates the value of historic preservation programs, and publicize the commitment of WSMR to historic preservation.

6.3.2 Action Plan Schedule

The purpose of this section is to present a template for carrying out the cultural resources program for WSMR. These projects were arrived at through analysis of what impacts to historic properties may occur and which properties have the highest probability of adverse effects. The projects are focused on historic properties in areas where military testing has the highest likelihood of adversely affecting the archaeological resources, for the effective preservation management of the historic resources that have been identified, and for unevaluated buildings and structures that are scheduled for demolition or renovation.

WSMR will include projects in this schedule in annual budget requests and will modify each submission to reflect the funding actually received, including an inflation factor, and projected mission changes that could affect cultural properties in ways not anticipated at the time this plan was prepared.

The fiscal year begins on October 1st of the calendar year and ends September 30th of the calendar year indicated. WSMR will have met its obligations under this plan if funds are obligated in amounts estimated to be required for the completion of projects and plans included in the Projected Schedule anytime during the fiscal year in which they are scheduled.

ALL YEAR PROJECTS-The following projects are proposed to occur in each of the five years of the ICRMP. As needs arise, based on undertakings that are new, projects can be added to the lists.

YEAR 1:

1. Architectural Historian Technical Support

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides direct architectural historian (approximately GS-12) support to the Cultural Resources Program to ensure cultural resources compliance for the inventory and evaluation of built-environment. Activities conducted under this project include, but are not limited to, a boundary revision for WSMR Historic District, documentation and evaluation of properties scheduled or disposal, preparation of interpretive materials for WSMR's Cold War resources, and inventory of Cold War instrumentation facilities.

Required Funding - $157,000 annually

Timeframe - 2025-2029

2. Recurring Cultural Resources Field Support

Driver - NHPA, ARPA, NAGPRA, DoDI 4715.16, AR 200-1

Description - This project would provide direct support to the Cultural Resources Program for archaeological fieldwork in the form of an Archaeological Technician (GS-11) for approximately 1.5 years. Duties of this contracted position would include, but are not limited to, monitoring, survey, site recording, accessioning of artifacts, and the physical protection of sites. The Archaeological Technician would be supervised by the CRMs.

Required Funding - $250,000 annually

Timeframe - 2025-2029

3. Data Sharing Agreement Fees

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - This is the annual cost for the Archaeological Records Management Section and the New Mexico Historic Preservation Division to provide service to WSMR under terms of the 2020 Data Sharing Agreement.

Required Funding - $50,000 annually

Timeframe - 2025-2029

4. Curation Fee-Ft Bliss Curation Facility

Driver - ARPA, NAGPRA, Antiquities Act of 1906, 36 CFR 79, 48 FR 44716, AR 200-1

Description - These fees are provided to Fort Bliss on a reimbursable basis to provide for continued curation of WSMR collections. Fort Bliss maintains the collections to 36 CFR 79 standards.

Required Funding - $5,000 annually

Timeframe - 2025-2029

5. Prescribed Burn Area Historic Properties Inventory

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - Conduct cultural resources surveys for prescribed burns on a sample of the burn area using the WSMR Predictive Model for selection of the area to inventory. The focus of this project will be woodland area in the Oscura Mountains or grasslands in the Stallion Basin. Other areas planned for prescribed burns are the San Andres mountains and the Red Canyon area. Burns support habitat improvement and are an integral part of natural resources management.

Required Funding - $150,000

Timeframe - 2025-2029

6. Facilities Reduction Program Historic Property Inventory

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides supplemental architectural historian technical support to the Cultural Resources Program to ensure cultural resources compliance for the Facilities Reduction Program. Facilities Reduction occurs annually and many structures are eligible for the National Register, necessitating compliance with Section 106.

Required Funding - $180,000

Timeframe - 2025-2029

7. Cultural Resources Evaluation in Support of Special Forces Operations

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of historic properties in areas where Special Force conduct training. WSMR has been designated a Special Forces Training Center which brings SF troops from the regular Army, National Guard and Reserves to the post for training is all facets of SF doctrine. Currently, over 5,000 troops train on WSMR areas and these exercises have the potential to effect historic properties. Maneuvers include off road traffic, force on force training, convoys, and movement to contact exercises.

Required Funding - $175,000

Timeframe - 2025-2029

8. Cultural Resources Evaluation-Paleoindian Historic Properties in Stallion Range

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of Paleoindian historic properties in the Stallion Range. New evidence is emerging that the Stallion area was a focus of Paleoindian occupation in the southern New Mexico area. Sites are being found on many different land forms and almost all are intact making the Stallion Basin an extraordinary landscape. The area will be potentially impacted by weapons testing it by the DTRA and TC long range missile tests from the WSMR launch complexes.

Required Funding - $130,000

Timeframe - 2025-2029

9. Maintenance of Archaeological Collections and Associated Records

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project continues management of archaeological collections and records associated with the cultural resources program. There is a large backlog of material needing to be brought up to the standards in 36 CFR 79. This includes both paper records and artifacts.

Required Funding - $120,000

Timeframe - 2025-2029

10. Archaeological Inventory, Prehistoric Trackways

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides Section 106 inventory of various trackways on WSMR. The general area of the trackways is an active drop zone for NASA, Navy sounding rocket program, ATACMS off-the-shelf testing, GMLRS, and other missile programs. There are at least 300,000 acres containing both Pleistocene megafauna trackways and Paleoindian and later trackways. There are also numerous human trackways which are being dated to the late Pleistocene. Potentially over 100,000 acres on WSMR contain various trackways and need an inventory.

Required Funding - $120,000

Timeframe - 2025-2029

11. Archaeological Survey and Inventory for Advanced Gunfire Program

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory and evaluation of historic properties in areas needed for Advanced Gunfire. The Advanced Gunfire is a suite of weapon systems that need land for long range precision fires including launch sites, telemetry sites, radar sites and impact areas. As scenarios change, new areas are need for placement of various equipment that supports the program.

Required Funding - $153,000

Timeframe - 2025-2029

YEAR 2:

1. Architectural Historian Technical Support

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides direct architectural historian (approximately GS-12) support to the Cultural Resources Program to ensure cultural resources compliance for the inventory and evaluation of built-environment. Activities conducted under this project include, but are not limited to, a boundary revision for WSMR Historic District, documentation and evaluation of properties scheduled or disposal, preparation of interpretive materials for WSMR's Cold War resources, and inventory of Cold War instrumentation facilities.

Required Funding - $157,000 annually

Timeframe - 2025-2029

2. Recurring Cultural Resources Field Support

Driver - NHPA, ARPA, NAGPRA, DoDI 4715.16, AR 200-1

Description - This project would provide direct support to the Cultural Resources Program for archaeological fieldwork in the form of an Archaeological Technician (GS-11) for approximately 1.5 years. Duties of this contracted position would include, but are not limited to, monitoring, survey, site recording, accessioning of artifacts, and the physical protection of sites. The Archaeological Technician would be supervised by the CRMs.

Required Funding - $250,000 annually

Timeframe - 2025-2029

3. Data Sharing Agreement Fees

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - This is the annual cost for the Archaeological Records Management Section and the New Mexico Historic Preservation Division to provide service to WSMR under terms of the 2020 Data Sharing Agreement.

Required Funding - $50,000 annually

Timeframe - 2025-2029

4. Curation Fee-Ft Bliss Curation Facility

Driver - ARPA, NAGPRA, Antiquities Act of 1906, 36 CFR 79, 48 FR 44716, AR 200-1

Description - These fees are provided to Fort Bliss on a reimbursable basis to provide for continued curation of WSMR collections. Fort Bliss maintains the collections to 36 CFR 79 standards.

Required Funding - $5,000 annually

Timeframe - 2025-2029

5. Prescribed Burn Area Historic Properties Inventory

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - Conduct cultural resources surveys for prescribed burns on a sample of the burn area using the WSMR Predictive Model for selection of the area to inventory. The focus of this project will be woodland area in the Oscura Mountains or grasslands in the Stallion Basin. Other areas planned for prescribed burns are the San Andres mountains and the Red Canyon area. Burns support habitat improvement and are an integral part of natural resources management.

Required Funding - $150,000

Timeframe - 2025-2029

6. Facilities Reduction Program Historic Property Inventory

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides supplemental architectural historian technical support to the Cultural Resources Program to ensure cultural resources compliance for the Facilities Reduction Program. Facilities Reduction occurs annually and many structures are eligible for the National Register, necessitating compliance with Section 106.

Required Funding - $180,000

Timeframe - 2025-2029

7. Cultural Resources Evaluation in Support of Special Forces Operations

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of historic properties in areas where Special Force conduct training. WSMR has been designated a Special Forces Training Center which brings SF troops from the regular Army, National Guard and Reserves to the post for training is all facets of SF doctrine. Currently, over 5,000 troops train on WSMR areas and these exercises have the potential to effect historic properties. Maneuvers include off road traffic, force on force training, convoys, and movement to contact exercises.

Required Funding - $175,000

Timeframe - 2025-2029

8. Cultural Resources Evaluation-Paleoindian Historic Properties in Stallion Range

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of Paleoindian historic properties in the Stallion Range. New evidence is emerging that the Stallion area was a focus of Paleoindian occupation in the southern New Mexico area. Sites are being found on many different land forms and almost all are intact making the Stallion Basin an extraordinary landscape.

Required Funding - $130,000

Timeframe - 2025-2029

9. Maintenance of Archaeological Collections and Associated Records

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project continues management of archaeological collections and records associated with the cultural resources program. There is a large backlog of material needing to be brought up to the standards in 36 CFR 79. This includes both paper records and artifacts.

Required Funding - $120,000

Timeframe - 2025-2029

10. Archaeological Inventory, Prehistoric Trackways

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides Section 106 inventory of various trackways on WSMR. The general area of the trackways is an active drop zone for NASA, Navy sounding rocket program, ATACMS off-the-shelf testing, GMLRS, and other missile programs. There are at least 300,000 acres containing both Pleistocene megafauna trackways and Paleoindian and later trackways. There are also numerous human trackways which are being dated to the late Pleistocene. Potentially over 100,000 acres on WSMR contain various trackways and need an inventory.

Required Funding - $120,000

Timeframe - 2025-2029

11. Archaeological Survey and Inventory for Advanced Gunfire Program

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory and evaluation of historic properties in areas needed for Advanced Gunfire. The Advanced Gunfire is a suite of weapon systems that need land for long range precision fires including launch sites, telemetry sites, radar sites and impact areas. As scenarios change, new areas are need for placement of various equipment that supports the program.

Required Funding - $153,000

Timeframe - 2025-2029

YEAR 3:

1. Architectural Historian Technical Support

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides direct architectural historian (approximately GS-12) support to the Cultural Resources Program to ensure cultural resources compliance for the inventory and evaluation of built-environment. Activities conducted under this project include, but are not limited to, a boundary revision for WSMR Historic District, documentation and evaluation of properties scheduled or disposal, preparation of interpretive materials for WSMR's Cold War resources, and inventory of Cold War instrumentation facilities.

Required Funding - $157,000 annually

Timeframe - 2025-2029

2. Recurring Cultural Resources Field Support

Driver - NHPA, ARPA, NAGPRA, DoDI 4715.16, AR 200-1

Description - This project would provide direct support to the Cultural Resources Program for archaeological fieldwork in the form of an Archaeological Technician (GS-11) for approximately 1.5 years. Duties of this contracted position would include, but are not limited to, monitoring, survey, site recording, accessioning of artifacts, and the physical protection of sites. The Archaeological Technician would be supervised by the CRMs.

Required Funding - $250,000 annually

Timeframe - 2025-2029

3. Data Sharing Agreement Fees

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - This is the annual cost for the Archaeological Records Management Section and the New Mexico Historic Preservation Division to provide service to WSMR under terms of the 2020 Data Sharing Agreement.

Required Funding - $50,000 annually

Timeframe - 2025-2029

4. Curation Fee-Ft Bliss Curation Facility

Driver - ARPA, NAGPRA, Antiquities Act of 1906, 36 CFR 79, 48 FR 44716, AR 200-1

Description - These fees are provided to Fort Bliss on a reimbursable basis to provide for continued curation of WSMR collections. Fort Bliss maintains the collections to 36 CFR 79 standards.

Required Funding - $5,000 annually

Timeframe - 2025-2029

5. Prescribed Burn Area Historic Properties Inventory

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - Conduct cultural resources surveys for prescribed burns on a sample of the burn area using the WSMR Predictive Model for selection of the area to inventory. The focus of this project will be woodland area in the Oscura Mountains or grasslands in the Stallion Basin. Other areas planned for prescribed burns are the San Andres mountains and the Red Canyon area. Burns support habitat improvement and are an integral part of natural resources management.

Required Funding - $150,000

Timeframe - 2025-2029

6. Facilities Reduction Program Historic Property Inventory

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides supplemental architectural historian technical support to the Cultural Resources Program to ensure cultural resources compliance for the Facilities Reduction Program. Facilities Reduction occurs annually and many structures are eligible for the National Register, necessitating compliance with Section 106.

Required Funding - $180,000

Timeframe - 2025-2029

7. Cultural Resources Evaluation in Support of Special Forces Operations

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of historic properties in areas where Special Force conduct training. WSMR has been designated a Special Forces Training Center which brings SF troops from the regular Army, National Guard and Reserves to the post for training is all facets of SF doctrine. Currently, over 5,000 troops train on WSMR areas and these exercises have the potential to effect historic properties. Maneuvers include off road traffic, force on force training, convoys, and movement to contact exercises.

Required Funding - $175,000

Timeframe - 2025-2029

8. Cultural Resources Evaluation-Paleoindian Historic Properties in Stallion Range

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of Paleoindian historic properties in the Stallion Range. New evidence is emerging that the Stallion area was a focus of Paleoindian occupation in the southern New Mexico area. Sites are being found on many different land forms and almost all are intact making the Stallion Basin an extraordinary landscape.

Required Funding - $130,000

Timeframe - 2025-2029

9. Maintenance of Archaeological Collections and Associated Records

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project continues management of archaeological collections and records associated with the cultural resources program. There is a large backlog of material needing to be brought up to the standards in 36 CFR 79. This includes both paper records and artifacts.

Required Funding - $120,000

Timeframe - 2025-2029

10. Archaeological Inventory, Prehistoric Trackways

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides Section 106 inventory of various trackways on WSMR. The general area of the trackways is an active drop zone for NASA, Navy sounding rocket program, ATACMS off-the-shelf testing, GMLRS, and other missile programs. There are at least 300,000 acres containing both Pleistocene megafauna trackways and Paleoindian and later trackways. There are also numerous human trackways which are being dated to the late Pleistocene. Potentially over 100,000 acres on WSMR contain various trackways and need an inventory.

Required Funding - $120,000

Timeframe - 2025-2029

11. Archaeological Survey and Inventory for Advanced Gunfire Program

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory and evaluation of historic properties in areas needed for Advanced Gunfire. The Advanced Gunfire is a suite of weapon systems that need land for long range precision fires including launch sites, telemetry sites, radar sites and impact areas. As scenarios change, new areas are need for placement of various equipment that supports the program.

Required Funding - $153,000

Timeframe - 2025-2029

YEAR 4:

1. Architectural Historian Technical Support

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides direct architectural historian (approximately GS-12) support to the Cultural Resources Program to ensure cultural resources compliance for the inventory and evaluation of built-environment. Activities conducted under this project include, but are not limited to, a boundary revision for WSMR Historic District, documentation and evaluation of properties scheduled or disposal, preparation of interpretive materials for WSMR's Cold War resources, and inventory of Cold War instrumentation facilities.

Required Funding - $157,000 annually

Timeframe - 2025-2029

2. Recurring Cultural Resources Field Support

Driver - NHPA, ARPA, NAGPRA, DoDI 4715.16, AR 200-1

Description - This project would provide direct support to the Cultural Resources Program for archaeological fieldwork in the form of an Archaeological Technician (GS-11) for approximately 1.5 years. Duties of this contracted position would include, but are not limited to, monitoring, survey, site recording, accessioning of artifacts, and the physical protection of sites. The Archaeological Technician would be supervised by the CRMs.

Required Funding - $250,000 annually

Timeframe - 2025-2029

3. Data Sharing Agreement Fees

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - This is the annual cost for the Archaeological Records Management Section and the New Mexico Historic Preservation Division to provide service to WSMR under terms of the 2020 Data Sharing Agreement.

Required Funding - $50,000 annually

Timeframe - 2025-2029

4. Curation Fee-Ft Bliss Curation Facility

Driver - ARPA, NAGPRA, Antiquities Act of 1906, 36 CFR 79, 48 FR 44716, AR 200-1

Description - These fees are provided to Fort Bliss on a reimbursable basis to provide for continued curation of WSMR collections. Fort Bliss maintains the collections to 36 CFR 79 standards.

Required Funding - $5,000 annually

Timeframe - 2025-2029

5. Prescribed Burn Area Historic Properties Inventory

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - Conduct cultural resources surveys for prescribed burns on a sample of the burn area using the WSMR Predictive Model for selection of the area to inventory. The focus of this project will be woodland area in the Oscura Mountains or grasslands in the Stallion Basin. Other areas planned for prescribed burns are the San Andres mountains and the Red Canyon area. Burns support habitat improvement and are an integral part of natural resources management.

Required Funding - $150,000

Timeframe - 2025-2029

6. Facilities Reduction Program Historic Property Inventory

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides supplemental architectural historian technical support to the Cultural Resources Program to ensure cultural resources compliance for the Facilities Reduction Program. Facilities Reduction occurs annually and many structures are eligible for the National Register, necessitating compliance with Section 106.

Required Funding - $180,000

Timeframe - 2025-2029

7. Cultural Resources Evaluation in Support of Special Forces Operations

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of historic properties in areas where Special Force conduct training. WSMR has been designated a Special Forces Training Center which brings SF troops from the regular Army, National Guard and Reserves to the post for training is all facets of SF doctrine. Currently, over 5,000 troops train on WSMR areas and these exercises have the potential to effect historic properties. Maneuvers include off road traffic, force on force training, convoys, and movement to contact exercises.

Required Funding - $175,000

Timeframe - 2025-2029

8. Cultural Resources Evaluation-Paleoindian Historic Properties in Stallion Range

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of Paleoindian historic properties in the Stallion Range. New evidence is emerging that the Stallion area was a focus of Paleoindian occupation in the southern New Mexico area. Sites are being found on many different land forms and almost all are intact making the Stallion Basin an extraordinary landscape.

Required Funding - $130,000

Timeframe - 2025-2029

9. Maintenance of Archaeological Collections and Associated Records

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project continues management of archaeological collections and records associated with the cultural resources program. There is a large backlog of material needing to be brought up to the standards in 36 CFR 79. This includes both paper records and artifacts.

Required Funding - $120,000

Timeframe - 2025-2029

10. Archaeological Inventory, Prehistoric Trackways

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides Section 106 inventory of various trackways on WSMR. The general area of the trackways is an active drop zone for NASA, Navy sounding rocket program, ATACMS off-the-shelf testing, GMLRS, and other missile programs. There are at least 300,000 acres containing both Pleistocene megafauna trackways and Paleoindian and later trackways. There are also numerous human trackways which are being dated to the late Pleistocene. Potentially over 100,000 acres on WSMR contain various trackways and need an inventory.

Required Funding - $120,000

Timeframe - 2025-2029

11. Archaeological Survey and Inventory for Advanced Gunfire Program

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory and evaluation of historic properties in areas needed for Advanced Gunfire. The Advanced Gunfire is a suite of weapon systems that need land for long range precision fires including launch sites, telemetry sites, radar sites and impact areas. As scenarios change, new areas are need for placement of various equipment that supports the program.

Required Funding - $153,000

Timeframe - 2025-2029

YEAR 5:

1. Architectural Historian Technical Support

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides direct architectural historian (approximately GS-12) support to the Cultural Resources Program to ensure cultural resources compliance for the inventory and evaluation of built-environment. Activities conducted under this project include, but are not limited to, a boundary revision for WSMR Historic District, documentation and evaluation of properties scheduled or disposal, preparation of interpretive materials for WSMR's Cold War resources, and inventory of Cold War instrumentation facilities.

Required Funding - $157,000 annually

Timeframe - 2025-2029

2. Recurring Cultural Resources Field Support

Driver - NHPA, ARPA, NAGPRA, DoDI 4715.16, AR 200-1

Description - This project would provide direct support to the Cultural Resources Program for archaeological fieldwork in the form of an Archaeological Technician (GS-11) for approximately 1.5 years. Duties of this contracted position would include, but are not limited to, monitoring, survey, site recording, accessioning of artifacts, and the physical protection of sites. The Archaeological Technician would be supervised by the CRMs.

Required Funding - $250,000.00 annually

Timeframe - 2025-2029

3. Data Sharing Agreement Fees

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - This is the annual cost for the Archaeological Records Management Section and the New Mexico Historic Preservation Division to provide service to WSMR under terms of the 2020 Data Sharing Agreement.

Required Funding - $50,000 annually

Timeframe - 2025-2029

4. Curation Fee-Ft Bliss Curation Facility

Driver - ARPA, NAGPRA, Antiquities Act of 1906, 36 CFR 79, 48 FR 44716, AR 200-1

Description - These fees are provided to Fort Bliss on a reimbursable basis to provide for continued curation of WSMR collections. Fort Bliss maintains the collections to 36 CFR 79 standards.

Required Funding - $5,000 annually

Timeframe - 2025-2029

5. Prescribed Burn Area Historic Properties Inventory

Driver - NHPA, ARPA, DoDI 4715.16, AR 200-1

Description - Conduct cultural resources surveys for prescribed burns on a sample of the burn area using the WSMR Predictive Model for selection of the area to inventory. The focus of this project will be woodland area in the Oscura Mountains or grasslands in the Stallion Basin. Other areas planned for prescribed burns are the San Andres mountains and the Red Canyon area. Burns support habitat improvement and are an integral part of natural resources management.

Required Funding - $150,000

Timeframe- 2025-2029

6. Facilities Reduction Program Historic Property Inventory

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides supplemental architectural historian technical support to the Cultural Resources Program to ensure cultural resources compliance for the Facilities Reduction Program. Facilities Reduction occurs annually and many structures are eligible for the National Register, necessitating compliance with Section 106.

Required Funding - $180,000

Timeframe - 2025-2029

7. Cultural Resources Evaluation in Support of Special Forces Operations

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of historic properties in areas where Special Force conduct training. WSMR has been designated a Special Forces Training Center which brings SF troops from the regular Army, National Guard and Reserves to the post for training is all facets of SF doctrine. Currently, over 5,000 troops train on WSMR areas and these exercises have the potential to effect historic properties. Maneuvers include off road traffic, force on force training, convoys, and movement to contact exercises.

Required Funding - $175,000

Timeframe - 2025-2029

8. Cultural Resources Evaluation-Paleoindian Historic Properties in Stallion Range

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory of Paleoindian historic properties in the Stallion Range. New evidence is emerging that the Stallion area was a focus of Paleoindian occupation in the southern New Mexico area. Sites are being found on many different land forms and almost all are intact making the Stallion Basin an extraordinary landscape.

Required Funding - $130,000

Timeframe - 2025-2029

9. Maintenance of Archaeological Collections and Associated Records

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project continues management of archaeological collections and records associated with the cultural resources program. There is a large backlog of material needing to be brought up to the standards in 36 CFR 79. This includes both paper records and artifacts.

Required Funding - $120,000

Timeframe - 2025-2029

10. Archaeological Inventory, Prehistoric Trackways

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides Section 106 inventory of various trackways on WSMR. The general area of the trackways is an active drop zone for NASA, Navy sounding rocket program, ATACMS off-the-shelf testing, GMLRS, and other missile programs. There are at least 300,000 acres containing both Pleistocene megafauna trackways and Paleoindian and later trackways. There are also numerous human trackways which are being dated to the late Pleistocene. Potentially over 100,000 acres on WSMR contain various trackways and need an inventory.

Required Funding - $120,000

Timeframe - 2025-2029

11. Archaeological Survey and Inventory for Advanced Gunfire Program

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project provides inventory and evaluation of historic properties in areas needed for Advanced Gunfire. The Advanced Gunfire is a suite of weapon systems that need land for long range precision fires including launch sites, telemetry sites, radar sites and impact areas. As scenarios change, new areas are need for placement of various equipment that supports the program.

Required Funding - $153,000

Timeframe - 2025-2029

SINGLE YEAR PROJECTS

These projects are to be executed for a one-year period and not be carried over to the following year.

FY 2026 Projects

1. Development of Historic Context for Civilian Conservation Corp (CCC) Historic Sites

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project records features associated with the Civilian Conservation Corp on the range. There are roads, bridges, camps, stock tanks and other ranching features built by the CCC. Virtually none of these has been recorded and or evaluated for their National Register eligibility. The historic context will aid in evaluation of the sites.

Required Funding - $250,000

Timeframe - FY 2026

2. HELSTF Phase I Architectural Inventory and Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project evaluates the High Energy Laser Test Facility (HELSTF). DOD began construction in the 1980s in support of the Regan Strategic Defense Initiative (SDI). The HELSTF facility developed the Mid-Infrared Advanced Chemical Laser (MIRACL), the most powerful continuous wave laser in the US. The MIRACL laser supported testing directed energy for anti-ballistic and anti-satellite weapons. Throughout the 1980s and early 1990s the HELSTF facility was highly instrumental in furthering research and development of laser technology and leading to the end of the Cold War.

3. Archaeological Damage Assessment Phase II LA104864

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - Continue archaeological damage assessment for additional tank trail areas occurring within boundary of LA 104864. This site location represents a small portion of the West Dry Lake Pueblo. Damages include multiple features identified within tank trail and possible portions of a pit house. The site has been damaged repeatedly by driving the MLRS heavy vehicles and by blading. This has resulted in damage to structural features of the site. However, recent small test excavations have revealed remaining integrity. The project will utilize test excavations to identify components of the site in the road and will record extents of the room block features as identified. The project will include collecting all artifacts from test excavations and will include collection of macrobotanical remains and charcoal for dating purposes.

4. National Register Evaluation of Sites in the High Velocity Projectile Impact Area

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - There are numerous archaeological sites within the impact area for the High Velocity Projectile. Most of these do not have eligibility determinations and the possibility of impact to the sites is high due to constant use of the area. Sites determined not eligible will need no further work allowing the military mission to proceed with minimal impacts.

Timeframe - FY 2026

5. NRHP Evaluation and Sampling Assessment of LA 175, Cottonwood Pueblo

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project will include selected specific scientific sample and studies that may include, but not be limited to carbon dating, macrobotanical studies, phytolith studies, obsidian hydration dating, dendrochronological studies as well as assorted geomorphological studies. The data collected through these samples and specialized studies will be included in a data recovery report for LA 175.

6. National Register Eligibility Determination for Historic V-2 Rocket Crater

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - The first full scale rocket testing utilizing captured V-2 rockets from Germany occurred at WSMR beginning in 1946. Several of the early rocket launches failed and resulted in craters nearby launch complexes. The crater under investigation is thought to possibly be the result of the failure of the very first rocket launched in the United States and is therefore a highly significant site. The resulting report will provide a detailed recordation of the site, providing a baseline of present remains at the site, which have not been documented. The resulting report will provide a historic context and background data in which to evaluate its significance and National Register of Historic Places eligibility.

7. Significance and Research Standards for Prehistoric Archaeological Sites at WSMR

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project is to design and create a document to guide future archaeological work at WSMR. It will review previous archaeological work in the region, assess the current body of relevant knowledge and suggest specific avenues for further inquiry. The intent is for this document to be a companion to the ICRMP for WSMR. This document will facilitate determinations of eligibility for the National Register of Historic Places (NRHP) for those prehistoric archaeological resources managed by WSMR. Research contexts for prehistoric archaeological properties will be created, however historical archaeological and historic architectural resource will not be included in this document.

8. Cultural Resources Evaluation Using Remote Sensing Technologies

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - WSMR includes approximately 200 historic ranches. Recordation of many of the ranches occurred in the 1990s however eligibility determinations were not completed. It is estimated that approximately 60 remain undetermined. Since that time many of the ranches have deteriorated significantly. The project will compile existing evaluations and will update them to support an eligibility determination and consultation. Presently many ranches are experiencing demolition by neglect resulting in an adverse effect. The goal of the project is to support a Memorandum of Agreement whereby approximately 12 of the best-preserved ranches will continue to be stabilized and the remaining 140 will be left. The lack of eligibility determinations is precluding forward movement with this action.

FY 2027 Projects

1. Trinity Site Archaeological Features Recordation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project records features associated with the Trinity Test which have not been included in previous work at the sites. There are magazines, optics sites and other similar locales that need recordation and evaluation of National Register eligibility.

Required Funding - $250,000

Timeframe - FY 2027

2. North Oscura Peak National Register Inventory and Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project inventories historic properties on North Oscura Peak and evaluates them for National Register of Historic Places eligibility. North Oscura Peak is a telemetry, communications and optics locales in the northern part of the installation.

Required Funding - $220,000

Timeframe – FY 2027

3. Honest John Assembly Area National Register Inventory and Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project continues management of archaeological collections and records associated with the cultural resources program. There is a large backlog of material needing to be brought up to the standards in 36 CFR 79. This includes both paper records and artifacts.

Required Funding - $120,000

Timeframe - FY 2027

4. National Register Evaluation of Salinas Base Camp (LA 116568)

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project re-evaluated the NR eligibility of LA 116568. There is both an archaeological component and a built environment component to be re-evaluated. The original recordation had no historic context and left out many associated features that need to be recorded.

Required Funding - $180,000

5. Solar Furnace National Register Inventory and Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project records features associated with the Solar Furnace facility on WSMR. This test site is one of the few solar furnace facilities in the world and supports various testing programs that need extreme high heat. The features constitute a district and will be evaluated for their NR eligibility.

Required Funding - $250,000

Timeframe - FY 2027

6. National Register Evaluations at Zumwalt Test Track

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project conducts National Register evaluations at several archaeological sites at the Zumwalt Test Track which has numerous large test missions occurring every month. Many of which have very large explosions munitions. These sites are unevaluated for the National Register and are in a zone where damage to them is highly likely.

Required Funding - $250,000

FY 2028 Projects

1. National Register Evaluations at ALT SHIST Site

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project conducts National Register evaluations at several archaeological sites at the ALT SHIST test site where very large explosions occur. These sites, LA 108484, LA 108485, LA 108486, and LA 108487 are unevaluated for the National Register. The sites are in a zone where damage to them is highly likely.

Required Funding - $250,000

Timeframe - FY 2028

2. Remote Instrumentation Sites National Register Inventory and Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project records and evaluates features at remote instrumentation sites throughout the range. Many remote sites were established in remote areas to meet the needs of test programs. The features will be evaluated for their NR eligibility.

Required Funding - $200,000

Timeframe - FY 2028

3. National Register Evaluations at Zumwalt Test Track

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project conducts National Register evaluations at several archaeological sites at the Zumwalt Test Track which has numerous large test missions occurring every month. Many of which have very large explosions munitions. These sites are unevaluated for the National Register and are in a zone where damage to them is highly likely.

Required Funding - $250,000

FY 2029 Projects

1. National Register Evaluations at the Ionosphere Station

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project conducts National Register evaluations at the Ionosphere Station, which is a facility developed in the early 1950s to conduct atmospheric research and determine what effects atmospheric phenomena have on missile flight. A historic context will be developed along with recordations of the structures at the locale.

Required Funding - $150,000

Timeframe - FY 2029

2. National Register Evaluations at the Oscura Range Camp

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project conducts National Register evaluations at the Oscura Range Camp. The Facilities Reduction Program has identified much of Oscura Range Camp for demolition. This range camp housed communications, optics and telemetry facilities and was also a launch point for RCATs (Radio Controlled Aerial Drones). The camp was established in the early 1950s and is the major facility created in the north central part of the range. In order to address the Section 106 requirements of the proposed Facilities Reduction Program impacts, a historic context will be developed along with recordations of the structures at the locale.

Required Funding - $250,000

Timeframe - FY 2029

3. EMRE Site National Register Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project conducts National Register evaluations at the EMRE Site which is the primary electromagnetic test site on the installation and dates to the early 1950s.

4. Launch Complex 34 Inventory and Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project conducts National Register inventory and evaluations at the Launch Complex 34. This complex dates to the late 1950s and was used until the late 1970s for a variety of programs such as Stinger, Mauler and other missiles. The complex is relatively intact and contains a variety of structures.

Timeframe - FY 2029

5. SVAD Test Site National Register Evaluation

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project inventories and evaluates properties of the Survivability and Vulnerability Assessment Directorate. These include the Fast Burst Reactor and other facilities along War Road at the south end of post. These facilities date to the early 1960s and are some of the most unique scientific facilities in the DOD.

6. Inventory and Evaluation of Optics Sites Archaeological Components

Driver - NHPA, DoDI 4715.16, AR 200-1

Description - This project inventories and evaluates properties at Optics sites that are archaeological in nature. Many of the sites have trash scatters and dumps along with long abandoned related facilities. These need an assessment of eligibility for the NR.

7. REFERENCES CITED

Ackerly, Neal W., P. Eidenbach, M. Carter, B. Morgan, M. Nawrocki, and J. O'Cain

1993 *Ranching in the Tularosa Basin: The White Sands Oral History Legacy Project*. Center for Anthropological Research, New Mexico State University, Las Cruces.

Amick, Daniel S.

1996 Regional Patterns of Folsom Mobility and Land Use in the American Southwest. *World Archaeology* 27:411-426.

Amick, Daniel S. and D.J. Stanford

1993 *Folsom Occupation in the Tularosa Basin of Southern New Mexico.* Manuscript on file, Alamogordo Townsend Library General Collection, Alamogordo, New Mexico.

Anschuetz, Kurt F., William H. Doleman, and Richard C. Chapmen (editors).

1990 *Landscape Archaeology in the Southern Tularosa Basin: I . Small Site Distributions and Geomorphology. Office* of Contract Archaeology, University of New Mexico Report No. 185-324D. WSMR Archaeological Research Report No. 90-7.

Bachman, George O.

1968 *Geology of the Mockingbird Gap Quadrangle, Lincoln and Socorro Counties New Mexico.* Geological Survey Professional Paper 594-J. United States Government Printing Office, Washington, DC.

Batcho, David G.

1987 A Descriptive Chronology of the Doña Ana Airport Sites near Santa Teresa, New Mexico. Manuscript on file, University Museum, New Mexico State University, Las Cruces.

Batcho, David G., David L. Carmichael, Meliha Duran, and Margaret Johnson

1985 *Archaeological Investigations of sites Located at the Southern Doña Ana County Airport Santa Teresa, New Mexico*. Part 1. Cultural Resource Management Division Report No. 533. New Mexico State University, Las Cruces.

Beckett, Patrick H.

1973 Cochise Culture Sites in South Central and North Central New Mexico. Unpublished Masters Thesis, Eastern New Mexico University, Portales.

1983 The Paleoindian Prehistory of the Tularosa Basin. In *The Prehistory of Rhodes Canyon, New Mexico*, edited by Peter L. Eidenbach, pp. 95-103. Human Systems Research, Inc. Tularosa, New Mexico.

Beckett, Patrick H., and Terry L. Corbett

1992 *The Manso Indians*. COAS Publishing and Research, Las Cruces.

Berry, Michael S.

1982 *Time, Space, and Transition in Anasazi Prehistory*. University of Utah Press, Salt Lake City.

Biota Information System of New Mexico (BISON-M) database.

2020 List of Threatened and Endangered Species and Species Accounts. www.bison-m.org. NMDGF.

Blair, Terence C., Jeffery S. Clark, and Stephen G. Wells

1990 Quaternary Stratigraphy and Landscape Evolution and its Application to Archaeological Studies. In *Landscape Archaeology in the Southern Tularosa Basin: Small Site Distribution and Geomorphology,* Vol 1, edited by K. F. Anschuetz, W. Doleman, and R. C. Chapman, pp. 167-203. Office of Contract Archaeology, University of New Mexico.

Boehm, William

1997 *From Barren Desert to Thriving Community: A Social History of White Sands Missile Range, 1945-1954*, Prepared for White Sands Missile Range by Human Systems Research, Tularosa, New Mexico.

Bowden, J.J.

1971 *Spanish and Mexican Land Grants in the Chihuahua Acquisition.* Texas Western Press, El Paso.

Buchanan, David, John P. Johnson, and William Brenner

1984 *Historic Properties Report White Sands Missile Range New Mexico and Sub-Installation Utah Launch Complex, Green River, Utah*, Prepared for DARCOM by Building Technology Inc.

Buck, Brenda J. and Monger, Curtis H.

1999 Stable Isotopes and Soil-geomorphology as indicators of Holocene Climate Change, Northern Chihuahuan Desert. *Journal of Arid Environments* 43:357-373.

Bullock, Peter Y.

2000 *The Phantom Palms: A Mesilla Phase Mogollon Site near Santa Teresa*. Office of Archaeological Studies Archaeology Note No. 266. Museum of New Mexico, Santa Fe.

Burkett, D. W.

2000 *Amphibians and reptiles of White Sands Missile Range.* Edited by C.W. Painter. Unpublished report, updated May 2000. US Department of the Army, Environmental Stewardship Division, WSMR, NM.

2008 *Amphibians and reptiles of White Sands Missile Range field guide 2008*. White Sands Technical Services, LLC., WSMR NM. 65 pp.

Carmichael, D. L

1982 Fresnal Shelter, New Mexico: Preliminary Dating and Evidence for Early Cultigens. Paper presented at the 47th Annual Meeting of the Society for American Archaeology, Minneapolis.

1985 Transitional Pueblo Occupation on Doña Ana Range, Fort Bliss, New Mexico. In Views of the Jornada Mogollon, edited by Colleen M. Beck, pp. 34-53. Contributions in Anthropology Number 12. Eastern New Mexico University, Portales.

1986 *Archaeological Survey in the Southern Tularosa Basin.* Historic and Natural Resources Report No. 3. Environmental Management Office, Fort Bliss, Texas.

Carroll, Thomas P.

1974 Historical Origins of the Sergeant Missile Powerplant. In *History of Rocketry and Astronautics, Proceedings of the Seventh and Eighth History Symposia of the International Academy of Astronautics, Baku, U.S.S.R. 1973, Amsterdam, Netherlands, 1974:* 121-146. American Astronautical Society, San Diego.

Civilian Conservation Corps (CCC) Legacy

2021 *CCC Brief History.* Electronic document, https://ccclegacy.org/CCC_Brief_History.html, accessed October 12, 2021.

Collins, Michael B.

1999 *Clovis Blade Technology*. University of Texas Press, Austin.

Connelley, James

2000 *Preservation Plan for Greer Ranch (LA116340) White Sands Missile Range*, Human Systems Research Report 9942A. Human Systems Research, Tularosa, New Mexico.

2001 *Final Report of Integrity Preservation at Rock House Spring House (LA104049) White Sands Missile Range, Doña Ana County, New Mexico*, Human Systems Research Report 9814B. Human Systems Research, Tularosa, New Mexico.

Crumpler, Larry

2020 Jornada Del Muerto Volcano. Electronic document, http://www.nmnaturalhistory.org/volcanoes/jornada-del-muerto-volcano, accessed April 1, 2020.

Defense Threat Reduction Agency (DTRA)

2007 Final Programmatic Environmental Impact Statement for Defense Threat Reduction Agency (DTRA) Activities on White Sands Missile Range, New Mexico." Virginia.

Department of State

2015 Gadsden Purchase, 1853-1854. Electronic document, https://history.state.gov.milestones/1830-1860/gadsden-purchase, accessed 4 April 2015.

Dinerstein, E., D. Olson, J. Atchely, C. Loucks, S. Contreras-Balderas, R. Abell, E. Inigo, E. Enkerlin, C.E. Williams, and G. Castilleja.

2000 Ecoregion-based conservation in the Chihuahuan Desert: A biological assessment and biodiversity vision. A collaborative effort by World Wildlife Fund, Comision National para el Conocimiento y Uso de la Biodiversidad (CONABIO), The Nature Conservancy, PRONATURA Noreste, and the Instituto Tecnologico y de Estudios Superiores de Monterrey (ITESM). World Wildlife Fund, Las Cruces, NM.

Doleman, W.H., R.C. Chapman, J.A. Schutt, M.K. Swift, and K.D. Morris

1991 Landscape Archaeology in the Southern Tularosa Basin. Vol 2, Testing, Excavation, and Analysis. University of New Mexico, Office of Contract Archaeology, Albuquerque.

Dunbar, Neila R.

1999 Cosmogenic 36Cl-Determined Age of the Carrizozo Lava Flows, South-Central New Mexico. *New Mexico Geology* 21(2):25-29.

Eckles, Jim

2013 *Pocketful of Rockets: History and Stories Behind White Sands Missile Range*. Fiddlebike Partnership, Las Cruces, New Mexico.

Ecosystem Management, Inc. (EMI)

2006 *Cultural Resource Survey of 27,368 Acres on White Sands Missile Range, Doña Ana and Otero Counties, New Mexico.* WSMR Project No. 493, EMI Report No. 622. Prepared by EMI, Albuquerque.

Eidenbach, Peter L.

1983 Summary and Conclusions. In *The Prehistory of Rhodes Canyon, New Mexico*, edited by Peter L. Eidenbach, pp. 145-150. Human Systems Research, Tularosa, New Mexico.

1989 *The West that was Forgotten, Historic Ranches of the Northern San Andres Mountain, White Sands Missile Range, New Mexico,* Human Systems Research Report No. 8824, Human Systems Research, Tularosa, New Mexico.

Eidenbach, Peter L. and Robert J. Burton

1987 *Historic Preservation Plan White Sands Missile Range New Mexico,* Prepared for White Sands Missile Range, United States Corps of Engineers and White Sands Missile Range Environmental Office.

Eidenbach, Peter and Beth Morgan

1994 *Homes on the Range: Oral Recollections of Early Ranch Life on the US Army White Sands Missile Range, New Mexico,* Prepared for Department of Defense Legacy Resource Management Program, Ranching Heritage Oral History Project.

Eidenbach, Peter and Linda Hart

1994 *School Days: Education During the Ranching Era on the US Army White Sands Missile Range, New Mexico,* Prepared for Department of Defense Legacy Resource Management Program, Ranching Heritage Oral History Project.

Eidenbach, Peter L., Richard L. Wessel, Lisa M. Meyer, and Gail C. Wimberly

1996 *Star Throwers of the Tularosa: The Early Cold War Legacy of White Sands Missile Range*. Human Systems Research Report 9422. Human Systems Research, Tularosa, New Mexico.

Eisenhour, Thomas

2012 (13) Historic Cultural Property Inventory Forms for the former Organ Mountain Riding Club (OMRC) Buildings, White Sands Missile Range. Ama Terra Environmental, Inc., Austin, Texas.

Eisenhour, Thomas , Kurt Korfmacher, and Lara Newcomer

2013 *Mitigation Document, Range Control Center, Buildings 300 and 301, White Sands Missile Range, New Mexico*. Ama Terra Environmental, Inc., Austin, Texas.

Ellison, Chris

2002 *Building 1592, the von Braun Bunker: Testing in the Early Phases of the V-2 Project Hermes,* Prepared for White Sands Missile Range, Ellison Historical Research, El Paso, Texas.

Elyea, Janette M.

1988 Analysis of Paleoindian Tools from LA 63880. In *The Border Star 85 Survey: Toward an Archaeology of Landscapes*, edited by Timothy J. Seaman, William H. Doleman, and Richard D. Chapman, pp. 231-238. Office of Contract Archaeology, University of New Mexico, Albuquerque.

Esser, Phillip S.

2017 *Historic Context for Astrodome Instrumentation Shelters and Types, White Sands Missile Range,* Epsilon Systems Report No. 2016-01, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

Feit, Rachel, Julian A. Sitters, Heather Barrett, and Kurt Korfmacher

2014 *Cultural Resource Assessment of the Green River Test Site, Utah*, Ama Terra Environmental Technical Report #71, Ama Terra Environmental, Inc., Austin, Texas.

Gile, Leland H., John W. Hawley, and Robert B. Grossman

1981 *Soils and Geomorphology in the Basin and Range Area of Southern New Mexico – Guidebook to the Desert Project.* Memoir 39. New Mexico Bureau of Mines and Mineral Resources, Socorro.

Goodfellow, Susan, Marjorie Nowick, Chad Blackwell, Dan Hart, and Kathryn Plimpton

2009 *Nationwide Context, Inventory, and Heritage Assessment of Works Progress Administration and Civilian Conservation Corps Resources on Department of Defense Installations.* Department of Defense Legacy Resource Program, Project 07-357, Washington D.C.

Greenwood, Richard, and Bruce Westerhoff

1985 National Register of Historic Places Inventory Nomination Form: Mesilla Plaza. On file with the New Mexico Historic Preservation Division, Santa Fe.

Grimmer, Anne E.

2017 *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings.* US Department of the Interior, National Park Service, Washington.

Hall, Stephen A., Myles R. Miller, and Ronald J. Goble

2010 Geochronology of the Bolson Sand Sheet, New Mexico. *Geological Society of America Bulletin*, November/December 2010:1950-1967.

Hard, Robert J.

1983 A Model for Prehistoric Land Use, Fort Bliss, Texas. *American Society for Conversation Archaeology Proceedings* 1983:41-51.

Hard, Robert J., and D. Nickels

1994 *The 1993 University of Texas at San Antonio Excavations at LA 89652*: *The Tortolita Canyon Site*. Center for Archaeological Research, University of Texas, San Antonio.

Hawley, J.W.

1986 Physiographic Provinces and Landforms. *In New Mexico in Maps*, ed. by Jerry L. Williams, pp. 23-31. University of New Mexico Press, Albuquerque.

Healy, D.L, R.R. Wahl, and F.E. Currey

1978 *Gravity Survey of the Tularosa Valley and Adjacent Areas, New Mexico*. United States Geological Survey Open-file Report 78-309. United States Government Printing Office, Washington D.C.

Heilen, M, L. Sebastian, J. H. Altschul, P. Leckman, and A. Byrd

2012 *Modeling of Archaeological Site Location and Significance at White Sands Missile Range, New Mexico.* Statistical Research Inc., Rio Rancho, New Mexico.

Heller, Charles E.

2010 The US Army, the Civilian Conservations Corps, and Leadership for World War II, 1933-1942. *Armed Forces and Society* 36(3):439-453.

Irwin-Williams, Cynthia, and C. Vance Haynes

1970 Climatic Change and Early Population Dynamics in the Southwestern United States. *Quaternary Research* 1(1):59-71.

Jackson, L., and M. Thompson

2005 Form and Function: A Reassessment of El Paso Polychromes. In *Archaeology Between the Borders: Papers from the 13th Biennial Jornada Mogollon Conference*, edited by M. Thompson, J. Jurgena, and L. Jackson, pp. 1-7. El Paso Museum of Archaeology, El Paso.

Jenks, Jim, Matthew Cuba, and Deborah Dobson-Brown

2015 *National Register Eligibility Recommendations of the Mule Peak Site, Lincoln National Forest, Otero County, New Mexico*, Ama Terra Technical Report No. 104. Ama Terra Environmental, Inc., Las Cruces, New Mexico.

Jenks, Jim, and Matthew Cuba

2015 *National Register Eligibility Evaluation of WC-50, WSMR, Sierra County, New Mexico*, Ama Terra Technical Report No. 103. Ama Terra Environmental, Inc., Las Cruces, New Mexico.

Judge, J. W.

1973 *The Paleoindian Occupation of the Central Rio Grande Valley, New Mexico.* University of New Mexico Press, Albuquerque.

Justice, Noel D.

2002 *Stone Age Spear and Arrow Points of the Southwestern United States*. Indiana University Press, Bloomington, Illinois.

Kammer, David

1994 *The Historic and Architectural Resources of the New Deal in New Mexico.* New Mexico Historic Preservation Division, Santa Fe.

Kennedy, Gregory P.

2009 *The Rockets and Missiles of White Sands Proving Ground 1945-1958.* Schiffer Military History, Atglen, Pennsylvania.

Kidder, Alfred V.

1927 Southwestern Archaeological Conference. *Science* 68:489-91.

Kirkpatrick, David T.

1994 *Hotel Site (George 31) High-Speed Cinetheodolite Station*, Human Systems Research Report 9362. Human Systems Research, Tularosa, New Mexico.

Korfmacher, Kurt, Erica Howard and Deborah Dobson-Brown

2020 *National Register Eligibility Recommendations of Army Navy Cantonment Historic District, Doña Ana County, New Mexico*. Ama Terra Technical Report No. 138. Ama Terra Environmental, Inc., Las Cruces, New Mexico.

Korfmacher, Kurt

2015 *National History of Cinetheodolite and Other Optical Tracking Technology at WSMR, 1945–1965*, Ama Terra Technical Report No. 70. Ama Terra Environmental, Inc., Las Cruces, New Mexico.

Kottlowski, Frank E.

1955 Geology of the San Andres Mountains. In *South-Central New Mexico, New Mexico Geological Society 6th Annual Fall Field Conference Guidebook*, pp 136-145. New Mexico Geological Society, Socorro.

Kurota, Alexander, F. Scott Worman, and Patrick Hogan (editors)

2012 *Hearth Mound Survey and Limited Excavations at White Sands National Monument, Otero and Doña Ana Counties, New Mexico.* Office of Contract Archaeology, University of New Mexico.

Kurota, Alexander (editor)

2015 *Archaeology of White Sands Missile Range: Data Recovery at Eight Sites in the Orogrande Training Area, White Sands Missile Range, Otero County New Mexico.* WSMR Report No. 805, OCA Project No. 185-1067. Prepared by Office of Contract Archaeology – University of New Mexico, Albuquerque.

Land, Lewis

2016 *Overview of Fresh and Brackish Water Quality in New Mexico.* New Mexico Bureau of Geology and Mineral Resource, Open-file Report 583.

Laumbach, Karl W.

1985 An Archaeological Survey of Two Areas Near the HELSTAF Facility, White Sands Missile Range, New Mexico. Human Systems Research Report Number 8502. Tularosa, New Mexico.

Lavin, Mary

1998 *Thematic Study and Guidelines: Identification and Evaluation of the US Army Cold War Era Military-Industrial Historic Properties*. US Army Environmental Center, Aberdeen Proving Ground, Maryland.

Legare, Lora Jackson and David Legare

2010 Pueblo Ceremonialism in the Jornada Mogollon Region. In *The Collected Papers from the 15th Biennial Mogollon Conference*, edited by Lora Jackson Legare, pp. 33-50. El Paso Museum of Archaeology, El Paso.

Lehmer, D. J.

1948 The Jornada Branch of the Mogollon. University of Arizona Social Science Bulletin No. 17, University of Arizona, Tucson.

Lentz, S.C. (Editor)

2006 *High Rolls Cave: Insectos, Burritos, Y Frajos. Archaic Subsistence in Southern New Mexico*. Archaeology Notes 345, Department of Cultural Affairs, Office of Archaeological Studies, Santa Fe.

MacCarter, J. S.

1996 "White Sands Pupfish." In *Wildlife Notes* (revised August 2006).

MacNeish, R. S. (editor)

1993 Preliminary Investigations of the Archaic in the Region of Las Cruces, New Mexico. Edited by R. S. MacNeish. Historic and Natural Resources Report No. 9, Cultural Resources Management Program, DOE, US Army Air Defense Artillery Center, Ft. Bliss, Texas.

MacNeish, Richard S., and Patrick H. Beckett

1987 *The Archaic Chihuahua Tradition of South-Central New Mexico and Chihuahua, Mexico*. COAS Monograph 7. COAS Publishing and Research, Las Cruces.

Mallouf, Robert J.

1985 A Synthesis of Eastern Trans-Pecos Prehistory. MA thesis, Department of Anthropology, University of Texas at Austin.

Marshall, Michael P.

1973 Background Information on the Jornada Culture Area. In *Technical Manual: 1973 Survey of the Tularosa Basin, The Research Design*. Human Systems Research, Inc., Albuquerque.

Mauldin, Raymond

1993 The Relationship between Groundstone and Agricultural Intensification in Western New Mexico. *Kiva* 58(3):317-330.

1994 Small Sites in Western Texas and Southern New Mexico. *Bulletin of the Texas Archaeological Society* 65:185-206.

1995 *Groping for the Past: Investigating Archaeological Patterns Across Time and Space in Southern Southwestern United States*. Unpublished Dissertation, Department of Anthropology, University of New Mexico.

McFie, Maude Elizabeth Bloom

1903 *A History of the Mesilla Valley, 1903*. Independent Publication, Las Cruces.

McNab, W.H., and P.E. Avers

1994 Ecological Subregions of the United States: Section Descriptions. Administrative publication no. WO-WSA-5. US Department of Agriculture, Forest Service, Washington, D.C. 267 pp.

Merlan, Thomas

1997 *The Trinity Experiments,* Human Systems Research. Human Systems Research, Tularosa, New Mexico.

2001 *Life at Trinity Base Camp,* Human Systems Research Report 9831. Human Systems Research, Tularosa, New Mexico.

Meyer, Lisa M., and Peter L. Eidenbach

1996 *Cultural Echoes: Traces of the Human Legacy on Holloman Air Force Base: Results of a Cultural Resources Sample Survey*. Human Systems Research Report Number 9425. Human Systems Research, Tularosa, New Mexico.

Miles, Richard C. (editor)

1961 Initiation of the Jet Propulsion Laboratory. In *Development of the Corporal: The Embryo of the Army Missile Program.* Historical Monograph No. 4, pp. 1-10. Army Missile Command, Hunstville, Alabama.

Miller, Myles R. and Nancy A. Kenmotsu

2004 Prehistory of the Jornada Mogollon and Eastern Trans-Pecos Regions of West Texas. In *The Prehistory of Texas*, edited by Timothy K. Perttula, pp. 205-265.

Miller, Myles R. and Graves, Tim

2019 Chronological Trends among Jornada Projectile Points. In *Recent Research in Jornada Mogollon Archaeology: Proceedings from the 20th Jornada Mogollon Conference,* edited by George O. Maloof. El Paso Museum of Archaeology, El Paso, Texas.

Miller, Myles R.

2005 Revision of the Jornada Mogollon Ceramic Period Sequence and Alignment with the Greater Southwest. In *Archaeology Between the Borders: Papers from the 13th Biennial Jornada Mogollon Conference*, edited by Marc Thompson, Jason Jurgena, and Lora Jackson, pp. 59-88. El Paso Museum of Archaeology, El Paso.

2007 *Excavations at El Arenal and Other Late Archaic and Early Formative Period Sites in the Hueco Mountain Project Area of Fort Bliss, Texas*. Historic and Natural Resources Report Number 02-12, Directorate of Environment, Fort Bliss, Texas.

2018 Archaic Transitions and Transformations in the Jornada Mogollon Region of Southern New Mexico and Western Texas. *In The Archaic Southwest: Foragers in an Arid Land*, edited by Bradley J. Vierra, pp. 119-144.

Monger, Curtis H.

1993 *Soil-Geomorphic and Paleoclimatic Characteristics of the Fort Bliss Maneuver Area, Southern New Mexico and Western Texas.* Historic and Natural Resources Report No. 10. Environmental Management Office, Fort Bliss, Texas.

Moore, James L.

1992 Archaeological Test Excavations and Data Recovery Plan for LA 86774 and LA 86780 at the Santa Teresa Port-of-Entry, Doña Ana County, New Mexico. Office of Archaeological Studies Archaeology Note No. 92, Museum of New Mexico, Santa Fe.

1996 *Archaeological Investigations in the Southern Mesilla Bolson*. Office of Archeological Studies Archaeology Note No. 188, Museum of New Mexico, Santa Fe.

Moyer, Robert C. and Kurt Korfmacher

2016 *National Register Eligibility Evaluation of the RAM and RAMPART Sites White Sands Missile Range, Otero County, New Mexico*, Ama Terra Technical Report No. 173. Ama Terra Environmental, Inc., Las Cruces, New Mexico.

Moyer, Robert C., Kurt Korfmacher and Deborah Dobson-Brown

2017 *National Register Eligibility Evaluation of the C-Station Site White Sands Missile Range, Sierra County, New Mexico*, WSMR Project No. 818. Ama Terra Environmental, Inc., Las Cruces, New Mexico.

Muldavin, E., Y. Chauvin, G. Harper, and P. Neville

2000 The Vegetation of White Sands Missile Range, New Mexico. Vol. 1, Handbook of vegetation communities; Vol. 2, Vegetation map. Final report for Cooperative Agreement no. 14-16-002-91-233, WSMR, USFWS, The Nature Conservancy, and the University of New Mexico. New Mexico Natural Heritage Program, Albuquerque, NM.

Muldavin, E., G. Harper, P. Neville, and Y. Chauvin

2000b The Vegetation of White Sands Missile Range, New Mexico, Volume II: Vegetation Map. Prepared under Cooperative Agreement No. 14-16-002-91-233 White Sands Missile Range, US Fish and Wildlife Service, The Nature Conservancy, and the University of New Mexico. Albuquerque.

Murphy, Molly and Rani T. Alexander

2015 Archaeological Overview and Assessment for White Sands National Monument. White Sands National Monument, New Mexico. Copies available electronically.

Myers, Nate, Brad Beacham, and Phillip Esser

2016a *A National Register Inventory and Evaluation of the Small Missile Range at White Sands Missile Range, Doña Ana County, New Mexico*, Epsilon Systems Report No. 2014-06, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2016b *A National Register Inventory and Evaluation of the Talos Defense Unit at White Sands Missile Range, Otero County, New Mexico*, Epsilon Systems Report No. 2015-03, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2017 *Historic Context for the White Sands Missile Range AN/FPS-16 Radar Facilities, Doña Ana County, New Mexico*, Epsilon Systems Report No. 2015-05, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2018 *A National Register Inventory and Evaluation of Launch Complex 32 at White Sands Missile Range Doña Ana County, New Mexico*, Epsilon Systems Report No. 2015-08, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

Myers, Nate and Phillip Esser

2017a *NHPA Section 106 Recommendations for the Proposed Navy Advanced Gunfire Project, Launch Complex 35, White Sands Missile Range*, Epsilon Systems Report No. 2017-01, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2017b *A National Register Inventory and Evaluation of Launch Complex 50 at White Sands Missile Range, Otero County, New Mexico,* Epsilon Systems Report No. 2017-05, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2019 *A National Register Inventory and Evaluation of the Meteor Trail Radar Site at White Sands Missile Range, Doña Ana County, New Mexico*, Epsilon Systems Report No. 2019-02, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2020a *A National Register Inventory and Evaluation of Launch Complex 33 at White Sands Missile Range, Doña Ana and Otero Counties, New Mexico*, Epsilon Systems Report No. 2018-01, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2020b *A National Register Inventory and Evaluation of the 300,000 Pound Static Test Stand at White Sands Missile Range, Doña Ana County, New Mexico*, Epsilon Systems Report No. 2018-03, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2020c *A National Register Inventory and Evaluation of the Army Missile Assembly Area*, Epsilon Systems Report No. 2020-02, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2020d *A National Register Inventory and Evaluation of the Special Weapons Assembly Facility* (SWAF) *Number 4*, Epsilon Systems Report No. 2020-03, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

2020e *A Historic Context for Missile Assembly Buildings at White Sands Missile Range, Doña Ana County, New Mexico*, Epsilon Systems Report No. 2020-01, Epsilon Systems Solutions, Inc., Las Cruces, New Mexico.

Natural Resource Conservation Service (NRCS)

2017 *Supplement to the Soil Survey of White Sands Missile Range New Mexico.* Accessible online at: http://soils.usda.gove/survey/printed_surveys/

2020 Web Soil Survey, electronic document. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx, accessed April 2, 2019.

National Park Service (NPS)

1995 *How to Apply the National Register Criteria for Evaluation*. NPS Bulletin #15, National Park Service, US Department of the Interior, Washington D.C.

2012 *White Sands National Monument: Geological Resources Inventory Report*. National Park Service, Geological Resources Division, Denver, CO.

2020 *Archaeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines.* Electronic document, https://www.doi.gov/pam/asset-management/historic-preservation/PQS, accessed October 14, 2924.

Neal, James T., Robert E. Smith, and Blair F. Jones

1983 Pleistocene Lake Trinity, an Evaporate Basin in the Northern Jornada del Muerto, New Mexico. In *New Mexico Geological Society Guidebook, 34th Field Conference, Socorro Region II*, pp 285-290. Edited by Charles E. Chapin and Jonathan F. Callender.

O'Laughlin, T. C

1980 *The Keystone Dam Site and Other Archaic and Formative Sites in Northwest El Paso, Texas.* Publications in Anthropology No. 8, El Paso Centennial Museum, University of Texas at El Paso.

O'Laughlin, T. C. and Martin, D.L

1992 Archaeological Testing of Three Sites Below the Rimrock of Diablo Plateau, Hudspeth County, Texas. *The Artifact* 30(1):1-81. El Paso Archaeological Society, Inc., El Paso.

Owen, Gordon R.

1999 The Mesilla Valley's Pioneer Settlements. *Southern New Mexico Historical Review* 6(1):6-11.

2005 *Las Cruces New Mexico: Multicultural Crossroads.* 2nd ed. Cultural Society of the Mesilla Valley, Las Cruces.

Paige, John C.

1985 *The Civilian Conservation Corps and the National Park Service, 1933-1942: An Administrative History*. National Park Service, US Department of the Interior, Washington D.C.

Parker, Patricia and King, Thomas

1992 *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. National Register Bulletin 38, U.S Department of the Interior, National Park Service.

Pertulla, T.K, M.R. Miller, R.A. Ricklis, D.J. Prikryl, and C. Lintz

1995 Prehistoric and Historic Aboriginal Ceramics in Texas. *Bulletin of the Texas Archaeological Society* 66:175-238.

Porter, Douglas, Angelyn Bass, and Keri Stevenson

2014 *Conditions Assessment and Treatment Recommendations, Historic Ranch Houses, White Sands Missile Range*, Prepared for the US Army by the School of Engineering, University of Vermont. WSMR Report No. 771, September.

Rachal, David, Robert Dello-Russo, and Alexander Kurota

2020 *Shoreline Soil Stratigraphy, Landscape Evolution, and Application to Archaeological Studies, White Sands National Monument, New Mexico.* Report submitted to Office of Contract Archaeology – University of New Mexico (OCAUNM).

Rachal, David M.

2019 *Geomorphological Investigation of Nine Archaeological Sites in the Otero Maneuver Area, White Sands Missile Range, Otero County, New Mexico.* Tierra Vieja Consulting, LLC. Prepared for AmaTerra Environmental, Inc., Austin.

Railey, Jim A. and Richard D. Holmes

2002 Cultural and Social-Evolutionary History. In *Across the Desert Floor: Cultural Resource Investigations Along US 54, Otero County, New Mexico,* edited by Jim A. Railey, pp. 17-76. Mex Mexico State Highway and Transportation Department Technical Report 2002-1.

Ream, Randy

2024 A New Start? Understanding the Latest NAPRA Regulations. Electronic document, https://savehistory.org/a-new-start-understanding-the-latest-nagpra-regulations-full-text/, accessed October 10, 2024.

Reed, Mary Beth and Robert Jones

2012 *Historic Architecture Survey and National Register of Historic Places Evaluation of the NASA White Sands Space Harbor on the US Army White Sands Missile Range Doña Ana County, New Mexico,* New South Associates Technical Report #208.

Richardson, Elmo R.

1966 The Civilian Conservation Corps and the Origins of the New Mexico State Park System. *Natural Resources Journal* 6(2):248-267.

Rieder, Morgan and Michael Lawson

1995 *Trinity at 50: 1945-1995,* Human Systems Research Report 9439. Human Systems Research, Tularosa, New Mexico.

Ritter, C.W. and Craig Holden

2014 *Mesilla Comes Alive: A History of Mesilla and Its Valley*. Ritter Publications, Las Cruces.

Rogowski, D.L., and C.A. Stockwell

2005 Parasites and salinity: costly tradeoffs in a threatened species. Oecologia, DOI 10.1007/s00442-005-0218-x.

Russell, William

1997-2001 *Ranches and Mines of White Sands Missile Range, New Mexico Volume 1-5,* Prepared for White Sands Missile Range by Human Systems Research, Tularosa, New Mexico.

Sale, Mark and Silberberg, Amy

2009 *Quail Run: Archaeological Data Recovery Excavations at LA 51225, White Sands Missile Range Headquarters, New Mexico.* WSMR Report No. 554, Ecological Communications Corporation Report No. 070-007. Prepared by Ecological Communications Corporation, Austin.

Sale, Mark, Amy B. Silberberg, and Matthew T. Cuba

2011 *Lizard Village Data Recovery Excavations at LA 32078, White Sands Missile Range, Doña Ana County, New Mexico.* WSMR Report No. 595, Zia Report No. Zia WSMR-04-2010. Prepared by Zia Engineering and Environmental Consultants, LLC, Las Cruces

Sale, Mark, Moira Ernst, Amy Silberberg, and Maria Hroncich-Conner

2014 *Archaeological Survey of 2,700 Acres Near the Rhodes Canyon Range Center, White Sands Missile Range, New Mexico.* WSMR Report No. 721, AmaTerra Environmental, Inc. Report No. 240-01-T2. AmaTerra Environmental, Inc. Austin, Texas.

Sale, Mark, Amy Silberberg, and Moira Ernst

2015 *Cracks and Crevices: Archaeological Survey of 1,600 Acres Near Oscura Range Center, White Sands Missile Range, New Mexico.* WSMR Project No. 722, AmaTerra Report No. 240-01-T1. Prepared by AmaTerra Environmental, Inc., Austin.

Salmon, John S.

2011 *Protecting America: Cold War Defensive Sites, a National Historic Landmark Theme Study*. The National Historic Landmarks Program, National Park Service, Washington DC.

Sayles, E. B., and E. Antevs

1941 The Cochise Culture. Medallion Papers 29. Gila Pueblo, Globe, Arizona.

Seaman, T.J., W. H. Doleman, and R.C. Chapman

1988 *Towards and Archaeology of Landscapes: The BorderStar 85 Project.* Office of Contract Archaeology, University of New Mexico, Albuquerque.

Seager, William R.

1981 *Geology of Organ Mountains and southern San Andres Mountains, New Mexico*. New Mexico Bureau of Mines and Mineral Resources, Memoir 36. Socorro, New Mexico.

Silberberg, Amy and Swain, Robert

2009 *NRHP Evaluations of 703 Archaeological Site Locations at White Sands Missile Range, New Mexico*. WSMR Project No. 549, ECOMM Report No. 070-006. Prepared by Ecological Communications Corporation, Austin.

Silberberg, Amy, Mark Sale, Moira Ernst, and Roger Klein

2019 *NRHP Evaluations at 11 Archaeological Sites in the Otero Maneuver Area, White Sands Missile Range, New Mexico.* WSMR Project No. 932, AmaTerra Report No. 217. Prepared by AmaTerra Environmental, Inc., Austin.

Simmons, Marc

1977 *New Mexico: A History*. W.W. Norton and Company, New York.

Slater, Mary

1997 *Housing the Bomb: Architectural Maintenance Plan for Ranches Associated with the Trinity Test Site*. Human Systems Research, Las Cruces.

Society for American Archaeology (SAA)

2024 Implementation of Revised NAGPRA Regulations Fact Sheet. Electronic document, https://documents.saa.org/container/docs/default-source/catf/final_nagpra_rule_fact_sheet_revised-(1).pdf?sfvrsn=8293d816_3, accessed October 10, 2024.

Sonnichsen, C.L.

1960 *Tularosa: Last of the Frontier West.* University of New Mexico Press, Albuquerque.

Stuart, D. E., and R. P. Gauthier

1981 *Prehistoric New Mexico: Background for Survey*. University of New Mexico, Albuquerque.

Tagg, Martyn D.

1996 Early Cultigens from Fresnal Shelter, Southeastern New Mexico. *American Antiquity* 61:311- 324.

Tainter, J.A.

1981 *Perspectives on the Abandonment of the Northern Tularosa Basin.* Paper presented at the Second Jornada Conference, Portales, NM.

1985 *Perspectives on the Abandonment of the Northern Tularosa Basin.* In *Views of the Jornada Mogollon*, edited by C.M. Beck, 143-147. Contributions in Anthropology, No. 12, Eastern New Mexico University, Portales, NM.

Taylor-Montoya, John, Neal Ackerly, Paul Demers, and Trisha Rude

2018 *Cultural Resources Inventory of 21,981 Total Acres of Parcels in the Mid and South Range Areas of White Sands Missile Range.* WSMR Project Numbers 660 and 832. Prepared by R. Christopher Goodwin & Associates, Inc., Las Cruces.

Taylor-Montoya, John and Rude, Trisha

2019 *Cultural Resources Inventory of 14,751 Total Acres of Parcels in the North Range Area of White Sands Missile Range.* WSMR Project No. 775. Prepared by R. Christopher Goodwin & Associates, Inc., Las Cruces.

Trieweiler, W. Nicholas, Robert Swain, and Beth Morgan

2004 *An Assessment of Historic Ranching Sites at White Sands Missile Range, New Mexico,* Ecological Communications Corporation Report No. 485, Ecological Communications Corporation, Austin, Texas.

Trieweiler, W. Nicholas, Beth Morgan, Robert Swain, and Richard Jones

2005 *An Assessment of 14 Historic Sites at White Sands Missile Range, New Mexico,* Ecological Communications Corporation Report No. 485, Ecological Communications Corporation, Austin, Texas.

Trierweiler, Nicholas, Robert Swain, and Richard S. Jones

2007 *NRHP Evaluations of Prehistoric Archaeological Sites in the Vicinity of the Old GB-FEL-TIE Facility at White Sands Missile Range, New Mexico.* WSMR Project No. 531, ECOMM Report No. 070-003. Prepared by Ecological Communications Corporation, Austin.

Trierweiler, Nicholas W., Robert Swain, and Richard S. Jones

2008 *NRHP Evaluations of 200 Prehistoric Archaeological Sites in the Vicinity of Orogrande Range Camp at White Sands Missile Range, New Mexico.* WSMR Project No. 538, ECOMM Report No. 070-005. Prepared by Ecological Communications Corporation, Austin.

Trierwieler, W. Nicholas and Swain, Robert S.

2009 *Archaeological Inventory of 15,775 Acres at White Sands Missile Range, New Mexico.* Prepared by Ecological Communications Corporation, Austin, Texas. Report on File at White Sands Missile Range, White Sands, New Mexico.

US Army Engineer Research and Development Center

2004 "Ecological Importance of Waters of the United States and Associated Wetlands to Wildlife at the US Army White Sands Missile Range New Mexico." Mississippi.

US Department of Agriculture (USDA) – Soil Conservation Service

1976 *Soil Survey of White Sands Missile Range, New Mexico: Parts of Otero, Lincoln, Dona Ana, Sierra, and Socorro Counties.* Government Printing Office, Washington, D.C.

US Fish and Wildlife Service

2020 Information, Planning, and Conservation System (IPac). https://www.fws.gov/southwest/es/NewMexico/IPAC.cfm.

US Forest Service (USFS)

2020 The Civilian Conservation Corps and the Lincoln, electronic document assessed June 24, 2020. https://www.fs.usda.gov/detail/lincoln/home/?cid=STELPRDB5297139

US Army White Sands Missile Range, Directorate of Public Works, Environmental Division

2015 *Facility #23240/N-78, the US Navy Block House Adaptive Reuse Project, White Sands Missile Range, New Mexico*, Submitted to the New Mexico State Historic Preservation Office, April.

Upham, Steadman

1984 Adaptive Diversity and Southwestern Abandonment. *Journal of Anthropological Research* 40:235-256.

1988 Archaeological Visibility and the Underclass of Southwestern Prehistory. *American Antiquity* 53:245-261.

Upham, S., R. S. MacNeish, W. C. Galinat, and C. M. Stevenson

1987 Evidence Concerning the Origin of Maize de Ocho. *American Anthropologist* 89 (2):410-419.

Upham, S., and MacNeish, R.S.

1993 The Evolution of Maize in the Jornada Region of New Mexico and its Implications for the Southwest. In *Preliminary Investigations of the Archaic in the Region of Las Cruces, New Mexico*, edited by R.S. MacNeish, pp. 101-116. Historic and Natural Resources Report No. 9, Cultural Resources Management Program, Directorate of Environment, United States Army Air Defense Artillery Center, Fort Bliss, Texas.

Velasco-Marquez, Jesus

2015 A Mexican Viewpoint on the War the United States. Electronic document, http://www.pbs.org/kera/usmexicanwar/prelude/md_a_mexican_viewpoint.html, accessed April 4, 2015.

Wallace, Laurel

2004 *Historic Highways in the NMDOT System*. New Mexico Department of Transportation Technical Series 2004-1, Santa Fe.

Ward, Christine G. and Vierra, Bradley J. (editors)

2010 *Archaeological Mitigation at LA 147117, a Prehistoric Site on the Lower Alluvial Fans* of the Organ Mountains, White Sands Missile Range, Doña Ana County, New Mexico. WSMR Report No. 589, SRI Report No. 10-59. Prepared by Statistical Research, Inc., El Paso.

Weber, R.H. and G.A. Agogino

1997 The Mockingbird Gap Paleoindian Site: Excavations in 1967. In *Annual Papers of Archaeological Society of New* Mexico 1997: 123-127.

Whalen, Michael E.

1978 Settlement Patterns of the Eastern Hueco Bolson. Centennial Museum Publications in Anthropology No. 4. The University of Texas at El Paso, El Paso.

1980 *Special Studies in the Archaeology of the Hueco Bolson.* Publications in Anthropology No. 9, El Paso Centennial Museum, the University of Texas at El Paso, El Paso.

1986 Small-Site Analysis in the Hueco Bolson of Western Texas. *Journal of Field Archaeology* 13:69-81.

1994 Moving Out of the Archaic on the Edge of the Southwest. *American Antiquity* 59(4):662-638.

White Sands Missile Range (WSMR)

2005 Integrated Cultural Resources Management Plan, 2004-2009. Environmental Stewardship Branch, Directorate of Public Works, WSMR, NM.

2007a Mammal checklist of White Sands Missile Range. September 2007. Directorate of Environment and Safety, WSMR, NM.

2007b Bird checklist of White Sands Missile Range New Mexico. Updated September 2007. Environmental Stewardship Branch, Directorate of Public Works, WSMR, NM.

2007c "Assessing Native Bee Biodiversity on White Sands Missile Range, New Mexico, Final Report." Environmental Stewardship Branch, Directorate of Public Works, WSMR, NM.

2009 Final Environmental Impact Statement (EIS) for Development and Implementation of Range-wide Mission and Major Capabilities at White Sands Missile Range, New Mexico. Vol. 1 and 2. WSMR, NM.

2010 Final White Sands Missile Range Land Use and Airspace Strategy Plan, WSMR NM.

2015 Integrated Natural and Cultural Resources Management Plan and Environmental Assessment 2015-2019. Environmental Stewardship Branch, Directorate of Public Works, WSMR, NM.

2023 White Sands Missile Range Integrated Natural Resources Management Plan 2023-2027. Directorate of Public Works Environmental Division, WSMR, NM.

Wheat, J. B.

1972 The Olsen-Chubbock Site: A Paleoindian Bison Kill. Society for American Archeology Memoir 26:1-179.

Wheaton, G. and L.S. Reed

2009 Possible Manso Occupation at Site LA 129533 Near El Paso, Texas. *Kiva: The Journal of Southwestern Anthropology and History*, Vol. 74, No. 3 (Spring 2009), pp. 337-351

Wills, W.H.

1988 *Early Prehistoric Agriculture in the American Southwest.* School of American Research Press, Santa Fe.

Wilson, C., S. Hordes, and H. Walt

1989 The South Central New Mexico Regional Overview: History, Historic Archaeology, Architecture, and Historic Preservation. Historic Preservation Division, Office of Cultural Affairs, Santa Fe.

EPSILON™ SYSTEMS