# BARRY M. GOLDWATER RANGE

## Integrated Cultural Resources Management Plan

### Part I: Background and Rangewide Management Issues

### Part II: Cultural Resource Management on the BMGR East

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# Part I

# Background and Rangewide Management Issues

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# ACKNOWLEDGEMENTS

Compiling a science-based, mission-oriented plan for the management of cultural resources on a 1.7 million acre range is an almost overwhelming task, especially when combined with the management of numerous contracts, programming and executing an extensive but methodical research program, and consulting with numerous agencies, tribes, and interested parties.

Beginning in 1996, a large number of projects were injected into a rapidly growing program in support of the Legislative Environmental Impact Statement which accompanied the request for the renewal of military use of the Barry M. Goldwater Range (BMGR). The Military Lands Withdrawal Act of 1999 renewed the Department of Defense's use of these withdrawn lands and inserted several new requirements, among them preparing a plan for managing the sensitive natural and cultural resources of the range. As planning for natural resource management proceeded, and during the process of preparing an Environmental Impact Statement for the Integrated Natural Resource Management Plan, the organization of the cultural resource management plan evolved and new emphasis was placed upon it.

A team of Air Force cultural resource professionals met at Luke AFB in February of 2002 to revise and restructure the existing draft Integrated Cultural Resources Management Plan for BMGR. The team included Adrianne Rankin, 56th Range Management Office (56 RMO) Staff Archaeologist and Carol Heathington, 56 RMO Historic Preservation Officer and Cultural Resource Manager; Jack Siegel and Deborah Tharp represented Air Education and Training Command. Additional expertise was provided by James Wilde, Senior Archeologist, Air Force Center for Environmental Excellence (AFCEE), and Newell Wright, formerly Cultural Resources Manager at Eglin AFB. Keith Myhrer, Nellis AFB Cultural Resources Manager, shared the template for the Nellis plan. Adrianne Rankin, Carol Heathington, and Deborah Tharp met again in April of 2002, and with key assistance from Julia Cantrell, AFCEE Cultural Resources Manager, edited and expanded the product of the first team meeting. Jan Lawson joined the staff of the Range Management Department, Marine Corps Air Station Yuma, in 2003 and has reviewed and contributed to this draft.

Much of Part I is based on the work of professional archaeological contractors, including Dames & Moore (now URS), SWCA Environmental Consultants, and Statistical Research, Inc., that have systematically surveyed large areas on BMGR under contract to the Air Force. The resulting reports represent a substantial contribution to our understanding of regional archaeology.

Without the dedicated efforts of all of these professionals, this plan would not have become a reality.

## Acronyms and Abbreviations

| | | |
|---|---|---|
| ACC | – | Air Combat Command |
| ACHP | – | Advisory Council on Historic Preservation |
| ACMI | – | Air Combat Maneuvering Instrumentation |
| AETC | – | Air Education and Training Command |
| AFAF | – | Air Force Auxiliary Field |
| AFCEE | – | Air Force Center for Environmental Excellence |
| AFI | – | Air Force Instruction |
| AFRES | – | Air Force Reserve |
| AGL | – | Above Ground Level |
| AIRFA | – | American Indian Religious Freedom Act |
| ANG | – | Air National Guard |
| APE | – | Area of Potential Effect |
| ARNG | – | Army National Guard |
| ARPA | – | Archeological Resources Protection Act |
| BLM | – | Bureau of Land Management |
| BMGR | – | Barry M. Goldwater Range |
| BO | – | Biological Opinion |
| CAF | – | Combat Air Forces |
| CES | – | Civil Engineering Squadron |
| CEV | – | Environmental Flight (of Civil Engineering) |
| CFR | – | Code of Federal Regulations |
| CPNWR | – | Cabeza Prieta National Wildlife Refuge |
| CRM | – | Cultural Resources Manager |
| CSAR | – | Combat Search and Rescue |
| DHS | – | Department of Homeland Security |
| DOD | – | Department of Defense |
| DOI | – | Department of Interior |
| EA | – | Environmental Assessment |
| EIAP | – | Environmental Impact Analysis Process |
| EIS | – | Environmental Impact Statement |
| EO | – | Executive Order |
| EOD | – | Explosive Ordnance Disposal |
| EPA | – | Environmental Protection Agency |
| ERP | – | Environmental Restoration Program |
| ESM | – | Environmental Science Management |
| ETAC | – | East Tactical Range |
| FAA | – | Federal Aviation Administration |
| FOIA | – | Freedom of Information Act |
| FPO | – | Federal Preservation Officer |
| FR | – | Federal Register |
| FY | – | Fiscal Year |
| GIS | – | Geographical Information Systems |
| GPS | – | Geo-stationary Positioning System |

HABS – Historic American Building Survey
HAER – Historic Architectural Engineering Record
HE – High Explosive
ICRMP – Integrated Cultural Resources Management Plan
INRMP – Integrated Natural Resources Management Plan
IO – Isolated Occurrence
MAJCOM – Major Command
MAP – Management Action Plan
MCAS – Marine Corps Air Station
MCO – Marine Corps Order
MLWA – Military Lands Withdrawal Act
MOA – Military Operating Area
MOA – Memorandum of Agreement
MOU – Memorandum of Understanding
MSP – Mission Support Plan
MTR – Military Training Route
NAGPRA – Native American Graves Protection and Repatriation Act
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NRHP – National Register of Historic Places
NTAC – North Tactical Range
OPCNM – Organ Pipe Cactus National Monument
PA – Programmatic Agreement
RMD – Range Management Department
RMO – Range Management Office
ROCC – Range Operations Control Center
SDNM – Sonoran Desert National Monument
SF – Security Forces
SHPO – State Historic Preservation Officer
STAC – South Tactical Range
TAC – Tactical
TCP – Traditional Cultural Place/Property
THPO – Tribal Historic Preservation Office/r
USBP – United States Border Patrol
U.S. – United States
U.S.C. – United States Code
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
USMC – United States Marine Corps
USN – United States Navy
UXO – Unexploded Ordnance

# INTRODUCTION

The Barry M. Goldwater Range (BMGR) encompasses almost two million acres of largely undisturbed desert, including a well-preserved record of human habitation and use. More significant for interpreting this record than any of its individual parts is that this landscape still includes evidence of the broad range of activities that took place here through time. Use of these lands for military training, and thus exclusion of other uses that produce significant and extensive ground disturbance, has inadvertently preserved intact a more complete "set" of sites than is generally available. Because of the size of the area and the number and significance of the resources present, management and long-term care of those resources is both a rare opportunity and a tremendous responsibility.

The principle goal of this Integrated Cultural Resource Management Plan (ICRMP) is to support the military mission on the BMGR by sustaining the withdrawal of public lands for that purpose through proactive cultural resource management. The management of cultural resources must directly support the military mission, for example, by ensuring that specific military activities on the range are conducted in compliance with Section 106 of the National Historic Preservation Act (NHPA; 16 U.S.C. 470 *et seq*.). Other activities that provide protection for cultural resources on the BMGR indirectly support the military mission by preventing or minimizing conflicts between military operations and resource protection goals.

This plan relies on and reflects several important principles:

- Cultural resources are nonrenewable resources.
- Cultural resource stewardship is a key component of strategic planning and land-use management.
- Investigation or documentation of cultural resources is only partial mitigation for their loss and archaeological excavation in itself constitutes an adverse effect.
- Consideration of cultural resources should begin at the earliest stage of project planning and design.
- Consultation with tribes must recognize the government-to-government relationship between federal agencies and federally recognized Indian tribes and be conducted in a culturally sensitive manner, in accordance with the Department of Defense (DOD) American Indian and Alaska Native Policy.

This document is an integral part of the Integrated Natural Resources Management Plan (INRMP) required by Congress in the Military Lands Withdrawal Act of 1999 (MLWA; Public Law [P.L.] 106-65). The basic components of cultural resource management on the BMGR are presented in Part I. Specific management plans for the BMGR East and the BMGR West comprise Parts II and III of the ICRMP. These subdivisions reflect the Congressionally mandated management authority of the Secretaries of the Air Force and Navy over the eastern and western portions of the BMGR, respectively, their specific regulatory requirements, and the differences in military activities and cultural and natural resources of the BMGR East and BMGR West.

Part I includes eight sections. Section 1 is a description and history of the BMGR. Section 2 establishes a regional framework for the ICRMP and INRMP for the BMGR, and in that context, the integration of this ICRMP and the INRMP are discussed. Section 3 outlines the legal drivers for cultural resource management on DoD lands in general, and the BMGR in particular. In Section 4, the environment is described and its importance in identifying, evaluating, and managing cultural resources is presented. Section 5 is an overview of cultural resources on the BMGR. Section 6 provides a detailed discussion of the National Register of Historic Places and the process of evaluating historic significance. Native American issues, including the history of consultation, traditional cultural places, and concerns expressed by representatives of tribes that claim affinity with places on the BMGR are summarized in Section 7. Section 8 describes several challenges facing the cultural resource program and summarizes the overall goals and objectives of this plan.

**Section 1**

# THE BARRY M. GOLDWATER RANGE

The Barry M. Goldwater Range (BMGR; Figure I-1) is the nation's second largest tactical aviation training range and is essential for developing and maintaining the combat readiness of the tactical air forces of the United States Air Force, Marine Corps, Navy, and Army. Since the beginning of World War II, the BMGR has contributed to the nation's defense by effectively accommodating the training requirements of changing air combat capabilities and missions. The two principal agencies that operate and use the range for combat aircrew training are the Air Force and the Marine Corps. The range is also used by the Navy, Air Force Reserve (AFRES), Air National Guard (ANG), Army National Guard (ARNG), and aircrews of allied nations.

Under the Military Lands Withdrawal Act of 1999 (MLWA), Congress reauthorized the withdrawal of over 1,650,000 acres of public land for military use. In addition to these withdrawn lands, inholdings of formerly private and State Trust Lands totaling almost 84,000 acres purchased between 1986 and 1998 are held in fee simple by the Air Force. MLWA assigned jurisdiction over the BMGR East and BMGR West to the Secretaries of the Air Force and Navy, respectively. BMGR East includes approximately 1,050,000 acres; BMGR West encompasses approximately 691,760 acres. The 56th Range Management Office (56 RMO) at Luke Air Force Base (AFB) administers the land and airspace of the BMGR East. The Range Management Department (RMD), Marine Corps Air Station (MCAS) Yuma, controls the BMGR West. A five-mile-wide air and ground buffer zone along the Mohawk and Sierra Pinta mountains separates the two segments (Figure I-1).

## 1.1 HISTORY OF THE BMGR

World War II stimulated the development of what today is the BMGR, and altered the historic patterns of land use in the region. The range was initially established in the fall of 1941 to support the Army Air Forces flying training programs at Luke Field (Luke AFB after 1950) and Williams Field (Williams AFB after 1947). The first parcel of land selected for the range had three key characteristics critical to its intended mission. First, the new range was in close flying proximity to Luke and Williams fields (straight line flying distances of about 52 and 69 miles, respectively). Second, except for some scattered ranches and mines, the land was uninhabited and undeveloped. Third, at 1,684 square miles (1,077,500 acres), the initial range tract was large enough to be subdivided into several separate training areas that could safely support several simultaneous but independent training missions, which added significantly to the productivity of the overall training program.

Although the initial range was expansive, land continued to be added to provide training capacity to produce qualified aircrews for the Nation's war effort. The complex expanded to a total of 4,339 square miles (2,776,968 acres) during the World War II era. In November 1942 and March 1943 lands were added to the western part of the range to support flight training programs

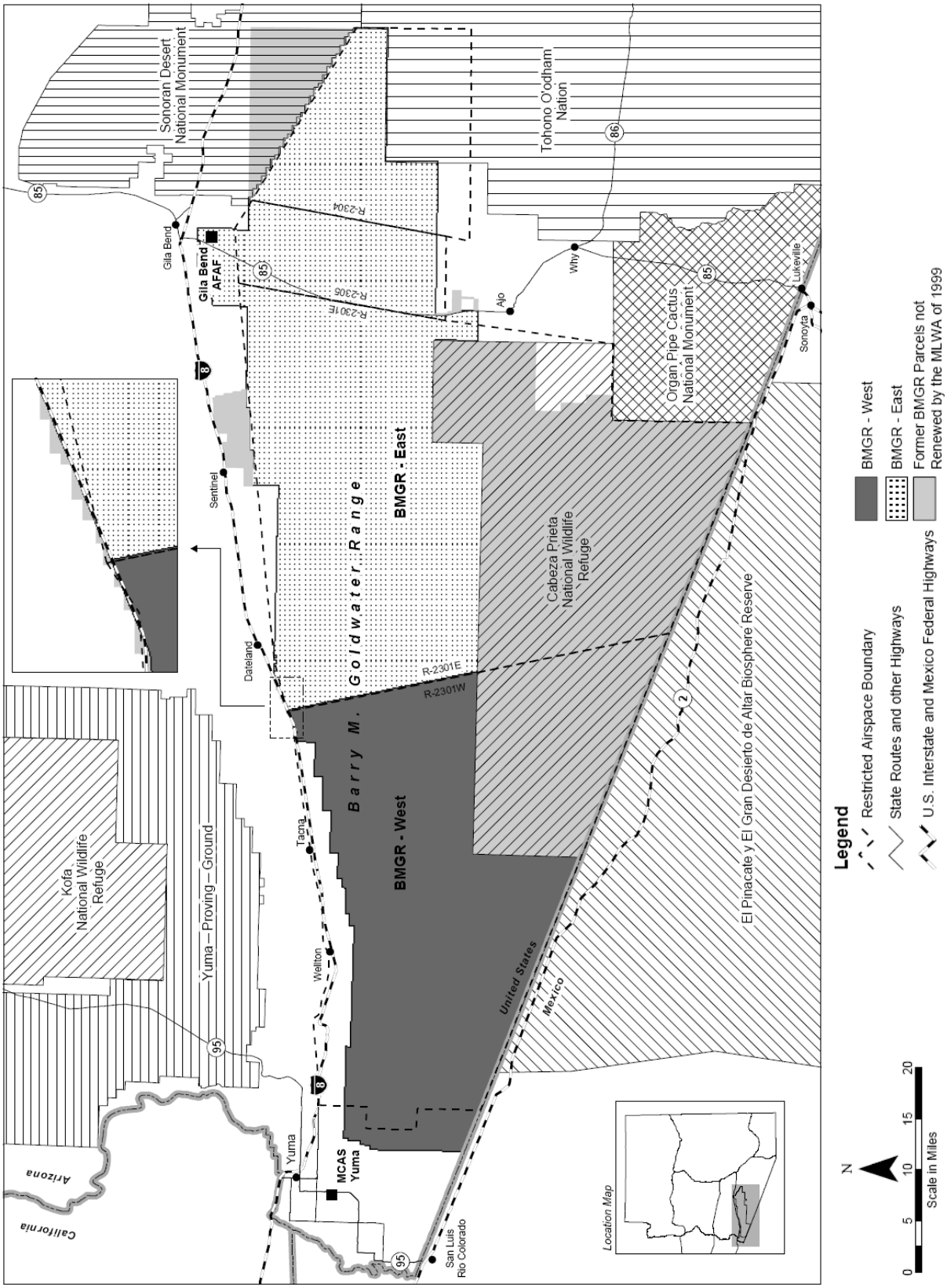



Figure I-1. The Barry M. Goldwater Range as renewed by the Military Lands Withdrawal Act of 1999.

at Yuma Army Air Base, which opened for operations on 29 June 1942 as a training command separate from those at Luke and Williams fields. By the end of 1942, the eastern and western range components were known as the "Gila Bend Gunnery Range" and "Yuma Aerial Gunnery and Bombing Range," respectively, and this east-west split of range resources continues today. The BMGR has had a number of official and unofficial names, including: *Ajo-Gila Bend Aerial Gunnery Range*; *Williams Bombing and Gunnery Range*; *Luke-Williams Bombing and Gunnery Range*; and, from 1963 to 1986, *Luke Air Force Range*. It was officially renamed the Barry M. Goldwater Air Force Range with the passage of the MLWA of 1986. Barry M. Goldwater Range East and Barry M. Goldwater Range West became the designated names of the segments managed by the Air Force and Marine Corps, respectively, in 1999.

## 1.2 THE MILITARY MISSION ON THE BMGR

The predominant use of the BMGR throughout its history has been to provide land and airspace for air combat training. The MLWA of 1999 continues the historic military purposes of the range, reserving the BMGR for use by the Secretaries of the Air Force and Navy for use as: (1) an armament and high-hazard testing area; (2) training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and (3) other defense-related purposes.

For the Air Force, Marine Corps, and other users, the BMGR is an essential component of their ability to produce the combat-ready aircrews needed to defend the nation and its interests. The BMGR has been one of the nation's most productive military reservations for training tactical aircrews since World War II and has the capacity and military air-base support that provide the flexibility needed to sustain a major share of the country's aircrew training requirements now and for the foreseeable future. The value of the BMGR for supporting high-quality aircrew training stems from a combination of the following attributes:

- Restricted land and airspace allows military activities that may be hazardous to either non-participating air traffic or ground surface users to occur safely and without interruption.
- The extensive land and airspace size has allowed the range to be partitioned into up to 13 subranges to support multiple independent training activities simultaneously or used to support large-scale range-wide exercises.
- Ten nearby supporting air bases provide the technical, academic, materiel, command and control, maintenance, personnel, and community support needed to keep aircraft and aircrews flying.
- Electronic training instrumentation on the range can be used to observe, measure, record, and replay the simultaneous actions of multiple aircraft participating in training activities and can simulate aircraft weapons use as well as enemy missile threats.
- Nearby supporting military airspace provides airborne staging areas for BMGR training activities and relieves BMGR airspace of the need to support lower priority training operations.
- Year-round flying weather allows most training activities to be efficiently performed as planned without weather delays.
- Varied natural terrain adds realism to target simulations and the flight training experience.
- Gila Bend Air Force Auxiliary Field (AFAF) provides emergency divert support for aircraft on range as well as added training capability, and also serves as a hub for on-range support operations.

Although the lands and airspace of the BMGR have been used periodically for testing and other defense-related purposes, these activities have been secondary to the training of combat-ready aircrews since its inception. The primacy of the aircrew training mission at the BMGR is expected to continue into the foreseeable future.

The current primary mission of BMGR East is to support the training of Air Force, AFRES, ANG, and ARNG student aircrews transitioning to frontline combat aircraft; it also supports readiness training by aircrews from operational units. The current primary mission of BMGR West is to support readiness training by Marine Corps and Navy aircrews from operational units.

A critical seasonal user is the "Operation Snowbird" training program hosted by Davis-Monthan AFB, which involves 14 to 17 AFRES, ANG, and other units and up to 200 aircraft per year. Operation Snowbird allows units stationed in locations with seasonally severe weather to deploy for one or more weeks for fair-weather training on the BMGR; although many of these units are from areas with severe winter weather, Operation Snowbird is busy year-round. No other range has both the needed air base and range capabilities and range time capacity to accommodate the Snowbird program; without it, these units would experience decreased combat readiness.

In addition to these regular users, the range also is used to support training by "casual users" from outside the local flying area. These important casual-user training deployments originate from active duty, reserve, and guard flying units from other areas of the country and from U.S. and allied units from overseas. MCAS Yuma is the most active deployment site for Marine aviation units from both the east and west coasts, hosting between 50 and 70 unit deployments involving up to 700 aircraft per year. The air station hosts Navy fliers as well.

The BMGR East and BMGR West currently support a wide variety of tactical aviation training activities as well as selected ground training and training support operations, and both are partitioned into a number of smaller subranges or operations areas in order to safely support multiple, simultaneous training or other operations. The BMGR also supports critical pre-deployment exercises for units headed for overseas assignments.

The use and operation of BMGR East is controlled by Air Force Instruction (AFI) 13-212, *Range Planning and Operations*, 16 November 2007, and AFI 13-212, Luke AFB Supplement 1. In accordance with this AFI, the BMGR East land area is currently subdivided into nine aviation subranges and numerous supporting facilities (see Figure I-2).

The use and operation of BMGR West is controlled by MCAS Yuma Station Order 3710.6H. The BMGR West land area is currently partitioned into four aviation subranges, 35 existing and four approved but undeveloped ground support areas, and other facilities (Figure I-3).

### 1.2.1 BMGR East

The BMGR East is divided into a number of manned and tactical ranges capable of supporting multiple, simultaneous training events. Gila Bend Air Force Auxiliary Field (AFAF), located in the northernmost extension of the range, provides key support for range operations. These and other facilities are described below.

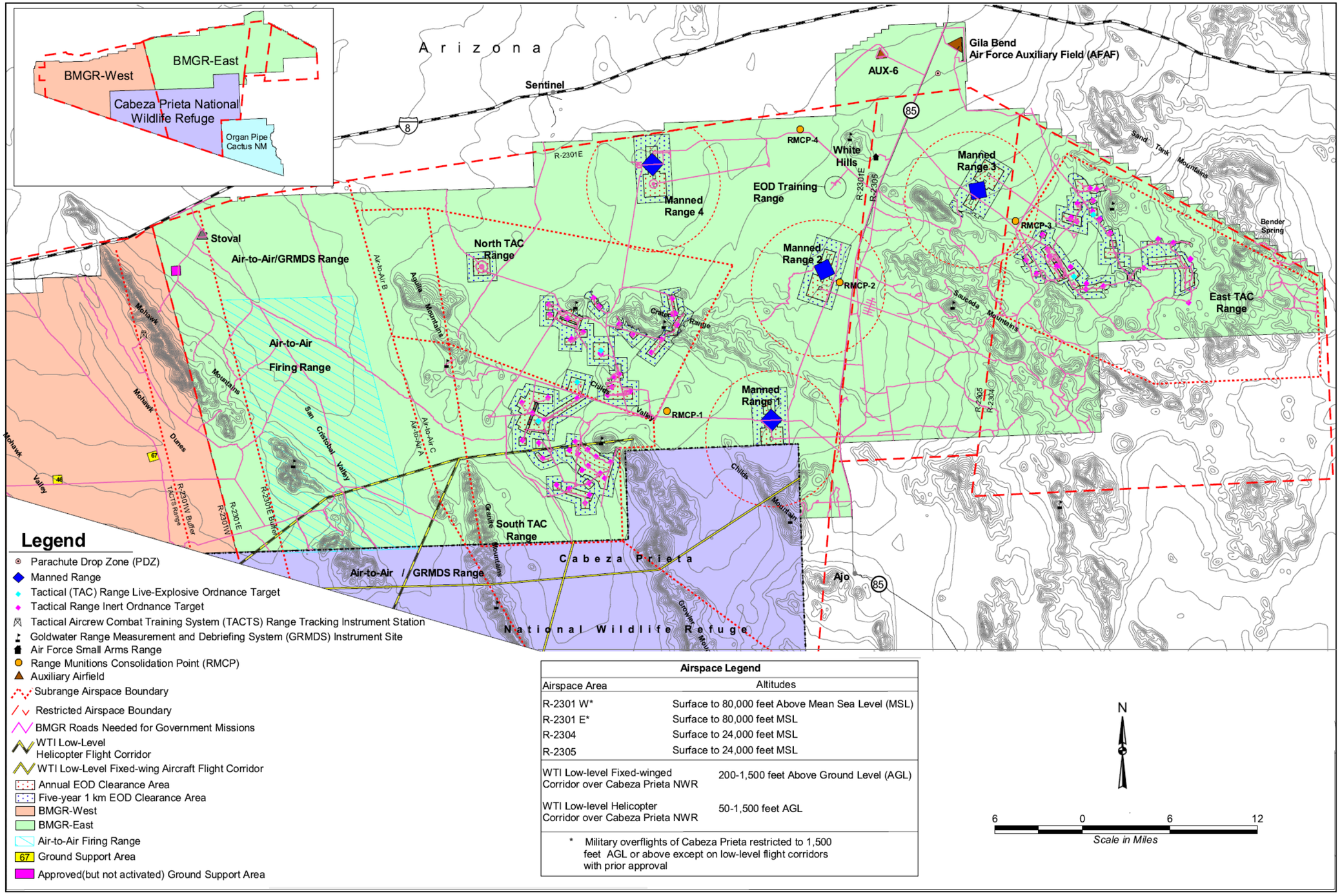
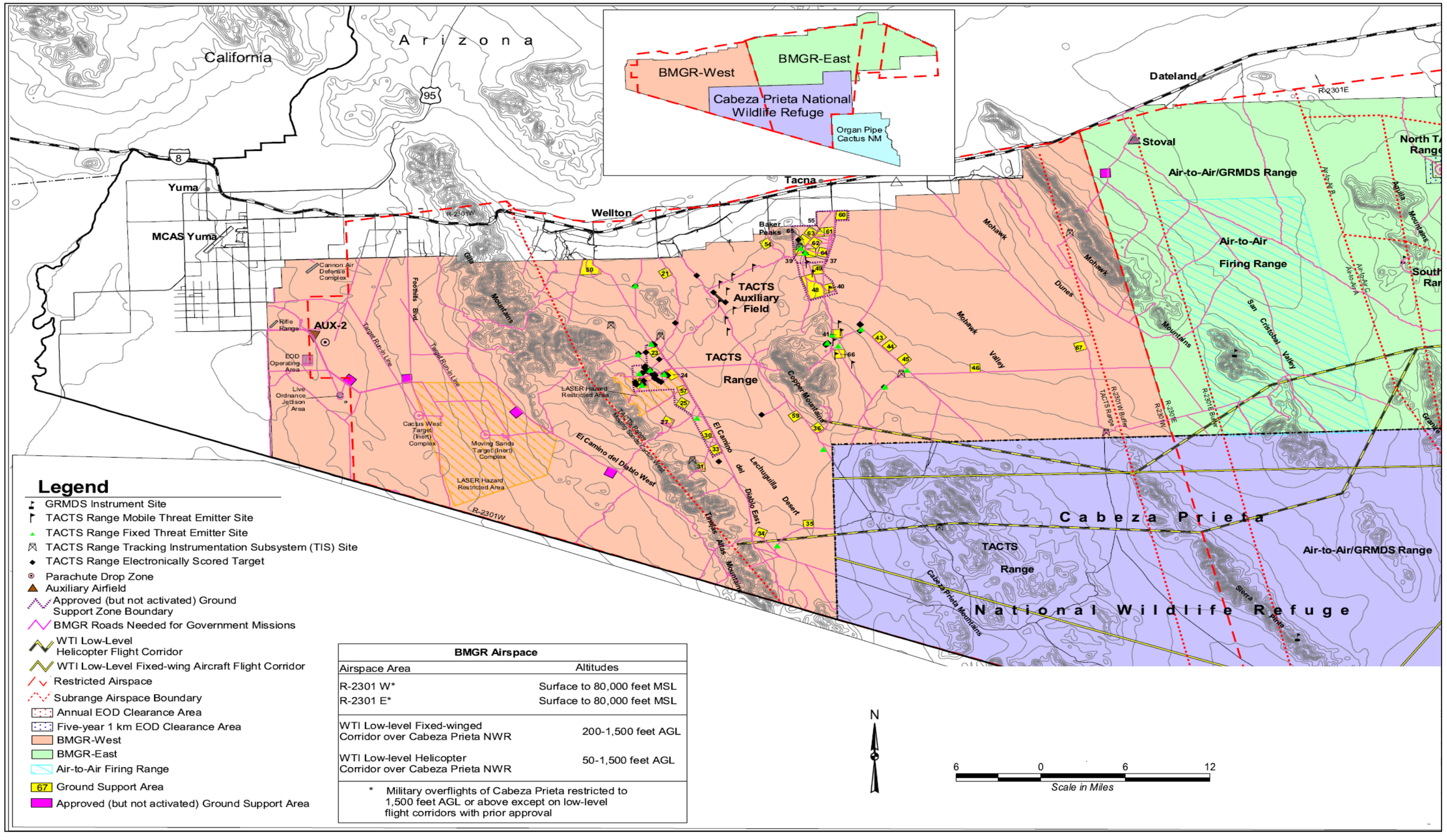



Figure I-2. Current military airspace and land use, Barry M. Goldwater Range East.




**BMGR Airspace**

| Airspace Area | Altitudes |
|---|---|
| R-2301 W* | Surface to 80,000 feet MSL |
| R-2301 E* | Surface to 80,000 feet MSL |
| WTI Low-level Fixed-winged Corridor over Cabeza Prieta NWR | 200-1,500 feet AGL |
| WTI Low-level Helicopter Corridor over Cabeza Prieta NWR | 50-1,500 feet AGL |

* Military overflights of Cabeza Prieta restricted to 1,500 feet AGL or above except on low-level flight corridors with prior approval

Figure 1-3. Current military airspace and land use, Barry M. Goldwater Range West.

#### 1.2.1.1 Tactical Ranges

Three tactical ranges on BMGR East support numerous target complexes used in training aircrews to use gunnery, bombs, rockets, and missiles to attack enemy positions, equipment, and material. These targets simulate tactical features such as airfields, railroad yards, missile emplacements, truck convoys, and battlefield tank formations. Tactical ranges also include manned and unmanned threat simulators that may be included in training scenarios to better reflect real-world conditions.

The East Tactical Range (ETAC) encompasses about 113,520 acres and supports more than 30 identified target complexes. Targets and their directly associated ordnance impact and laser hazard areas affect approximately 8,700 acres. The remainder of the land area lies within, between, or near the surface danger zones in which errant ordnance or laser energy may strike without harm to people or property. All of ETAC must be regarded as potentially contaminated with unexploded ordnance (UXO). The vast majority of such contamination, however, is found in close proximity to targets.

The North and South Tactical Ranges (NTAC and STAC) serve the same aircrew training purposes as ETAC and feature similar target arrays. A total of 17,747 acres of NTAC and STAC, combined, is included in annual explosive ordnance disposal (EOD) clearances; 26,600 acres are included in five-year EOD clearances. The sizes and shapes of these ranges, the types of ordnance authorized for use, and the approved methods of delivery and target placement are collectively configured to contain all ordnance impact and blast effects. As with ETAC, all areas of NTAC and STAC must be regarded as potentially hazardous during live-fire training missions, and UXO could be encountered in surface or subsurface locations throughout these ranges.

In response to conditions faced by military pilots today, the 56 RMO has modernized targets throughout the tactical ranges. Improvements include a maneuver area for search and rescue operations with helicopter landing zones, drop zones, simulated enemy positions, and a small plywood structure; a simulated urban/industrial area where pilots use precision-guided munitions to target specific locations; and a simulated cave entrance at an existing rail yard target. Remotely operated, unmanned threat simulators have been added on all tactical ranges. The Laser Evaluation System – Mobile (LES-M) emits a radio tone when it senses being targeted by a targeting laser, providing an audible feedback to the aircrews.

Explosive Ordnance Disposal (EOD) programs control surface build-up of expended munitions within weapons ranges on BMGR East serve both safety and environmental management purposes. EOD surface clearances are performed within all Air Force weapons ranges in accordance with AFI 13-212. That AFI has been revised twice since the most recent range withdrawal; with each revision, the area affected by clearance procedures has been substantially reduced. When work on this ICRMP began, the AFI required EOD clearance out to a nautical mile around each target every five years. In 2002, the AFI was revised to require clearance to a distance of 1,000 feet annually and 1000 meters (or to the distance at which the density of munitions on the surface is reduced to fewer than five complete ordnance items per acre, whichever is closer to the target) every five years. The

2007 revision further reduced the extent of the area affected by range clearance requirements. The frequency of clearances has been reduced from 1- and 5-year intervals to 2- and 10-year intervals. EOD personnel will clear a radius of 300 to 500 feet (depending on the density of munitions identified) around all targets every 2 years and a radius of 1000 feet every 10 years (AFI 13-212, paragraphs 7.4.4.3 and 7.4.4.4). In addition, roads, the immediate vicinity of targets, and other areas will be cleared annually so that range maintenance activities may be conducted safely.

These changes have resulted in an important cultural resource protection benefit because they have substantially reduced the total area of tactical ranges and manned ranges that is subject to EOD surface-clearance activities and associated ground disturbance (see Part II, Section 2 for additional details).

General public access to the tactical ranges is not permitted because it is incompatible with the current training mission and prevailing levels of UXO surface contamination.

#### 1.2.1.2 Manned Ranges

There are four manned ranges on BMGR East. Each has bull's-eye targets for training in simulated nuclear weapons delivery as well as conventional bombing and rocketry, an applied tactics target (a single target vehicle) for conventional bombing or rocketry training, and strafe targets for air-to-ground gunnery training. Controllers in observation towers at each manned range control the movement of aircraft and ground personnel and the delivery of munitions within the range. Only inert munitions are used on the manned ranges. Recent improvements at the manned ranges include replacing scoring systems at the strafing and bombing targets. The Improved Range Strafe Scoring System (IRSSS) is a more accurate acoustic system that can generate a pattern showing misses and hits and can be configured for scoring high-angle strafe, which is set up at the left-most target on each manned range. The Weapons Impact Scoring System (WISS) is a camera-based system for scoring bomb deliveries. It is operated by a single individual at a console rather than the two people formerly required to use the M-2 scope system. Cameras can be remotely adjusted to score different targets or to reduce the size of the bulls-eye.

Annual EOD clearances affect roughly 7,615 acres on Manned Ranges 1, 2, 3, and 4; approximately 19,070 acres are included in five-year EOD clearances. All surface entry to manned ranges by military and civilian personnel is controlled because of the safety hazards presented by the ongoing munitions delivery training missions performed in these ranges and by the relatively high concentrations of UXO present on the ground surface. General public access to manned ranges is not permitted because it is incompatible with the current training mission and prevailing levels of UXO surface contamination.

#### 1.2.1.3 Air-to-Air Firing Range

The Air-to-Air range includes most of the R-2301E airspace west of NTAC and STAC (see Figure I-2; roughly 101,040 acres). The designated lands serve as a fallout area for munitions

expended in the overlying Air-to-Air Firing Range. Current munitions use is limited to 20 millimeter (mm) cannon rounds fired in air-to-air gunnery.

Past training activities in the Air-to-Air Firing Range included regular use of live air-to-air missiles. As a result, some types of air-to-air ordnance are likely present as UXO on the land beneath this rangeand adjacent R-2301E airspace. Surface entry to the Air-to-Air Firing Range fallout area by both military and civilian personnel is controlled because of the safety hazards presented by the ongoing weapons training missions performed in this range and by the expected concentrations of UXO present on the ground surface. General public access is not permitted, except under special circumstances, because it is incompatible with the current training mission and prevailing levels of UXO surface contamination.

#### 1.2.1.4 Gila Bend Air Force Auxiliary Field

The 56 RMO operates and maintains Gila Bend Air Force Auxiliary Field (AFAF), which is located on and is a critical part of the BMGR East complex. The 8,500-foot by 150-foot paved runway at Gila Bend AFAF is used for emergency or precautionary recoveries of military aircraft that experience malfunctions, hung ordnance, or damage during operations on the BMGR. Its location on the BMGR has been invaluable in saving many aircraft over the past several years. A six-pad heliport is used routinely to support ARNG training operations, and the airfield is used daily by F-16 and A-10 aircrews from Luke and Davis-Monthan AFBs and the Arizona ANG for practicing traffic pattern and emergency simulated flameout (engine power loss) procedures which cannot be accommodated at their home installations. No aircraft are permanently based at Gila Bend AFAF.

A control tower provides air traffic control whenever Gila Bend AFAF is open. The auxiliary field also is equipped with a fire department, tie-down ramp, munitions storage area, and aircraft hangar. Aircraft with malfunctions or damage are repaired at Gila Bend AFAF by maintenance crews that travel from their home base to the auxiliary field for each event. Gila Bend AFAF also houses support facilities for control, maintenance, and security of the BMGR East, as well as air traffic control, fire department, and flightline transient alert services for the airfield.

In 2006, the 56 FW established expeditionary training programs for aircrews, maintainers, and operations planners at Gila Bend AFAF, in a setting that simulates conditions at a remote, deployed location. Other pre-deployment conducted at Gila Bend AFAF prepared ground personnel for deployment in forward areas, including development of individual and team war-fighting skills that would be needed at an expeditionary forward air base or during convoy operations. Although these 56 FW programs have been suspended, units from other installations and services continue to use Gila Bend AFAF for this purpose.

Gila Bend AFAF is operated by approximately 140 civilian contractor personnel at a cost of about $10 million a year. Contractors also provide maintenance and operations support for the BMGR East outside of Gila Bend AFAF—maintaining targets, serving as range control officers on the manned ranges, and performing other activities. Air Force civilian personnel serve as quality assurance evaluators, overseeing this function.

The Range Operations Coordination Center (ROCC, call sign Snake-eye) was moved from Gila Bend AFAF to Luke AFB in December 2003. The ROCC is responsible for authorizing and coordinating all military and non-military aircraft entering and departing R-2301E, R-2304, and R-2305 (see Figure I-2 for restricted areas), as well as surface users entering or departing the BMGR East.

#### 1.2.1.5 Other Military Use Areas

Other developed facilities within the BMGR East include Stoval Auxiliary Airfield, Auxiliary Airfield 6 (AUX-6), a small arms range, four range munitions consolidation points (RMCPs), and an EOD training range. Stoval is an unmanned outlying auxiliary airfield that was constructed to support training during World War II. The airfield consists of three approximately 3,700-foot runways laid out as an equilateral triangle, with a parking apron appended to the runway on the east side. Although this airfield is not maintained and its macadam surface has deteriorated, Stoval Airfield continues to support periodic training activities requiring remote, primitive airfield conditions. One such activity is the semiannual Weapons Tactics Instructors (WTI) Course conducted by the Marine Corps which includes Marine air and ground units. Stoval Airfield is incorporated in the WTI Course as a deployment site for ground units performing air defense, communications, and command and control functions and as a location for conducting helicopter and C-130 aircraft operations from a forward airfield.

AUX-6 is used on an irregular schedule throughout the year as a staging area, drop zone, or forward arming and refueling point for helicopter operations and as a field training/bivouac site for ARNG or Air Force Security Police units. In 2006, the runways at AUX-6 were cleared of vegetation and repaired and stabilized, and this facility now can be used as an assault landing strip by C-130 aircraft. Like Stoval, AUX-6 is used by WTI exercises as an assault landing field. AUX-6 is not used for munitions training by ground or air forces. The primary parachute training DZ is located just east of AUX-6, about 3.5 miles west southwest of Gila Bend AFAF.

The approximately three-acre small arms range is located west of State Route 85 and east of the White Hills. This facility is used for small arms training by range security personnel and law enforcement agents stationed in the vicinity.

Range Munition Consolidation Points (RMCPs) 1, 2, 3, and 4 serve as range EOD and maintenance support areas for BMGR East. Expended munitions, munitions scrap, and metal target debris that is safe for handling is cleared from the three tactical and four manned ranges and transported to the RMCPs for demilitarization and decontamination processing before being released for off-range recycling or disposal. Each RMCP is about 5.8 acres in size and is fenced and locked to control entry.

The EOD training range is located north of Manned Range 2 just south of the Manned Range 4 access road (Figure I-2). This facility occupies a portion of a munitions treatment range which was deactivated in 1996. The training range is used for training EOD technicians to

safely detonate UXO. Detonation of high-explosive charges of up to 2,000 pounds net explosive weight is authorized in this area.

### 1.2.2 BMGR West

The current primary mission of BMGR West is to support readiness training by Marine Corps and Navy aircrews from operational units. Current regular users include AV-8B, F-5, F/A 18, and VMFAT-101 aircrews from Marine Air Group (MAG) 13, Marine Aviation Weapons and Tactics Squadron (MAWTS) 1, and other Marine aviation units. MCAS Yuma is also host to training deployments from Marine Corps and Navy aviation units from throughout the fleet.

The area of BMGR West that lies east of the Gila and Tinajas Altas mountains (roughly 431,642 acres) supports a mix of Marine Corps and Navy training activities. Marine air defense, air control, communications, and command units select among 35 existing ground support areas as sites from which they may perform their missions. Marine Corps ground units also use the ground support areas for training at other times.

The area of BMGR West that lies west of the Gila and Tinajas Altas mountains (about 158,688 acres) currently supports six types of training facilities and three training support areas (Figure I-3). The training facilities include the Urban Training Area (formerly called Moving Sands), the Cactus West target complex, AUX-2, a parachute DZ, four approved ground-support areas, a rifle range, and the Cannon Air Defense Complex. Cactus West also supports an EOD operating area and a live-ordnance jettison area.

#### 1.2.2.1 TACTS Range

The TACTS Range simulates both air-to-ground weapons delivery missions and surface-to-air missile threats. Eleven target complexes simulate airfield installations, power stations, fuel storage facilities, buildings, railway facilities, anti-aircraft missile and gun positions, and military vehicles. Aircrews training in air-to-ground weapons delivery maneuver their aircraft to attack these targets but neither carry nor release actual munitions. Instead, electronic pulses (rather than inert ordnance drops) simulate the release of munitions. There are no munitions impact areas. The main airfield complex also accommodates the use of airborne targeting lasers to designate the target intended for attack. Because the lasers used are not eye safe and could cause eye injury or blindness if an observer looks directly into the laser light, the area approved for laser use is posted as a laser hazard area.

Seventeen mobile and 18 fixed electronic threat emitter sites are located adjacent to existing roads within BMGR West, to the east of the Gila and Tinajas Altas Mountains (see Figure I-3). Controllers operate the threat emitters to challenge aircrews training within the TACTS Range with realistic air defense threats. The radar energy transmitted by the threat emitters is sufficient to be a radiation burn hazard to people close to the transmitter and in the path of the transmitted energy. Personnel on the ground at active mobile threat emitter sites keep people clear of hazardous areas associated with the emitter equipment. The fixed threat emitter transmitters are sufficiently elevated to ensure that emitted energy can strike the

ground only after it is attenuated to a safe level. Fixed emitters are posted and fenced to keep people and large mammals a safe distance from the site.

TACTS Range electronic instrument sites, target simulation, and laser hazard areas, are off limits except to specifically authorized personnel. Access to ground unit deployment areas (for other than missile firings) is restricted to protect the safety of both participating and nonparticipating personnel and to prevent disruption of the training exercise. With these exceptions, general public access to this area of BMGR West is currently permitted at most times because it is compatible with the regularly scheduled ongoing training missions.

**Urban Training Area and Cactus West Target Complex**

The Urban Training Area and Cactus West target complex provide a variety of scored air-to-ground targets for bombing, rocketry, and strafing. Ordnance deliveries on both complexes are restricted to the use of inert training practice munitions of up to 1,000 pounds. Both complexes include circular target areas 3000 feet in diameter that are used for training in conventional bombing and rocketry as well as separate targets for training in low-angle strafing. The Cactus West conventional target is a bull's-eye target designed to provide aircrews with training in the basic mechanics of delivering air-to-ground ordnance in a structured and tightly controlled target setting. What was then called the Moving Sands target complex was reconfigured in the late 1990s to represent a developed urban site with simulated streets and buildings set within the original impact area. This target complex also contains a remotely controlled movable target that runs in a racetrack pattern and can be operated at various speeds up to 50 miles per hour. The Urban Training Area is approved for air-to-ground laser use for designating targets. A posted laser hazard area extends around this target to warn surface users not to enter this area because of the risk of eye damage. Both target complexes are equipped with lighting for night operations.

**Auxiliary Airfield 2, Cannon Air Defense Complex, and Other Military Use Areas**

AUX-2 is a small, outlying airfield, a remnant of the World War II training era. Its original east-west oriented runway has been redeveloped with aluminum runway matting and a landing control tower to resemble the deck and control island of a Navy Landing Helicopter Assault (LHA) ship. This LHA deck is used to train and refresh helicopter and AV-8B aircrews in the basic flight mechanics and visual references used for landing, taking off, and taxiing their aircraft aboard an LHA ship. A northeast-southwest oriented runway serves as a 4,000-foot-long landing strip, known as a tactical landing zone (TLZ). The TLZ is used to train C-130 transport aircrews in landings and takeoffs from narrow, unimproved, and even improvised forward airfields. The third leg of the triangle serves as a range access road. Construction of a new hard-surfaced runway at AUX-2 to support AV-8B training in narrow-width roadway operations has been approved but not completed. The TLZ also serves as a DZ for tow banners used by the Marine Corps as aerial gunnery targets within the Chocolate Mountain Aerial Gunnery Range in southeastern California.

A parachute DZ used for training C-130 aircrews to perform cargo parachute drops is presently located a short distance southeast of AUX-2.

The rifle and pistol range is located just inside the BMGR entrance gate at Yuma County 19th Street. This entrance also provides access to AUX-2 and the Moving Sands and Cactus West target complexes. The rifle range has 30 firing lanes and is used by MCAS Yuma personnel to meet proficiency requirements for the use of small arms.

The Cannon Air Defense Complex, located in the northwest corner of the BMGR, provides administrative, support, and training areas for a Marine Air Control Squadron (see Figure 1.3). The complex is a permanent facility of about 0.3 square miles in size with a developed cantonment area.

The EOD operating area is just southwest of AUX-2. This area is used for EOD training and for disposing of munitions with expired shelf-lives. Both open burn and open detonation techniques are employed.

An area located about 5 miles west northwest of the Cactus West conventional target is used as a jettison area, where aircraft may safely release live but unarmed ordnance or drop tanks. Aircrews carrying live, unarmed ordnance are directed to this site when an in-flight malfunction requires the jettisoning of the munitions or other fuel tanks prior to a recovery of the aircraft at MCAS Yuma. EOD personnel recover jettisoned ordnance and fuel tanks after each release event.

Entry to the portion of BMGR West that is west of the Gila and Tinajas Altas mountains and also west of the extension of Foothills Boulevard and the western alignment of El Camino del Diablo (see Figure 1.3) is restricted at all times to authorized personnel. Public recreation is not permitted within this area.

General public access to the portion of BMGR West that is west of the Gila and Tinajas Altas mountains and east of the extension of Foothills Boulevard and the western alignment of El Camino del Diablo is generally not restricted (see Figure 1.3). Requirements for temporary restrictions on entry to this area to support special training activities are implemented on a case-by-case basis.

## 1.3 SUMMARY OF MILITARY LAND USE

In addition to developed targets and ground support areas, the current inventory identifies 2,085 miles of roads on the BMGR, of which 1,305 miles are used regularly to support the combined operations of the Air Force, Marine Corps, and nonmilitary agencies. Less than three percent of the 2,085 miles of roads are paved. This road network provides surface access to, between, or within the various functional areas of the range. All vehicles are restricted to designated roads except as required by EOD, maintenance, emergency response, and environmental staff and contractors conducting required mission support activities.

Approximately 273,000 acres, or about 16 percent of the BMGR, are or have been used to directly or indirectly support military operations (Table I-1). Included within these direct use acres are the following:

- locations used as munitions and target debris fall out for air-to-air gunnery
- ground-based targets or simulations (such as bull's-eye targets or simulated airfields)
- air-to-ground munitions impact areas
- EOD clearance areas
- auxiliary airfields
- maintenance and clean-up areas
- ground support training areas
- developed training facilities
- retired target or test areas

The remaining cumulative military surface use area from past and present activities is 172,000 acres or about 10 percent of the BMGR.

The level of surface disturbance within these areas ranges from low to complete. Areas of high to complete surface disturbance, however, are limited to about 0.2 percent of the BMGR surface.

**Table I-1**

**MILITARY SURFACE USES AND ASSOCIATED DISTURBANCE**

| **Military Surface Uses (Acres)** | **Associated Surface Disturbance** | **Total Acres** |
|---|---|---|
| Primary air-to-air gunnery range (101,040)<br>Inactive alternative air-to-air gunnery range (86,914) | Negligible disturbance to ground surface across affected area | 101,040 |
| Manned range annual EOD clearance area (7,615)<br>Manned range five-year clearance areas (27,238)<br>Tactical range five-year EOD clearance area (92,548) | Low to moderate levels of disturbance to ground surface across affected area | 127,401 |
| HE hill dispersed munitions blast area (2,976)<br>Tactical range inert target munitions impact area (17,154)<br>Tactical range annual EOD clearance area (25,494)<br>AUX-6 (182)<br>Stoval Auxiliary Airfield (182)<br>AUX-2 (215)<br>Closed auxiliary airfields (910)<br>Ground troop deployment support areas (10,922)<br>Retired target areas (823) | Low to high levels of disturbance to ground surface across affected area | 38,728 |
| Gila Bend AFAF (2,007)<br>Manned range 50-use day EOD clearance area (308)<br>Range maintenance, cleanup, and EOD support areas (435) | Moderate to high levels of disturbance to ground surface across affected area | 2,750 |
| Manned range cleared layout and targets (939)<br>Tactical range cleared-target simulations (430)<br>HE hill target core munitions blast areas (51)<br>Moving Sands/Cactus West cleared target centers (400)<br>Developed training sites (180)<br>Retired test areas (841) | High to complete levels of disturbance to ground surface across affected area | 2,841 |
| **Total Military Surface Use** | | **272,760** |

**Section 2**

# THE REGIONAL MANAGEMENT SETTING AND THE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN FOR THE BARRY M. GOLDWATER RANGE

This section summarizes the regional management setting and the history of interagency cooperation that characterizes it. The bulk of the section describes the process of developing the Integrated Natural Resources Management Plan (INRMP) required by MLWA and its relationship to this ICRMP.

## 2.1 REGIONAL PARTNERS

The Environmental Impact Statement (EIS) for the INRMP described in some detail the management roles of several state and federal agencies on BMGR, including BLM, USFWS, USBP, and AGFD (U.S. Air Force and others 2005). These agencies have a long and productive history of cooperating to achieve their respective missions on BMGR.

In 1982 the Air Force, Navy/Marine Corps, USFWS, BLM, and AGFD signed a Natural Resources Management Cooperative Agreement. That agreement led to the production of the Luke Air Force Range Natural Resources Management Plan in 1986, which was in turn adopted by the BLM as the basis for preparing the Goldwater Amendment to the Lower Gila South Resource Management Plan which took effect in 1990. Over the course of these planning efforts, the agencies recognized that effective resource management on the BMGR depends on addressing natural and cultural resource management issues from a broad-scope, integrated perspective that promotes resource protection and conservation opportunities created by military use requirements, and emphasizes interagency communication and cooperation.

Non-military agencies with ongoing missions on the BMGR include the Arizona Game and Fish Department (AGFD), U.S. Fish and Wildlife Service (USFWS), and the Border Patrol (a unit of U.S. Customs and Border Protection (CPB), Department of Homeland Security (DHS)).

### 2.1.1 Arizona Game and Fish Department

The AGFD manages the state's resident wildlife, which is held in trust for the citizens of the State of Arizona; this wildlife management responsibility also applies to the BMGR. The AGFD's mission is

> To conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and management programs, and to protect wildlife resources and safe watercraft and off-highway vehicle (OHV) recreation for the enjoyment, appreciation, and use by present and future generations.

The primary wildlife management responsibilities of AGFD on the BMGR are to

- Issue hunting permits, enforce hunting regulations, and establish game limits for hunting, trapping, and non-game species collection

- Develop and maintain habitat assessment/evaluation, protection, management, and enhancement projects
- Conduct wildlife population surveys
- Manage wildlife predators and endangered species/special status species
- Manage OHV use in terms of habitat protection and user opportunities

Under a previous withdrawal, AGFD and the Bureau of Land Management (BLM) jointly prepared the 1997 Lechuguilla-Mohawk Habitat Management Plan (HMP). AGFD joined with the BLM and Luke AFB to prepare the 1999 Draft Barry M. Goldwater East HMP. The objectives of these plans include maintenance and enhancement of habitat for Sonoran pronghorn *(Antilocapra americana sonoriensis*), desert tortoise (*Gopherus agassizii*), flat-tailed horned lizard (*Phrynosoma mcallii*), mule deer (*Odocoileus hemionus*), desert bighorn sheep (*Ovis canadensis*), upland game, nongame species, and other sensitive wildlife habitat on the BMGR. To implement these objectives, AGFD actively manages wildlife waters on the BMGR, including constructing and maintaining man-made and reconstructed natural water catchments.

## 2.2 U.S. Fish and Wildlife Service

The mission of the USFWS is *working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people*. Among other things, the agency advises and assists the Air Force and Marine Corps with their efforts to protect and recover all threatened and endangered species as mandated by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

The USFWS leads the Sonoran Pronghorn Recovery Team and the implementation of the USFWS Sonoran Pronghorn Recovery Plan of 1998, as amended in 2002. The plan includes a list of 51 proposed management actions, some of which have potential to disturb cultural resources; examples include habitat enhancements, placement and maintenance of artificial water sources, and selective thinning of vegetation. Much of the animal's current range lies within the BMGR, including most of the area west of State Route 85 and east of the Copper Mountains.

## 2.3 Border Patrol and Other Department of Homeland Security Agencies

The Border Patrol is responsible for preventing illegal entry into the United States and for apprehending undocumented aliens (UDAs) who have entered the United States illegally. The southern boundary of the westernmost portion of the BMGR includes approximately 37 miles of the international border between the United States and Mexico. In recent years, Border Patrol apprehensions of UDAs in the BMGR vicinity have represented about 3 percent of all apprehensions along the Southwestern border (U.S. Air Force and others 2005). Activities involving the smuggling of drugs or other contraband also occur on the BMGR. Two Border Patrol jurisdictional sectors, the Tucson and Yuma sectors, are responsible for the entire Arizona-Mexico border, including the BMGR.

The Border Patrol conducts daily reconnaissance by air or ground surveillance. Traditional Border Patrol operations/activities on BMGR include patrolling roads and off-road areas,

dragging unimproved roads to facilitate the observation of foot traffic, conducting aerial reconnaissance, and inspecting vehicles at checkpoints. For the most part, the Border Patrol conducts ground surveillance by observing tracks on drag roads. Drag roads are prepared by dragging several bolted-together tires across a dirt road or well-used trail in order to assist agents in detecting evidence of illegal crossings by people or vehicles. The Tucson and Yuma sectors maintain helicopters and fixed-wing aircraft that can provide assistance to any station within the two sectors. Other Border Patrol activities include road blocks and road patrols.

Due to the extreme temperatures that occur in southwestern Arizona from May through October, the Border Patrol conducts rescue missions to save UDAs who are severely dehydrated or suffering from other heat-related distress. In recent years, border towns in California and Texas have been closely monitored; as a result, crossings in more remote areas, particularly through the CPNWR and Organ Pipe Cactus National Monument, and BMGR West, have increased. Because of the remoteness of these areas and the harsh environmental conditions, the Border Patrol's role in rescue missions in the area in general and on BMGR in particular has increased in response.

The Border Patrol also offers assistance on the range and surrounding lands to AGFD, BLM, and USFWS. Border Patrol helicopters are occasionally used to locate lost recreationists, record illegal off-road vehicle use, and assist in wildlife management activities. The Border Patrol also maintains distress beacons that may be activated by persons in need of rescue.

Other units and agencies within DHS play a role on the BMGR, both on the ground and in the air, and these efforts are expected to increase over the first five years covered by this plan, as the government steps up its efforts to control the borders. As specific proposals are made, their potential to affect cultural resources is assessed, and alternatives considered as needed.

In October 2006, President George W. Bush signed into law H.R. 6061, the Secure Fence Act, authorizing the construction of 700 miles (1,125 kilometers) of physical fences and barriers to prevent vehicles and pedestrians illegally crossing the US-Mexico border. Motion-detecting ground sensors, remote-controlled cameras, helicopters, radar, and unmanned aerial vehicles will further secure the border in what some call a "virtual fence." The Act also calls for an additional 14,000 Border Patrol agents to be added to the current force of 11,300 and increases the number of off-highway vehicles (such as ATVs, motorcycles, and SUVs) for agents in the field. By order of the President, National Guard units also have been sent to the border to assist the Border Patrol. This and other related legislation are part of the Secure Borders Initiative launched in 2005 to develop and implement a strategy to secure America's borders and to stem illegal entry into the country.

Border Patrol operations and ongoing tactical infrastructure (TI) projects within the BMGR and adjacent lands include approximately 34 miles of post-on-rail permanent vehicle barriers (PVB) and an associated patrol and drag road on the CPNWR. As of March 2007, 2 miles from the eastern boundary of the OPCNM had been completed. More than 75 miles of PVB are being constructed on the Tohono O'odham Nation (TON). These PVBs include both bollard-style and post-on-rail construction. The USBP maintains a temporary checkpoint on State Route 85 at

milepost 17.8. Negotiations are in progress between the USBP and the Air Force regarding a proposal to make this temporary checkpoint permanent.

SBInet, the newly established technology arm of CBP, is currently testing a technology-based solution in the Sasabe area (named Project 28 or P28) of the Tucson Sector. Once completed, it is expected to be implemented on the Tohono O'odham Nation, OPCNM, and CPNWR. The solution includes a combination of technology, personnel and infrastructure. PVBs and access roads support field personnel and rapid response vehicles. Strategically placed towers are outfitted with ground-based radar, cameras and radio repeater equipment. Vehicle and communication centers operate on satellite technology. No timelines or equipment locations have been identified outside of P28 at this time.

Initial construction of a bollard-style vehicle barrier on the BMGR West began in January 2007, working from west to east along the 37-mile-long border between Mexico and the BMGR West. A shorter segment of a fence to prevent pedestrian crossings has also been constructed. An all-terrain road has been laid along the border fences, and numerous access roads, patrol roads, and drag roads now cross BMGR West.

Environmental analyses for the actions on the BMGR West proposed by the Border Patrol and the DHS began in 2005 but were halted in early 2007 when Department of Homeland Security Secretary Michael Chertoff exercised the authority granted him under the Real ID Act (2005) to waive environmental and historical preservation laws.

### 2.1.4 Bureau of Land Management

Under MLWA, BLM no longer exercises overall management authority for the BMGR; however, that agency retains a role in BMGR management. The BMGR is withdrawn and reserved for the following military uses: (A) an armament and high-hazard testing area; (B) training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; (C) equipment and tactics development and testing; and (D) other defense-related purposes consistent with the purposes specified in this paragraph. MLWA section (a)(5) directs the Secretaries of the Air Force and Navy to consult with the Secretary of the Interior before using the lands withdrawn and reserved by this section for any other purposes. This function has been delegated to the BLM at the local level: Phoenix (BMGR East) and Colorado River (BMGR West) Districts.

## 2.2 THE BARRY M. GOLDWATER RANGE EXECUTIVE COUNCIL

Since 1997 representatives of these agencies have met frequently to discuss BMGR regional issues. This group, called the Barry M. Goldwater Range Executive Council (BEC), is not a decision-making body, but the sharing of information that takes place at these meetings facilitates regional solutions to common problems that are difficult or impossible to address one agency or jurisdiction at a time. This is particularly useful because the missions and responsibilities of the nonmilitary agencies cross-cut land management boundaries.

## 2.3 THE INTERGOVERNMENTAL EXECUTIVE COMMITTEE

In recognition of the level of public interest in the management of the natural and cultural resources of the BMGR, the MLWA of 1999 called for the creation of an Intergovernmental Executive Committee (IEC) comprised of "selected representatives from interested federal agencies, as well as at least one elected officer (or other authorized representative) from State government and at least one elected officer (or other authorized representative) from each local and tribal government, as may be designated at the discretion of the Secretary of the Navy, the Secretary of the Air Force, and the Secretary of the Interior" (P.L. 106-65 §3031(b)(6)). Its sole purpose is to exchange views, information, and advice pertaining to the management of natural and cultural resources on BMGR. The IEC meets three times a year, rotating the location between Tucson, the Phoenix metropolitan area, and Yuma, and its meetings are open to the interested public.

Cities, towns, and counties in the region, and tribes that attach cultural importance to the BMGR were invited to become members of the IEC. To date, 14 state and federal agency offices, 5 local governments, and 5 federally recognized tribes have accepted membership.

## 2.4 THE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

The MLWA of 1999 specified that the INRMP for the BMGR should include provisions for the proper management and protection of cultural as well as natural resources and for sustainable use of those resources by the public to the extent consistent with the military purposes of the range [see P.L. 106-65 §3031(b)(3)(E)(i)]. The MLWA directed that the INRMP be prepared and implemented in accordance with the Sikes Act (16 U.S.C. 670 *et seq*.). The scope of the Sikes Act, however, is limited to the conservation and management of natural resources on DoD lands and does not include guidance for the management and protection of cultural resources. To satisfy these requirements, this ICRMP is incorporated by reference in the INRMP.

MLWA and the Sikes Act establish parameters that limit the types of nonmilitary land uses that may be accommodated on the BMGR. Most of these parameters exclude rather than permit potential nonmilitary land uses. Appropriative land uses are excluded from the range by two provisions of the MLWA of 1999. First, this act specifically withdraws these lands from all forms of entry under the general land laws and mining and mineral leasing laws for at least the duration of the 25-year withdrawal. Second, grazing and agricultural outleasing also are effectively excluded from the range by another provision of the MLWA of 1999 which states that the INRMP for the range shall support only the continuation of these activities where they currently exist. Neither livestock grazing nor agricultural leasing has been sanctioned on the BMGR since 1941, when these activities were determined to be incompatible with the military purposes of the range. Thus, the INRMP does not support mining or grazing on BMGR.

Under MLWA, public use of the range must be consistent with the military mission and the protection, conservation, and rehabilitation of natural and cultural resources. Safety hazards or security concerns are present on a near continuous basis on about 62 per cent of the BMGR, and public access to these areas is prohibited. Safety hazards or security concerns are present within the other 38 percent of the BMGR only at selected times or in selected confined locations, and

public visitation can be accommodated on a regular basis as long as certain necessary restrictions are observed.

The DOD approach to integrated resource management planning, which is central to the INRMP, is founded on several broad concepts including sustainability, biodiversity, and ecosystem management. MLWA calls for sustainable use by the public of the natural and cultural resources on these withdrawn lands. Unfortunately, the concept of sustainable use of cultural resources on BMGR is impractical at best. This fundamental disconnect between natural and cultural resource management practices must be acknowledged and addressed in both this ICRMP and the INRMP.

The concept of sustainable consumptive use of natural resources is based on the premise that these resources are generally renewable and can be managed to provide an annual or periodic yield of goods, services, and direct and indirect benefits over the long term. In contrast, cultural resources are not renewable, are in finite supply, often are easily damaged or destroyed by even casual or limited use, and in most if not all instances, cannot be recovered or restored once damaged. Because of these characteristics, the broad body of federal laws, regulations, and other forms of guidance addressing management of cultural resources on military installations and other federal lands has stressed the need to protect, curate, and interpret rather than use these resources (see Section 3 for summary of legal requirements). The concept of sustainable consumptive use is incompatible with cultural resource management requirements.

Nonconsumptive use of cultural resources also is problematic because of the vulnerability of these resources to physical damage, loss of historic information potential, or damage to or desecration of their cultural or religious values. Use of culture resources on most federal lands, which is generally limited to nonconsumptive viewing and interpretation of these resources in place, is supported because of the benefits of increased public awareness of their importance and fragility. Park-like development and interpretation of most cultural resources on BMGR is probably not appropriate, because such developments are expensive to establish and maintain, and may be more likely to diminish rather than promote the preservation of sites in remote, largely unregulated settings.

Most of the cultural resources on BMGR are surficial archaeological sites that are sensitive or vulnerable to such a degree that they cannot be sustained without special protections from typical public use. Under this ICRMP and the INRMP, then, access to these locations may be prohibited or restricted in order to protect them.

These constraints place DoD natural and cultural resource management requirements and public access strategies in direct conflict; this conflict was a source of considerable debate in meetings of the interagency INRMP Core Planning Team. The Air Force and Marine Corps strategies for resolving this conflict are outlined in the INRMP and in a programmatic agreement that demonstrates the agencies' compliance with Section 106 of the National Historic Preservation Act (NHPA) for the actions described in the INRMP that may be implemented without further analysis under the provisions of National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*). Those strategies are further defined in ICRMP Parts II and III, respectively.

The Environmental Impact Statement (EIS) for the INRMP analyzed the impacts of five alternative strategies, including the proposed action and a no-action alternative, for managing natural and cultural resources and public access within the BMGR. The five strategies were developed in accordance with NEPA and guided by BMGR resource management goals developed during the EIS process. These goals reflect applicable statutory and regulatory guidance; the needs of the military mission of the range; public and tribal viewpoints gathered through scoping, workshops, and other efforts; input regarding the management missions and needs of the USFWS, AGFD, and USBP; and the specific qualities of BMGR natural and cultural resources.

The EIS identified five overarching policy goals that support and are consistent with the military mission, protection and conservation of natural and cultural resources, and public access to the BMGR. In no implied order of importance, they are:

- Maintain and enhance the natural resources to ensure that these resources are sustained in a healthy condition for compatible uses (for example, low-impact recreation) by future generations, while supporting the existing and future military purposes of the BMGR.
- Manage cultural resources in accordance with the BMGR ICRMP.
- Provide for public access to BMGR resources for sustainable multipurpose use, consistent with the military purposes of the range (including security and safety requirements) and ecosystem sustainability.
- Apply ecosystem management principles through a goal- and objective-driven approach that recognizes social and economic values; is adaptable to complex, changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests.
- Meet or exceed the statutory requirements of the MLWA of 1999, Sikes Act, and other applicable resource management requirements.

Alternatives that were consistent with these overall requirements were developed during the public scoping and workshop phases of the EIS planning process for the proposed INRMP. These four strategies, identified as A through D, were designed to represent the full spectrum of management requirements and issues identified during these early planning phases. The strategies outline resource management guidance for each of 17 separate areas of natural resource management. Management of cultural resources is not an element of this matrix, as their management will be governed by this ICRMP.

Management Strategy A represented the no-action alternative, which would have continued the ongoing management practices of the Goldwater Amendment and established HMPs rather than to develop new management practices in the INRMP. Strategies B, C, and D were developed to reflect the spectrum of public opinion received during scoping regarding motorized access, resource protection and conservation, and acceptable approaches to wildlife and ecosystem management.

Strategy B included the greatest degree of motorized access to the BMGR, including expanding the road network available for public use, to the extent compatible with the military mission and the maintenance of a functioning natural ecosystem. This alternative provided for the application of resource protection and conservation measures, but its focus was on resource-specific

monitoring, targeted wildlife management actions (such as continued development and maintenance of wildlife waters), and basic compliance with regulatory requirements.

Strategy C placed more limitations on public access and use, principally as a result of either road closures or restrictions on public access to selected roads, and included a greater focus on proactive conservation elements. Strategy D represented the opposite end of the spectrum from Strategy B; it imposed the most limits on motorized access and public use activities and conservation of unroaded blocks of land of 3,000 acres or more, and emphasizes adaptive management methods incorporating feedback from ecosystem monitoring.

The analysis of the impact of implementing any of these management strategies, as presented in the EIS, summarized effects on cultural resources likely to result from road use and road closures, permitting public access, and wildlife management activities. Some of the existing roads pass through archaeological sites, and their continued use may damage those sites. More extensive impacts are likely to result from vehicle-based camping along roads. The causes of inadvertent damage and intentional vandalism of archaeological sites are complex, but ease of vehicular access was identified as a major factor (U.S. Air Force and others 2005: 5-265). Secondary effects are difficult to quantify, but a reduction in the road network is likely to have beneficial effects by decreasing the rate of damage to archaeological sites that occurs as an indirect impact of motorized vehicle access.

The effect of established camping and visitor stay limits was difficult to assess because the extent of such camping activities on the BMGR is not well documented. Many cultural resources are fragile surface manifestations that could be seriously damaged or destroyed by driving over them even once or twice. Occasional limited camping typically does not result in the level of ground disturbance that could adversely affect archaeological and historical sites, but extended stays, camping by large parties, or repeated use of popular camp sites results in relatively greater disturbance. All of the alternatives supported non-vehicle based camping in all areas open to the public and vehicle-based camping within 50 feet of most existing roads.

All alternatives included many measures to improve general vegetation, wildlife, and wildlife habitat. Most are likely to have little or no impact on cultural resources, but some activities, such as habitat restoration or invasive species eradication, might involve ground disturbance and therefore could potentially affect archaeological and historical sites. In addition, as many as six wildlife water development projects might be undertaken, and 43 existing wildlife water developments would be maintained and repaired as needed. Many of the existing water developments are at or near natural water sources. Because water sources are rare on the BMGR, the density of archaeological sites is likely to be relatively high at such locations. In addition, tribal representatives have identified such water sources as places of traditional cultural importance. New construction or maintenance activities at such sites may adversely affect cultural resources.

The Record of Decision described the management framework to be implemented in the INRMP, which is a composite of elements from Strategies A, B, C, and D. A separate INRMP that reflects that decision and supporting information developed in the EIS is in effect (U.S. Air Force and others 2007).

The following were identified during the INRMP EIS process as required actions regardless of the management strategies selected and implemented through the INRMP:

- Comply with federal statutory requirements (such as the ESA, Clean Air Act, NHPA, Archeological Resources Protection Act (ARPA), etc.), DoD policy and guidance, NEPA, MLWA of 1999, and the Sikes Act, as well as state and local statutory requirements (such as the Arizona Native Plant Law, air and water quality standards, hunting regulations, and requiring all campsites to be more than one-quarter-mile from any water source).
- Enforce federal, state, and local environmental protection laws and the resource protection provisions of the INRMP.
- Adhere to the policy and range-wide resource management goals established for the INRMP.
- Be consistent with the provisions of memoranda of understanding (MOUs), letters of agreement, conservation agreements, biological opinions, or other types of agreements or decisions developed for management or regulatory compliance purposes.
- Incorporate the principles of ecosystem management.
- Require that public access and use of BMGR be compatible with mission activities and other considerations such as security, safety, and resource conservation and protection goals.
- Incorporate cultural resource protection strategies that reflect the DoD's mandate to preserve cultural resources and to include consideration of those resources in its decision-making process.
- Comply with direction provided in 36 CFR Part 800, *Protection of Historic Properties,* and DoD policy, which requires agencies to initiate consultation with the State Historic Preservation Officer (SHPO), tribes, and others pursuant to Section 106 of the NHPA early in the planning process, when the widest range of prudent and feasible alternatives is available and issues identified through consultation may be resolved most easily.
- Be consistent with the ICRMP for the BMGR.
- Prohibit commercial tour operations on the BMGR unless a range policy is developed to permit and regulate or restrict this use.
- In accordance with Section 3031(b)(3)(E)(vi)(I) of the MLWA of 1999, develop a memorandum of agreement (MOA) with agencies and tribal governments responsible for lands adjacent to the BMGR to establish courses of action to be taken by the Secretaries of the Navy and Air Force to prevent, suppress, and manage brush and range fires occurring outside the boundaries of the range resulting from military activities.

### 2.4.1 INRMP Management Units

The EIS and INRMP identify seven management units within the BMGR; three within BMGR West and four within BMGR East. Numbered one through seven from west to east, these units are shown on Figure I-4.

- Management Unit 1 - approximately 230,000 acres
- Management Unit 2 - approximately 265,000 acres
- Management Unit 3 - approximately 195,000 acres
- Management Unit 4 - approximately 280,000 acres
- Management Unit 5 - approximately 440,000 acres
- Management Unit 6 - approximately 138,000 acres
- Management Unit 7 - approximately 188,000 acres

Because of differences in their historic and proposed uses, as well as differences in the natural resources they contain, the ROD includes different management strategies for some units.

Most of Management Unit 1 lies within the restricted area in the westernmost portion of BMGR West and is off limits to most public visitation. Although a number of military operations occur within this unit, the surface effects of these activities are limited to a small aggregate proportion of the entire area. Existing roads provide limited access to most of the unit.

Management Unit 2 incorporates a topographically diverse landscape including the Gila Mountains, Copper Mountains, Wellton Hills, and Baker Peaks, as well as the Lechuguilla Desert Valley. TACTS Range facilities and Marine Corps ground support areas are located within this unit. With the exception of the laser hazard area, public access is compatible with current military operations throughout most of this unit. This unit, which includes areas with some of the highest road densities within the BMGR, has long been a popular public outdoor recreation area.

Management Unit 3 occupies the easternmost area of BMGR West and is generally bounded on the east by the Mohawk Mountains, although the northeastern corner of the area lies on the eastern side of these mountains. This unit contains some of the largest unroaded areas on the BMGR. Military surface use within Unit 3 is limited to five widely dispersed ground support areas and scattered TACTS Range instrument sites. The area is generally open to public visitation, but the rates of visitation are less than those experienced in Management Unit 2. With the exception of the upland slopes of the Mohawk Mountains, the entire unit is within the current distribution of the endangered Sonoran pronghorn, which extends eastward into the BMGR East and southward into the CPNWR. As a result, Unit 3 is closed to public entry from March 15 to July 15 each year as a part of the overall effort to recover the subspecies.

Management Unit 4 includes some of the most remote locations within the BMGR. It is the westernmost area managed by the Air Force and generally underlies the Air-to-Air Firing Range. General public access to this area is restricted. Like Management Unit 3, Unit 4 straddles the Mohawk Mountains. The southwest corner of this unit lies west of the mountains and is often mistakenly regarded as part of BMGR West. Except for its mountain upland locations, Unit 4 is within the current distribution of the Sonoran pronghorn. Unit 4 includes Stoval Field, which is used as an assault landing field, and also serves as the munitions fallout impact area for the Air-to-Air Firing Range. Surface disturbance associated with the latter is minimal.

Management Unit 5 includes NTAC, STAC, and Manned Ranges 1, 2, and 4. Although the target impact and EOD clearance areas associated with these ranges represent the most extensive military use areas of the BMGR, most of the surface of this unit is relatively undisturbed. This management unit is bounded on the west by the Aguila and Granite mountains and on the east by State Route 85. Public access to Unit 5 is restricted because of hazards associated with past and present uses of the weapons ranges and other training sites.

Management Unit 6 includes two separate subunits. The larger subunit lying east of State Route 85 between the Sauceda and Batamote Mountains is also known as Area B. Military surface use in this area is currently limited to the target lead-in-lines to Manned Ranges 1 and 2 and an

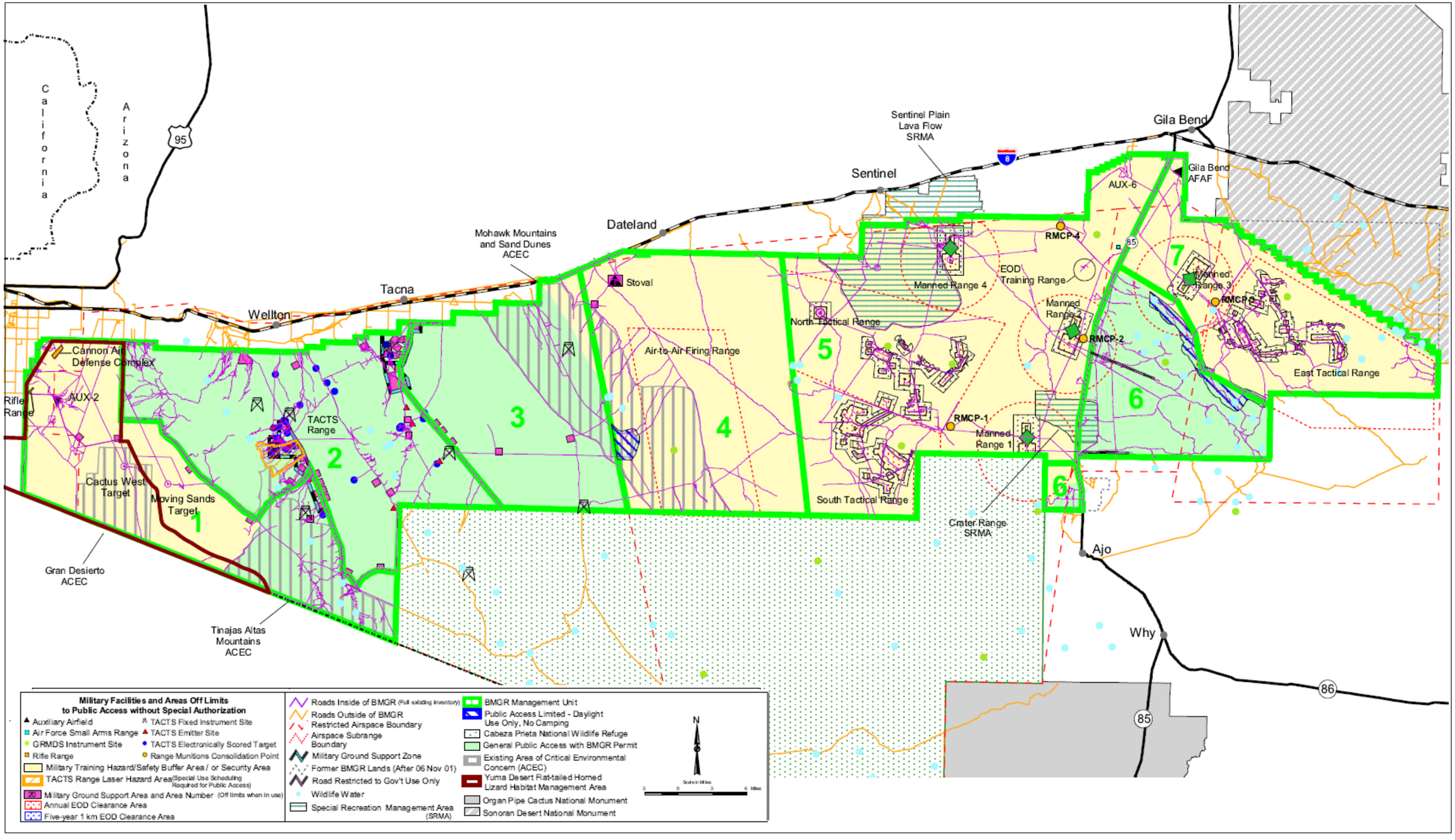



Figure I-4. BMGR management units and existing public access restrictions

instrument site on Hat Mountain. Public travel on the two target lead-in-lines is not permitted, but general public access is allowed in the rest of the subunit, and it is a popular back-country recreation site. No camping or nighttime travel is permitted along the road that roughly parallels and crosses the boundary between Units 6 and 7 because of hazards associated with air-to-ground munitions delivery training in Unit 7 (ETAC). The smaller of the two subunits lies between State Route 85 and Childs Mountain. The southeastern quarter of this subunit, which is known as the Ajo Air Force Station area, is open to public access. The northern half of the subunit provides a safety buffer for munitions delivery training missions at Manned Range 1 and is not open to the public.

Management Unit 7 comprises the easternmost areas of BMGR East including the Gila Bend AFAF; that facility, which is located in the northern portion of this unit, is the only industrial/urban area identified within the BMGR. Military surface use is generally confined to the northwestern valley areas of the unit and includes Manned Range 3 and ETAC (see Figure I-4). General public access is not compatible with military activities within nearly all of this unit because of ongoing munitions delivery training missions, high UXO concentrations, targeting laser use, and airfield security requirements. Public entry to Management Unit 7 is limited to the use of existing roads which parallel the unit boundary and cross in and out of the restricted area for short distances.

With the exception of a small campground on Gila Bend AFAF which is available for active duty and retired military personnel, there are no developed recreation sites or facilities on the BMGR. All recreational access to the BMGR is by permit only. Additional AGFD permits must be obtained for hunting. Areas on the BMGR currently open to regular AGFD hunting seasons include Management Units 2, 3, and 6 and the portion of Management Unit 1 that is open to public access. A portion of Unit 4 along the Mohawk Mountains is open to big horn sheep hunters under an Air Force Special Use Permit. All permit applicants must sign a hold-harmless agreement; applicants also must watch a range safety video in order to access Unit 6 and the small portion of Unit 1 that is open to the public. All permit holders are expected to comply with general rules of conduct for public lands. These rules address sanitation; terms of occupancy; vehicle use; natural and cultural resources; and health, safety, and comfort.

### 2.4.2 Cultural Resources and the INRMP

The INRMP incorporates the provisions of this ICRMP by reference, and public access to and use of portions of BMGR may be restricted or curtailed if and when such measures are required in order to protect vulnerable resources. The INRMP also specifically incorporates the cultural resource monitoring requirements identified in Parts II and III.

Because most cultural resource inventories completed by the Air Force and Marine Corps to date have focused on the military use areas, the vast area that has been and remains open to public use is largely unsurveyed. As a result, our knowledge of the resources that may have been and may continue to be affected by public use is extremely limited. Some cultural resources have been identified in these areas over the years, either by small, systematic surveys (for example, around developed wildlife waters) or through reports of discoveries by casual range users.

Cultural resources recorded to date on BMGR include artifact scatters, hearths, roasting pits, possible agricultural fields, petroglyphs, pictographs, bedrock milling sites, cairns, quarries geoglyphs, trails, trail shrines, sites associated with historic Euro-American use such as mines and related features, wells, ranches, roads, and military training-related features such as World War II auxiliary airfields.

Native American tribes in the region have indicated that these places represent their history and heritage, and are thus important parts of their cultures. Consultation with tribes that attach cultural importance to places on BMGR has identified several general concerns or recommendations regarding natural and cultural resource management and the INRMP. Those comments were summarized as follows:

- Continue efforts to preserve and protect cultural resources and, in particular, continue to involve tribes in cultural resource issues
- Prohibit off-road vehicular travel because such activity damages resources
- Ensure DoD maintains adequate cultural and biological staffing to address the complexity of the BMGR and the associated management issues
- Control recreational access to protect natural and cultural resources
- Coordinate with and involve tribes in range management activities
- Restrict development of tinajas and other natural water sources on the range as wildlife waters.

#### 2.4.2.1 Section 106 Review of INRMP Implementation

The Air Force and Marine Corps completed the review required by Section 106 of the NHPA and 36 CFR Part 800, *Protection of Historic Properties*, to support implementing the INRMP (see Part I, Section 3, for more information on the NHPA) by executing a programmatic agreement (PA) consistent with 36 CFR 800.14(b)(1)(ii), which provides for the use of a PA when effects on historic properties cannot be determined prior to approval.

The undertaking includes those actions described in the proposed action that would be implemented without further analysis when the INRMP was signed. Specifically, it includes 6 of the 17 conservation elements shown in Table 3-3 of the EIS (elements 3-7 and 9): motorized access and unroaded area management; camping and visitor stay limits; recreation services and use supervision; rockhounding; woodcutting, gathering, and firewood use, and collection of native plants; and recreational shooting.

Consulting parties included the SHPO and tribes that claim cultural affiliation with places on BMGR. The BLM and USFWS, on behalf of the Secretary of the Interior; and the AGFD, on behalf of the State of Arizona, also were afforded an opportunity to participate in consultation. Through the IEC, the agencies also invited the public—interested individuals, organizations, and entities— to participate in PA development (36 CFR 800.14(b)(2)(ii)). The Advisory Council on Historic Preservation (ACHP) declined to participate in consultation.

The area of potential effect (APE) is the area within which any historic properties that may exist may be affected by the undertaking. Impacts associated with the six elements listed above result from public use of BMGR, so the APE is limited to areas where public access will be permitted.

On BMGR East, the APE includes almost all of Management Unit 6 (Area B plus what is known as the Ajo Air Station area) and a very small portion of Management Unit 7, which are open to public access. On BMGR West, the APE is Management Units 2 and 3 (some areas off-limits when used for training), plus the southeastern-most extension of Unit 1, which encompasses the existing Tinajas Altas Mountains Area of Critical Environmental Concern.

Historically, the Air Force and Marine Corps have concentrated their inventory efforts on areas that may be affected by the military mission; as a result, most of the area where public access is permitted has not been systematically surveyed. On BMGR East, only 2,346 of the roughly 138,000 acres within Unit 6 have been systematically surveyed. On BMGR West, more than 5000 acres within Unit 1 were surveyed as a part of the Tinajas Altas project sponsored by the Air Force during the previous range withdrawal. With this exception, most surveys have been limited to military use areas. In all, roughly 39,000 acres on BMGR West have been systematically surveyed.

The executed PA, which has been filed with the ACHP, demonstrates compliance with Section 106 by listing historic properties known to exist in the APE and describing a phased strategy for identifying and evaluating other potentially eligible properties within the APE, and taking into account potential impacts to those properties.

All of the permitted actions listed above may affect historic properties. The INRMP will continue to support vehicle-based camping within 50 feet of the approved road system, and this activity is likely to adversely affect any historic properties that exist within this zone. Firewood collecting, rock hounding, and recreational shooting also may affect historic properties. Other permitted recreational activities (for example, hiking) are unlikely to have an appreciable effect on cultural resources. Activities that are not permitted (that is, not allowed under the INRMP and the rules governing recreational use by permit) but are facilitated by permitted access—such as vandalism or artifact collecting—may have a considerable adverse effect. Permit enforcement, environmental awareness education, and other efforts will be used to avoid or minimize these potential effects.

The Air Force and Marine Corps, with the consulting parties, will make determinations of eligibility for previously recorded sites, and also will prioritize areas for survey. Priority survey areas will include known camping and recreational use sites, areas adjacent to most heavily traveled roads, and natural water sources such as washes, springs, and tinajas. Other priority areas may be identified based on recreation monitoring or other management activities, including observations made by range security patrols and volunteer Site Stewards.

Measures to avoid, minimize, or mitigate adverse effects will be tailored to the nature of the resource and the likely impacts. Adverse effects to some resources may be avoided or minimized through management actions such as road closures, signing, monitoring by Site Stewards or increased range security patrols.

The Air Force and Marine Corps will prepare an annual report outlining actions taken to implement the PA and will distribute it to the consulting parties.

**Section 3**

# THE LEGAL SETTING

The MLWA of 1999 specified that the INRMP for the BMGR would include provisions for the proper management and protection of cultural as well as natural resources and for sustainable use by the public of those resources to the extent consistent with the military purposes of the range [P.L. 106-65 §3031(b)(3)(E)(i)]. To satisfy these requirements, the ICRMP for BMGR is incorporated in the INRMP by reference.

Authority and guidance for cultural resources management on DoD lands is derived from a number of other federal laws, regulations, executive orders and memoranda, and military requirements (Table I-2).

## 3.1 FEDERAL LAWS, REGULATIONS, AND GUIDELINES

Although private efforts to study and preserve the cultural resources of the United States date to the late 1700s, laws to promote cultural resource preservation date only from the early 1900s (King and others 1977). The following sections summarize the laws relating to the management of cultural resources on the BMGR.

### 3.1.1 Military Lands Withdrawal Act of 1999 (P. L. 106-65)

The MLWA of 1999 renewed the withdrawal of the BMGR for military use for a period of 25 years, and assigned full land management responsibility to the Secretaries of the Air Force and Navy for their respective portions of the range. It also directs the Secretaries to develop an INRMP that will "include provisions for proper management and protection of the natural and cultural resources of such lands, and for sustainable use by the public of such resources to the extent consistent with the military purposes for which such lands are withdrawn and reserved by this section." (P.L. 106-65 Sec. 3031(b)(3)(E)(i).

The MLWA also includes provisions that emphasize the importance of natural and cultural resource management in sustaining the withdrawal. The Secretary of the Interior, upon determining that the withdrawn lands are not being managed in accordance with the INRMP and that "the failure to do so is resulting in significant and verifiable degradation of the natural or cultural resources of such lands, is required to notify the Secretaries of the Air Force and Navy. Ultimately, if identified problems are not resolved, responsibility for the management of natural and cultural resources on the BMGR may be transferred to the Secretary of the Interior.

MLWA (Section 3031(b)(9)(B)) also defines sacred sites:

> The term "sacred site" means any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or its designee, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, but only to the extent that the tribe or its designee, has informed the Secretary of the Navy or the Secretary of the Air Force of the existence of such

site. Neither the Secretary of the Department of Defense, the Secretary of the Navy, the Secretary of the Air Force, nor the Secretary of the Interior shall be required under section 552 of title 5, United States Code, to make available to the public any information concerning the location, character, or use of any traditional Indian religious or sacred site located on lands withdrawn and reserved by this subsection.

**Table I-2**

**SUMMARY OF LEGAL REQUIREMENTS**

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|---|
| ***Federal Laws*** |
| Military Lands Withdrawal Act of 1999, P.L. 106-65 |
| Antiquities Act of 1906, P.L. 59-209, 16 U.S.C. 431-433 |
| Historic Sites Act of 1935, as amended, P.L. 74-292, 16 U.S.C. 461-467 |
| National Historic Preservation Act of 1966, as amended, P.L. 89-665, 16 U.S.C. 470 et seq. |
| National Environmental Policy Act of 1969, P.L. 91-190, 42 U.S.C. 4321 et seq. |
| Archeological and Historic Preservation Act of 1974, P.L. 93-291, 16 U.S.C. 469-469c-1 |
| American Indian Religious Freedom Act of 1978, P.L. 95-341, 42 U.S.C. 1996 |
| Archaeological Resources Protection Act of 1979, as amended, P.L. 96-95, 16 U.S.C. 470aa et seq. |
| Native American Graves Protection and Repatriation Act of 1990, P.L. 101-601, 25 U.S.C. 3001-3013 |
| ***Federal Regulations*** |
| 32 CFR Part 229, Protection of Archaeological Resources: Uniform Regulations |
| 36 CFR Part 60, National Register of Historic Places |
| 36 CFR Part 63, Determinations of Eligibility for Inclusion in the National Register of Historic Places |
| 36 CFR Part 65, National Historic Landmarks Program |
| 36 CFR Part 68, The Secretary of the Interior's Standards for the Treatment of Historic Properties |
| 36 CFR Part 78, Waiver of Federal Agency Responsibilities under Section 110 of the National Historic Preservation Act |
| 36 CFR Part 79, Curation of Federally-Owned and Administered Archeological Collections |
| 36 CFR Part 800, Protection of Historic Properties |
| 43 CFR Part 3, Preservation of American Antiquities |
| 43 CFR Part 10, Native American Graves Protection and Repatriation Act Regulations |
| ***Executive Memorandum and Orders*** |
| Executive Memorandum, 29 April 1994, Government-to-Government Relations with Native American Tribal Governments |
| Executive Order 13007, 24 May 1996, Indian Sacred Sites |
| Executive Order 13175, 6 November 2000, Consultation and Coordination with Indian Tribal Governments |
| ***Military Requirements*** |
| DoD Directive 4710.1, Archeological and Historic Resources Management, 21 June 1984 |
| DoD Instruction 4710.02, DoD Interactions with Federally Recognized Tribes, 14 September 2006 |
| DoD Instruction 4715.3, Environmental Conservation Program, 3 May 1996 |
| DoD Instruction 4715.16, Cultural Resources Management, 18 September 2008 |
| DoD American Indian and Alaska Native Policy, 20 October 1998 |
| Air Force Instruction 32-7065, Cultural Resources Management Program, 1 June 2004 |
| Interim Guidance: Treatment of Cold War historic Properties for U.S. Air Force Installations, June 1993 |
| SECNAV Instruction 4000.35A, Department of the Navy Cultural Resources Program, 9 April 2001 |
| MCO P5090.2A, Marine Corps Environmental Compliance and Protection Manual |
| ***Other Guidance*** |
| Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines, 48 FR 44716 |
| The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings |
| Guidelines for Federal Agency Responsibilities under Section 110 of the National Historic Preservation Act |
| Guidelines for Restricting Information on the Location of National Register Properties |
| Consultation with Native Americans Concerning Properties of Traditional Religious Cultural Importance, Advisory Council on Historic Preservation, 1993 |
| Guidelines for Evaluating and Documenting Traditional Cultural Properties, 1994 |

### 3.1.2 Antiquities Act of 1906 (16 U.S.C. §§431-433)

The Antiquities Act codified at 43 Code of Federal Regulations (CFR) Part 3 is the first federal law to provide protection of ruins and objects of antiquity on federal lands. It authorizes the President to establish national monuments and objects of historic or scientific interest. The Act also established a system to permit examination and excavation by qualified researchers to increase knowledge and collect antiquities for permanent preservation in public museums. Penalties were established for unauthorized excavation and collection. Other laws have largely superceded the Antiquities Act; however, the authority to withdraw public lands from multiple use status to create National Monuments continues to be exercised. Also, the Antiquities Act remains the fundamental authorization for protection of paleontological resources.

### 3.1.3 Historic Sites Act of 1935 (16 U.S.C. §§461-467)

The Historic Sites Act (36 CFR Part 65) established a national policy to identify and preserve historic sites, buildings, objects, and antiquities of national significance. The law authorized the Secretary of the Interior to conduct surveys, collect and preserve data, and acquire historic and archaeological sites. The Historic American Building Survey (HABS) and Historic American Engineering Record (HAER) stem from this act, as well as the National Park Service program of designating National Historic Landmarks.

### 3.1.4 National Historic Preservation Act of 1966 (16 U.S.C. §470 et seq.)

The NHPA, as amended, is the cornerstone of the current federal cultural resource preservation program. The Act proclaims the historical and cultural foundations of the Nation should be preserved as a living part of our community life in order to give a sense of orientation to the American people. The NHPA expanded the policy enunciated by the Historic Sites Act to encompass resources of state and local significance as well as national, thus providing the basis for an expanded National Register of Historic Places (National Register) maintained by the Secretary of the Interior.

The NHPA also established the ACHP and the network of SHPOs. The ACHP advises the President and Congress on matters relating to historic preservation, encourages public interest and participation in historic preservation, and assists state and local governments in drafting legislation relating to historic preservation. The NHPA also directed the ACHP to promulgate regulations implementing Section 106. Under that regulation—36 CFR Part 800, *Protection of Historic Properties*—the SHPOs represent the people's interests in consultation with federal agencies regarding historic properties.

The main purpose of the NHPA is to protect "historic properties," defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register. To be determined eligible for the National Register, properties must be significant in American history, architecture, archaeology, engineering, or culture and generally must be at least 50 years old. They must also possess integrity of location, design, setting, materials, workmanship, feeling, or association, and meet at least one of the criteria set forth in the National Register regulations (36 CFR Part 60).

Sections 106 and 110 of the NHPA and the regulations at 36 CFR Part 800 have particular relevance for ICRMPs. Section 106 establishes a strategy for protecting historic properties by directing federal agencies to make reasonable and good faith efforts to identify properties eligible for listing on the National Register and take into account the effects of their undertakings on such properties and to provide the Council an opportunity to comment on these activities. Section 110(a)(2) directs agencies to identify, evaluate, and nominate to the National Register historic properties under their jurisdiction or control. This section also stipulates that these activities be conducted in consultation with federal, state, and local agencies, Native American tribes, and interested parties.

The NHPA was substantially amended in 1992 to recognize that properties of traditional religious or cultural importance to a Native American tribe may be eligible for inclusion in the National Register. Section 101(d)(6)(B) of the NHPA requires agency officials to consult with any Native American tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by an undertaking. The Council issued revised regulations in 2001 which significantly modified the Section 106 review process to emphasize the role of Native American consultation.

Other regulations implementing NHPA include the *Secretary of Interior's Standards for Historic Preservation Projects* (36 CFR Part 68), which address approaches to preservation, rehabilitation, restoration, and reconstruction. Additional direction is provided by *Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines,* which address preservation planning; identification, evaluation, and registration of resources; historical, architectural and engineering, and archaeological documentation; and professional qualification standards.

### 3.1.5 National Environmental Policy Act of 1969 (42 U.S.C. §4321et seq.)

NEPA established the protection and enhancement of the environment as national policy. In addition to natural resources, NEPA specifically stipulates that federal agencies should work to preserve historic and cultural aspects of our national heritage. Implementing regulations issued by the Council on Environmental Quality are codified at 40 CFR Parts 1500-1508, and the Air Force has published counterpart regulations at 32 CFR Part 989. These regulations encourage combining NEPA compliance with other regulatory requirements such as those of the NHPA, American Indian Religious Freedom Act (AIRFA), and Native American Graves Protection and Repatriation Act (NAGPRA).

### 3.1.6 Archeological and Historic Preservation Act of 1974 (16 U.S.C. §§469-469c-1)

The Archeological and Historic Preservation Act (AHPA), promulgated as an amendment of the Reservoir Salvage Act of 1960, provides for the preservation of archaeological and historical information that otherwise might be lost as a result of federal construction projects and other federally licensed activities and programs. This Act stipulates that up to one percent of the funding appropriated by Congress for federal undertakings can be spent to recover, preserve, and protect

archaeological and historical data. A subsequent amendment authorized the one-percent limit to be administratively exceeded under certain circumstances.

### 3.1.7 American Indian Religious Freedom Act of 1978 (42 U.S.C. §1996)

The American Indian Religious Freedom Act (AIRFA) reiterates the First Amendment guarantee of religious freedom, with specific reference to the inherent right of Native Americans, Native Alaskans, and Native Hawaiians to believe, express, and exercise their traditional religions. Such rights include, but are not limited to, access to religious sites, use and possession of sacred objects, and freedom to worship through ceremonial and traditional rites. Federal agencies are directed to evaluate their policies and procedures to determine if changes are needed to ensure that such rights and freedoms are not disrupted by agency practices. The Act is not implemented by regulations.

### 3.1.8 Archeological Resources Protection Act of 1979 (16 U.S.C. §470aa et seq.)

The Archeological Resources Protection Act (ARPA) strengthened protection of archaeological resources on federal and tribal lands by increasing the penalties for unauthorized excavation, collection, or damage from misdemeanors defined by the Antiquities Act of 1906 to felonies with fines up to $10,000 and one year of imprisonment for first offenses. Trafficking in archaeological resources from public and tribal lands is also prohibited by ARPA. ARPA requires notification of affected Native American tribes if archaeological investigations would result in harm to or destruction of any location considered by tribes to have religious or cultural importance. When archaeological investigations are performed under contract to the installation or facility where they are located, such contracts serve in lieu of a permit. The implementing regulations are at 32 CFR Part 229.

Regulations for *Curation of Federally Owned and Administered Archeological Collections*, 36 CFR Part 79, define standards, procedures, and guidelines to be followed by federal agencies to preserve collections of prehistoric and historic material remains and associated records. These regulations apply not only to collections recovered under the authority of ARPA, but also the Antiquities Act, AHPA, and NHPA.

### 3.1.9 Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. §3001 et seq.)

The Native American Graves Protection and Repatriation Act (NAGPRA) protects human remains, funerary objects, sacred objects, and items of cultural patrimony of indigenous peoples on federal lands. The Act stipulates priorities for assigning ownership or control of such cultural items excavated or discovered on federal or tribal lands.

The Act also provides for repatriation of human remains and cultural items previously collected from federal lands and in the possession or control of a federal agency or federally funded repository. Implementing regulations are codified at 43 CFR Part 10. In addition to defining procedures for dealing with previously collected human remains and cultural items, these regulations outline procedures for negotiating plans of action or comprehensive agreements for

treatment of human remains and cultural items encountered in intentional excavations or inadvertent discoveries on federal or tribal lands.

## 3.2 EXECUTIVE MEMORANDUM AND ORDERS

Three presidential directives are particularly relevant to managing cultural resources. An Executive Memorandum and an Executive Order (EO) address how executive agencies should consult with Native American tribal governments, which have a unique status as dependent sovereign nations. Another EO directs executive agencies to protect sites that are sacred to Native Americans.

### 3.2.1 Executive Memorandum, 29 April 1994, Government-to-Government Relations with Native American Tribal Governments

Executive Memorandum of 29 April 1994 addressed the nature of relations with Native American tribes. It requires federal agencies to establish and operate within a government-to-government relationship with federally recognized tribes.

### 3.2.2 Executive Order 13007 of May 24, 1996, on Indian Sacred Sites

EO 13007 addressed Native American sacred sites. It requires that to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, federal land managers must accommodate access to and ceremonial use of Native American sacred sites by native religious practitioners, and avoid adversely affecting the physical integrity of sacred sites. The order also charges agencies to maintain the confidentiality of sacred sites when appropriate.

### 3.2.3 Executive Order 13175 of November 6, 2000, on Consultation and Coordination with Indian Tribal Governments

This order established provisions for regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications. It further has provisions to strengthen government-to-government relationships, and reduce the imposition of unfunded mandates on Native American tribes. EO 13175 directs agencies to establish an accountable process to ensure meaningful and timely input by tribal officials in the development of any regulatory policies that have tribal implications.

## 3.3 MILITARY REQUIREMENTS

In addition to federal legislation and regulations, the DoD, Air Force, Navy, and Marine Corps have developed formal guidance to aid land managers in implementing cultural resource regulations. Relevant documents are summarized here.

### 3.3.1 **DoD Directive 4710.1, *Archaeological and Historic Resources Management*, 21 June 1984**

This directive provides policy, prescribes procedures, and assigns responsibilities for the management of archaeological and historic resources under DoD control. It is the policy of DoD to integrate historic preservation requirements with the planning and management of activities under DoD control. It also is DoD policy to minimize expenditures through judicious application of options available in complying with applicable laws, and to encourage practical and economical rehabilitation and adaptive use of significant historic buildings and structures.

### 3.3.2 DoD Instruction 4710.02, DoD Interactions with Federally Recognized Tribes, 14 September 2006

This instruction implements DoD policy, assigns responsibilities, and provided procedures for DoD interactions with federally recognized tribes in accordance with DoD guidance, executive orders, and presidential memoranda. It is the policy of DoD to: 1) meet its responsibilities to tribes and comply with applicable statutes, regulations, and guidance; 2) build stable and enduring relationships with tribal governments; 3) fully integrate the principles and practices of meaningful consultation and communication with tribes; and, 4) take into consideration the significance that tribes ascribe to protected tribal resources.

### 3.3.3 DoD Instruction 4715.3, Environmental Conservation Program, 3 May 1996

DoD Instruction (DoDI) 4715.3 covers a wide range of topics pertinent to the integrated management of natural and cultural resources on properties under DoD control and describes means and assigns responsibilities for implementing policies, and prescribes appropriate procedures. It also directs DoD installations to take a proactive approach to consultation with Native American tribes, both in the Section 106 process and with respect to tribal cultural concerns in general. Among other things, it also directs installations to select a staff member to serve as a liaison to tribes and to educate appropriate staff about tribes with cultural ties to lands managed by DoD.

### 3.3.4 DoD Instruction 4715.16, Cultural Resources Management, 18 September 2008

This instruction establishes DoD policy and assigns responsibilities in accordance with other DoD instructions and directives for compliance with applicable Federal statutory and regulatory requirements, executive orders and memoranda for the integrated management of cultural resources on DoD-managed lands. It is DoD policy to:

- Manage and maintain cultural resources under DoD control in a sustainable manner through a comprehensive program that considers the preservation of historic, archaeological, architectural, and cultural values; is mission supporting; and results in sound and responsible stewardship.
- Be an international and national leader in the stewardship of cultural resources by promoting and interpreting the cultural resources it manages to inspire DoD personnel and to encourage and maintain U.S. public support for its military.

- Consult in good faith with internal and external stakeholders and promote partnerships to manage and maintain cultural resources by developing and fostering positive partnerships with Federal, tribal, State, and local government agencies; professional and advocacy organizations; and the general public.

It provides guidance in several areas, including the processes of cultural resource management, programming funds for cultural resource programs, and the contents of ICRMPs, and establishes cultural resource metrics for DoD components.

### 3.3.5 DoD American Indian and Alaska Native Policy, 20 October 1998

The DoD American Indian and Alaska Native Policy addresses trust responsibilities to tribes. This policy enunciates principles based on federal statutes, treaties, and other policies for DoD to use in working with federally recognized American Indian and Alaska Native Governments. The goal of the policy is to build stable and enduring relationships and to establish procedures for meaningful consultation and communication with tribes. The policy recognizes that tribes ascribe significance to certain natural resources and properties of traditional or customary religious or cultural importance, and that DoD will manage its lands to conserve, protect, and provide access to those resources to the extent practicable and consistent with military training, security, and readiness requirements.

The policy supports tribal self-governance and recognizes the obligations for establishing government-to-government relations between the federal government and tribes. It recognizes the importance of increasing understanding and addressing tribal concerns of the past, present, and future. The policy stipulates that tribal consultation needs to be conducted prior to reaching decisions on matters that have the potential to significantly affect protected tribal resources, tribal rights, or Indian lands.

### 3.3.6 Air Force Instruction 32-7065, Cultural Resources Management, 1 June 2004

AFI 32-7065 provides guidance for protecting and managing cultural resources and implements DoDI 4715.3. This AFI is comprehensive and covers the full range of cultural resource management issues pertinent to Air Force operations. It outlines the requirements for cultural resource management plans such as this document, and also addresses appropriate training of Air Force personnel with regard to cultural resource management, and describes the steps to follow in evaluating and nominating eligible properties to the National Register. The AFI defines compliance requirements for protecting cultural resources.

AFI 32-7065 also provides guidance for determining the eligibility of properties for National Register listing and for nominating those properties that qualify. Guidance for consulting with experts and preparing MOAs is included, along with advice about preparing statements of work and when necessary, issuing ARPA permits. The AFI includes general guidelines for data recovery, budgeting, database management, and cultural resource management training.

### 3.3.7 Interim Guidance: Treatment of Cold War Historic Properties for U.S. Air Force Installations, June 1993

The Cold War had a tremendous impact on cultural and political developments throughout the world. Because of concern that highly significant properties may be destroyed prior to reaching the normal 50-year age for evaluation, the Air Force requires its installations in the United States to consider Cold War-era properties for National Register eligibility and offers "Interim Guidance." Only a carefully selected, relatively small number of these resources are expected to meet eligibility requirements for National Register listing for properties less than 50 years of age.

### 3.3.8 Secretary of the Navy (SECNAV) Instruction 4000.35A, Department of the Navy Cultural Resources Program, 9 April 2001

SECNAV Instruction 4000.35A establishes policy and assigns responsibilities for a cultural resources program under the direction and oversight of the Secretary of the Navy (Installations and Environment). This instruction assigns responsibilities to the Commandant of the Marine Corps, which are applicable to Marine Corps activities on the BMGR, and the Commandant will issue implementing instructions. The *Navy Historic and Archaeological Resources Protection Planning Guidelines* also address preparation of Historic and Archaeological Resource Protection (HARP) plans, which are comparable to ICRMPs.

### 3.3.9 Marine Corps Order P5090.2A, Environmental Compliance and Protection Manual

Chapter 8 of Marine Corps Order P5090.2A, *Environmental Compliance and Protection Manual,* addresses historic and archaeological resources protection. This manual defines regulatory requirements, states Marine Corps policy, and assigns responsibilities to staff of the Commandant of the Marine Corps and installation commanders.

**Section 4**

# THE NATURAL ENVIRONMENT

The BMGR is located within the most arid portion of the Sonoran Desert. Despite this harsh environment, humans have utilized the natural and biotic resources of the area for at least 12,000 years. Any study of human behavior must take into account the environmental setting for human survival and adaptation to changing environmental conditions. Decisions regarding mobility and sedentism, settlement location, scheduling of subsistence activities, and travel were influenced by the distribution of various natural and biotic resources (Flannery 1968). This section provides general information about the natural resources of the BMGR based on an assessment and summary of published data presented by Ahlstrom (2000) and concludes with a summary of environmental changes during the last 12,000 years. Detailed studies of the various aspects of the natural and biotic environment can be found in Dean (1988), Sellers and Hill (1974), McGuire and Schiffer (1982), and McClellan and Vogler (1977).

## 4.1 THE PAPAGUERÍA

The Papaguería is a unique geographic area in southwestern Arizona and northwestern Sonora, Mexico, which extends from south of the Gila River on the north to the Gulf of California on the south, and from the Colorado River on the west to Three Points (west of Tucson) on the east (Figure I-4). This region is subdivided into the eastern and western Papaguería based on cultural and environmental factors: the boundary between two Piman-speaking O'odham groups, and the juncture of two biotic communities coupled with a marked change in annual rainfall. The boundary between these areas is located near and roughly parallels the eastern boundary of the BMGR East. This term is used extensively in archaeological and other literature, including this report, to identify a geographic region, an environment, and a cultural area, and it features prominently in the discussions of historic themes and culture history in Sections 5 and 6.

## 4.2 TOPOGRAPHY AND SURFICIAL GEOLOGY

The Basin and Range physiographic province (Fenneman 1931; McClellan and Vogler 1977) is characterized by a series of long and narrow, parallel northwest trending mountain ranges that are separated by alluvium-filled basins or valleys. Two subprovinces of the Basin and Range are present within the BMGR. The Salton Trough subprovince includes the area west and south of the Gila and Tinajas Altas Mountains and the Yuma Desert and west of the Disierto de Altar. The Salton Trough is a down-warped or down-faulted area that was once part of the Gulf of California, but has been filled in by the accretion of the Colorado River delta. This province is characterized by "desert alluvial slopes and delta plain" (Fenneman 1931: 377-379, Plate I). The Sonoran Desert subprovince includes the area east of the Gila and Tinajas Altas Mountains and north of the United States—Mexico border. This subprovince is characterized by widely separated short ranges in desert plains. These ranges are linear, and most trend northwest-southeast.

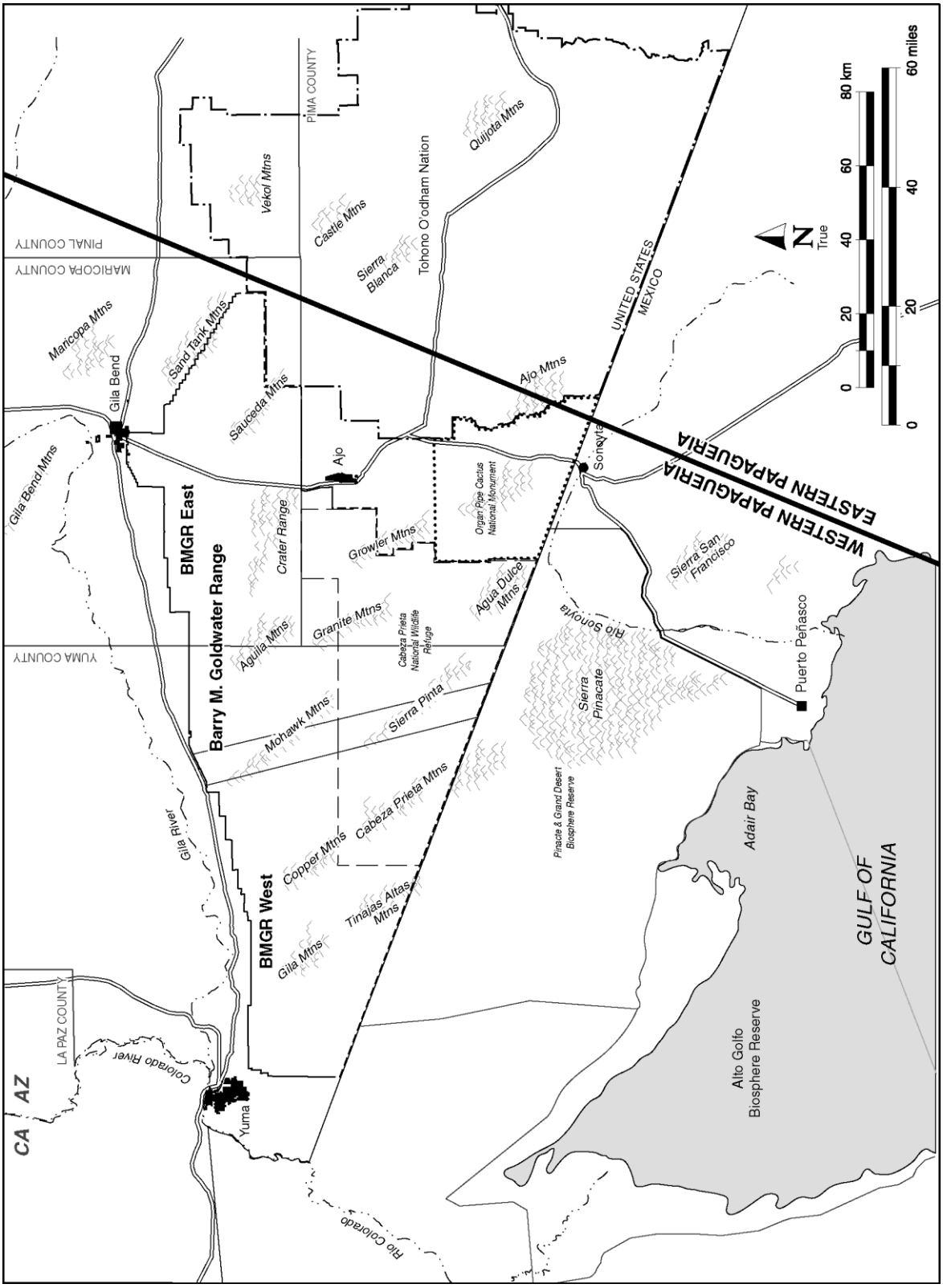


Figure I-4 The Eastern and Western Papaguería

Three major landforms are identified in the Basin and Range province: mountain ranges, piedmont slopes, and basins. Mountain ranges represent the first component, and two types are found on the BMGR. The sierra-type (sharp-crested) mountains were produced during the late Tertiary and early Quaternary Basin and Range disturbance. A series of earthquakes during that event simultaneously caused the mountains to thrust upward and the valleys to drop downward along north- to northwest-trending faults, producing a geologic structure commonly referred to as horst and graben. Bedded mesa-type mountains, composed of volcanic ash (NRPT 1986: 4-5), were formed by volcanism that also occurred during the Tertiary and Quaternary periods.

The piedmont slope, a large area of sloping land that is partly erosional, extends from the mountain fronts to the basins. The piedmont consists of an upper surface of eroded bedrock—the pediment—and a lower convex-shaped depositional surface—the alluvial fan. Lateral coalescence of the alluvial fan has resulted in the formation of extensive *bajadas* that slope gently toward the centers of the basins or valleys.

The basins were formed when sediments from the mountain and pediment slopes washed down and filled the troughs forming the valleys. Basin filling halted when structural uplift, accompanied by tilting of basins and faulting of basin-fill beds occurred during the Tertiary. The floors of the valleys slope gradually from 1,800 feet above sea level at the eastern end of the BMGR to just 200 feet at the western end. A secondary elevational gradient crosscuts this slope, as elevations of the valley floors decrease to the north, toward the Gila River valley (McClellan and Vogler 1977). Drainages, including Growler Wash and San Cristobal Wash, began to erode and cut the basin fill, forming watercourses through the central part of the basin and establishing a through-flowing drainage system.

In addition to these basin fill sediments, sand dunes occur in several valleys in the central and western portions of the BMGR. Most of the dunes on the BMGR are semistabilized (McClellan and Vogler 1977: 12). According to Bryan,

> The Yuma Desert is almost completely mantled with sand from 1 to 10 feet deep. Along the eastern margin of the Lechuguilla Desert, Tule Desert, and Mohawk Valley are belts of sand dunes. The belt of dunes is particularly conspicuous at the south end of the Pinta Mountains. In this locality the dunes are invading the mouths of the mountain canyons and impeding stream erosion. A belt of wind-blown sand from a quarter of a mile to a mile wide surrounds the Pinacate plain. Growler Valley and the valley of the Ajo are almost free of wind-blown sand, but patches of drifted sand occur on the Sentinel Plain and around its margin (Bryan 1925: 107).

The rocks of the mountain ranges are much older than the late Tertiary to early Quaternary faulting that led to the formation of the basin-and-range topography. Proterozoic granitoid and metamorphic rocks (1,450 to 1,800 million years ago [mya]) are distributed throughout the BMGR (Reynolds 1988). Late Cretaceous to Early Tertiary granitic and granitoid rocks (45 to 85 mya) are common in the western two-thirds of the range. Tertiary volcanic rocks (middle Miocene to Oligocene, 15 to 38 mya) occur in the eastern two-thirds of the BMGR and are dominant in the eastern one-third. Finally, Holocene to Tertiary (Pliocene to middle Miocene)

basaltic rocks (0 to 16 mya) are found as lava flows in the north central and south central portions of the BMGR.

Specific rock types associated with human use include rhyolite and quartzite quarries in the Sand Tank Mountains and the Crater Range, and rhyolite quarries in the Sauceda Mountains (Bayman 1992: 15; Blanchard 1992; Seymour and Doak 1993: 55, 59). Chert quarries have been recorded in the Crater Range (Seymour and Doak 1993: 59, 72). Quartz quarries, associated with volcanic rocks, have been recorded in the Crater Range and the Wellton Hills (Bayman 1992: 15; Blanchard 1992; Bowen 1982: 8). A metasandstone quarry recorded in the Baker Peaks also includes crystalline and volcanic rocks (Altschul and Jones 1989: 27, 61). Obsidian quarries are documented in and around the Sauceda Mountains and on the southwest side of the Sand Tank Mountains (Shackley 1995). Cryptocrystaline cobbles in ancient flood deposits also were used.

## 4.3 CLIMATE AND HYDROLOGY

Climate, which is an expression of meteorological phenomena over a long period of time, can be described in terms of local weather conditions such as temperature and precipitation. Climate influences the natural characteristics and processes on the BMGR. Climate and hydrology are interrelated environmental parameters that play key roles in the prehistoric and historic human use of the BMGR.

### 4.3.1 Temperature

The large amount of solar radiation received by the BMGR accounts for its generally mild winters and hot summers. Ahlstrom (2000: 24-27) summarizes temperature and precipitation data for three weather stations located around BMGR from 1941 through 1970: Wellton, at an elevation of 260 feet; Gila Bend, at 735 feet; and Ajo, at 1,763 feet. These data show that mean daily maximum temperatures are highest at Gila Bend, intermediate at Wellton, and lowest at Ajo. During the summer months, mean daily maximum temperatures at Gila Bend range from 104.8 to 109.1 degrees Fahrenheit (F). Mean daily minimum temperatures in most months are highest at Ajo, intermediate at Gila Bend, and lowest at Wellton. During the winter months, mean daily minimum temperatures at Wellton range from 34.5 to 38.2 degrees F. The mean freeze-free period at the three stations ranges from around 260 days at Gila Bend and Wellton to 314 days at Ajo (Ahlstrom 2000: 27). The growing season is longer at Ajo, an upland location, than at the other two stations, which are located in the Gila River Valley.

### 4.3.3 Precipitation

The BMGR climatic regime is characterized by a bimodal precipitation pattern that is unique to western North America (Dean 1988; Sellers and Hill 1974). Data from the Ajo, Gila Bend, and Wellton stations indicate two precipitation maxima (July-September and December-March) separated by intervals of reduced rainfall (October-November and April-June). The summer precipitation pattern reflects thunderstorms during July, August and September, which are associated with warm, moist air moving northwestward over the state from the Gulf of Mexico. Winter precipitation results from storms that enter the state from the Pacific Ocean and is more variable from year to year.

Annual precipitation during the period from 1941 to 1970 ranged from 0.62 to 8.81 inches at Wellton, 2.02 to 13.58 inches at Gila Bend, and 3.46 to 15.27 inches at Ajo (Ahlstrom 2000). Mean summer precipitation around the BMGR ranges from 0.5 to 4 inches, and mean winter precipitation from 1 to 2 inches. Almost no rain falls during the spring drought months of May and June.

### 4.3.3 Hydrology

The location of reliable water sources is vital to human settlement. Six types of natural water sources are found on the BMGR: washes, tinajas, charcos, playas, springs, and pozos (Ahlstrom 2000: 30). The BMGR contains through-flowing drainage systems with major drainages running along the axes of the intermountain basins. Several washes, including San Cristobal Wash and its tributary Growler Wash, Quilotosa Wash, Bender Wash, Sand Tank Wash, and Sauceda Wash, flow northward to the Gila River. Washes on the west side of the Gila and Tinajas Altas Mountains flow toward the Colorado River. Washes on the BMGR are ephemeral; that is, they "flow only during or after rains and as an immediate result of the rain" (Bryan 1925: 120). Both the Gila River, located north of the range, and the Rio Sonoyta, located to the south, are intermittent, which means they "have a permanent flow over short stretches of their courses throughout the year" (Bryan 1925: 119).

Tinajas, also known as rock tanks or plunge pools, are the most reliable source of water on the BMGR. They are basins or depressions that are worn into bedrock that capture rainfall and runoff; some tinajas may hold water throughout the year. Tinajas are found primarily in the bottoms of drainages and typically form as plunge pools below falls (Bryan 1925: 129-130): the Tinajas Altas, a series of nine plunge pools, and Baker Tanks are examples. According to Bryan (1925:127), "Streams of the size common in southwestern Arizona are competent to erode pools 10 to 20 feet in diameter and 3 to 10 feet deep." Some tanks are filled with sand, but contain water that can be obtained by digging. These sand tanks "are less likely to be foul than rock tanks, and as the sand slows evaporation, the water commonly lasts longer" (Bryan 1925: 257).

Broyles (1996: Table 1) defines perennial water holes as lasting "through drought to the next rainfall cycle, which ... should be within six months," and intermittent water holes as lasting from one to six months. Perennial water holes are found in the Aguila Mountains, Baker Peaks, Gila Mountains, and Tinajas Altas Mountains.

Charcos are formed by the ponding of water in channels underlain by fine-grained alluvium and vary from shallow pans 18 inches wide by 6 feet long to depressions 5 to 6 feet deep, 15 to 30 feet wide, and more than 1,000 feet long (Bryan 1925: 121). The larger charcos are of great importance to travelers through the desert, because only these hold sufficient water to last for more than a few days after a rain and are found in the same location from year to year" (Bryan 1925: 123).

Playas, which are located in the basins or valley bottoms, are flat areas where water occasionally stands and evaporates. Many playas contain evaporate salt deposits referred to as *salinas*. Playas, or dry lakebeds, are similar to charcos in that they are underlain by alluvium and at times

hold surface water. Playas occur primarily in the central portion of the range north of the Crater Range, the San Cristobal Valley, west of the Mohawk Mountains on the east side of the Mohawk Dunes, east of the Aguila Mountains, and east of the Sierra Pinta Mountains (Huckell 1979: Figures 1 and 6; McClellan and Vogler 1977: Map 1). Laguna Prieta, a salt water lake, is located farther west, between the Tinajas Altas Mountains and the Colorado River (Davis and others 1990; Ezell 1955: Figure 106; Lumholtz 1912: 254; Minckley and Brown 1982: Figure 151).

Springs and seeps (the latter having flows of less than 5 gallons per minute) are not common in mountain ranges on BMGR. Bryan identified two kinds of springs in his study area: " (1) fracture springs, which depend on water derived from rainfall, and stored in the fractures characteristic of certain types of rocks; and (2) fissure springs, which depend on fissures that penetrate the deeper parts of the earth's crust and allow deep-seated waters to rise to the surface" (1925: 161). Springs are found only in the far eastern portion of the BMGR; none has been located west of the Sand Tank Mountains. Two springs have been identified in Organ Pipe Cactus National Monument south of BMGR: Dripping Spring located in the Puerto Blanco Mountains (a fracture spring) and Quitobaquito Springs (a fissure spring).

Pozos are fresh- or brackish-water springs that are fed by precipitation that has percolated into the sand; they "are frequently associated with faults along the margin of the Gulf" (Davis and others 1990: 136; also Hayden 1976: 285). None has been identified on the BMGR; however, there has been no systematic survey of surface water sources to date.

## 4.4 PLANT AND WILDLIFE COMMUNITIES: THE BIOTIC ENVIRONMENT

The BMGR is located within the central portion of the Sonoran Desert, which is further divided into seven subdivisions (Shreve and Wiggins 1964: Map 1). Two of the latter, the Lower Colorado Valley and Arizona Upland subdivisions, occur within the BMGR. Shreve and Wiggins defined the boundary between these two subdivisions as extending north-south through the eastern end of the BMGR.

A second system of vegetation classification was developed by Brown and Lowe (1980) and applied to the Southwest (also see Brown 1982). The hierarchical structure of Brown and Lowe's classification system "provides for sensitivity to scale," and can be used to describe the environment at scales ranging from the regional to the local. Thus, the Sonoran Desertscrub biotic community, or biome, is divided into subdivisions, the subdivisions into series or plant communities, and the series into associations. Ahlstrom (2000: 42-43) grouped the 34 associations to create a finer scale mapping of the Lower Colorado River Valley and Arizona Upland subdivisions within the BMGR (Figure I-5).

The Lower Colorado River Valley subdivision is the driest of the Sonoran desert subdivisions, and plant growth is typically both open and simple, reflecting the intense competition existing between plants for the scarce water resource (Turner and Brown 1982: 190). This subdivision accounts for valley settings throughout the BMGR, as well as for portions of a number of mountain ranges. The Lower Colorado River Valley subdivision can be described with reference to a single plant series or community, Creosotebush-White Bursage. Alternatively, it can be divided into two dominant series, Creosotebush-White Bursage and Saltbush, and two lesser

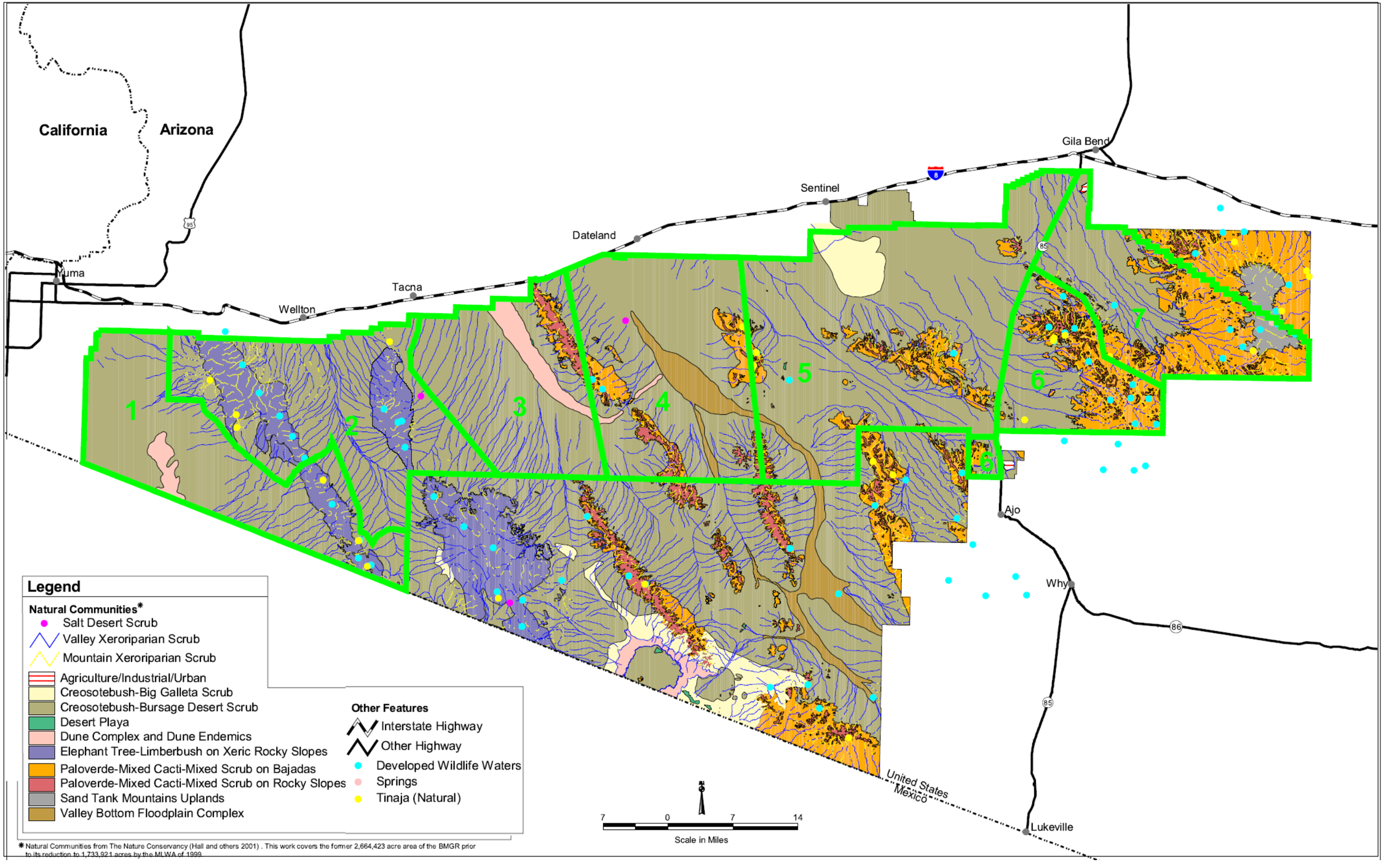


Figure I-6. Natural community conservation elements and BMGR management units

series, Creosotebush-Big Galleta and Mixed Scrub. Dominant plant species include white bursage (*Ambrosia dumosa*) and creosotebush (*Larrea tridentata*); others include mesquite (*Prosopis* sp.), big galleta grass (*Hilaria rigida*), triangle-leaf bursage (*A. deltoides*), ocotillo (*Fouquieria splendens*), blue paloverde (*Cerdicium floridum*), foothill paloverde (*C. microphyllum*), and ironwood (*Olneya tesota*).

Fauna include coyote (*Canis latrans*), desert bighorn sheep (*Ovis canadensis nelsoni*), which occupies the region's mountain ranges, the endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*), which lives in the basins, and mule deer (*Odocoileus hemionus*). Small mammals include the desert cottontail, black-tailed jackrabbit (*Lepus californicus*), and numerous species of rodents (Hoffmeister 1986; Turner and Brown 1982: 200).

Most mammals of the Lower Colorado subdivision have adapted to high daytime temperatures by spending much of the day underground or aestivating [passing the summer in a dormant or torpid state]. Consequently, the sandy plains of this subdivision may host large populations of burrowing rodents, at least one of which, the Round-tailed Ground Squirrel (*Spermophilus tereticaudus*), is characteristic of the subdivision (Turner and Brown 1982: 200). Because of the sparseness and openness of its vegetation, the Lower Colorado River Valley subdivision supports a less diverse avifauna than the Arizona Upland subdivision. "Its avian inhabitants are largely lesser numbers of arid-adapted desert species" (Turner and Brown 1982: 200). There are, on the other hand, a variety of snakes and lizards, some adapted to sandy habitats.

Most of the region containing the Arizona Upland subdivision of Sonoran Desertscrub "is on slopes, broken ground, and multi-dissected sloping plains (Turner and Brown 1982). The Arizona Upland subdivision is found at the extreme eastern portion of the BMGR, as well as on mountain ranges throughout the range. The Paloverde-Cacti-Mixed Scrub series is the primary Arizona Upland series. Foothill paloverde and saguaro (*Carnegia gigantea*) dominate the series, with ironwood playing a secondary role (NRPT 1986: 7-9). Additional species listed as dominants in one or another of the plant associations making up this community include creosotebush, brittlebush (*Encilia farinosa*), limberbush (*Jatropha* sp.), white bursage, and ocotillo.

Plants of this subdivision important to Native Americans include the saguaro, organ pipe cactus (*C. thurberi*), mesquite and other leguminous trees, cholla and prickly pear cacti (*Opuntia* sp.), and desert agave (*Agave deserti*). Saguaro can be expected in many of the Arizona Upland communities in bajada and mountain settings within BMGR (Turner and others 1995: 146). Desert agave occurs in scattered locations and has been observed generally in mountain settings at elevations above 200 m on the BMGR (Turner and others 1995: 50-54). Tables I-3 and I-4 list plant species used by the region's Native American inhabitants.

Like the Lower Colorado River Valley subdivision, large mammals of the Arizona Upland subdivision include the coyote, mule deer, white-tailed deer (*O. virginianus*), desert bighorn sheep, and collared peccary or javelina (*Dicotyles tajacu*); small mammals include desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit, and numerous species of rodents (Ahlstrom 2000: 50). The subdivision supports numerous and varied birds, lizards, and snakes (Turner and Brown 1982: 203). Animal species of economic importance are listed in Table I-5.

## Table I-3

## Plant Species of Economic Importance in the Western Papaguería

| Scientific Name | Common Name | Location | Edible Parts | Availability |
|---|---|---|---|---|
| *Acacia greggii* | cat-claw | bajada | seeds | July-September |
| *Agave deserti* | agave | mountain slopes | basal rosette, stem, leaves, flowers | November-May |
| *Allium* | wild onion | mountain slopes | leaves | winter |
| *Amaranthus* | pig-weed | valley floor | leaves, seeds | July-November |
| *Atriplex* | saltbush | bajada | seeds | spring, fall |
| *Boerhaavia* | spiderling | bajada | seeds, leaves | July-September |
| *Capsicum* | chillipiquin | mountain slopes | fruit | summer |
| *Carnegiea gigantea* | saguaro | bajada | fruits | July-November |
| *Celtis* | hackberry | valley floor | berries | July-November |
| *Cercidium* | paloverde | bajada | seeds | July-November |
| *Datil* | yucca | bajada | leaves, root | July-November |
| *Dichelostemma* | Papago blue-bells | mountain slopes | leaves | winter |
| *Eriogonum* | wild buckwheat | bajada | seeds | fall |
| *Ferocactus wislizenii* | fishhook barrel cactus | bajada | seeds | October-November |
| *Fouqieria* | ocotillo | bajada | flowers, seeds | April-June |
| *Franseria* | bursage | valley floor | leaves | July-November |
| *Larrea tridentata* | creosotebush | bajada | leaves | July-November |
| *Lycium* | wolfberry | bajada | berries | July-August |
| *Olneya tesota* | ironwood | bajada | seeds | July-August |
| *Opuntia* | cholla, prickly pear | bajada | buds | July-November |
| *Prosopis juliflora* | mesquite | valley floor | pods, seeds | July-November |
| *Quercus* | oak | mountain slopes | seeds | summer |
| *Rumex* | wild sorrel, dock | valley floor | leaves | March-April |
| *Solanum* | wild potato | mountain slopes | root | summer |
| *Suaeda* | seepweed | bajada | seeds, leaves | fall |

*Compiled from Brown and Lowe (1980: Appendix II), Coe (1979: 13-14), and Doelle (1980b: 84)

**Table I-4**

**Plants Mentioned in Oral Histories as Food and Beverage Sources Used by Hia C-Ed O'odham in the Twentieth Century***

| Scientific Name | Common Name | Edible Parts |
|---|---|---|
| *Acacia greggii* | cat-claw | pods |
| *Agave deserti* | agave, mescal | hearts |
| *Agave murpheyi* | agave, mescal | hearts |
| *Amaranthus fimbriatus* | desert spinach | leaves |
| *Amaranthus palmeri* | desert spinach | leaves |
| *Atriplex elegans* | wheelscale | greens |
| *Atriplex wrightii* | saltbush | greens |
| *Capsicum annuum* | chiltepine | fruits |
| *Carnegiea gigantea* | saguaro | fruits |
| *Cercidium floridum* | paloverde | fruits |
| *Cercidium microphyllum* | paloverde | seeds |
| *Chenopodium murale* | goose-foot | greens |
| *Cirsium neomexicanum* | thistle | stems (chewed) |
| *Citrullus lanatus* | watermelon | fruits |
| *Condalia globosa* | condalia | fruits |
| *Cucumis melo* | cantaloupe | melons |
| *Cucurbita argyrosperma* | squash | fruits |
| *Descurainia pinnata* | tansy mustard | seeds |
| *Dichelostemma pulchellum* | covenas | |
| *Echinocereus engelmannii* | hedgehog cactus | fruits |
| *Echinocereus fasciculatus* | hedgehog cactus | fruits |
| *Echinomastus erectrocentrus* | acuna cactus | stems |
| *Ephedra aspera* | Mormon tea | stems |
| *Ephedra trifurca* | Mormon tea | stems |
| *Ferocactus cylindraceus* | barrel cactus | fruits |
| *Ferocactus emoryi* | barrel cactus | fruits |
| *Ferocactus wislizenii* | barrel cactus | fruits |
| *Ficus carica* | fig | fruits |
| *Hoffmanseggia glauca* | hog potatoes | |
| *Lophocereus schottii* | senita | fruits |
| *Lycium andersonii* | wolfberry | berries |
| *Lycium berlandieri* | wolfberry | berries |
| *Lycium exsertum* | wolfberry | berries |
| *Lycium fremontii* | wolfberry | berries |

**Table I-4, continued**

**Plants Mentioned in Oral Histories as Food and Beverage Sources Used by Hia C-Ed O'odham in the Twentieth Century***

| Scientific Name | Common Name | Edible Parts |
|---|---|---|
| *Lycium parishii* | wolfberry | berries |
| *Mammillaria thornberi* | fishhook cactus | fruits |
| *Monolepis nuttalliana* | patota greens | |
| *Olneya tesota* | ironwood | seeds |
| *Opuntia acanthocarpa* | buckhorn cholla | buds |
| *Opuntia arbuscula* | pencil cholla | fruits |
| *Opuntia engelmannii* | prickly pear | fruits |
| *Opuntia fulgida* | jumping cholla | buds |
| *Opuntia leptocaulis* | cholla | fruits |
| *Opuntia violacea* | prickly pear | buds |
| *Orobranche cooperi* | broomrape | stalks |
| *Peniocereus greggii* | cereus | roots |
| *Phoenix dactlyifera* | data palm | fruits |
| *Pholisma sonorae* | sandfood | |
| *Plantago insularis* | psyllium | seeds |
| *Portulaca oleracea* | purslane greens | |
| *Prosopis pubescens* | screwbean | pods |
| *Prosopis glandulosa* | mesquite | pods |
| *Prosopis velutina* | velvet mesquite | |
| *Punica granatum* | pomegranite | seeds |
| *Salvia columbariae* | chia | seeds |
| *Sambucus mexicana* | elderberry | fruits |
| *Sarcostemma cynanchoides* | milkweed | sap |
| *Solanum eleagnifolium* | nightshade | fruits |
| *Stenocereus thurberi* | organ pipe | fruits |
| *Trianthema portulacastrum* | horse purslane | leaves |
| *Triticum aestivum* | wheat | seeds |
| *Vitis vinifera* | grapes | |
| *Zea mays* | corn | seed |
| *Zizyphus obtusifolia* | abrojo | fruits |

*This list is based on Nabhan and others (1989: Table 3) and includes both introduced and domesticated plants.

**Table I-5**

**Economically Important Animals of the Western Papaguería***

| Species | Common Name |
|---|---|
| *Antilocapra americana sonorensis* | sonoran pronghorn |
| *Bassariscus astutus* | ring-tailed cat |
| *Canis latrans* | coyote |
| *Citellus harrisii saxicola* | Harris' antelope squirrel |
| *Citellus tereticaudus* | round-tailed ground squirrel |
| *Dicotyles tajacu* | javelina |
| *Dipodomys deserti deserti* | desert kangaroo rat |
| *Lepus californicus deserticola* | black-tailed jack rabbit |
| *Lophortix* | quail |
| *Neotoma albigula* | white-throated wood rat |
| *Neotoma lepida* | desert wood rat |
| *Odocoileus hemionus crooki* | desert mule deer |
| *Ovis canadensis* | desert bighorn sheep |
| *Perognathus amplus rotundus* | Arizona pocket mouse |
| *Perognathus baileyi domensis* | Bailey's pocket mouse |
| *Peromyscus eremicus* | cactus mouse |
| *Sylvilagus auduboni* | desert cottontail |
| *Urocyon cinereoargenteus* | gray fox |
| *Vulpes macrotus* | kit fox |

*Compiled from Brown and Lowe (1982: Appendix II), Coe (1979: 14-15), and Doelle (1980b: 103)

## 4.5 PALEOCLIMATE

Human occupation in the Papaguería began in the Late Wisconsin era, at the end of the Pleistocene epoch, and the changes in regional environmental conditions since then must be a part of any attempt to reconstruct the history of human occupation. Paleoenvironmental scientists have used evidence derived from alluvial stratigraphy, pollen trapped in sediments, and plant materials incorporated in packrat middens to reconstruct that environment and describe its changes. See McGuire (1982b), Moratto (1984), Stone (1987), Weide (1982), and Ahlstrom (2000) for summaries of that research. Van Devender and others (1987), Van Devender (1990), and Betancourt and others (1990) have produced syntheses of vegetation history in the arid interior of western North America based on data from packrat middens.

There is considerable evidence that conditions in the Late Pleistocene were cooler and wetter than in the Holocene (Weide 1982: 8). As a result, lakes formed in many desert basins, and some plant species occurred at lower elevations than they do today.

Antevs (1948, 1955) identified the Provo Pluvial at the end of the Pleistocene and divided the Holocene into the Anathermal, Altithermal, and Medithermal ages. As summarized by Ahlstrom, the Provo Pluvial (to ca. 7000 B.C.), corresponding to the last advance of the Wisconsin continental ice sheet, was a time when the playas of the Great Basin were filled with water; the Anathermal (7000-5000 B.C.) was a warm, moist interval, becoming warmer and drier through time. The Altithermal (5000-2400 B.C.) was a warm and dry period, drier than today; the Medithermal (since 2000 B.C.) has been a cool and moist interval (Ahlstrom 2000: 56).

The shift from Late Pleistocene to Holocene conditions began within 1,000 years before or after 9000 B.C. according to Weide (1982:10). Vegetation during the late Pleistocene-Holocene transition (12,000-6000 B.C.) consisted of a widespread piñon-juniper woodland (*Pinus monophyla*, *Juniperus osteosperma*). The pinyon-juniper woodland was replaced by subtropical desert species during the period of 10,000-6000 BC. The woodland retreated to higher elevations and the desert expanded. Relict populations of juniper are found in the Sand Tank Mountains. Many species of animals (mammoth, giant ground sloth, camel, and horse) became extinct, particularly between 11,000 B.C. and 6000 B.C. (Moratto 1984: 88). The shift to relatively modern vegetation occurred in the Mohave Desert by about 6000 B.C. (Van Devender and others 1987:34).

Only one approach—the study of plant macrofossils from packrat middens—has been applied successfully to the Western Papaguería. Using packrat-midden data, Van Devender (1990) documented changes in the vegetation of rocky habitats within the Sonoran desert from the late Wisconsin through the Holocene. In the Late Wisconsin (14,000-9000 B.C.), desertscrub covered most of the region, including the Colorado River Valley; pygmy conifer woodland would have occurred along the region's eastern edge, as well as in the BMGR East (Betancourt and others 1990). Although the majority of the BMGR was primarily desertscrub at this time, mountain ranges like the Tinajas Altas Mountains supported the pygmy conifer woodland species of single-leaf piñon and California juniper. Single-leaf piñon disappeared from the Tinajas Altas samples at the late Wisconsin-early Holocene boundary, whereas California juniper persisted through the early Holocene (9000-7000 B.C.).

Desertscrub species present in samples dating from the late Wisconsin or early Holocene, through the middle Holocene (7000-2000 B.C.) and into the late Holocene (2000 B.C.-present), include white bursage, creosotebush, desert agave, brittlebush, mormon tea, and catclaw acacia (Van Devender 1990). In the middle Holocene, catclaw and blue paloverde were growing on slopes; today they are restricted to washes. Foothill paloverde does not appear in the assemblages until the late Holocene. Van Devender noted that "in the middle Holocene nearly twice as many species were growing near the rock shelters [where the Tinajas Altas samples were collected] as occur there today" (1990: 148). Also according to Van Devender: "Desertscrub communities in the harshest environments may have changed minimally. Potential examples include the creosote bush-white bursage communities of the Gran Desierto and the halophyte communities surrounding the head of the Gulf of California" (1990: 153).

Based on packrat-midden analysis, the climate of the Late Wisconsin was cooler and wetter than that of today. "The middle and late Wisconsin records of single-leaf piñon associated with Joshua tree from 460-550 m elevation in the Tinajas Altas Mountains reflect 40 to 60 percent increases in annual precipitation, with over 100 percent increase for the cool season" (Van Devender 1990: 155).

The modern climatic regime was established by the beginning of the late Holocene. Data from middens in the Puerto Blanco Mountains, located in Organ Pipe Cactus Monument, suggest that a brief climatic fluctuation, with greater summer and winter rainfall than the Late Holocene norm, occurred around A.D. 1000. In the Tinajas Altas Mountains and elsewhere, "impoverished modern floras at the midden sites suggest that the present climate is as hot and dry today as at any time in the Holocene" (Van Devender 1990: 159).

Many researchers believe that environmental change has been an important causal factor in human occupation of the Southwestern U.S. Thus paleoenvironmental reconstruction should play an important role in interpreting the archaeological evidence of that occupation. On the BMGR, climate change may help explain the variation in subsistence practices, as observed in the archaeological record, across time and space. For example, evidence indicating a wetter climate around A.D. 1000 would help explain the inferred presence of Hohokam agriculturalists in what is considered an inhospitable environment today. Only through multiple lines of evidence can the record of past human occupation be understood.

## Section 5

# CULTURE HISTORICAL OVERVIEW

In this chapter, a culture historical overview of the region is presented; it includes a summary of each time period defined and identifies some current research issues. Additional detail will be developed in Parts II and III regarding specific resource inventories and their results.

Since the first Spanish explorers wrote about the area, southwestern Arizona and northern Sonora, Mexico have been known as the Papaguería (Haury 1975: 3). The term is derived from the O'odham word, *Papavi Kuadam* or "Tepary [Bean] Eaters," which the Spanish condensed to Papago (Nabhan 1985: 113). As described in Section 4, the term has been used to describe a region, and environment, and a culture area (see Figure I-4). The BMGR lies within the Western Papaguería.

Culture histories of the Western Papaguería tend to emphasize history at the expense of culture. Most of these have simply reiterated longstanding assumptions about human habitation in and use of the region, which are largely based on a sequence of narrowly defined innovations in material culture—projectile point styles, the appearance and type of pottery. There are several explanations for this pattern. First, to a greater degree than in most other regions of the world, there is an apparent uniformity to the archaeology—mainly rock piles and artifact scatters—that is difficult to interpret in a broadly conceived diachronic framework. Like the better known Formative cultures to the east and west, the people of the Western Papaguería had a diverse and changing material culture, but that diversity and its accompanying shifts in ceramic, architectural, and burial style are difficult to study when prehistoric populations typically had few possessions, and for the most part did not live in permanent settlements.

Three related patterns have characterized the archaeology of the Western Papaguería. First, there is the laserlike focus on diagnostic artifacts, particularly ceramics. In all regions, archaeologists use temporally sensitive artifacts to help date sites, but in the Western Papaguería this orientation dominates all other research avenues. A single sherd becomes the object of intense scrutiny, and the absence of such artifacts renders entire collections uninterpretable. A strong "pots equal people" mentality is reflected in studies of the Western Papaguería, although most archaeologists decry this equation (see Ahlstrom and Chenault 2000: 248). Second, although archaeologists recognize that stone tools dominate collections from the Western Papaguería, lithic analysis has not featured prominently in posing or addressing research questions. This is in marked contrast to the archaeology of the adjoining Mojave and Colorado Deserts, as well as the Great Basin and other arid regions of the world. Third, attention has been placed on Formative cultures rather than on hunters and gatherers. This emphasis seems misplaced. Evidence for village life and agriculture—the hallmarks of the Formative way of life (Willey and Phillips 1958)—in the Western Papaguería is very limited, although these attributes were certainly well established in the Eastern Papaguería and in the Gila Bend area along the Gila River. Even during the fluorescence of the Hohokam and Patayan cultures, much of the population of the Western Papaguería remained organized in small, mobile groups that depended primarily on wild plants and animals for their sustenance (Altschul and others 2002).

The following overview is designed to provide the reader with an understanding of current research topics. Readers wanting more general background information on the prehistory, ethnography, and history of the Western Papaguería are referred to the more comprehensive regional overviews (Ahlstrom, editor 2000; McGuire and Schiffer 1982; Whittlesey and others 1994).

Current issues in American archaeology today include "who were the first Americans?" and "when did they arrive?" Archaeologists have long argued that the first Americans were hunters in pursuit of large game animals who crossed the Bering land bridge, thereby leaving their Asian homeland for the New World about 12,000 years ago. Recent finds have complicated this picture. The site of Monte Verde in Chile, for example, contains evidence of human occupation coeval with (if not earlier than) the earliest sites in northern North America (Dillehay 1997). Sites on the Pacific coast in British Columbia and off the shore of California have yielded similarly early dates, but show a fully maritime culture. Instead of the monolithic land-bridge hypothesis, most archaeologists today consider that multiple migrations into the New World (Anderson and Gillam 2000) of different populations and by different routes are likely to have occurred.

Julian Hayden (1976) developed a culture-history framework for southwestern Arizona and northwestern Mexico based in part on the work of Malcolm Rogers (1939, 1945, 1958, 1966). Hayden added an archaeological culture, the Malpais, to the beginning of Roger's sequence and suggested that it predated 12,000 BP and could be as old as 35,000 BP. The Malpais artifact assemblage, identified primarily from the Sierra Pinacate region of northwest Mexico, contains choppers, scrapers, and worked shell. The flaked stone typically exhibits heavy patination called desert varnish. These tool assemblages also are found in association with "sleeping circles", trails, rock shrines, and intaglios (Hayden 1982). Dating of the Malpais complex based on desert varnish present on the tools remains controversial.

## 5.1 PALEOINDIAN PERIOD

The term *Paleoindian* has been used traditionally to refer to the earliest evidence of human occupation of North America dating from about 10,000 B.C. to 7500 B.C. Climate in the western portion of the Papaguería during the Paleoindian period was much colder and wetter than today. Analyses of packrat middens indicate that the vegetation consisted of piñon, juniper, yucca, and grasses.

Traditionally, archaeologists have argued that the original inhabitants of the continent were accidental visitors. Hunters in pursuit of herds of large game crossed the Bering land bridge, thereby leaving their Asian homeland for the New World about 12,000 years ago. These hunters were immensely successful, following Pleistocene megafauna, including mammoths, bison, and horses, from Alaska to the tip of South America in only a few thousand years, and lending an unintended hand in the extinction of these animals. The spread of the early big-game hunters, termed Paleoindians, is relatively easy to follow, marked by a particular style of fluted projectile point, referred to as Clovis.

The few Paleoindian sites in the Papaguería have not entered into the debate surrounding the first Americans. Only a single site containing deposits of Paleoindian age—Ventana Cave, roughly 48 miles west of Ajo, Arizona, on the Tohono O'odham Nation—has been systematically excavated (Haury 1950). Sites in the Western Papaguería that have been attributed to this period consist entirely of surface artifacts.

Ezell (1954) reported a fluted Clovis-style projectile point from near the northwest boundary of Organ Pipe Cactus NM in the Cabeza Prieta NWR, and another fluted point was found along the Gila River near Painted Rocks (Whittlesey et al. 1994). A Clovis-style point was identified in the Fortuna Mine area on the BMGR West by BLM archaeologist Cheryl Blanchard, BLM. In 1998, AZ Y:8:100 (ASM) was recorded in the East Pass on the North Tactical Range of the BMGR East; evidence of multiple temporal components including the Clovis period, the early Archaic period, the middle Archaic period, and the Ceramic period was noted (Tucker, ed. 2000). The site consists of 12 features including rock clusters, rock rings and roasting features, and four Clovis-style fluted projectile points and point fragments, as well as artifacts dating to later periods (Tucker, ed. 2000: 405–424).

The surficial nature of early sites has led to research into the areas of chronometrics and classification. Surficial sites are notoriously difficult to date, and since most Paleoindian sites in the Western Papaguería are surface scatters of artifacts, archaeologists have long been intrigued by methods for dating desert pavement. Rogers used the association of cultural materials with "extinct" or Pleistocene landforms as a relative measure of time, whereas Hayden argued that the degree of varnish on the surface of lithic artifacts was an indicator of age. The thicker the varnish, the older the artifact—and some artifacts are so well varnished that they must be Paleoindian or older (dating to a period referred to as Malpais) in age. Recently, Schneider and Zreda (2000) have presented evidence that calls into question this time-honored method of dating. Other methods of dating desert varnish, including cation-ratio dating and radiocarbon dating of organic material trapped in the varnish, also have been investigated (for example, Dorn 1983). As yet, none of these methods has been successful (for example, Harry 1992, 1995).

Archaeologists have used more than one classification scheme to refer to Paleoindian sites. Archaeologists trained in Arizona generally refer to Paleoindian sites as Clovis, whereas those from California use the term San Dieguito or Lake Mohave. The Clovis complex is characterized by distinctive, large lanceolate points with a channel flake removed from the center to produce a flute. Dates for Clovis sites cluster between 9500 B.C. and 9000 B.C. San Dieguito is divided into three phases, based on the presence or absence of various lithic tool types. San Dieguito I is the only phase that has been identified in the southwestern desert of Arizona. San Dieguito II and III are confined to the area along the Colorado River and the deserts of southeastern California. San Dieguito I is characterized by large flakes and cobbles, cores, hammer stones, cleavers, cobble choppers, beveled flakes, and other specialized flakes (Bauer et al. 1996).

Theoretically, Clovis sites are the remains of big-game hunters; the San Dieguito/Lake Mohave adaptation, in contrast, centered on resources available at pluvial desert lakes and coastal marshes of the late Pleistocene and early Holocene. Neither concept is necessarily appropriate

for the Western Papaguería; most of the region did not support either herds of megafauna or pluvial lakes.

The adaptations represented by the two types are often construed as mutually exclusive subsistence strategies (see McGuire 1982a); an alternative view is that Paleoindian culture was composed of highly opportunistic societies. Essentially, they were hunters when there was something to hunt (rarely), and gatherers of whatever plants were available (more frequently). Their success in settling an entire hemisphere in less than two millennia suggests that they were constantly moving into new territories with new resources. Flexibility had to be at the center of this mobile culture's tool kit. Questions about whether we should call them Clovis or San Dieguito (for example, Henshaw and others 2000: 209) fade in importance to more central questions of how the people who first entered the Western Papaguería conceptualized the land and its resources, and adapted correspondingly.

## 5.2 ARCHAIC PERIOD

The term Archaic refers to a period of time from approximately 8500 B.C. to A.D. 1, as well as an economy of hunting and gathering that gradually adapted to local environments and resources. Analysis of pollen and macrofossils from packrat middens in the Papaguería (Van Devender 1977, 1987; Van Devender and Spaulding 1979) indicates that Sonoran desert vegetation was established by 8000 B.C. and that Archaic paleoenvironments were similar to the modern Sonoran desert. By this time, the large Pleistocene fauna that helped to fuel the Paleoindian hunting economy were extinct. The Archaic lifeway was characterized by hunting small game animals and gathering wild plants. Tools used by these hunters and gatherers reflect this economic base and the change in vegetation. Grinding tools such as manos and metates were used in plant processing. Less specialized projectile points probably were used as dart points and knives.

Artifact assemblages recorded in different regions have been identified as distinct complexes based on the presence of specific projectile point styles. These cultural traditions are clearly defined in the regions where they were first defined but are difficult to identify elsewhere. This situation is exemplified by the diverse Archaic remains from Ventana Cave, which could not be identified with a single Archaic tradition. Haury (1950) suggested that the area was a meeting ground or an area of cultural overlap. The Papaguería is located in an area considered transitional between two major Archaic traditions, the Amargosa and the Cochise culture. Recent work has yielded data that challenge this framework. The identification of a Southwestern Archaic tradition that incorporates the older Archaic traditions into a systematic framework is presented below.

Archaic period cultures of the Southwest only rarely have been the focus of intense study. Some archaeologists have spent their careers on the Clovis sites of Arizona and New Mexico, and many more have focused their attention on the pueblos and pit house villages of the Hohokam, Mogollon, and Anasazi, but relatively few have paid attention to the period in between. The lack of interest is probably related to a belief that little happened. Projectile point styles change, but not much else. Archaeologists have conceived of an 8,000-year (or longer) Archaic period during which cultures settled in and gradually adapted to local environments and resources.

Malcolm Rogers was the first to identify the Archaic period in the Western Papaguería. In 1939, he defined the Amargosa tradition to include the Archaic cultures of southern California and the lower Colorado River region (Rogers 1939). Two years later, Sayles and Antevs independently defined the Cochise culture to describe the Archaic period cultures of southeastern Arizona (Antevs 1941; Sayles 1941; see also Eddy and Cooley 1983). Much like the Clovis–San Dieguito debate discussed above, Papaguerían archaeologists have argued about whether the Amargosa or Cochise traditions should be applied to Archaic sites in the region. McGuire (1982a: 178) suggests that the differences between the Amargosa and Cochise cultures reflect the east-west environmental gradient in southern Arizona. In the east, where the Cochise culture was established, the environment was wetter, and people had greater access to grasses and large game animals. This is reflected in the material culture by the presence of metates and projectile points. By contrast, groups in the more arid western desert had to rely more on desert-adapted species such as mesquite. The Amargosa grinding technology, as illustrated in the gyratory crusher, reflects this latter adaptation (Hayden 1969).

Our understanding of the Archaic cultures of the Western Papaguería has been hampered at least as much by archaeological concepts as by the nature of the data. Archaeologists have tended to paint Archaic culture with a broad brush, using many of the same concepts across the arid western United States; yet, if there is any consensus within the archaeological community about the period, it is that groups became better adapted to their individual immediate environments. The evidence suggests that instead of being culturally homogeneous, the Southwest supported a greater variety of cultural adaptations than ever before. Thus, to understand the Archaic period in the Western Papaguería, and on BMGR, we should concentrate on evaluating local adaptations rather than developing global explanations.

To explain Archaic cultural development in the Western Papaguería, we need to understand how hunters and gatherers perceived their environment—what resources were targeted and how the resource mix changed over time. Next, we need hypotheses that tie economic decisions to organizational and logistical choices. Finally, we need to link these hypotheses to the archaeological record.

Vanderpot and Altschul (2004) contend that the hard seeds of wild grasses in the Childs Valley were an important Archaic period resource, and that reliance on wild-grass seeds fluctuated with climatic conditions and technological innovation.

> Grasses would have been more available during moister regimes, and grass seeds would have been more useful in the diet after the introduction of slab or flat-surface grinding implements. During drier periods, people would have placed greater reliance on desert succulents, legumes, and riverine resources. We predict, therefore, that intense use of desert grasses coincided with moister regimes after the introduction of grinding implements (ca. 3000 B.C.). The size and range of the social unit exploiting these grasses depended on the amount and reliability of the resource. Small, mobile groups are expected if the grasslands were restricted in size, available for short periods, or unpredictable from season to season; larger groups, in contrast, probably coalesced in these grasslands during generation-long periods of abundant resources (Vanderpot and Altschul (2004: 12).

Once identified, patterns identified in the availability and exploitation of resources in localized environments may be combined with patterns in other resource areas to create a cohesive model of resource exploitation, population movement, and culture in the Western Papaguería during the Archaic period.

## 5.3 FORMATIVE PERIOD

The terms Formative and Ceramic have been used to describe the period from the beginning of the Common Era (A.D. 1) to A.D. 1450. The events and processes that transpired on the BMGR and in the western portion of the Papaguería in this time period are often interpreted relative to cultural sequences identified in areas to the north and east (Hohokam), west (Patayan), and to a lesser degree, the south (Trincheras). The Areneños, another culture located to the southwest in the Sierra Pinacate (Hayden 1967), has not figured as prominently in interpretations of regional prehistory.

The occupation of the Papaguería during this period has been the focus of archaeological study, and as with earlier periods, cultural sequences developed for the Formative period in regions to the east and west have been used to describe events and processes in the Papaguería. Because our knowledge of Hohokam culture is so much better than that of Patayan culture, most culture histories of the Papaguería look eastward (for example, Ahlstrom and others 2000).

An argument can be made, however, that Hohokam culture was largely irrelevant, or at most tangential, to cultural processes in the Western Papaguería over the last 1,000 years of prehistory. Haury (1950, 1976) recognized that Hohokam culture was largely riverine in focus. To account for nonriverine sites with Hohokam traits, Haury created two branches of Hohokam culture—riverine and desert. Masse (1980) attacked this distinction using data from Gu Achi and other pre-Classic sites in the Papaguería. Recognizing a general consistency in pre–A.D. 1000 material culture, Masse (1980) applied the Hohokam label to Formative culture of the pre-Classic period in the Papaguería, but argued that such an affiliation ended around A.D. 1000. Between A.D. 1000 and 1100, Masse contended that much of the Papaguería was abandoned, and subsequently resettled by a non-Hohokam culture.

There is no denying that Hohokam pottery and other items are found in the Western Papaguería; Hohokam pottery types are represented by large numbers of sherds at sites in the northern half of the region, and even at a few sites in the southern half. The question is what these sherds and other Hohokam material culture items signify. Do these remains mean that Hohokam people lived in or traveled through the Western Papaguería? Did a culture indigenous to the Western Papaguería obtain these items through trade and exchange? These same questions apply equally to the Patayan sherds and artifacts that are found in greater frequency to the west.

At stake in this argument is whether we view the Western Papaguería as a hinterland for Hohokam and Patayan cultures or the heartland of a group with an essentially Archaic period lifeway that interacted with, but was not dominated by, its Formative period neighbors to the east and west. Most archaeologists have taken the first view, in which inhabitants of permanent settlements along the Gila and Colorado Rivers of central and western Arizona made forays into the desert to obtain specific resources (for example, Ahlstrom and others 2000: 126–127; Altschul and Jones 1989; Bayman 1988; Doelle 1980). This construct reflects the idea that the Western

Papaguería was an inhospitable place to live. The problem with this notion, is that it is at odds with the archaeological data. In the 75 years since Malcolm Rogers began surveying the Western Papaguería, hundreds of archaeological sites have been recorded in the interior. Some of these are large sites reflecting intensive occupations, such as Verbena Village, Lago Seco, Kuakatch Village, and Lost City (see Ahlstrom 2000).

The ethnography of the Western Papaguería is instructive on this point. The Yumans were a semisedentary, riverine culture, inhabiting the banks of the Colorado and Gila Rivers and dependent for at least 50 percent of their diet on agricultural produce (Castetter and Bell 1951; Kelly 1977; Spier 1978). The Tohono O'odham to the east practiced a mixed agriculture-hunting-foraging economy with a two-settlement system, occupying a well village in winter and moving in summer to locations near their fields (Fontana 1983a; see also Castetter and Bell 1942; Jones 1969). In contrast, the Hia C-ed O'odham were a mobile people who formed few villages, depended heavily on hunting and gathering, and only occasionally practiced agriculture (Crosswhite 1981; Ezell l955; Nabhan and others 1989).

One might assume that the Hia C-ed O'odham had the most precarious of these adaptations. It is instructive, however, to note that groups similar to the Hia C-ed O'odham occupied most of the Sonoran, Colorado, and Mojave Deserts. The Pai groups to the north, for example, practiced a seasonal round that focused on the plants and animals of the canyons and mesas, and only rarely visited the permanent waters of the Colorado River (Dobyns and Euler 1970; Euler 1958).

During the Archaic period, hunter-gatherers successfully adapted to the Western Papaguería. The advent of agriculturally based societies along the major rivers might have complicated the social landscape, but it is hard to understand how or why their presence would have vitiated a previously successful lifeway. Ahlstrom and his colleagues argue that the riverine Formative cultures would have made forays into the desert to obtain specific goods and their presence and activities would have "changed the dynamic of interaction for groups of hunter-gatherers (and part-time farmers) who inhabited the Western Papaguería" (Ahlstrom and others 2000: 126). In particular, Hohokam people were major consumers of marine shell, mostly from the Gulf of California, as well as obsidian from the Sauceda and Sand Tank Mountains. The implication is that these Formative groups would have out-competed or at least pushed back the indigenous Western Papaguerían groups.

Certainly the emergence of Formative cultures along the Gila and Colorado Rivers, as well as those along the Ríos de la Concepción and Sonoyta, would have altered the social equation for hunters and gatherers of the Western Papaguería. This situation, of course, has been repeated throughout the world for millennia, as Neolithic farming communities developed and interacted with neighboring pastoral and hunter-gatherer societies. Ahlstrom and others (2000: 125) note two types of interaction that have dominated the anthropological literature. The first involves some form of social umbrella that allows individuals to change from farmers to foragers and back again as conditions allow. The second is a more mechanical form of exchange of goods and services. Such exchanges are generally one-sided, with the foraging population being economically and politically dependent on the farmers.

Complicating the relationship between desert and river groups is the issue of language. All Piman groups speak languages of the Uto-Aztecan linguistic family. Traditionally, it was assumed that the Proto-Uto-Aztecan (PUA) speech community originated in the Great Basin and spread south to Mexico and Latin America (Fowler 1983; Lamb 1958). Fowler argues that PUA might have been associated with the Oshara phase of the Archaic period, and thus, dates the origin of the PUA language groups to around 5000 B.P. Fowler states that a breakup of the Northern PUA community around 3000 B.P. could be consistent with her thesis. According to this viewpoint, agriculture was introduced from the south by Mixe-Zoquean speakers. Some indigenous foraging-based PUA speech communities as well as other language communities, such as Yuman, Tanoan, Keresan, and Zuni, gradually adopted agriculture techniques, whereas others continued their hunter-gatherer lifeways. In this view, Upper Piman–speaking groups were all originally hunter-gatherers, with some such as the Tohono O'odham incorporating agriculture into their subsistence strategy, and others like the Hia-Ced O'odham retaining their foraging lifeway.

Bellwood (1997) and Hill (2001) have recently turned this argument on its head, suggesting instead that PUA originated in the south and moved north. Combining linguistic with archaeological evidence, Hill (2001: 929) concludes: "Under this model, the Uto-Aztecan presence in California, the Great Basin, and the Southwest is the result of a migration northward, driven by the demographic consequences of an early commitment to cultivation." Citing evidence from the Santa Cruz Valley, Hill argues that agriculture was introduced into the southern Southwest by around 3700 B.P. and that the breakup of PUA did not occur until as late as 2900 B.P. Hill views PUA hunter-gatherer groups, such as the Hia-Ced O'odham and Takic speakers in the deserts of eastern California, as "devolving" from cultivators to foragers.

Although much of Hill's argument is compelling, we find the conclusion that PUA speaking hunter-gatherers of the Papaguería originated as Mexican cultivators is at odds with the archaeological record (see also Carpenter and others 2002). There is no evidence that Hohokam or Patayan communities established along the Gila and Colorado Rivers ever pushed out the indigenous groups of the Papaguería. Instead the groups adapted to each other. A much more parsimonious explanation for the language distribution is one of symbiotic adaptations in which farmers and foragers developed social networks to gain access to resources of economic and ideological value.

As with many dichotomies in anthropology, the extremes represent the ends of a continuum, the specifics of which depend on local conditions and history. In the Western Papaguería, for example, there is substantial ethnographic evidence of Hia C'ed and Tohono O'odham individuals working as seasonal laborers on farms along the Gila River, first on Akimel O'odham (Pima) farms and later on Anglo-American farms (Fontana 1983a, 1983b; Jones 1969). The relationships between the laborers and the two groups of farmers were, of course, radically different. The Hia C'ed and Tohono O'odham workers had social and cultural ties to the Akimel O'odham, allowing a relationship of relative equality to emerge, in which Hia C'ed and Tohono O'odham workers shared in the crop. In contrast, the relationship with Anglo-American farmers was one of employee to employer in a cash market.

To better understand the late prehistoric and protohistoric periods in the Western Papaguería, archaeologists must stop thinking of the indigenous population as necessarily either Hohokam or Patayan and should carefully examine evidence of the relationship between desert and riverine cultures. Instead of viewing prehistory solely with reference to the desires and objectives of the riverine farmers, we should also examine the benefits of this interaction for both the riverine farmers and the hunter-gatherers of the Western Papaguería. This analysis also should examine changes in the different components of that interaction over time. Were the relationships among Hohokam, Patayan, and indigenous Western Papaguerían peoples similar to those documented ethnographically among the Akimel O'odham, Hia C-ed O'odham, Tohono O'odham, and riverine Yuma? This question goes to the heart of continuity and change before and after European contact, which has dominated Southwest archaeology for more than a century.

## 5.4 SPANISH PERIOD

The rugged, arid, and isolated nature of the Western Papaguería acted as a constraint on historical-period European activities in the region. The Spanish presence in the Southwest began with the expedition of Francisco Vásquez de Coronado in the 1540s, but this *entrada* passed far to the east of the Papaguería. Coronado did send one of his lieutenants, Melchor Díaz, across the Western Papaguería to Yuma, where he forded the Colorado River into California (Sheridan 1995: 26), but the expedition did little more than provide limited information on the region, which was largely forgotten by the Spanish for the next 150 years. Later sixteenth- and early-seventeenth-century Spanish exploration remained well to the north, following more reliable water sources.

In the late seventeenth century, the Spanish missionary effort, already well established farther south, brought the Jesuit Francisco Eusebio Kino to the Papaguería. During the period 1693–1707, Kino made numerous trips across the region, both as an exploring cartographer and in search of suitable locations for permanent missions. Although he passed through the Papaguería many times en route to the Gila River, he spent little time in the region and made no attempt to establish settlements there. His efforts along the Santa Cruz River, on the eastern edge of the Papaguería, led to the establishment of Jesuit missions at Guevavi and Bac in 1730, and eventually to the establishment of a presidio at Tubac in 1753, but even the Santa Cruz Valley remained sparsely settled for the remainder of the Spanish colonial era, primarily because of persistent Apache raiding. In 1775, Juan Bautista de Anza, commander of the presidio at Tubac, led a group of Spanish settlers down the Gila River and across the California desert, thus opening an overland route to the Franciscan missions being established along the coast. But the road to California was soon closed because of the hostility of the Yumans living on the lower Colorado River, and after a few years the limited Spanish presence in the Papaguería implied by this route ended (Bischoff 2000; Hartmann 1989; Majewski and Ayres 1997; Weber 1992: 248–258).

In their discussion of the early historical period, Tucker and others (2000) focus largely on documented events relating to Native American interactions in the area. We also believe this theme is important, but we would stress that during the historical period the study of Native Americans cannot be undertaken without a consideration of the effects of European contact in the area. Much remains to be done in terms of historical-period Native American material culture, particularly during the transition from protohistory to history, but it is clear that Spanish

introductions, including cultivars, livestock, and technology, had a significant impact on indigenous lifeways in the Papaguería, despite the lack of Spanish settlements (Sheridan 1988).

## 5.5 MEXICAN PERIOD

With continued Apache raids on the thinly populated frontier, settlement was hampered. By 1821, Spain lost its grip on the region, and Mexico gained its independence. The current project area, because of its isolation, witnessed little change during this period. Mexican authority over the area did little to curb the Apache threat, and settlements declined in many places. Much of present-day Arizona passed into American hands in 1848. Following subsequent border disputes, the southwestern portion of Arizona was acquired by the United States under the Gadsden Purchase of 1854 (Homburg and others 1994: 38). Little is known regarding settlement of the Western Papaguería during this period.

## 5.6 EARLY AMERICAN PERIOD

American interest in the project area began with attempts to link California with other states to the east. With the discovery of gold in California in 1848, this became critical. The Camino del Diablo first used by Europeans in Kino's day and crossing the formidable southern portion of the Papaguería, became a common—and often lethal—route for the rush of forty-niners headed to California. Another, less hazardous east-west route followed the Gila River to its confluence with the Colorado (Hartmann 1989; Sheridan 1995). An important north-south route across the Papaguería passed through the Quijotoa Valley, to the east of the project area, connecting what is now Gila Bend with Pozo Blanco and points south. This route was also first used by Kino and other Spanish explorers and was later followed by miners and others in the nineteenth century (Homburg and others 1994).

Survey parties crossed the Gadsden Purchase during the 1850s in search of routes for a transcontinental railroad, although it would be decades before a railroad was constructed across the region. Surveys of the U.S.-Mexican border were also commissioned and constituted the first exploration of much of southwestern Arizona. Such surveys brought the region to the attention of others, particularly those seeking precious minerals. Stagecoach lines were established across the region, most notably the Butterfield Overland Stage in 1858. The stage line allowed for more concerted exploration of southwestern Arizona, including the project area. Mines were sought out in the area, and a few were opened during this frontier period. The American military followed the settlers and miners in order to afford them protection. Military presence in this portion of the west, however, remained slight. With the outbreak of the Civil War, American military resources were sent east, and in other portions of the region (for example, south and southeast of the Papaguería), Apache raiding again took its toll. Transportation corridors throughout the region slowly expanded during this period, and archaeological traces of the associated activities, including mining, can be expected throughout the BMGR.

## 5.7 POST–CIVIL WAR PERIOD

Following the end of the Civil War, ranching and mining activity increased in Arizona, and routes of travel improved across the region. In order to protect the new settlers, the military

began a concerted effort to subdue "hostile" Native American groups throughout the territory. To supply the military posts and the new settlements, cattle ranches sprouted up across the state, even in such arid places as southwestern Arizona. Mines also began to be exploited during this period. As miners and ranchers moved across the state, communication and transportation links were improved. Trails that had been used by Native Americans for centuries were expanded and improved to handle wagon transportation. Perhaps one of the most significant events for the project area during the historical period was the arrival of the railroad in the early 1880s. The railroad connected the region to the rest of the nation, providing access to all sorts of markets and goods. Cattle, ore, and other natural resources could now be carried to markets with ease, making the pursuit of these enterprises far more profitable. As a result, ranches expanded, and prospecting increased in the late nineteenth century. A profitable avenue of study for this period is to consider the overall effects of the region's involvement in the global economy.

## 5.8 EARLY TWENTIETH CENTURY

During the early twentieth century, the arrival of the automobile spurred further development of roads across the territory. Arizona was admitted to the union as a state in 1912. With American involvement in World War I, demand for copper and agricultural products (including cattle) led to further economic development of the region. Numerous mining claims were made in the project area during this period. Company towns, such as Ajo, grew up near the mines (Sheridan 1995: 253). What is now State Route 85 was established as the main road between Ajo and Gila Bend. Homesteads were filed across the region early in the century, but few were ever "proved-up" (Stein 1990). We expect there to be a fair number of archaeological sites and isolates relating to this period on the BMGR.

## 5.9 WORLD WAR II TO PRESENT

The military potential of aircraft was realized during World War I, by which time American pilots were using airplanes for everything from reconnaissance to air-to-air combat. The beginning of World War II marked the meteoric growth in American military aviation; between 1940 and 1944, Congress had appropriated over $60 billion to the Army Air Forces. Establishing training areas for aircrews was a critical component of this buildup. The isolated nature of southwestern Arizona, along with its nearly ideal flying climate led to federal acquisition of the area in 1941. Initially, 1.1 million acres were acquired in order to create a training range for air-to-air and air-to-ground combat. The training was directed from Luke Field, which had been established in June 1941. The acreage was soon thereafter expanded to 2.1 million acres. Ranchers and other settlers in the area were told to vacate their property. Many refused, however, claiming their rights to lease the land under the Taylor Grazing Act of 1934, and some remained in the area until the mid-1950s (Homburg and others 1994: 40).

During World War II, the War Department divided the range into eastern and western components, designated the Gila Bend Gunnery Range and the Yuma Aerial Gunnery and Bombing Range. Since then, the range has been renamed several times, and in 1986, it was redesignated the Barry M. Goldwater Range. With the MLWA of 1999, Congress reauthorized the withdrawal of over 1,650,000 acres of public land for military use. In addition to these withdrawn lands, inholdings of formerly private and State Trust Lands totaling almost 84,000

acres purchased between 1986 and 1998 are held in fee simple by the Department of Defense. MLWA assigned jurisdiction over the BMGR East and BMGR West to the Secretaries of the Air Force and Navy, respectively.

The Barry M. Goldwater Range is the nation's second largest tactical aviation range and continues to be essential for developing and maintaining the combat readiness of the tactical air forces of the United States Air Force, Marine Corps, Navy, and Army for more than 50 years. Since the beginning of World War II, the Goldwater Range has contributed to the nation's defense by effectively accommodating the training requirements of changing air combat capabilities and missions.

In addition to aircrew training, the BMGR has occasionally been the site of military testing projects. The first large-scale, surfaced-based test project known to have occurred on the BMGR was initiated in April 1977 at a location about 12 miles south of Wellton, Arizona. This project was the first of a series of tests that was part of the larger Air Force study program to develop workable basing modes for the MX Peacekeeper missile. These projects evaluated two protective shelter designs, a hardened underground missile silo and a buried, hardened tunnel through which a missile would be shuttled and ultimately launched. The intent of both projects was to protect a missile launching system so that it could survive the effects of a nuclear "first strike." Subscaled prototypes of the proposed shelters were tested using blast and shock pressures generated by conventional high explosives in an increasingly powerful series of separate detonation tests calculated to simulate the effects of a nuclear weapon detonation. The validity of the tunnel-basing mode was further tested within the eastern range area beginning in 1978. All of the above-ground infrastructure and debris from these projects was later removed from the range, with the exception of two large bunkers, one which the Marine Corps now uses as a storage facility.

Buildings and structures, targets arrays, and other facilities on BMGR are associated with historic events from the buildup of military aviation during World War II through the evolution of jet aircraft, missile defense systems, and other advances in military technology, weapons, and training.

## 5.10 SUMMARY

The BMGR region has hosted a long and complex history of human activity in a harsh and unforgiving environment. Despite these harsh conditions, it is clear that people lived and thrived here for generations. Reconstruction of these events is but one focus of cultural resource studies in the region.

**Section 6**

# EVALUATING HISTORIC SIGNIFICANCE: THE NATIONAL REGISTER OF HISTORIC PLACES

When the first cultural resource overview of the BMGR was prepared in 1977, only 46 archaeological and historical sites had been recorded. Within a decade the number had almost doubled, and it had reached about 400 by 1995, when the most recent overview was initiated (Ahlstrom 2000). The total number of sites recorded now exceeds 1500. The vast majority of cultural resources found on the BMGR consists of archaeological sites, and a discussion of strategies for evaluating the historic significance of these sites is the focus of this chapter.

## 6.1 THE NATIONAL REGISTER OF HISTORIC PLACES

Since the passage of the NHPA in 1966, publicly funded surveys and excavations have constituted an increasingly important component of professional archaeological research each year. Federal agencies spend millions of dollars annually to identify and evaluate *historic properties*, that is, places that are listed or eligible for listing on the National Register, and to avoid, minimize, or mitigate the impacts of their actions on those properties. By law, federal agencies must consider impacts to historic properties in decision-making.

Section 101 of the NHPA authorized the Secretary of the Interior to "expand and maintain a National Register of Historic Places composed of districts, sites, building, structures, and objects significant in American history, architecture, archeology, engineering, and culture" (16 U.S.C. § 470a(1)(A)). The criteria for National Register eligibility require that a property be historically important (by meeting at least one of four defined categories of significance) and have sufficient historical integrity to convey that importance. Properties of local and state significance also are eligible for inclusion on the National Register.

The National Register does not include intangible resources, although intangible characters and associations often are what make a property significant. The relationship between a property and its historical associations (whether that is a specific event, a cultural theme, or traditional beliefs and practices) must be documented. Physical boundaries must be specified for all properties.

Historic properties may include sites, buildings, structures, districts, or objects. A *site* is the location of a significant activity or event, and often refers to archeological sites or traditional cultural places, although the term also may be used to describe military properties such as testing ranges, treaty signing locations, and aircraft wrecks. *Buildings* include houses, barns, churches, and other buildings created to shelter any form of human activity, including administration buildings, dormitories, garages, and hangars. *Structures* are built for purposes other than human shelter and include bridges, tunnels, dams, roadways, and military facilities such as missiles and their silos, launch pads and weaponry, runways, and water towers. *Objects* typically are small in scale and often artistic in nature, and include sculpture, monuments, boundary markers, and fountains. *Districts* are concentrations of significant sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

Evaluating the historic significance of the numerous archaeological sites, traditional cultural places, and facilities associated with World War II and the Cold War that are found on the BMGR is a daunting task. This chapter provides some basic guidance in addressing those challenges by discussing data that must be collected to support an eligibility assessment. Much of this section is taken verbatim from two National Register Bulletins: *How to Apply the National Register Criteria for Evaluation* and *How to Complete the National Register Registration Form.*

### 6.1.2 Historic Significance

*Historic significance* is the importance of a property to the history, architecture, archaeology, engineering, or culture of a community, a state, or the nation. It is achieved by meeting one or more of the following criteria:

- Association with events, activities, or patterns (Criterion A)
- Association with important persons (Criterion B)
- Distinctive physical characteristics of design, construction, or form (Criterion C)
- Potential to yield important information (Criterion D)

### 6.1.2 Historic Integrity

*Historic integrity* is the ability of a property to convey its significance. To be eligible for the National Register, a property must be historically significant. It also must possess historical integrity, which is a measure of authenticity and not necessarily condition. A building in a state of disrepair but with strong historical associations is likely to be eligible, in contrast to a property in good condition but highly modified since its period of significance. Elements of integrity to be considered include location, design, setting, materials, workmanship, feeling, and association. Not all seven aspects of integrity need to be retained, but a property must have sufficient physical remnants from its period of historical importance to illustrate significant aspects of its past.

The integrity of archaeological sites typically is evaluated by the degree to which they can provide important contextual information. The integrity of traditional cultural places is interpreted with reference to the views of closely affiliated traditional groups, if traditional people will write or talk about such places so information can be filed with a public agency. If a place retains integrity in the perspective of affiliated traditional groups, it probably has sufficient integrity to justify further evaluation. National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, provides guidance for identifying and assessing traditional cultural places.

### 6.1.3 Historic Themes and Contexts

The significance of a property must be evaluated within its historic context. A *historic context* is an organizing structure for interpreting history that groups information about historic properties which share a common theme, common geographical location, and common time period. The development of historic contexts is a foundation for decisions about the planning, identification,

evaluation, registration, and treatment of historic properties, based upon comparative significance. A *theme* is a trend or pattern in history or prehistory relating to a particular aspect of cultural development.

Historic contexts are patterns or trends in history that form the framework for understanding specific events, properties, or sites. According to National Register guidance, to decide whether a property is significant within its historic context, determine the following:

1. The facet or trend of significant local, state, or national prehistory or history associated with the property
2. Whether the property has relevance to understanding and illustrating the historic context
3. How the property specifically illustrates that history compared with other properties of the same or similar period, characteristics, or associations

Examples of broad historic contexts include subsistence practices, settlement patterns, migration, exploration, colonization, trade, transportation, religion, industrialization, and responses to documented environmental changes. More specific contexts relevant to southern Arizona might include Pleistocene subsistence and settlement; Archaic hunting and gathering adaptations; trade of obsidian, marine shell, ceramic, and turquoise objects; irrigation; migration; sedentism; political organization; and food production. Some broad contexts appropriate to understanding cultural resources on BMGR are discussed below.

## 6.2 HISTORIC THEMES AND CONTEXTS FOR BMGR

This section explores themes or broad contexts relevant to interpreting and evaluating BMGR sites. The vast majority of cultural resources recorded on the BMGR reflect the occupation of the region by indigenous cultures, and the first three themes focus on that adaptation. These themes have been an important focus of research regarding the cultural history of the Western Papaguería (Ahlstrom 2000; see Figure 4.1). They are (1) culture history and cultural identity, (2) subsistence and settlement, and (3) trade and exchange. Although recent research directions, as summarized in Section 5, have espoused a different perspective on these issues, they remain important concepts in the interpretation of the history of human occupation of the Western Papaguería.

The themes developed for the period of Euro-American occupation are based on a combination of oral history and documentary research. Oral history research completed to date includes interviews with long-time residents conducted in the 1980s by Bill Broyles as part of his independent effort to document the history of the western Papaguería. Other interviews have been conducted over the last three years as part of the BMGR oral history project carried out by Statistical Research, Inc. under contract to 56 RMO. On the BMGR, as elsewhere, oral history can provide valuable information on historical-period activities, but human memories are fallible, and inherent biases must be weighed. Interviewees often skew their responses to fit their view of the world or the situation under discussion. Whenever possible, oral history data should be compared with documentary information and archaeological evidence.

Ranching was the dominant Euro-American activity during the historic era and is well represented in the archaeological record. Mining was important in some areas. Closely related to both ranching and mining is transportation, and many roads pass through or near the BMGR. These roads often began as trails used by Native Americans, were later adopted and sometimes improved by prospectors, further used by ranchers, and improved once again with the coming of automobiles. Military activity also is well represented at archaeological sites throughout the region. After acquisition of the area by the military in 1941, the ranchers were forced to leave. Most left by the early 1950s, but some held out until the mid-1960s. The region's isolation, lack of population, dry climate, and rugged topography provided the military with unprecedented training opportunities.

The following discussion is not intended to present fully developed historic contexts, but to provide a foundation for context development.

### 6.2.1 Culture History, Chronology, and Archaeological Cultural Affiliation

Although much has been written about the cultural chronology of the Western Papaguería, many issues relating to that chronology have yet to be resolved. Details of Preceramic adaptations, Patayan chronology, a Hohokam chronology for the Papaguería, and the meaning of the overlapping distributions of Patayan and Hohokam ceramics have yet to be thoroughly explored. Recently, researchers have suggested that although chronology building remains an important issue, its goal should not be modifying the Hohokam or Patayan chronology, but building chronology centered on the BMGR or Western Papaguería.

In his discussion of the Preceramic period in southern Arizona, McGuire noted that most researchers have assigned Archaic period sites to either the Cochise culture and or the Malpais/San Dieguito/Amargosa cultural tradition, based largely on their experience and whether they brought a California or an eastern Arizona perspective to their work (McGuire 1982a: 177). Ahlstrom (2000:75) described three preceramic chronologies that have been applied to sites in the Papaguería: a western chronology analogous to McGuire's California perspective, an eastern chronology analogous to McGuire's eastern Arizona perspective, and a revised eastern chronology which divides the Archaic into Early, Middle, and Late complexes (Huckell 1984).

As a foundation for future research, some basis questions should be answered: (1) is enough information available about area archaeological sites to support applying either the Cochise or San Diegito/Amargosa chronologies to sites on the BMGR? (2) are sites representing both traditions present, and if so, are they found in particular geographic areas? (3) is it productive to maintain a framework of possibly distinct traditions as a research focus, or is the panregional approach to the Archaic Period (Early, Middle, and Late) suggested by Huckell (1982) a more effective framework for evaluating the Archaic age resources on the BMGR?

Two chronologies have been applied to Formative period sites on the Western Papaguería—Hohokam and Patayan—and researchers have relied on the presence of distinctive pottery types to assign sites to one or the other of these traditions. Regional variants of the Hohokam chronology developed for the Salt-Gila Basin, Tucson Basin, and Eastern Papaguería have been applied to the BMGR, and the recorded sites represent the entire Hohokam chronology from the

Pioneer through the Colonial, Sedentary, and Classic periods. Ahlstrom (2000: 247-248) notes that Hohokam pottery diagnostic of the Pioneer and Colonial periods is found only on the eastern portions of the BMGR. Pottery dating to the subsequent Sedentary and Classic periods is found on the eastern and central portions of the BMGR.

Waters (1982) defined the most thorough typology and chronological sequence for the Lower Colorado Buff Ware ceramic tradition, basing his analysis on the work of Malcolm Rogers. The Patayan chronology consists of three ceramic groups, labeled Patayan I, II, and III. Waters (1982: Figures 7.4-7.6) documented the occurrence of all three groups in the Gila Bend area.

According to Waters (1982: 275), "Lower Colorado Buffware was produced and used along the Colorado River from the southern tip of Nevada to the Gulf of California, along the drainage of the lower Gila River, and in the peripheral deserts of western Arizona and southern California." Whether this ware was in fact produced in the deserts of western Arizona—that is, in the Western Papaguería—has been an open question until very recently. Hill and Bruder (2000) report the results of pilot petrographic analyses that indicate that at least some Lower Colorado buff wares were locally produced in the Western Papaguería.

Some studies of ceramic data from the Western Papaguería have shown a separation between the distribution of Lower Colorado Buff Ware on the west and Hohokam wares (including Hohokam Buff Ware and Tucson Basin Brown Ware) on the east (for example, Huckell 1979), supporting a ceramic division first proposed by Gifford (1946).

Researchers such as Huckell (1979) and Schroeder (1967) have viewed the boundary between ceramic wares as an ethnic/linguistic boundary (McGuire 1982a: 214). They have interpreted the ceramic distribution as indicating that Patayan people (identifiable linguistically as Yumans in the historical period) inhabited the western area, and the Hohokam or people with a Hohokam-like cultural pattern (in either case, generally identified as Piman speakers) inhabited the eastern area.

Ezell (1955:372) addressed this issue, arguing that the boundary between the ceramic wares was a material-culture boundary and not a cultural or ethnic boundary. He cited as evidence the case of the Hia C-ed O'odham (also called Sand Papago). Ezell (1955) thought that the material-culture boundary for the Hia C-ed O'odham began on the coast of the Gulf of California in the area between Punta La Cholla and the mouth of the Río Sonoyta. He extended the boundary up the Sonoyta to Quitobaquito, and northward through the OPCNM area to the Gila Bend area. Surveys conducted over the last decade suggest that the notion of a boundary between the Patayan and Hohokam ceramic traditions must accommodate a broad area of overlap in the northeastern BMGR.

Some researchers have suggested that Patayan pottery was the dominant ware used, and perhaps made, by the non-Hohokam inhabitants of the Western Papaguería, who acquired limited amounts of Hohokam pottery through trade and/or during visits to Hohokam communities located to the northeast and east. Many have favored the hypothesis that Hohokam groups living to the east brought their pottery with them during excursions into and across the BMGR. Still others have suggested that at least some of the pottery identified as Hohokam was locally made.

The Trincheras culture or tradition has been identified in the area immediately southeast of the Western Papaguería. The Trincheras culture is relevant to the prehistory of the Western Papaguería for two primary reasons. First, it was the source of the Trincheras Purple-on-red ceramics that occur with low frequency on Papaguerían sites (Whittlesey and others 1994: 215). Second, Trincheras settlements and culture might have influenced the settlement history of the Western Papaguería. For example, individuals or groups from the Trincheras settlements might have entered the region on hunting forays or trading expeditions. The Trincheras settlements might have served as refuges for the residents of the Western Papaguería during times of drought. Either of these relational models could account for the presence of Trincheras ceramics at Western Papaguerían sites.

### 6.2.2 Subsistence and Settlement

Information on the types and distributions of archaeological sites and features can help archaeologists understand how different cultural groups subsisted on and occupied a landscape. Although few archaeological sites have been excavated on the BMGR, surveys provide information about the variability of the archaeological record that can be used to infer aspects of the subsistence and settlement systems of the aboriginal occupants of the region.

The types of features recorded at archaeological sites include artifact scatters (pottery sherds, flaked stone, ground stone, shell, and other items), artifact scatters with features, bedrock grinding features or ground stone tools, fire-affected rock, hearths and cooking pits, rock alignments, trails, clearings in desert pavement, and evidence of houses or temporary shelters. Limited evidence of agriculture has been identified at several sites on BMGR East. Ahlstrom (2000: 253-257) recognized trends in the spatial distribution of such features on BMGR. In general, the frequency of artifact assemblages comprising pottery sherds, grinding features and artifacts, and hearths and cooking pits, decreases from east to west. This pattern suggests that activities associated with a relatively more sedentary lifeway—such as use of ceramic vessels, cooking, and grinding seeds—were more common in the less arid eastern areas. Conversely, the pattern suggests that smaller and relatively more mobile groups, reflected in fewer artifact types, were more common in the drier western portions of the BMGR.

The proportion of sites represented only by flaked stone increases to the west. Potential explanations for this finding include: (1) a simpler range of activities conducted at those sites, (2) use of basketry instead of pottery by more mobile populations on the west side of BMGR, or (3) a higher proportion of sites associated with the Archaic rather than later periods in this area.

The relationships among the mobile hunter-gatherers of the Western Papaguería and their riverine neighbors to the east and west should be a major focus of investigation under this theme. Likewise, substantial changes in lifeway were brought about by European contact and should be reflected in the distribution and nature of archaeological remains of the contact period.

### 6.2.3 Trade and Exchange

Marine shell and obsidian artifacts found on archaeological sites on the BMGR are indicators of prehistoric trade and exchange, as is the presence of artifacts made of obsidian from sources on

BMGR at sites elsewhere in the Southwest. Analysis of the distribution of shell and obsidian artifacts provides evidence of aboriginal networks for trade and exchange.

Marine shell artifacts are common at Hohokam sites in central Arizona. McGuire and Howard (1987) and McGuire and Schiffer (1982) argue that the evidence of shell working in the Western Papaguería supports the hypothesis that the occupants of this region were shell traders who brought items of shell jewelry and unworked shell to the Hohokam. According to Ahlstrom (2000:257-261) marine shell has been noted at archaeological sites across the entire BMGR, although sites with shell are most common in the central portion of the BMGR. He suggests this represents a broad trading corridor along which shell was transported from the Gulf of California north to the Gila Bend area along trails identified by Hayden (1972).

Four sources of obsidian have been recognized in the Western Papaguería, including the Sauceda Mountains, Sand Tank Mountains, Los Vidrios in northern Sonora, and an "Unknown A" source. Shackley's research has shown that "Sauceda Mountain obsidian is the most common volcanic glass found in Classic Hohokam contexts in both the Phoenix Valley and Tucson Basin" (Shackley 1995:547). Procurement of obsidian from sources within the Western Papaguería may have been linked to the transport of shell through the region (Doyel 1996; Mitchell and Shackley 1995).

Ahlstrom's analysis of obsidian and marine shell distribution in the BMGR database shows that both obsidian and shell have come from site clusters in the eastern and central parts of the BMGR. In the western areas of BMGR, shell artifacts are relatively common but obsidian artifacts are rare.

Ahlstrom (2000:261) concludes that before the Classic period, people in the Papaguería participated in the procurement and production of shell artifacts along with limited amounts of obsidian for exchange to the Hohokam of the Salt-Gila Basin. Doyel (1996) demonstrated that obsidian reached the Gatlin site in the Gila Bend area in raw form and was worked there, but apparently was not extensively used or worked throughout much of the BMGR. Following the transition to the Classic period, the shell trade in the Western Papaguería evolved into an exchange of mostly unworked shell with an increased emphasis on obsidian trade.

The distribution of marine shell and obsidian on sites within the BMGR provides insight into aboriginal systems of trade and exchange over substantial distances. The sites on the BMGR provide opportunities to learn more about aboriginal spheres of regional interaction and influence. The discussion offered by Ahlstrom and his colleagues focuses on the role of trade and exchange in Hohokam and Patayan cultures. Current research suggests that approaching these issues from the perspective of the inhabitants of the Western Papaguería, rather than neighboring riverine areas, should be the primary focus of BMGR research.

### 6.2.4 Ranching

Many homesteads were filed in the late nineteenth and early twentieth centuries on what is now the BMGR, although very few were ever patented. The extreme aridity of the land, difficult transportation routes, and rugged topography all contributed to a dearth of successful

homesteads. Few homesteaders tried to "prove up" their claims by planting or making improvements to the land (Ahlstrom and others 2000:1 34). A significant exception is the homestead patent issued in 1929 to Thomas Childs, Jr., for a 320-acre parcel centered around Batamote Well, about 9 miles north of Ajo. This homestead, just east of the intersection of the road to Manned Range 1 and State Route 85, became the headquarters of the Childs Ranch, one of two large, family-owned ranching operations in the area. The other important family-owned ranch in the region belonged to the Stout family whose land extended eastward from the Gila Bend area. The history of the Childs and Stout homesteads typify the process through which many ranching operations in the Western Papaguería became established, and shows how at the base of the ranching theme lies a homesteading theme, albeit a largely unrealized one (Vanderpot and Altschul 2001).

### 6.2.5 Mining

The history of mining on BMGR East centers on the Ajo Hills, which were known as a source of copper as early as the eighteenth century. The first efforts at mining made under U.S. jurisdiction came in 1854, immediately after the Gadsden Purchase (Wilson 1949:6). These earliest efforts failed, and the first relatively successful operations occurred at the end of the nineteenth century. In 1890, the Cornelia Copper Company purchased the mining claims of Thomas Childs, Sr., who had staked the claims in 1887. These claims formed the center of the first large-scale mining operation in the Ajo Hills.

The Cornelia Copper Company failed within a few years but was succeeded by a series of claim consolidations that became the New Cornelia Copper Company in 1909. The Tucson, Cornelia and Gila Bend Railroad, built by New Cornelia in 1915–1916, linked Ajo to the Southern Pacific Railroad at Gila Bend to make development of the Ajo mine and associated processing facilities feasible. By 1916, the New Cornelia operation employed as many as 1,200 men, and a planned community was built to house company employees. Under the direction of John C. Greenway, a mining engineer and general manager of the Calumet and Arizona Company's operation at Bisbee, the New Cornelia acquired further claims in the Ajo area and developed an improved leaching process that allowed for large-scale processing of low-grade copper ores. In 1917, the New Cornelia plant produced 10,000 tons of copper, the start of a boom that lasted until the collapse of the stock market in 1929. The New Cornelia Mining Company merged with the Calumet and Arizona Company following the collapse, and in 1931 Phelps-Dodge Corporation, based in Bisbee, purchased the new company. Phelps-Dodge operated the mine, through alternating periods of boom and bust, until 1984, when the mine was closed permanently (Hyde 1998: 145–147; Rickard 1998, 1999).

The Fortuna Mine, 30 miles east of Yuma on BMGR West, began with the 1895 discovery of a small but rich outcrop of gold. A year later, Charles D. Lane bought the mine for $150,000 and organized the La Fortuna Gold Mining and Milling Company (Dunning 1959: 146). A 20-stamp mill was operated at the mine until 1904. At the peak of operations, the mine supported a community of 80 to 100 miners who lived in frame, adobe, and tent houses. The Fortuna Mine produced 2.6 million dollars in gold during this period. Efforts to reopen the mine in the 1930s were unsuccessful.

Prospectors combed the Wellton Hills and Copper Mountains in the late 1800s, and the La Posa Mining District was organized. Some copper, gold, and silver was recovered from the district, but in general development was no more than prospects or shallow mines, and the production was limited and sporadic. Named mines in the district include the Betty Lee and Last Chance Mines in the Copper Hills and the Double Eagle, Wellton Hill, and Poorman mines in the Wellton Hills (Bruder and others 1996: 86). At the Betty Lee, extensive shafts and tunnels were excavated and a small mill was erected; up to 30 miners were employed, but the mine was never profitable (Broyles and Hartman 2000: 190). Other claims clustered in the Sauceda and Sand Tank mountains but results did not warrant organization of a mining district (Ahlstrom 2000: 133).

### 6.2.6 Transportation

Roads in isolated southwestern Arizona were critical to survival during the historical period. Trails used for millennia by Native Americans became the first roads of the historical period, but others were added as Spanish, Mexican, and Anglo-American travelers passed through and eventually settled the area. At the start of the twentieth century, few roads passed through the Western Papaguería, and these were largely limited to the routes connecting the scattered dependable water sources in the region (Bryan 1922). This situation changed with the appearance of automobiles and the development of state highways, and even more following acquisition of the area by the U.S. military.

Along with automobiles and better roads, the twentieth century saw a great increase in smuggling from Mexico. Because of their proximity to the international border and their isolated character, the roads of the western Papaguería have long been used by smugglers, the first major wave coming during Prohibition. Bootleg liquor frequently would be brought from Sonoyta into Arizona on the Darby Well Road. The smugglers followed regular routes, always maintaining vigilance against police, and delivering their goods at night. Later, the smuggling of marijuana and other drugs and contraband followed many of the same routes (Rojo 1987).

Early travel across the BMGR was extremely difficult because of the aridity of the region, its rugged nature, and the dearth of knowledge about the topography. Those familiar with the region generally knew the location and reliability of water sources, but without this information, travel could be deadly (Bryan 1922, 1925). It also served as an important link between northern Sonora and southern California, allowing travelers to avoid the area along the Gila River, which was subject to Apache raiding for extended periods of time, especially during the nineteenth century.

One of the earliest routes across the region was the Camino del Diablo, which ran from the towns of Altar and Caborca in Sonora to Yuma. The first European to use the route was Melchor Díaz, a member of the Coronado expedition, who in 1540 traveled from what is now Ures, Sonora, to the mouth of the Colorado River at what is now Yuma. In 1699, Father Kino followed portions of the Camino del Diablo from Sonoyta to the Gila River at what is now Wellton. Kino located and named several rock tanks along this route, including Heart Tank and Cabeza Prieta Tank; however, Kino missed the important water source at Tinajas Altas (Thurtle and others 2000:1.25). In 1774, Juan Bautista de Anza sought a route to California from Sonora, and followed the Camino, possibly stopping at Tinajas Altas. From there he went north through

Tinajas Altas Pass, and crossed the Yuma Desert; later, his route would be followed by numerous travelers. The Camino was used by many hopeful prospectors during the California gold rush, and it was during this period that the road received its name. An estimated 400 travelers died along the route during the 1840s (NRPT 1986:10–17).

A route through the Quijotoa Valley was also used early in the historical period, by Father Kino and others traveling from missions in northern Mexico to Native American settlements along the Gila River. This route passed between the Sauceda and Sand Tank Mountains, extending between settlements at what are now known as Pozo Blanco and Gila Bend. Other Spanish explorers, soldiers, and missionaries followed the same route, as did prospectors and ranchers from the early nineteenth century on.

A few trails or roads emerged following U.S. acquisition of the area in the 1850s. The Arizona Mining and Trading Company created a road connecting Gila Bend with mines in Ajo in 1854, providing access from the mines to the Gila River. From there, the ore was transported to the Colorado River along what is known as the Yager wagon road, developed by Louis J.F. Jaeger. Archaeologists surveying the area noted that USGS bench marks dated 1925 were placed along the road for an undetermined distance (Slaughter and others 2000: 206).

The Yuma wagon road also developed as mines began to emerge in the Ajo area beginning in the middle of the nineteenth century. The road followed the Camino del Diablo from Yuma, branching off in the region of Las Playas. From there, the road headed due east through the Agua Dulce Mountains, then northeast to Ajo. Many of the early miners in Ajo followed this route, including organizers of the Arizona Mining and Trading Company in 1854. At that time, Papago Well and Bates Well were not yet established, making the journey perilous (NRPT 1986:10–17). Other routes of travel were developed to supply mines and ranches.

For the most part, however, the focus of travel through the region remained to the north, along the Gila River. It was along this route that the Butterfield Overland Stage Line connected San Antonio, Texas with San Diego, California. With the start of the Civil War, however, the line was abandoned. Other stage companies used the old route after the end of the war until the arrival of the railroad in 1880. The railroad made the area accessible to more and more people, and more importantly, provided a link to outside markets. Ore and cattle could be shipped with greater ease and less expense (Homburg and others 1994:337-338). With the construction of the Southern Pacific Railroad across southern Arizona in the 1880s, additional feeder lines sprouted up almost immediately. In 1915, construction began on the Tucson, Cornelia and Gila Bend Railroad from Gila Bend to Ajo.

The arrival of the automobile also led to the creation of new roads, particularly after 1910, when mining and cattle ranching expanded and automobile ownership became more widespread. The Automobile Club of Southern California placed signs on many of these roads during this period, although travel was hazardous at best. Water sources were few, far between, and unreliable. The roads were generally little better than trails, and vehicles could easily become mired in sand. Mileages were often listed in half-miles on signs established by the Auto Club. Many of the routes of travel through this inhospitable region were described in the early 1920s by USGS geologist Kirk Bryan (Bryan 1922). The purpose of Bryan's survey was to inform travelers of

water sources along these trails, and provide information on the condition of the trails, as well as the country in general.

Sometime in the 1920s or early 1930s, a settler named Charlie Bell established a road from Ajo to his well in the Growler Mountains. At one time there was a road from Ajo to Sentinel, passing through the Crater Range. Several other roads were constructed or improved during this period, as automobiles became more common; many of these roads followed earlier foot or wagon trails (NRPT 1986:10-17).

In 1934, Highway 84 was completed across western Arizona, providing an automobile route along the Gila River. The arrival of the military in the 1940s changed much of the historical-period travel patterns in the project area. Travel routes sought to connect training sites, bases, airfields, and targets with outside travel routes (Highway 84) or larger bases (Luke AFB). Old roads that had been used by settlers were less frequently used, and many fell into disuse. Hunters, sightseers, and to a lesser extent the military, continue to use many of these routes of travel.

### 6.2.7 Military Use of the BMGR

The military use of the BMGR can be divided into five periods: (1) World War II era, 1941 to 1949, (2) Korean War and early Cold War era, 1950 to 1959, (3) middle Cold War and Vietnam War era, 1960 to 1974, (4) late Cold War and Persian Gulf War era, 1975 to 1991, and (5) post Cold War era, 1992 to present. The BMGR was used for a variety of military purposes during those six decades but training of aircrews was and remains paramount.

Air Force use of the BMGR East and Marine Corps use of BMGR West reflect the evolution of weapons systems and training programs through time; however, the footprint of military operations has remained essentially unchanged throughout most of its history. The most substantial changes on BMGR East related to an expanded program of annual and 5-year EOD clearance operations within the manned and tactical target areas. On BMGR West, two targets—Rakish Litter and Panel Stager—were developed, upgraded, and then replaced with the new Moving Sands and Cactus West target complexes. Also, Marine Corps ground troops were integrated into aircrew training operations such as the biannual Weapons Tactics Instructor course.

Because many of the same areas have been used for successive generations of targets and ranges, features associated with the early periods are rare and most are in poor condition. Remnants of earlier episodes of military training do survive, and some have been evaluated for possible inclusion on the National Register as cultural resources associated with the history of military aviation tactical training during the World War II era and throughout the Cold War (Rogge and others 1995; Thompson 2004).

## 6.3 ARCHAEOLOGY AND THE NATIONAL REGISTER

According to National Register guidance, archaeological sites are associated with human activity, through events, processes, settlement, migration, beliefs, lifeways, and other facets of

the development or maintenance of cultural systems. The significance of an archaeological site should be determined by how well the site represents and can illustrate these factors. Formal context development has not been emphasized in the Section 106 review process, and most sites are simply evaluated by reference to regional culture histories. The historic significance of archaeological sites is almost always evaluated under Criterion D (having the potential to contribute significant information).

### 6.3.1 Archaeological Site Significance

The historic significance of most archaeological sites is evaluated under Criterion D because of their scientific importance within the discipline of archaeology; however, they also may be considered significant for other values.

#### 6.3.1.1 Criterion D: Information Potential

Both of the following requirements must be met for a property to be eligible under this criterion:

1. The property must have, or have had, information to contribute to our understanding of human history or prehistory.
2. The information must be considered important and significant to current or traditional research interests.

One may argue that all archaeological sites meet the first test, but establishing the importance of information yet to be acquired is more challenging. Evaluating the importance of information should be done within an appropriate context. To be considered important, the information must have a significant bearing on current or traditional research issues or *on a priority area identified in an agency management plan* (emphasis added; the latter is a little-used provision that allows agencies some flexibility in identifying and managing historic properties under their care). Contexts for archaeological site assessment should be developed from the body of information already collected from similar properties and environments.

Additional considerations include:

1. Information likely to be obtained from a particular property must confirm, refute, or supplement existing information in an important way.
2. The connection to a context may be established through particular research questions using data that may be contained in the property—these may be property-specific questions or broader questions about a geographic area.
3. A property must be shown to have the potential to yield important information through surface indications, animal burrows, erosion, remote sensing, or test excavations.
4. The property should be sufficiently intact to yield the expected information if the appropriate study methods are used; partly excavated or disturbed properties might retain sufficient information potential to be eligible.
5. Completely excavated sites can be considered eligible under Criterion D.

### 6.3.1.2 The Significance of Small Sites

A major challenge for archaeologists and land managers is the evaluation of small sites. Small sites, sites without surface features, flaked stone scatters, scatters of fire-affected rock, and other small, low-density, or so-called "ephemeral" manifestations are often found not to be eligible because recordation during survey has "exhausted all research potential." By this device, these sites are frequently written off; that is, their treatment is essentially the same as that accorded isolated artifacts. Yet, increasingly, archaeologists also recognize that isolated features, work stations, and other evidence of limited human activity are an important part of a settlement system or a cultural landscape. Resource procurement sites, processing locales, caches, markers, individual petroglyphs, vision sites, pot drops, and other such places illustrate behaviors that are invisible at the larger, more complex sites with which they are associated. Small sites must be honestly assessed by considering their place in the universe of neighboring sites, their age or cultural affiliation, and whether they have the potential, either individually or as a class, to yield important information through further investigation (thus achieving significance under Criterion D).

In recent years, there has been considerable discussion of redundant data and even redundant site types. Researchers and agency officials have suggested that important data about prehistory are not likely to be produced by investigating yet another site of several common types, ranging from flaked stone scatters to pit house villages. Often this represents the logical culmination of a trend toward addressing a standard set of research questions about particular features, artifact classes, or site classes. To an extent, it is also a self-fulfilling prophecy, for another part of this trend has been to develop a set of techniques designed to produce data to answer only those particular questions as efficiently and inexpensively as possible. Through repetition, research methods have been fine-tuned to the point that no other useful data can or will be collected. Is it possible that all questions about this type of site have been answered and all important information collected? Is it likely that if other research questions were defined and appropriate research designs were developed and implemented, no important data are likely to be produced? If the answer to these questions is no, then these sites should not be considered an insignificant part of the archaeological record.

Compounding this problem is that in many of the areas where small, low-density sites are ubiquitous, including the BMGR, systematic research is a relatively recent phenomenon, and fully developed historic contexts are only now being written based on that research (see for example Doolittle and others 2006). In some areas of the BMGR and the Western Papaguería, a few areally extensive surveys have located only a handful of isolated artifacts and a few extremely low-density artifact scatters. While these resources may not meet site definition criteria applied in other settings, given that they are the only evidence of human use in some areas, they clearly do provide important information about regional prehistory and land use.

What are the characteristics of sites that are "likely" to yield important information? Is it possible to list the hallmark surface characteristics of an eligible site? Probably not. All sites must be considered within a larger context—an environmental zone or geographic area, a

postulated archaeological settlement/subsistence system, or a cultural landscape. This last concept is being used increasingly to describe not just a system of past human behavior, but a broader universe that incorporates its environmental and cultural setting, including its visual and other sensory characteristics.

If the goal of archaeology is studying past human behavior, then the foundation of the significance assessment must be a broader perspective on past use of multiple sites and settings, their interrelationships, and the possibility that an examination of these relationships may inform on both the ways people perceived and interacted with their world and the ways in which that world shaped prehistoric and modern Native American cultures.

Archaeological evidence indicates that the inhabitants of larger, more complex sites lived, worked, and interacted with others over a surprisingly large area. Small sites and features of the natural environment are important components of that area and are critical to understanding those larger sites. Unfortunately, small sites are being selectively destroyed with little or no study, on the premise that all important data have been recovered through limited observations made during survey. Seldom is an effort made to place these sites within a detailed context as a part of the significance evaluation.

The selective destruction of any one component of a settlement system or cultural landscape forever limits our ability to reconstruct and understand past human behavior, yet that is precisely the result produced by wrongly identifying whole classes of sites as insignificant. A true assessment of site significance should be based on a historic context that includes all kinds of archaeological sites and gives careful consideration to their import both individually and collectively.

An important outcome of consultation with federally recognized tribes is an increased awareness of the cultural significance ascribed by tribes to most or all archaeological sites. The perspective of culturally affiliated tribes must be recognized and considered in determining eligibility. Cultural significance may qualify such places for inclusion on the National Register under Criterion A, B, or C.

#### 6.3.1.3 Traditional Cultural Significance and Criterion A

More than a decade after the NHPA was amended to incorporate tribal concerns, meaningful tribal participation in the evaluation and treatment of archaeological sites remains an elusive goal. One strategy for complying with the 2000 revision of 36 CFR 800 is emphasizing more meaningful consultation with federally recognized tribes in the process of determining the National Register significance of archaeological resources. The foundation of this change should be the development of historic contexts that reflect Native American perspectives on their history and heritage.

Historic contexts that place archaeological sites within a traditional cultural perspective can be developed using information provided by federally recognized tribes that attach cultural significance to those sites. For example, three basic steps might demonstrate that an archaeological site exemplifies or is associated with an identified “broad pattern” of a tribe’s

or group's history and is therefore eligible for inclusion on the National Register under Criterion A.

1. Establish culture history (using early written accounts, oral history, ethnographies, early military records, Native Claims Act hearing records, treaties, studies of places names, or other evidence, such as documented tribal histories) and develop historic contexts from a tribal perspective using traditional knowledge.
2. Identify the types of places that are associated with a tribe or group (specific places by name, classes of places by generic description).
3. Examine the characteristics of individual archaeological sites and assign them to identified types as warranted.

### 6.3.2 The Evaluation Process

#### 6.3.2.1 What Do We Need to Know?

Several important issues must be considered to improve evaluations of eligibility. Too often, the information needed to evaluate the significance of archaeological sites is not collected during archaeological survey. Generally it is more difficult to demonstrate that a site lacks the potential to yield important information than to agree to consider it "potentially" eligible; yet over the long term, this strategy makes agency management of cultural resources more difficult. What kinds of information should be recorded during survey to fully support an eligibility determination? The answer to this question must be based on an archaeological context or contexts. To insure that data collection is adequate, the contexts within which eligibility will be assessed must be defined in a research design before the identification and evaluation process begins.

There are good management reasons to insist that survey reports provide well-supported significance assessments. Statements of work (SOWs) should require sufficient data collection and evaluation during surveys. To meet this goal, after preparing a work plan or research design and completing required consultation, the identification effort may include shovel testing or other methods to insure that sufficient data are collected.

Judgments made from surface observations must be explained and supported, especially as they pertain to the likelihood of associated buried archaeological deposits. For example, did the recorder base this finding on soil profiles observed in a nearby road cut or entrenched stream channel, "backdirt" from a rodent burrow, or the results of excavation of a similar-looking site in an adjoining region? The potential presence of subsurface deposits alone is not the determining factor in evaluating the significance of archaeological sites.

Test excavations often are viewed as an essential part of the eligibility assessment process, especially where environmental factors limit the utility of surface observations. Throughout most of Arizona, however, surface observations have been shown to be a relatively reliable predictor of the occurrence of subsurface archaeological deposits, and numerous sites have been determined eligible for inclusion in the National Register in the absence of subsurface remains. For this reason and others, the Arizona SHPO does not require testing as a part of

making determinations of eligibility. The SHPO has stated that many if not most sites can and should be evaluated on the basis of surface evidence only.

#### 6.3.2.2 How to Describe an Archaeological Site or District

National Register guidance directs researchers to include the following information in site descriptions and reports:

1. Environmental setting of the property today and, if different, its environmental setting during the periods of occupation or use. Emphasize environmental features or factors related to the location, use, formation, or preservation of the site or district.
2. Period of time when the property is known or projected to have been occupied or used. Include comparisons with similar sites and districts that have assisted in identification.
3. Identity of the persons, ethnic groups, or archaeological cultures that, through their activities, created the archaeological property. Include comparisons with similar sites and districts that have assisted in identification.
4. Physical characteristics

   For individual sites, describe:
   - Site type, such as rockshelter, temporary camp, lithic workshop, rural homestead, or shoe factory
   - Prehistorically or historically important standing structures, buildings, or ruins
   - Kinds and approximate number of features, artifacts, and ecofacts, such as hearths, projectile points, and faunal remains
   - Known or projected depth and extent of archaeological deposits
   - Known or projected dates for the period when the site was occupied or used, with supporting evidence
   - Vertical and horizontal distribution of features, artifacts, and ecofacts
   - Natural and cultural processes, such as flooding and refuse disposal, that have influenced the formation of the site
   - Noncontributing buildings, structures, and objects within the site

   For districts, describe:
   - Type of district, such as a village with outlying sites, a group of quarry sites, or a historic manufacturing complex
   - Cultural, historic, or other relationships among the sites that make the district a cohesive unit
   - Kinds and number of sites, structures, buildings, or objects that make up the district
   - Information on individual or representative sites and resources within the district; for small districts, describe individual sites, and for large districts, describe the most representative sites individually and others in summary or tabular form or collectively as groups
   - Noncontributing buildings, structures, and objects within the district
5. Likely appearance of the property during the periods of occupation or use; include comparisons with similar sites and districts that have assisted in description
6. Current and past impacts on or immediately around the property, such as modern development, vandalism, road construction, agriculture, soil erosion, or flooding.

Describe the integrity of a district as a whole and, in written or tabular form, the integrity of individual sites.

7. Previous investigations of the property, including:
    - Archival or literature research
    - Extent and purpose of any excavation, testing, mapping, or surface collection
    - Dates of relevant research and fieldwork. Identity of researchers and their institutional or organizational affiliation
    - Important bibliographic references

#### 6.3.2.3 How to Discuss the Significance of Archaeological Sites

Discussions of significance in reports refer to the research design and should include the following:

1. What is the cultural context in which the property is considered significant? How does the site relate to what is currently known of the region's prehistory or history and similar known sites?
2. What kinds of information can the known data categories yield? What additional kinds of information are expected to be present on the basis of knowledge of similar sites? What similarities permit comparison with other known sites?
3. What is the property's potential for research? What research questions may be addressed at the site? How do these questions relate to the current understanding of the region's archaeology? How does the property contribute or have the potential for contributing important information regarding human ecology, cultural history, or cultural process? What evidence, including scholarly investigations, supports the evaluation of significance?
4. How does the integrity of the property affect its significance and potential to yield important information?
5. If the site has been totally excavated, how has the information yielded contributed to the knowledge of American cultures or archaeological techniques to the extent that the site is significant for the investigation that occurred there?
6. Does the property possess resources, such as buildings or structures, which in their own right are architecturally or historically significant? If so, how are they significant?

#### 6.3.2.4 How to Discuss the Significance of Archaeological Districts

A slightly different set of questions should be addressed in evaluating districts, including:

1. What is the cultural context in which the district has been evaluated, including its relationship to what is currently known about the area's prehistory and history and the characteristics giving the district cohesion for study?
2. How do the resources as a group contribute to the significance of the district?
3. How do the resources individually or in representative groupings contribute to the significance of the district?
4. What is the district's potential for research? What research questions may be addressed at the district? How do these questions relate to the current understanding of the region's archaeology? How does the property contribute or have the potential for contributing important information regarding human ecology, cultural history, or cultural process?

What evidence, including scholarly investigations, supports the evaluation of significance? Given the existence of material remains with research potential, what is the context that establishes the importance of the recoverable data, taking into account the current state of knowledge in specified topical areas?

5. How does the integrity of the district affect its significance and potential to yield important information?
6. Does the district possess resources, such as buildings or structures that in their own right are architecturally or historically significant? If so, how are they significant?

### 6.3.3 Multiple Property Documentation or Cultural Landscape?

Multiple-property documentation may "be used to nominate and register thematically-related historic properties simultaneously or to establish the registration requirements for properties that may be nominated in the future" (NPS 1991: 2), in accordance with the National Register Bulletin *How to Complete the National Register Multiple Property Documentation Form*. This strategy supports the assessment of a broad range of site types within a regional or temporal framework. The multiple-property approach fully supports determinations of eligibility for individual sites as members of a class of sites; however, it is not conducive to the identification and evaluation of cultural landscapes. Landscapes are typically treated as districts, where the relationships among individual sites and sites types are as important as, or perhaps even more important than, the individual properties.

The landscape concept is increasingly used to describe what archaeologists have called settlement/subsistence systems or archaeological districts; it combines elements of both constructs, but also includes other aspects (viewshed, auditory elements, and other sensory characteristics). In the mid-1990s, the National Park Service (NPS) launched a Historic Landscape Initiative; among the results of this initiative are published guidelines for the treatment of cultural landscapes and an inventory of properties managed by NPS that should be managed as landscapes and listed as such on the National Register. Cultural landscapes can range from thousands of acres of open space to a small property surrounding and associated with a historic homestead. A cultural landscape is defined as " a geographic area, including both cultural and natural resources … associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values" (*Preservation Brief 36*, Protecting Cultural Landscapes, p. 1).

NPS continues to provide leadership in the identification and treatment of cultural landscapes. In 2000, NPS held a workshop on archaeological landscapes at its Santa Fe regional office. As a result of its continuing efforts, NPS now recognizes *ethnographic landscapes* as "a landscape containing a variety of natural and cultural resources that associated people define as heritage resources" (*Preservation Brief 36,* Protecting Cultural Landscapes, p. 2). This concept appears well suited to accommodating the concerns of Native Americans in the evaluation of significance.

It is also well suited to the needs of archaeologists who view individual sites as a component of a settlement system, cultural landscape, or other overarching construct. Using a landscape approach accommodates small and large sites, single- and multifunction sites, and sites that have significance for reasons other than, or in addition to, their information potential. A historic

context based on the landscape concept would identify the archaeological site types (and features of the natural world) associated with it, and give careful consideration to their import both individually and collectively. An ethnographic or archaeological landscape with its component features, incorporating the traditional cultural values of Native American tribes that attach significance to that landscape, could be described using National Register guidance.

Such a landscape-level context would provide critical support for interpreting and evaluating cultural resources recorded on BMGR, tremendously simplifying the evaluation process.

## 6.4 IDENTIFYING AND EVALUATING TRADITIONAL CULTURAL PROPERTIES

Section 101(d)(6)(A) of the NHPA states that: "Properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the National Register" (16 U.S.C. 470a(d)(6)(A)). The following subparagraph (B) states: "In carrying out its responsibilities under section 106, a federal agency shall consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to properties described in subparagraph A" (16 U.S.C. 470a(d)(6)(B)). Together they establish two important concepts: some (but not all) places of religious and cultural importance will meet the standard for eligibility, and agencies will consult with all tribes that attach importance to those places in evaluating them. Both NPS and the ACHP have published guidance to assist federal agencies in this process.

In 1994, the National Park Service issued National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990). It defines TCPs, a particular type of historic property, as places of special heritage value to contemporary communities (often, but not necessarily, Native American) because of their association with the cultural practices or beliefs that are rooted in the histories of those communities and are important in maintaining their cultural identity. Bulletin 38 advises agencies that some kinds of historic properties may be identified only by members of and experts in the cultures that use or value those places, such as tribal elders, religious leaders, or other holders of traditional or ceremonial knowledge.

> An early step in any effort to identify historic properties is to consult with groups and individuals who have special knowledge about and interests in the history and culture of the area to be studied. In the case of traditional cultural properties, this means those individuals and groups who may ascribe traditional cultural significance to locations within the study area, and those who may have knowledge of such individuals and groups (p. 6).

The bulk of Bulletin 38 describes the process of evaluating the significance of traditional cultural properties. "It is vital to evaluate properties thought to have traditional cultural significance from the standpoint of those who may ascribe such significance to them…" (p. 4) and specifically addresses the significance and potential eligibility of natural landscapes and features if they are associated with significant traditions or uses.

Because identifying and evaluating such properties requires tribal consultation, the ACHP issued a policy statement in 1993 titled *Consultation with Native Americans Concerning Properties of*

*Traditional Religious Cultural Importance*. The policy emphasizes the importance of using culturally informed and culturally appropriate methods for consulting with Native Americans (ACHP 1993:3-4).
Consultation with Native Americans must be conducted with sensitivity to cultural values, socioeconomic factors, and the administrative structure of the group. Specific steps are to be taken to address language differences and issues such as seasonal availability of necessary participants. The ACHP policy and NPS guidance also acknowledge that Native American groups may consider it inappropriate to divulge some traditional cultural information, particularly to non-tribal members. The concern for confidentiality was addressed in the NHPA and the Section 106 regulation. Sensitive information about the location, character, or ownership of a historic property can be restricted if disclosure would endanger properties or impede the use of a traditional religious site by practitioners. The ACHP policy reaffirms the federal government's commitment to maintaining confidentiality regarding sensitive cultural resource information and limiting collection of sensitive information only to that necessary for planning in a manner that respects Native American need for confidentiality. A National Register Bulletin, *Guidelines for Restricting Information on the Location of National Register Properties*, provides details on how to appropriately restrict sensitive information.

Developing historic contexts that reflect traditional cultural values and establish a framework for evaluating the historic significance of such places from that perspective would both enhance the consultation process and simplify the process of identifying and evaluating properties eligible for inclusion on the National Register.

**Section 7**

# NATIVE AMERICAN CONCERNS

Since 1996, the Air Force and Marine Corps have worked with Native American tribes and groups in the BMGR region to establish procedures for meaningful consultation and identify Native American concerns for places on BMGR. This section summarizes the history and results of that effort. Issues identified through consultation about particular resources and areas of BMGR, as well as ongoing Air Force- and Marine Corps-specific consultation procedures will be discussed in Parts II and III.

## 7.1 CONSULTATION

During preparation of the Legislative Environmental Impact Statement (LEIS) that supported the range renewal under the MLWA of 1999, the Air Force, Marine Corps, and BLM coordinated with representatives of tribes that expressed an interest in federal management of the BMGR or claimed cultural affiliation with the area. Tribal representatives received project newsletters and meeting notices. Native American tribes and groups were invited to participate in all public meetings, and two of the eight scoping meetings were held on the Tohono O'odham Nation in the communities of Sells and Santa Rosa.

A literature search and preliminary archival survey were undertaken to provide ethnohistoric and historic background on the area encompassed today by the BMGR and to identify affiliated tribes and potential TCPs and sacred sites. More than 40 published and unpublished sources were consulted at the Arizona State Museum at the University of Arizona, and the Arizona Room at the Hayden Library at Arizona State University. Individuals with knowledge of the BMGR or expertise in TCP/sacred sites issues also were contacted. The results of these efforts were summarized by Tisdale (1997).

The next step in this process was the preparation of a comprehensive plan to guide efforts to identify TCPs and sacred sites through consultation with affiliated tribal representatives (Tisdale 1998). The plan identified the collection of oral histories provided by traditional cultural experts and practitioners as the critical component of this effort, but ethnographic research also was recommended.

In late 1996, a team of agency and contractor cultural resource professionals led by Bruce Masse (then 56 RMO archaeologist) initiated consultation with Native American groups specifically with regard to cultural resources. All federally recognized tribes in Arizona and the Hia C-ed O'odham Alliance, the Pueblo of Zuni, the Campo Band of Mission Indians, the Chemehuevi Tribe, and the Torres Martinez Desert Cahuilla Indians were initially contacted (Table I-6).

Telephone inquiries were made by Dames & Moore staff, under contract to the 56 RMO, between December 1996 and February 1997. Tribal governmental offices were contacted and asked to designate an official contact person; each of the contacted tribes did so. Each contact was asked to indicate the proper procedure for future contacts. Colonel David L. White (then

**Table I-6**

**Tribal Consultation Summary**
(after Tisdale 2000)

| Group | ICRMP Participation | TCP/Sacred Sites Study Participation | Keep Informed of ICRMP and TCP/Sacred Studies | No Interest in BMGR |
|---|---|---|---|---|
| Ak-Chin Indian Community | X | X | X | |
| Campo Band of Diegueño Mission Indians | | | X | |
| Chemehuevi Indian Tribe | | | X | |
| Cocopah Tribe* | X | | X | |
| Colorado River Indian Tribes* | X | | X | |
| Fort McDowell Yavapai Nation* | | | X | |
| Fort Yuma-Quechan Tribe | X | | X | |
| Gila River Pima-Maricopa Indian Community | X | X | X | |
| Havasupai Tribe | | | X | |
| Hia C-ed O'odham Alliance* | X | X | X | |
| Hopi Tribe* | X | X | X | |
| Hualapai Tribe | | | X | |
| Kaibab Band of Paiute Indians | | | X | |
| Navajo Nation | | | | X |
| Pascua Yaqui Tribe | | | | X |
| Salt River Pima-Maricopa Indian Community | X | X | X | |
| San Carlos Apache Tribe* | | | X | |
| San Juan Southern Paiute Tribe | | | | X |
| Tohono O'odham Nation* | X | X | X | |
| Tonto Apache Tribe | | | | X |
| Torres Martinez Desert Cahuilla Mission Indians | | | X | |
| White Mountain Apache Tribe* | | | X | |
| Yavapai-Apache Nation* | X | | X | |
| Yavapai-Prescott Indian Tribe | X | | X | |
| Zuni Tribe | X | X | X | |

*indicates a written response

Director of the 56 RMO) sent formal consultation letters to tribal leaders and cultural resource representatives of the 26 groups on 30 July 1997 inviting them to participate in preparing an ICRMP for the range and a study of traditional cultural values. Follow-up telephone calls were made to discuss whether the respective tribe wished to be involved in the study and to ask if a protocol had been established for consultations such as this. Tribes that expressed an interest in the project were invited to attend a coordination meeting on 25 October 1997 at Baker Peaks on the BMGR. Eight tribal groups were represented at the coordination meeting, where the team solicited tribal input concerning consultation protocols, confidentiality, and level of participation in the multifaceted project. The 56 RMO also offered to support research studies to be completed by individual tribal groups that chose to participate in the TCP/sacred sites study.

By December of 2000, the 56 RMO/Dames & Moore research team had presented project information and answered questions at 35 individual tribal meetings around the state. Additionally, they participated in more than 500 telephone conversations with tribal members and held 16 meetings with individual tribal representatives. Of the 26 contacted groups, 4 have indicated no interest in consulting about the cultural resources of the BMGR. The rest said they wished to be kept informed about the ICRMP and the TCP/sacred sites study as well as the LEIS. Twelve groups indicated that they wished to participate in the TCP/sacred sites inventory.

## 7.2 IDENTIFICATION OF TRADITIONAL CULTURAL PLACES AND SACRED SITES

As described in the comprehensive plan prepared by Tisdale (1998), the goal of the proposed TCPs and sacred sites study was to identify and document known places on the BMGR. Much of this effort focused on consultation with affiliated tribes. As Stoffle (1994) points out, general consultation should include identifying cultural resources and should consider at least the following: (1) archaeology sites, (2) petroglyphs, (3) human burials, (4) traditional cultural properties, (5) plants, (6) animals, (7) minerals, and (8) water. He recommends also considering sacred sites, including: (1) creation story locations and boundaries, (2) sacred portals recounting star migrations, (3) universal center locations, (4) historical migration destiny locations, (5) places of prehistoric revelations, (6) traditional visions quest sites, (7) plant-animal relationship locations, (8) mourning and condolence sites, (9) historical past occupancy sites, (10) spirit sites, (11) recent historical event sites, (12) plant, animal and mineral gathering sites, and (13) sanctified ground.

Native Americans attach religious and cultural significance to both land and resources on a broad scale. For example, a mountain or a viewshed may be recognized as traditionally important or sacred. Because of the significance of these places, and their importance in maintaining living cultures, tribal cultural experts are concerned about any potential use that would be incompatible with their beliefs and values. Traditional cultural concerns also may focus on discrete locations, access to specific ceremonial places, or the freedom to collect, possess, and use certain resources, such as particular plant and animal species. The challenge for an effective ICRMP is to consider such traditional places and resources in a manner consistent with regulatory and military requirements.

National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990), defines TCPs as places of special heritage value to contemporary communities (often, but not necessarily, Native American) because of their association with the cultural practices or beliefs that are rooted in the histories of those communities and are important in maintaining their cultural identity (see Section I-4). Sacred sites are defined more narrowly by Executive Order 13007 as discrete locations on federal land identified as sacred by virtue of their religious significance or ceremonial use by Native American religious practitioners. MLWA, Section 3031(b)(9)(B), defines sacred sites as "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or its designee, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion" and identified as such to the Secretary of the Navy or Air Force. Such regulatory definitions often are a poor fit with traditional cultural perspectives, and are problematic to most tribal representatives and traditional practitioners.

Ethnographers, including Griffith (1992), Nabhan (1987), Russell (1975), and Walker (1991), have identified some of the types of places valued by the native peoples of the Southwest, including the following:

- monumental geographical features that have sacred meaning, including mountains and mountain peaks, caves, and rock shelters
- water sources such as springs, wells, and bedrock catchment tanks (*tinajas*)
- gathering areas where sacred plants, stones, minerals, salt and other natural materials are available
- cultural features such as vision quest sites
- trails and roads
- rock cairns, shrines, and trail markers
- rock art (pictographs and petroglyphs), intaglios, and geoglyphs
- caches and storage locations for village fetishes and the belongings of important people such as medicine men
- burial areas and cemeteries
- places of origin described in a group's oral histories

An example of a TCP listed on the National Register of Historic Places is *I'itoi Mo'o,* located in Organ Pipe Cactus National Monument (OPCNM). *I'itoi Mo'o* is a natural rock spire located at the northern end of the Ajo Mountains. The O'odham consider this spire to be sacred because it marks one of the locations where the O'odham deity, *I'itoi*, emerged to live among the Desert People and to teach them how to build homes, hunt, grow food, and gather the saguaro fruit to make into wine. When he completed his teaching, *I'itoi* returned to the top of the mountain, where people continue to go to seek his guidance.

Like *I'itoi Mo'o*, other mountains and hills play a significant role in the creation stories of many of the lower Colorado River tribes. For example, Avikwamé or Spirit Mountain (Newberry Mountain north of Needles, California) is important to the Quechan, Cocopah, Mojave, and other Yuman speaking groups because the mountain plays a pivotal role in their creation stories.

In other instances, mountains or other promontories are important directional or territorial markers for travelers. For example, Native Americans who participated in consultation about

quarrying at Antelope Hill, which is located along the Gila River north of the BMGR, identified it as a place frequently stopped at while traveling along the Gila River.

During the course of an archaeological survey of the area surrounding Tinajas Altas, which was conducted by SWCA, Inc., under contract to the Air Force, Native Americans talked with project archaeologists and researchers about the significance of Tinajas Altas in their cultures; several traditional cultural experts indicated that members of their tribes continue to visit and make offerings at Tinajas Altas. Ocotillo "spirit sticks" and corn pollen identified during the survey also may indicate ritual use of the area.

Peaks and mountains in the BMGR region have been identified in other studies as places of traditional cultural value. In a report prepared for the Legacy Resource Management Program, Vine Deloria, Jr., identified *Ahvakouotut* above Parker Dam in La Paz County as the ancient home of the Mojave, and *Huquempavi*, three sharp peaks south of Topock, as the place where *Mastamho*, a powerful spirit, killed an enormous sea serpent (Deloria 1998).

Among the site and feature types recorded on BMGR that have been identified by traditional cultural experts as culturally significant places that should be evaluated for National Register eligibility as TCPs are:

- pictographs, petroglyphs, and geoglyphs
- rock piles, mounds, cairns, and other accumulations that may represent shrines and trail markers,
- trails, and
- water sources such as springs, tinajas, and streams.

## 7.3 SUMMARY OF NATIVE AMERICAN CONCERNS

Beginning in 1997, the 56 RMO offered sole-source contracts to those tribal groups that indicated an interest in completing studies of TCPs and sacred sites on BMGR. The Hopi Tribe, the Yavapai-Prescott Tribe, the Pueblo of Zuni, the Yavapai-Apache Nation, and the Hia C-ed O'odham Alliance have completed studies as of this writing. Some of these studies have provided more specific information about places and issues of cultural importance. The concerns expressed by cultural advisors representing those tribes are similar in many respects and focus on several key topics.

### 7.3.1 Natural and Cultural Resource Protection and Management

Not surprisingly, the first recommendation of all tribes consulted is that all archeological sites should be left in place, and all TCPs and sacred sites should be avoided by modern activities. Tribal representatives do recognize the need for ongoing military training, and in consultation, most have recommended that military training activities should continue to impact the same areas that have been used since the 1940s rather than expanding disturbance to new areas.

They strongly recommend that, in cases where previously undisturbed areas must be impacted in order to accomplish the needs of the mission, both archaeological and TCP surveys should be conducted. Tribal representatives also have acknowledged that, when avoidance is not possible,

they understand the value of making a record of a site through scientific study, rather than seeing that site destroyed without a record being made. In general, however, tribal consulting parties have indicated that scientific investigations of resources not immediately threatened by other destructive forces should be avoided.

Some tribal representatives stressed that rock art, geoglyphs, and rock shelter sites should be monitored and protected from vandalism; they also recommended that the Air Force and Marine Corps take steps to prevent sites from being damaged or destroyed by erosion.

Most of the tribal studies stressed that Native Americans do not differentiate between natural and cultural resources, but rather take a more holistic approach to resource management. Several tribes indicated that water sources should be monitored and protected; some specifically stated that no new water control structures should be built at these locations, and that existing wildlife water catchments (such as enhanced tinajas) should be dismantled. Other recommendations include conducting ethnobotanical studies, supporting tribal gathering of traditional plants, and prohibiting predator control activities on the BMGR.

Some recommended that public education through interpretation with tribes be incorporated into the cultural resources management program as one way to protect sensitive archaeological sites.

### 7.3.2 Cultural Affiliation

Based on archaeological evidence of trade and travel through the BMGR area through time, as well as ethnographic evidence, numerous tribes have claimed cultural affiliation with places on BMGR. Because of the overlapping (in both time and space) claims of cultural affiliation throughout Arizona and the Southwest, several tribal representatives identified ongoing cultural affiliation research (see discussion of historic contexts in Part I, Section 4) as an important area of study.

### 7.3.3 Treatment of Human Remains

All of the tribal representatives consulted in this process have recommended complete avoidance of human remains and burial sites. Several tribes have stated that if remains are inadvertently disturbed, or if complete avoidance of impacts is impossible due to project constraints, the burial should be excavated and reburied out of harm's way, as close as possible to the original burial site. Those tribes have also recommended that the Air Force and Marine Corps negotiate and execute an agreement (or agreements) under NAGPRA to specify how that act will be implemented on the BMGR. Some have suggested a cemetery be created where all remains can be reinterred on the BMGR.

### 7.3.4 Identification of Traditional Cultural Places and Confidentiality of Sensitive Information

All tribes stress that the methods for carrying out TCP assessments and evaluations are different from those for archaeological surveys and must rely on the knowledge of the traditional practitioners. On that basis, they recommend that tribal experts be used to identify such places.

This perspective is consistent with a recent memorandum from John Fowler, ACHP Executive Director, entitled *Fees in the Section 106 Process* (16 July 2001). Mr. Fowler advised that agencies may need to request specific information and documentation regarding the location, nature, and condition of individual sites, or may request that a survey be conducted by a tribe as a part of the identification phase of Section 106 review.

Tribal cultural experts also expressed concern about Air Force and Marine Corps management and protection of site locations, and access to archaeological data and any sensitive information provided by tribes during consultation.

### 7.3.5 Developing a Programmatic Agreement

Several tribes specifically recommended that the Air Force and Marine Corps develop an agreement (or agreements) to which tribes that claim affiliation with places on BMGR would be signatories, which describes how those tribes will be involved in the protection and management of cultural resources on BMGR. Some have suggested that tribal monitoring of sensitive resources and streamlining the Section 106 review process be addressed in that document.

### 7.3.6 Future Research

There is no question that Native American tribes can provide valuable insight and information, and collaborative efforts between tribal groups and the scientific community can lead to new knowledge about the past. Several of the tribes consulted have asked to be involved in future research efforts. The Yavapai-Prescott Indian Tribe would like to continue to work with the BMGR cultural resource staff to identify trade routes that cross the BMGR, identify and research the rock art left behind by ancient travelers, and prepare a National Register Nomination for the Gila Mountains, where the creator's cremated remains were placed and then stolen by Coyote.

The Hopi Tribe recommends additional ethnographic and other research into cultural affiliation for NAGPRA purposes and has identified other important research issues. One is tying the oral tradition of clan migrations to the archaeological record and using this information to resolve some of the debate about the origins and demise of the Hohokam culture. Farming is a fundamental aspect of Hopi culture, and the Hopi Tribe is interested in ancestral farming practices. The technology and diversity of farming by ancient peoples also is a topic of intense interest to archaeologists. The Hopi report emphasized the importance of shell in Hopi ceremonial contexts and identified shell trade, manufacture, and distribution, and particularly shell trade routes, as areas of special interest (Anyon 1999: 65).

Both tribal representatives and archaeologists have expressed an interest in studying the trail systems that cross the BMGR. Trade played an important role in both intercultural and commodity exchange between the north and south. The BMGR is strategically located for the trade routes required to transport such goods as shell, salt, and turquoise.

There is particular interest in current research centered on defining the Patayan archaeological culture. The Yavapai-Prescott Indian Tribe identified this issue as potentially influencing investigations currently being undertaken throughout the Southwest. The AhaMakav Cultural

Society, Ft. Mojave Tribe, has expressed interest in reconciling the archaeological construct called Patayan with ethnographic and historic evidence and has commented favorably on research and interpretations presented in draft reports of surveys being conducted on BMGR.

## 7.4 ACCESS TO SACRED SITES

The MLWA directs the Air Force and Marine Corps to provide access by Native Americans to TCPs and sacred sites, and several of the tribal studies indicated that tribes should be allowed access to places on and collections from the BMGR. Unrestricted access (after initial contact and arrangements have been made) may be possible in some portions of the BMGR. Access to any TCPs and sacred sites identified in military operating areas (for example, the tactical ranges on BMGR East), however, will be constrained by both ongoing training activities and the hazards present in these areas. Consultation should identify times and conditions when access would be permissible. Specific information about access to BMGR East and BMGR West will be presented in Parts II and III, respectively.

**Section 8**

# CONCLUSION

The cultural resource programs at BMGR East and West support the military mission; sustain the range withdrawal; ensure compliance with cultural resource protection statutes; identify places and issues of cultural importance to Native Americans; sponsor professional cultural resource studies; consult with Native Americans, the SHPO, the ACHP and other preservation partners about the management and protection of cultural resources on the BMGR; and provide opportunities for public involvement and education. This mission can be achieved most effectively by fostering a shared understanding of our legal obligations under federal laws and regulations, inventorying and identifying significant cultural resources by applying scientific methods, coordinating these activities with appropriate governmental and other organizations, and participating in regional and statewide outreach programs.

This ICRMP will guide Air Force and Marine Corps cultural resource programs in achieving their missions. Part I provides a solid foundation for the remainder of this document, which includes specific plans tailored to the needs of the two services and the cultural resources on their respective training lands.

Three overarching cultural resource program goals have been identified.

- Support military operations through proactive management of cultural resources
- Fulfill legal obligations for protection of historic properties
- Address Native American concerns, including disposition of cultural items

In this section, which concludes Part I, important issues in cultural resource management are identified, potential impacts to resources on BMGR are reviewed, and the relationship of cultural resource and other environmental and resource management actions is described.

## 8.1 CHALLENGES

The BMGR encompasses almost two million acres of largely undisturbed desert, including a well-preserved record of human habitation and use. More significant for interpreting this record than any of its individual parts is that this landscape still includes evidence of the broad range of activities that took place there through time. Use of these lands for military training, and thus exclusion of other uses that produce significant and extensive ground disturbance, has inadvertently preserved intact a more complete "set" of sites than is generally available. Because of the size of the area and the number and significance of the resources that may be impacted by Air Force and Marine Corps actions (or inaction), management and long-term care of those resources is both a rare opportunity and a tremendous challenge. In some situations, the size of the BMGR also works to the advantage of the Air Force and Marine Corps; when sensitive cultural resources are located early in the planning process, it is often quite feasible to avoid impacts by relocating or redesigning an action.

Working relationships between the Air Force and Marine Corps and tribes that claim affinity with places on BMGR have consistently improved since consultation began; nonetheless, a number of challenges will be faced in the years to come. Among them are developing procedures for taking into account the traditional cultural importance tribes attach to different kinds of resources on BMGR and developing agreements regarding the treatment of human remains and other items covered by NAGPRA.

Public Law 106-65 section 3013(b)(3)(E)(ii)(II) directs the Air Force and Marine Corps to "allow access to and ceremonial use of sacred sites to the extent consistent with the military purposes for which such lands are withdrawn and reserved." Relatively unrestricted access is possible in some portions of the BMGR; however, access to sacred sites identified in the three tactical ranges, the four manned ranges, and the air-to-air range on the east side of the BMGR, and several live-fire and other training areas on BMGR West, will be constrained by the fact that these areas are heavily used by the military during most of each year. The Air Force and Marine Corps will provide access to these areas on request, when it is safe to do so, in accordance with procedures outlined in Parts II and III respectively.

Large areas within BMGR are off-limits to archaeological research for most of the year. The three tactical ranges on BMGR East comprise over 300,000 acres, and each is available for investigation for only six to eight weeks annually, yet these areas, where military training may be most likely to adversely impact cultural resources, are among the Air Force's highest priority for inventory, evaluation, and impact assessment. These constraints affect the pace of cultural resource field studies, Section 106 reviews, and planning efforts.

In other areas, impacts of illegal border-related activity, law enforcement efforts, and border infrastructure development have had and likely will continue to have a substantial impact on all kinds of cultural resources. Given the surficial nature of most of these resources, they are extremely vulnerable to off-road vehicle traffic, whether legal or illegal. The attraction of natural water sources for travelers on foot tends to concentrate impacts in those areas, where cultural resources are often concentrated. Although the Air Force and Marine Corps cannot control these impacts, they can and should coordinate with Border Patrol and other law enforcement entities to minimize impacts of border-related activities on cultural resources to the extent possible.

## 8.2 POTENTIAL IMPACTS TO CULTURAL RESOURCES ON THE BMGR

In addition to military activity and border-related activities, Air Force and Marine Corps activities driven by the INRMP and other environmental mandates also may affect cultural resources. Environmental compliance requirements such as removal of contaminated soils may have an adverse effect on cultural resources. Seemingly low impact natural resource management actions also may affect sensitive resources. One example is the modification or enhancement of natural water sources to improve the reliability of these water sources for endangered species or game animals. These water sources were equally important to prehistoric human inhabitants, are often surrounded by archaeological evidence, and are culturally important to many modern tribes.

Of primary importance to the natural resource management program are Air Force and Marine Corps efforts to protect and recover threatened and endangered species, including the endangered Sonoran pronghorn and its habitat, which includes most of the BMGR west of SR 85 and east of the Copper Mountains, and the flat-tailed horned lizard, which is found west of the Gila and Butler mountains on BMGR West.

The primary objective of the USFWS Sonoran Pronghorn Recovery Plan of 1998, as amended (U.S. Fish and Wildlife Service 2002) is down-listing of the endangered Sonoran pronghorn. The plan includes a list of 51 proposed management actions, some of which have potential to disturb cultural resources; examples include habitat enhancements, placement and maintenance of artificial water sources, and selective thinning of vegetation. Some of the proposed activities meet the threshold established in regulation for Section 106 review; resource inventories, consultation, and other efforts will be as needed in advance of such undertakings.

The presence, or potential presence, of pronghorn on BMGR also affects the ability of the Air Force and Marine Corps to conduct cultural resource investigations, including survey and excavation. For example, cultural resource contractors working on BMGR East are affected by pronghorn monitoring and avoidance procedures as are training, maintenance, and EOD activities. While necessary, these constraints may limit the amount and timing of work that can be accomplished, and project schedules and budgets must be designed to reflect this level of uncertainty.

Other natural resource management activities on BMGR include studies of small owls, diurnal raptors, neotropical migratory birds, bats, small nocturnal mammals, desert tortoise, amphibians, and Pierson's milk vetch. Most of these efforts involve small teams of researchers who typically access study areas by vehicle on existing roads and by foot in the more remote areas. Most research can be designed and conducted in ways that are unlikely to impact cultural resources to any appreciable extent; however, many will require Section 106 review. Because some plants and animals may be of sacred or ceremonial value to traditional cultures, and because areas where particular plants were traditionally gathered may be eligible for inclusion on the National Register, tribal consultation will be required in many instances before such work begins.

A long-standing concern among archaeologists and tribal cultural experts is the modification of natural water sources to create more reliable wildlife waters. Water has always been a critical resource for desert dwellers and travelers, and archaeological evidence is often concentrated around tinajas and other water sources. These resources may be damaged or destroyed by activities associated with the modification of these natural sources to create more reliable wildlife waters, and may be further affected by ongoing maintenance of those waters. Tribal cultural leaders also are concerned about these modifications, which damage these traditionally significant or sacred places.

Finally, public recreation may constitute the greatest threat to cultural resources in some areas, and this permitted activity should be carefully managed and its impacts on cultural resources monitored. In particular, permitted vehicle-based camping within 50 feet of almost all roads in areas open to the public may damage or destroy fragile resources. Permit enforcement, surveys to identify and evaluate resources and establish baseline conditions in areas open to public use,

and regular monitoring of those resources will be key components on Air Force and Marine Corps management of cultural resources on BMGR. Increased recreational use supervision will reduce the likelihood of vandalism and intentional removal of protected resources. Under the terms of the programmatic agreement for INRMP implementation (see Section 2), the Air Force and Marine Corps will prioritize survey of areas likely to be affected by public access. These efforts will be discussed in detail in Parts II and III.

## 8.3 POTENTIAL IMPACTS ON THE AIR FORCE AND MARINE CORPS MISSIONS ON THE BMGR

Important objectives of cultural resource management on BMGR are to prevent conflicts between the military mission and resource protection and to sustain that mission by ensuring that the Air Force and Marine Corps comply with resource preservation statutes, regulations, and guidance in a way that minimizes the likelihood of successful legal challenge to their management decisions. Nonetheless, such conflicts between the military mission and resource management needs may arise occasionally.

The cultural resource programs of BMGR East and BMGR West place a high priority on completing required inventories and consultations in a timely manner, so that project schedules are not impeded. Successful integration of resource management and mission also requires that mission planners and project proponents understand and accept the requirements of the review process and involve cultural resource staff in planning at the very earliest stages. Potential project or mission impacts or delays are most likely to result from: 1) failure to involve cultural resource staff early in the process; 2) lack of available funding to complete the identification and evaluation effort in a timely manner; or 3) identification of significant resources in the area of potential effect.

Clearly, the best methods for reducing mission conflicts and delays are to: 1) involve cultural resource staff early in project planning, initiate the consultation process as soon as viable alternatives have been identified, and complete the process in accordance with applicable regulation; 2) conduct planning-level inventories to identify "red-flag" resources that should be avoided if at all possible; and 3) develop a team relationship between resource managers and mission planners, project proponents, and operators. Agency-specific procedures for avoiding or minimizing both conflicts and possible delays will be presented in Parts II and III.

## 8.4 COMMITMENT

Proactive resource stewardship is required by law; it is also the best tool for insuring that cultural resource issues do not threaten sustained use of BMGR for essential military training through the life of the present range renewal and beyond. Cultural resource protection and stewardship efforts on the BMGR will be addressed in Parts II and III, including the following issues:

- Preservation in place
- Archaeological site monitoring
- ARPA permitting and law enforcement
- Controlling access to site location and other data

- Collections management and curation
- Education and outreach programs

Successful implementation of this plan requires funding and other support at all levels within the Air Force and Marine Corps. The goals and priorities established in this ICRMP, as approved, represent the agencies' commitment to sound resource management and stewardship for the 25-year life of the BMGR land withdrawal. This plan will be evaluated annually and updated at least every five years. Execution of the program activities identified in this plan will continually improve our understanding of the extent and nature of cultural resources on BMGR, and management and stewardship strategies will be constantly reassessed and revised as needed.

# Glossary

**Advisory Council on Historic Preservation (ACHP):** The independent federal agency charged by the National Historic Preservation Act (NHPA; Section 201), as amended, to advise the president, Congress, and federal agencies on matters related to historic preservation. The ACHP also administers Section 106 of the NHPA through its regulation at 36 CFR Part 800, *Protection of Historic Properties*.

**Aeolian:** Accumulated through wind action; commonly refers to sandy material in dunes.

**Aggradation:** The building of a floodplain by sediment deposition; the filling of a depression or drainageway with sediment; the building of a fan by deposition of an alluvial mantle.

**Air Force Instruction (AFI) 32-7065 *Cultural Resource Management Program*:** This AFI establishes guidelines for managing and protecting cultural resources on property affected by Air Force operations in the United States, its territories and possessions, to support the military mission and to meet legal compliance requirements.

**Alluvial:** Pertaining to processes or materials associated with transportation or deposition by running water.

**Alluvial fan:** A semiconical or fan-shaped constructional, major landform that is built of more or less stratified alluvium, with or without debris flow deposits, that occurs on the upper margin of a piedmont slope and that has its apex at a point source of alluvium debouching from a mountain valley into an intermontane basin. Also, a generic term for like forms in various other landscapes.

**Alluvium (as in alluvial deposits and alluvial fans):** Deposits of organic and inorganic material made by streams on riverbeds, floodplains, and alluvial fans, particularly deposits of clay or silty clay laid down during a time of flood.

**Archaeological resources/Archeological resources:** Any material remains of past human life or activities that are capable of providing scientific or humanistic understandings of past human behavior and cultural adaptation through the application of scientific or scholarly techniques such as controlled observation, contextual measurement, controlled collection, analysis, interpretation, and explanation (see the Archeological Resources Protection Act and 32 CFR §229.3).

**Archeological Resources Protection Act (ARPA) of 1979:** This act (16 U.S. Code [U.S.C.] 470aa-mm) strengthened protection of archaeological resources on federal and tribal lands by increasing the penalties first included in the Antiquities Act of 1906 for unauthorized excavation, collection, or damage of those resources from misdemeanors to felonies, including fines and imprisonment for first offenses. Trafficking in archaeological resources from public and tribal lands is also prohibited by ARPA. ARPA requires notification of affected Native American tribes if archaeological investigations would result in harm to or destruction of any location considered by tribes to have religious or cultural importance.

**Area of potential effect (APE):** The area within which any existing historic properties may be affected by a federal undertaking. The APE includes the footprint of the proposed project and areas around the footprint that might be affected by visual, auditory, erosional, and other direct and indirect results of the undertaking. The APE may consist of a single area or two or more geographically discontiguous areas.

***Bajada*:** When several alluvial fans laterally coalesce, the resulting feature is called a *bajada* (Spanish for "that which is below"). *Bajadas* may be hundreds to thousands of feet thick and may hold deposits of water deep beneath the surface.

**Basin:** A loose abbreviation for intermontane basin, bolson, or semibolson. Also, a depressed area with no surface outlet or only limited surface outlet.

**Basin floor:** A generic term for the nearly level, lower most major part of intermontane basins, the floor includes all of the alluvial, aeolian, and erosional landforms below the piedmont slope. Component landforms include playas, broad alluvial flats with ephemeral drainageways, and relict alluvial and lacustrine surfaces that rarely, if ever, are subject to flooding.

**Bedrock:** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

**Boulder:** A rock fragment larger than 2 feet (60 cm) in diameter.

**Building:** One of the five National Register of Historic Places property types. A structure created to shelter any form of human activity—includes houses, barns, churches, and other buildings created to shelter any form of human activity, including administration buildings, dormitories, garages, and hangars.

**Channel:** The bed of a single or braided watercourse that commonly is devoid of vegetation and is formed of modern alluvium. Channels may be enclosed by banks or splayed across and slightly mounded above a fan surface and may include bars and dumps of cobbles and stones. Channels, excepting floodplain playas, are landform elements.
***Charco*:** Shallow, natural, water catchment in clay, adobe flats or braided-wash channels. Also referred to as a "mudhole" in other parts of the U.S. Southwest.

***Cienega*:** Spanish term for marshy area.

**Clay:** As a soil separate, the mineral soil particles are less than 0.002 mm in diameter. As a soil textural class, soil material that is 40 percent or more clay, is less than 45 percent sand, and is less than 40 percent silt.

**Coarse-textured soil:** Sand or loamy sand.

**Cobble:** A rounded or partly rounded fragment of rock 3–10 inches (7.6–25 cm) in diameter.

**"Cold War" historic resources:** Buildings, structures, sites, objects, and districts built, used, or associated with critical events or persons during the "Cold War" period (1945–1989) that possess exceptional historic importance to the nation or that are outstanding examples of technological or scientific achievement (see DOD Instruction 4715.3).

**Colluvium:** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Concretion:** Cemented body with crude internal symmetry organized around a point, a line, or a plane that typically takes the form of concentric layers visible to the naked eye.

**Conglomerate:** A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 mm in diameter. It commonly has a matrix of sand and finer-textured material. Conglomerate is the consolidated equivalent of gravel.

**Conservation:** Planned management, use, and protection of natural and cultural resources to provide sustainable use and continued benefit for present and future generations and to prevent the exploitation, destruction, waste, and/or neglect (DOD Instruction 4715.3).

**Consultation:** A reasonable and good faith effort to involve affected parties in the findings, determinations, and decisions made during the Section 106 process and other processes required under other statutes and regulations. Consultations with Indian tribes must be on a government-to-government level to respect tribal sovereignty and to recognize the unique legal relationship between the federal government and Indian tribes set forth in the Constitution, treaties, statutes, and court decisions.

**Creosotebush community:** Found on fine-grained soils of lower alluvial fan and valleys; creosotebush, bursage.

**Cultural landscape:** A geographical area that historically has been used by people, or shaped or modified by human activity, occupancy, or intervention, and that possesses a significant concentration, linkage, or continuity of areas of land use, vegetation, buildings and structures, and/or natural features.

**Cultural resource:** Cultural resources represent the nation's collective heritage, and broad public sentiment for protecting these heritage resources has been codified over the years in numerous federal, state, and local laws (King 1998; King et al. 1977). This term includes: (1) buildings, structures, sites, districts, and objects that may be eligible for or that are included in the National Register of Historic Places (historic properties); cultural items as defined in 25 U.S.C. 3001; American Indian, Eskimo, Aleut, or Native Hawaiian sacred sites for which access is protected under 42 USC 1996; archeological resources as defined by 16 USC 470bb; archeological artifact collections and associated records defined under 36 CFR 79 (see DOD Instruction 4715.3); and any definite location of past human activity, occupation, or use, identifiable through field inventory (survey), historical documentation, or oral evidence.

**Culture:** The traditions, beliefs, practices, lifeways, arts, crafts, and social institutions of any community, be it an Indian tribe, a local ethnic group, or the people of the nation as a whole. Man's use of and adaptation to the environment as seen through his behavior, activities, and the methods employed to transmit customs, knowledge, and ideas to succeeding generations.

**Curation:** The process of managing and preserving an archaeological collection of artifacts and records according to professional museum and archival practices, as defined in 36 CFR 79. For details, see Legacy Resource Management Program Office, Legacy Project No. 98-1714,

Guidelines for the Field Collection of Archaeological Materials and Standard Operating Procedures for Curating Department of Defense Archaeological Collections, available through the DENIX and AFCEE Web sites.

**Deflation:** The removal of material from the land surface by wind erosion.

**Desert pavement:** Large, flat, conspicuous areas devoid of vegetation and covered by a layer of tightly packed small stones, which are frequently very dark-colored due to the development of desert varnish. Desert pavement is formed through a process of physical weathering and the accumulation of a porous mineral layer in the soil that separates and levels the desert-pavement surface from the underlying, uneven rocky material.

**Desert varnish (also rock varnish):** A glossy coating found on rock, stone, or boulder surfaces that provides the dark complexion of the rock surface despite the internal color of the rock. Desert varnish is very thin, at most a few hundredths of a millimeter thick (about the thickness of a sheet of paper). The thickest, darkest coatings of varnish found on older deposits may be the result of accumulation over many tens of thousands of years to more than 100,000 years.

**Department of Defense (DoD) Instruction 4715.3, *Environmental Conservation Program* (3 May 1996):** This instruction covers a wide range of topics pertinent to the integrated management of natural and cultural resources on properties under DOD control and describes means and assigns responsibilities for implementing policies, and prescribes appropriate procedures. It also directs DOD installations to take a proactive approach to consultation with Native American tribes, both in the Section 106 process and with respect to tribal cultural concerns in general. Among other things, it also directs installations to select a staff member to serve as a liaison to tribes and to educate appropriate staff about tribes with cultural ties to lands managed by DOD.

**Determination of eligibility**: A formal determination of eligibility is a decision by the Department of the Interior that a district, site, building, structure or object meets the National Register criteria for evaluation although the property is not formally listed in the National Register.

**Dissection:** The partial erosional destruction of a land surface or landform by gully, arroyo, canyon, or valley cutting that leaves flattish remnants, ridges, hills, or mountains separated by drainageways.

**District:** One of the five National Register of Historic Places property types. Districts are concentrations of significant sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

**Dune:** A mound, ridge, or hill of loose windblown granular material (generally sand), either bare or covered with vegetation.

**Effect:** Any change in the characteristics that contribute to the uses determined appropriate for a cultural resource, or to the qualities that qualify a cultural property for the National Register of Historic Places (NRHP). Determination of effect is guided by criteria in 36 CFR Part 800.9.

**Erosion:** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

**Ethnography:** The branch of anthropology that describes and analyzes extant cultural systems.

**Ethnohistory:** Ethnographic information that can be obtained from historical documents; for example, diaries of early explorers and early newspaper accounts.

**Ethnology:** The branch of anthropology that deals with the comparative cultures of various people, including their distributions, characteristics, folkways, religions, and organizations.

**Evaluation:** Assessing the historic significance and historic integrity of a site, building, structure, district, or object by applying the criteria of eligibility for inclusion in the NRHP.

**Fan:** A generic term for constructional landforms that are built of more or less stratified alluvium and occur on the piedmont slope, downslope from their source of alluvium.

**Fine-textured soil:** Sandy clay, silty clay, or clay.

**Floodplain:** A nearly level alluvial plain that borders a stream and is subject to flooding unless artificially protected.

**Floor:** A generic term for the nearly level, lower part of an intermontane basin (a bolson or semibolson) or a major desert stream valley.

**Foothill:** A steeply sloping upland that has relief of as much as 1,000 feet (300 m) and fringes a mountain range or high-plateau escarpment.

**Geomorphic surface:** An episode in landscape development; a mappable part of the land surface that is defined in terms of morphology (relief, slope, aspect), origin (erosional, constructional), age (absolute, relative), and stability of component landforms.

**Geomorphology:** The science that treats the general configuration of the earth's surface; specifically, the study of the classification, description, nature, origin, and development of the landforms and their relationships to underlying structure and the history of geologic changes as recorded by these surface features.

**Gravel:** Rounded or angular fragments of rock as much as 3 inches (2 mm to 7.6 cm) in diameter. An individual piece is a pebble.

**Groundwater**: Water filling all the unblocked pores of the material below the water table.

**Historic archaeology:** Investigation of historical-period sites through archaeological techniques; study of the material culture of people living during recorded history in order to understand cultural history and human behavior.

**Historic context:** An organizing structure for interpreting history that groups information about historic properties that share a common theme, geographical location, and time period. The development of historic contexts is a foundation for decisions about the planning, identification,

evaluation, registration, and treatment of historic properties based upon comparative significance.

**Historic integrity:** The ability of a property to convey its historic significance. To be eligible for the National Register of Historic Places, a property must be historically significant. It also must possess historical integrity, which is a measure of authenticity and not necessarily condition. Elements of integrity to be considered include location, design, setting, materials, workmanship, feeling, and association. Not all seven aspects of integrity need to be retained, but a property must have sufficient physical remnants from its period of historical importance to illustrate significant aspects of its past. The integrity of archaeological sites typically is evaluated by the degree to which they can provide important contextual information. The integrity of traditional cultural places is interpreted with reference to the views of closely affiliated traditional groups, if traditional people will write or talk about such places so information can be filed with a public agency. If a place retains integrity in the perspective of affiliated traditional groups, it probably has sufficient integrity to justify further evaluation. National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, provides guidance for identifying and assessing traditional cultural places.

**Historic preservation:** 16 U.S.C. 470w, Section 301(8), states that historic preservation "includes identification, evaluation, recordation, documentation, curation, acquisition, protection, management, rehabilitation, restoration, stabilization, maintenance, research, interpretation, conservation, and education and training" regarding cultural resources.

**Historic property:** Any district, site, building, structure, or object listed in or eligible for inclusion in the National Register of Historic Places (NRHP) because of its historic significance. The regulation at 36 CFR 60.4 explains criteria for determining eligibility for listing in the NRHP.

**Historic significance:** The importance of a property to the history, architecture, archaeology, engineering, or culture of a community, a state, or the nation. It is achieved by meeting one or more of the following criteria: association with events, activities, or patterns (Criterion a); association with important persons (Criterion b); distinctive physical characteristics of design, construction, or form (Criterion c); potential to yield important information (Criterion d).

**Historic theme:** A trend or pattern in history or prehistory relating to a particular aspect of cultural development.

**Holocene:** The second epoch of the Quaternary period of geologic time, extending from the end of the Pleistocene (about 10,000–12,000 years ago) to the present.

**Identification:** The first step in the National Historic Preservation Act Section 106 process includes preliminary work (such as archival research or literature review), actual efforts to identify properties, and the evaluation of identified properties to determine if they qualify as historic properties. The standard is a "reasonable and good faith effort" for identification and evaluation.

**Igneous rock:** Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

**Indian tribe:** Under AFI 32-7065, the term Indian tribe includes federally recognized American Indian tribes, Alaska Native villages, and Native Hawaiian organizations. A federally recognized tribe is one the U.S. government formally recognizes as a sovereign entity that requires government-to-government relations. The federal government holds lands in trust for many, but not all, Indian tribes. Some tribes are not federally recognized and are not afforded special rights under federal law, with the following exception. According to National Register of Historic Places guidelines, traditional cultural places include places of cultural significance to both federally recognized tribes and other groups.

**Inert:** Nonreactive, nonexplosive (in regard to inert ordnance).

**Intaglio:** A figure or design incised beneath the surface of the earth or composed of rock alignments.

**Integrated Cultural Resources Management Plan (ICRMP):** A document that defines the procedures and outlines plans for managing cultural resources on DOD installations (see DODI 4715.3; AFI 32-7065).

**Integrated Natural Resources Management Plan (INRMP):** An integrated plan based, to the maximum extent practicable, on ecosystem management that shows the interrelationships of individual components of natural resources management to mission requirements and other land use activities affecting an installation's natural resources (see DODI 4715.3).

**Intensive archaeological survey:** A pedestrian survey that is designed to locate and record all archaeological resources within a specified area from surface and exposed profile indications. Crew member spacing is 15 m or less for surveys conducted in southwestern Arizona.

**Intermontane basin:** A generic term for wide structural depressions between mountain ranges that are partly filled with alluvium and are called "valleys" in the vernacular. Also a relatively small structural depression within a mountain range that is partly filled with alluvium and commonly drains externally through a narrower mountain valley.

**Inventory:** A process of descriptive listing and documentation of cultural resources within a defined geographic area based on a review of existing data, fieldwork, and other means.

***Lago:*** Spanish word for lake.

**Landform:** A three dimensional part of the land surface, formed of soil, sediment, or rock that is distinctive because of its shape, its significance for land use or to landscape genesis, its repetition in various landscapes, and its fairly consistent position relative to surrounding landforms.

**Medium-textured soil:** Very fine sandy loam, loam, silt loam, or silt.

**Mesa:** A broad, nearly flat topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

**Microphytic soil crust:** Also cryptogamic or cryptobiotic soil crust. The fragile, crusty, top layer of many desert soils characterized by the growth of lichens, algae, blue-green algae (cyanobacteria), liverworts, or mosses, in combination or singularly.

**Mountain:** A highland mass that rises more than 1,000 feet (300 m) above its surrounding lowlands and has merely a crest or restricted summit area (relative to a plateau).

**National Register criteria:** The criteria applied to evaluate the historic significance of properties to determine their eligibility for inclusion on the National Register of Historic Places. 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 meet one of four criteria (listed individually below).

**National Register criterion *a*:** associated with events that have made a significant contribution to the broad patterns of our history.

**National Register criterion *b*:** associated with the lives of persons significant in our past.

**National Register criterion *c*:** embodying the distinctive characteristics of a type, period, or method of construction, representing the work of a master, possessing high artistic values, or representing a significant and distinguishable entity whose components may lack individual distinction.

**National Register criterion *d*:** having yielded, or may be likely to yield, information important in prehistory or history (information potential).

**National Register of Historic Places (NRHP):** The official federal list of sites, districts, buildings, structures, and objects worthy of preservation consideration because of significance in American history, architecture, archeology, engineering, or culture. The NRHP is administered by the Department of the Interior, National Park Service. Criteria for eligibility, and the procedures for nomination, making changes to listed properties, and for removing properties from the NRHP are detailed in 36 CFR 60, *National Register of Historic Places*. Significance may be local, state, or national in scope. NRHP eligibility criteria are published in 36 CFR 60.

**Native Americans:** American Indians, Eskimos, Aleuts, and Native Hawaiians (DODI 4715.3).

**Object:** One of the five National Register of Historic Places property types. Objects typically are small in scale and often artistic in nature, and include sculpture, monuments, boundary markers, and fountains.

**Outcrop:** That part of a geologic formation or structure that appears at the surface of the earth.

**Paleosol:** A soil that formed on a landscape of the past with distinctive morphological features that result from a soil-forming environment that no longer exists at the site. The former pedogenic process was either altered because of external environmental change or interrupted by burial.

**Palo verde–mixed cacti community:** Found on piedmont slope (*bajada*) upper alluvial fans, pediments, mountainous areas; palo verde, saguaro, triangle leaf bursage, creosote, various cacti, ocotillo (Turner and Brown 1982).

**Papaguería:** A unique geographic area in southwestern Arizona and northwestern Sonora, Mexico; subdivided into the eastern and western Papaguería based on cultural and environmental factors. This term is used extensively in archaeological literature to identify a geographic region, an environment, and a cultural area.

**Pediment:** Broad, gently sloping erosional surface developed at the foot of a receding hill or mountain slope. The pediment extends from the abrupt contact of the mountains with the valley floor. The pediment formation is a smooth, eroded bedrock surface formed over time and often covered with a thin, discontinuous, alluvial veneer. It may be thinly mantled with alluvium and colluvium, ultimately in transit from upland front to basin or valley lowland.

**Physiographic province:** Very large, general landscape units that display dominant geologic formations and patterns such as basins, plateaus, and mountain ranges.

**Piedmont:** A general slope rising to mountains.

**Plain:** A flat, undulating, or even rolling area, larger or smaller, which includes few prominent hills or valleys, is usually at low elevation in reference to surrounding areas, and may have considerable overall slope and local relief.

**Playa:** The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

**Pleistocene:** The first epoch of the Quaternary period of geologic time, following the Pliocene epoch and preceding the Holocene (about 2 million–10,000 years ago). The last epoch of the Tertiary period of geologic time, following the Miocene epoch and preceding the Pleistocene epoch (about 7 million–2 million years ago).

**Pluvial lake:** A lake formed in a period of exceptionally heavy rainfall; a lake formed in the Pleistocene epoch during a time of glacial advance and now either extinct or existing as a remnant. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapo-transpiration.

***Pozo:*** A dug or drilled well; a freshwater, spring-like upwelling occurring in estuaries or salt flats.

**Prehistory:** That period of time before written history. In North America, prehistoric usually refers to the period before European contact.

**Protohistory:** The study of historical-period groups who themselves did not maintain written records. The protohistoric period is usually defined as between A.D. 1450 and A.D. 1700.

**Quaternary:** The second period of the Cenozoic era of geologic time, extending from the end of the Tertiary period (about 2 million years ago) to the present and consists of two epochs, the Pleistocene (Ice Age) and the Holocene (recent).

**Remnant:** A remaining part of some larger landform or of a land surface that has been dissected or partially buried.

***Represo:*** A small, shallow, dug pond, usually on a floodplain. It is 3–5 feet deep and generally has water only during rainy seasons.

***Represos:*** Reservoirs or dams constructed on the alluvial fan or in the valley (Tohono O'odham).

**Restricted airspace:** Airspace with defined vertical and lateral dimensions that has been established by the Federal Aviation Administration (via the rule-making process) to denote areas where military activities can occur.

**Ridge:** A long, narrow elevation of the land surface, typically sharp crested with steep sides and forming an extended upland between valleys.

**Riparian habitat or area:** A zone of transition from the aquatic to terrestrial ecosystems, whose presence is dependent upon surface and/or subsurface water, which reveals the influence of that water through its existing or potential soil/vegetation complex. Riparian habitat may be associated with features such as lakes, reservoirs, estuaries, potholes, springs, bogs, wet meadows, muskegs, and ephemeral, intermittent, or perennial streams. Riparian areas are often characterized by dense vegetation and an abundance and diversity of wildlife.

**Riverine:** Located along or in the banks of a river.

**Road:** A motor vehicle travelway within the BMGR.

**Runoff:** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff.

**Sand:** As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 mm in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sand dune:** An aeolian dune and landform element built of sand-sized mineral particles. Dunes commonly occur on the leeward side of a Pleistocene lake bed.

**Sandstone:** Sedimentary rock predominantly containing sand-sized particles.

**Sheet erosion:** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Silt:** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very fine sand (0.05 mm). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Site:** One of the five National Register of Historic Places property types. The physical location of a significant activity or event; often refers to archaeological sites or traditional cultural places, although the term also may be used to describe military properties such as testing ranges, treaty signing locations, and aircraft wrecks. All sites are the location of past human activities or events.

**State Historic Preservation Officer (SHPO):** The official appointed by the governor of each state and territory to carry out the functions defined in the NHPA and to administer the state's historic preservation program. SHPOs provide advice and assistance to federal agencies regarding their historic preservation responsibilities.

**Stewardship:** The management of resources entrusted to one's care in a way that preserves and enhances the resources and their benefits for present and future generations (DODI 4715.3).

**Stratified:** Arranged in strata or layers.

**Stream terrace:** One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream and representing the dissected remnants of an abandoned floodplain, streambed, or valley floor produced by a former stage of erosion or deposition.

**Structure:** One of the five National Register of Historic Places property types. A work constructed for purposes other than human shelter, including bridges, tunnels, dams, roadways, and military facilities such as missiles and their silos, launch pads, weaponry, runways, and water towers.

**Surface drainage:** Runoff or surface flow of water from an area.

**Talus:** Fragments of rock and other soil material accumulated by the forces of gravity at the foot of slope.

**Terrace:** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour; an old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Tertiary:** The first period of the Cenozoic era of geologic time, following the Mesozoic era and preceding the Quaternary (from approximately 65 million to 2 million years ago). Epoch or series subdivisions include, in order of increasing age, Pliocene, Miocene, Oligocene, Eocene, and Paleocene.

***Tinaja:*** A cavity or natural depression eroded into bedrock by stream or wind action and fill with direct rainfall or runoff. Small, rock pocket *tinajas* (formed by aeolian erosion) are found in rock outcrops away from streambeds. Stream channel *tinajas* (formed by alluvial action) are bedrock pools that range in size from small pot holes to large plunge pools. These are one of the most reliable water sources in the Sonoran Desert. They can hold several hundreds of gallons and in some cases are perennial.

**Topography:** The relative position and elevation of the natural or man-made features of an area that describe the configuration of its surface.

**Traditional cultural property (or place):** A property that is eligible for inclusion in the National Register of Historic Places 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. The traditional cultural significance of a historic property is derived from the role the property plays in a community's historically rooted beliefs, customs, and practices. Examples of properties possessing such significance include: a location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world; a rural community whose organization, buildings and structures, or patterns of land use reflect the cultural traditions valued by its long-term residents; a location where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice.

**Tribe:** A federally recognized tribe or other federally recognized Native American group or organization (DODI 4715.3).

**Undertaking:** Any project, activity, action, or program wholly or partly funded under the direct or indirect jurisdiction of a federal agency. Includes projects and activities that are executed by or on behalf of a federal agency; federally funded; require a federal permit, license, or approval; or are subject to state or local regulation administered through delegation or approval authority by a federal agency. Also, any action meeting this definition that may have an effect on NRHP resources and thereby triggers procedural responsibilities under 16 USC 470 et seq. (see DODI 4715.3).

**Unexploded ordnance (UXO):** Refers to military munitions that have been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

**Upland:** Land at a higher elevation than the alluvial plain or stream terrace; land above the lowlands along streams.

**Valley:** An elongate, relatively large, externally drained depression of the earth's surface that is primarily developed by stream erosion.

**Valley fill:** In glaciated regions, material deposited in stream valleys by glacial movement. In nonglaciated regions, alluvium deposited by heavily loaded streams.

**Varnish (desert varnish):** A surface stain or crust of brown or black manganese or iron oxide, typically with a glistening luster, that characterizes many exposed rock surfaces in the desert. It coats not only ledges or rocks in place but also boulders and pebbles that are scattered over the surface of the ground.

**Viewshed:** The total area visible from a point (or series of points along a linear transportation facility) and conversely the area that views the facility.

**Volcanic:** Pertaining to the deep-seated, igneous processes by which magma and associated gases rise through the crust and are extruded onto the earth's surface and into the atmosphere. Also, the structures, rocks, and landforms produced by these processes.

**Wash (dry wash):** The broad, flat-floored channel of ephemeral stream, commonly with very steep or vertical banks cut in alluvium.

**Weathering:** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

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