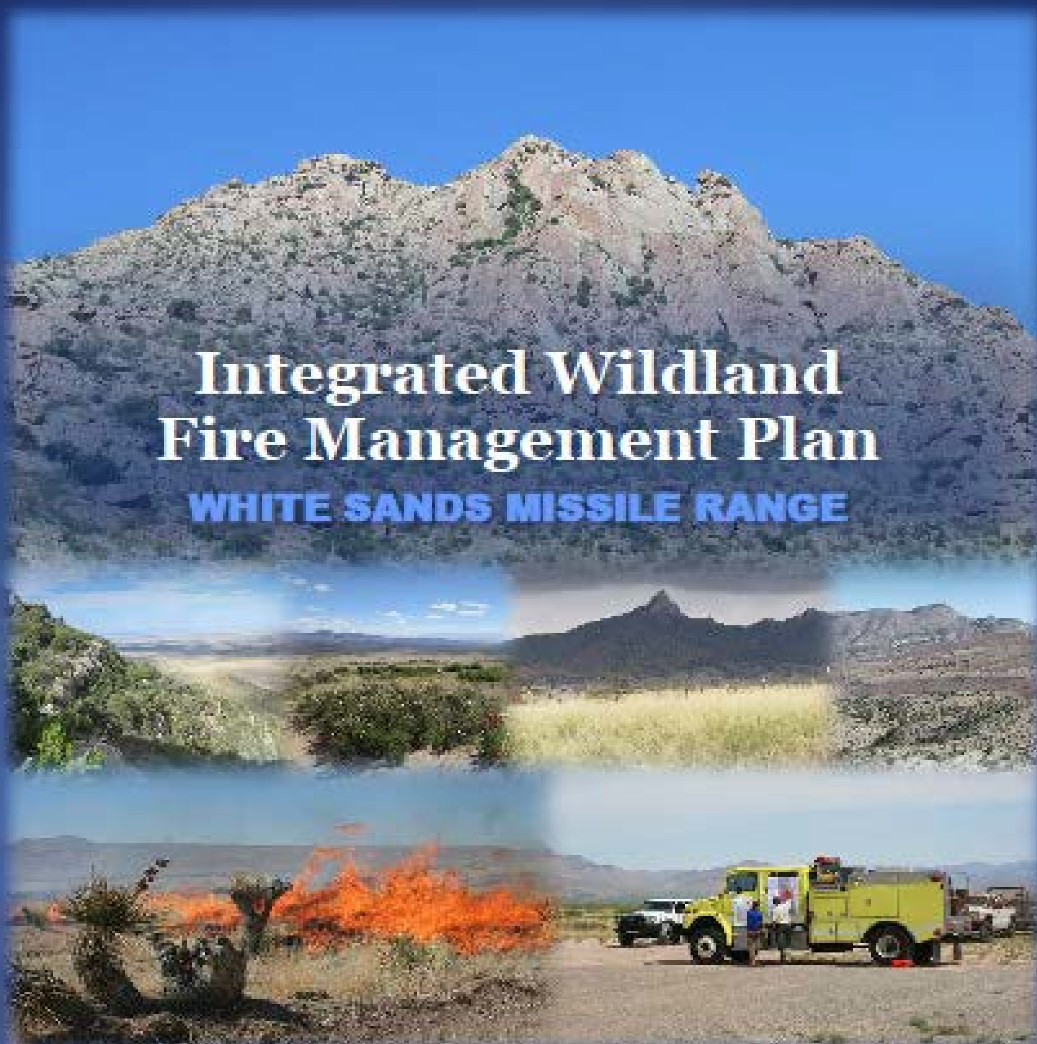
Integrated Wildland Fire Management Plan

WHITE SANDS MISSILE RANGE



Photomontage by Rob Wu (Original photos by Rob Wu, Patrick Morrow)

MAY 2018

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Acknowledgements

The preparer of this plan would like to thank and recognize the many people who provided important technical expertise and contributions to this plan. This list is not all inclusive, not in order of importance or volume but includes: Brian Knight, Patrick Morrow, Debbie Nethers, Trish Cutler, Cristina Rodden, Kelly Norwood, Jim Bowman, Dave Anderson, Matt Cuba, Fire Chief Carlos Soto, Deputy Fire Chief Marc Davis and Captain Christopher Gomez. Thanks are also due to the Eco, Inc. LLC team of Doug Burkett, Patrick Mathis, Matt Hartsough, Rob Wu, Gilbert Villegas, Nadia Martinez and Carol Placchi and her GIS Team, including Kristen Hestir and Austin Shaver, for their skills in formatting, mapmaking, intelligence gathering and sharing and other technical assistance as required throughout the formulation of this plan.

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1 Wildland Fire Management Guidance

1.1 Introduction

The White Sands Missile Range (WSMR) Integrated Wildland Fire Management Plan (IWFMP) is prepared in accordance with Army Regulation (AR) 420-01, Chapter 25, *Fire and Emergency Services* (4 October 2006); AR 200-1, *Environmental Protection and Enhancement* (13 December 2007); AR 525-27, *Army Emergency Management Program* (2011); 32 CFR 651 *Environmental Analysis of Army Actions*; Department of Defense (DOD) Instruction 6055.06-*DOD Fire and Emergency Services (F&ES) Program*; DODI 6055.17 *DoD Emergency Management Program* (2017); and a Memorandum from the Office of the Assistant Chief of Staff for Installation Management-*Army Wildland Fire Policy Guidance*, August 2002. Implementation of these regulations and guidelines requires that an IWFMP be developed and maintained for WSMR that addresses firefighter and public safety, wildland fire management, wildland fire program capabilities, and funding and environmental compliance for the burnable wildland acreage found on WSMR.

This plan is an update to the approved 2004 WSMR IWFMP.

Key wildland fire terminology throughout this document is italicized and bolded. These terms are defined further in Chapter 6 Glossary of Terms.

Chapter 1 defines the purpose and need for the WSMR IWFMP including the goals and objectives for an effective wildland fire management program. It includes the relevant policies that give this plan authority to guide wildland fire management on WSMR.

Chapter 2 provides background information about the installation including military organization, partners and cooperators in WSMR land management, and the natural and cultural resources found across WSMR**.**

Chapter 3 discusses the wildland fire factors found on WSMR such as fuel types, fire regimes, fire history, climate, weather and terrain and discusses how these factors interact to affect wildland fire behavior, fire spread and fire frequency.

Chapter 4 details the constraints and opportunities for managing wildfires for ecosystem benefits, and for suppressing and preventing wildfires on WSMR. This chapter contains safety concerns, strategies and tactics for firefighters and managers to consider in order to successfully contain and control wildfires. Chapter 4 contains alternatives for managing wildfires, including as a tool for ecosystem benefit, cost effectiveness or for firefighter safety. Chapter 4 contains detailed guidance for planning and implementing prescribed fires.

Chapter 5 lists references cited within this planning document.

Chapter 6 contains an alphabetical listing of terminology used in wildland fire operations and their key definitions and includes a listing of acronyms used throughout this plan.

Appendix A contains a summary of WSMR wildland fire goals, objectives and best management practices. The main body of Appendix A contains detailed fire management information for each of WSMR's 36 Fire Management Units (FMUs). Each FMU contains text and a map which includes location, size, fuels information, suppression and structure protection strategies, topographical features, water points for engine fill and environmental and military constraints. **Appendix A, Fire Management Units and Maps** is meant to serve as a stand-alone document that can be carried in a notebook or downloaded to a laptop and used as a fire reference inside wildland fire engines and command vehicles.

Appendices B through I contain information related to wildland fire suppression and management including WSMR FES SOP for Wildland Fire Responses, expected fire effects on endangered, threatened and sensitive plant and animal species found on WSMR, standard wildland firefighting safety checklists and unexploded ordnance (UXO) safety considerations, wildland urban interface strategies, copies of Mutual Aid Agreements (MAAs), a template for assigning a Delegation of Authority to an outside agency for managing WSMR wildfires, guidelines for utilizing minimum impact suppression tactics (MIST) and guidance for avoiding, recognizing and understanding fire effects on the vast amounts of cultural resources found across WSMR.

1.2 Key Terms Defined for Wildland Fire Management

Wildland fire terminology and definitions used throughout this document can be found in Chapter 6, Glossary of Terms on page 107, or within the National Wildfire Coordinating Group (NWCG) online glossary https://www.nwcg.gov/glossary/a-z.

Wildland fire management is the application of scientific principles and land management activities necessary for the prevention of harmful wildfires, for the sustainment and enhancement of ecosystem components, for the reduction of undesirable brush and weed species and for the suppression of wildfires. Wildland fire management supports WSMR by utilizing mechanical fuels reduction treatments and wildland fires to enhance the resiliency of WSMR lands and reduce hazardous fuel loads in order to reduce the size and intensity of unwanted wildfires.

Wildland Fire is any fire, controlled or uncontrolled, occurring on lands covered wholly or in part by timber, brush, grass, or other flammable vegetation. Two distinct types of wildland fires have been defined and include ***wildfires*** and ***prescribed fires.***

Wildfire is any unplanned, unwanted wildland fire, including unauthorized human-caused fires, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

Prescribed Fire is any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and National Environmental Policy Act (NEPA) requirements must be met, prior to approval for ignition.

1.3 WSMR Wildland Fire Management Goals

1. Firefighter and public safety is the first and highest priority on every WSMR wildland fire.
2. Impacts of wildfires upon firefighters, civilians, WSMR test missions and training activities are minimized by following guidelines that call for rapid suppression responses in order to keep man-caused wildfires small but also allows for lightning-caused wildfires or remote, hard to reach wildfires to burn for safety, economic and environmental reasons within the boundaries of Fire Management Units (FMUs).
3. Coordinated wildland fire management protects lives and WSMR property including cultural and sensitive natural resources from wildfire's harmful effects through effective implementation of wildfire prevention, fuels management, wildfire suppression and public education programs.

4. Wildfire severity is reduced and WSMR ecosystems are enhanced through a wildland fire management program that includes adequate funding, training, planning and implementation for mechanical fuels reduction projects, wildfire suppression, prescribed fire treatments, firebreak maintenance, and ***wildland fire use*** (a program that allows wildland fires to burn across the landscape unfettered as long as they are within defined parameters of designated FMU boundaries).

5. WSMR contractors, Department of Army Civilians (DAC) and Soldiers understand the role that wildland fire plays for sustaining WSMR's fire-adapted landscapes and support the use of wildland fire to enhance WSMR's natural resources and testing mission by doing their part in maintaining defensible space around structures and improvements for which they are responsible.

6. WSMR FES, PWO and PWE understand their roles and responsibilities for effective wildland fire management and work together to coordinate actions in order to implement and sustain an excellent wildland fire management program.

1.4 WSMR Wildland Fire Management Objectives

1. WSMR assets, structures, infrastructure, and historic cultural resources will be protected from the harmful effects of wildland fires to the extent possible by maintaining defensible space around these assets. Activities to maintain defensible space include mowing, trimming, brush removal, thinning of excess brush and trees, and/or maintaining green belts for about 30 feet out from structures from October 1 to March 15 (time period outside migratory birds nesting season on WSMR).

2. Existing firebreaks on WSMR are maintained, primarily existing roads and border trails, in conditions that help prevent the spread of wildfires (i.e. keeping road surfaces free of vegetation for a minimum of 8' across the width of the road and keeping road shoulders mowed where it is feasible to do so).

3. Prescribed fires will improve the effectiveness of fire breaks by burning excessive accumulations of wildland fuels where they occur alongside roads.

4. Prescribed fires will be used to improve the health, resilience and diversity of native ecosystems across WSMR.

5. Firefighters will use Minimum Impact Suppression Tactics (MIST), to the extent practicable, for all wildfires on WSMR (See **Appendix H**).

6. PWE archaeologists will be notified whenever wildfire suppression is occurring outside of established Impact Areas due to protection concerns for the vast amounts of cultural resources located throughout WSMR.

7. PWE biologists will be notified when wildfire suppression is occurring within vicinity of the Todsen's Pennyroyal protected area near WSMR's west central boundary or within vicinity of the White Sands pupfish protected habitat areas along Salt Creek, Malpais Spring and Mound Springs.

8. Due to firefighter safety and cost concerns, wildfires that continue to spread after initial attack efforts fail or are still burning after 24 hours will be considered for ***fire use*** and may be allowed to burn within the defensible perimeters of Fire Management Units (FMUs).

9. WSMR will pursue an MOA (Memorandum of Agreement) with Alamogordo Dispatch Center (ADC). This agreement will include guidance for communicating with ADC and how to order equipment, manpower and aircraft. This MOA will aid WSMR when wildfires threaten installation resources or boundaries by quickly being

able to obtain outside firefighting resources, including engines, hand crews, air tankers, overhead, helicopters, lead planes, and ***aerial supervision modules*** (ASMs).

10. WSMR FES will develop a system for certifying and providing an incident qualifications card to all FES wildland fire certified firefighters.

1.5 Authority for Wildland Fire Management on WSMR

The Office of the Assistant Chief of Staff for Installation Management (OACSIM), Installation Services-Environment (DAIM-ISE) working in coordination with Installation Services-Logistics (DAIM-ISL) is responsible for oversight of the wildland fire program, updating policy, and resolving policy questions. The OACSIM will provide information to installations necessary to perform wildland fire management in accordance with Army guidance (See Sec. 1.1).

The OACSIM will insure that wildland fire program reviews are incorporated into Fire and Emergency Services Operational Readiness Inspections and Environmental Compliance Assessment Screenings (DA 2002).

Overall responsibility for the WSMR Integrated Wildland Fire Management Plan and its implementation lies with the Garrison Commander-White Sands (GC). The GC has the responsibility for all Main Post operations and for the prevention and suppression of human-caused wildfires on WSMR. The GC delegates authority for wildfire suppression and prevention and prescribed fire implementation to the Directorate of Emergency Services (DES), Fire and Emergency Services Division (FES) (See Table 4.6). The GC also designates an installation Wildland Fire Program Manager (WFPM), approves the installation IWFMP, approves prescribed fire projects, and approves the deployment of Army civilian firefighters to any off-installation incident (DOD 2002).

The Fire Chief of WSMR, as the head of the Fire and Emergency Services Division (FES), is designated as the WSMR WFPM by the GC and is responsible for implementing this IWFMP. The WFPM has primary responsibility to ensure that wildfire prevention activities are occurring, that WSMR wildland firefighters are properly trained, equipped and fit for wildland fire operations and are in compliance with National Fire Protection Association (NFPA) and National Wildfire Coordinating Group (NWCG) standards for fitness, equipment and training, and that mutual aid agreements and/or cooperative agreements remain relevant and current. The WFPM also approves all prescribed fire projects for WSMR (DOD 2002).

Other departments within WSMR have key responsibilities under this plan. The Directorate of Public Works-Environment Division-Conservation Branch (PWE) is responsible for writing, updating and maintaining the WSMR IWFMP, maintaining a wildfire and prescribed fire database, and for proposing, designing, and writing prescribed fire plans for ecosystem benefits. PWE also works with the WFPM to ensure that sensitive natural resources found on WSMR are protected and that FES resources are aware of them, that the WSMR IWFMP complies and integrates with WSMR DES/FES regulations and with the WSMR Integrated Natural and Cultural Resources Management Plan (INCRMP). The Directorate of Public Works-Operations and Maintenance Division (PWO) has responsibility to maintain roads to firebreak standards and to maintain WSMR grounds and infrastructure as necessary for their protection from wildfires (DA 2002).

This IWFMP adopts standards and policies as directed by DOD from the following authorities:

- DOD Instruction 6055.06, *DOD Fire and Emergency Service Program*, most recent edition.
- Army Regulation (AR) 200-1 *Environmental Protection and Enhancement*, Aug 2007.
- 32 CFR 651 *Environmental Analysis of Army Actions*, Mar 2002.
- AR 420-1, *Army Facilities Management*, Chapter 25, *Fire and Emergency Services*, most recent edition.
- Army Memorandum *Army Wildland Fire Implementation Guidance,* most recent addition.
- Army Memorandum *Army Wildland Fire Policy Guidance,* August 2002.
- National Fire Protection Association (NFPA) Standards-*1143: Standard for Wildland Fire Management; Standard 1977: Standard on Protective Clothing and Equipment for Wildland Fire Fighting; Standard 1906: Standards for Wildland Fire Apparatus; Standard 1051: Standard for Wildland Firefighter Professional Qualifications,* most recent editions.
- 2001 Federal Fire Policy, *A Review and Update of the 1995 Federal Wildland Fire Management Policy,* Jan 01, 2001.
- *Guidance for Implementation of Federal Wildland Fire Management Policy* (February 2009).
- National Wildfire Coordinating Group (NWCG) *Wildland Fire Qualifications Subsystem Guide*, *PMS 310-1*/NFES 1414.
- NWCG PMS-205 *Glossary of Wildland Fire Terminology*, most recent edition.
- *Interagency Prescribed Fire Planning and Implementation Procedures Guide* (PMS 484) Apr 2014.
- *White Sands Missile Range Integrated Natural and Cultural Resources Management Plan and Environmental Assessment,* 2015-2019.
- *White Sands Missile Range Integrated Wildland Fire Management Plan*, March 2004.
- *Environmental Assessment for the White Sands Missile Range Integrated Wildland Fire Management Plan.* March, 2004.

1.6 Funding for Effective Wildland Fire Management

Effective wildland fire management on WSMR depends on adequate funding for the following program areas: ***fire prevention***, ***wildfire suppression*** and ***fuels management*** (including prescribed fire and mechanical fuels treatments). Funding for these program areas is an installation responsibility. Funding for program areas is pre-planned and based on prior years funding and on how much of that money was executed within the program area. Requests for additional funding are made at the program execution level and require written justification and cost breakdown (Table 1.1).

Unplanned funding includes actual wildfire suppression costs. All of the operational costs incurred by WSMR resources to fight wildfires occurring as results of military activities, unknown causes, or on unimproved grounds is reimbursable and are charged to the PWO appropriated Army Management Structure (AMS) codes, the military unit causing the fire, or a combination of both (Table 1.1) (DA 2002).

Table 1.1 Army Funding for Wildland Fire Management

MDEP	Responsibility	Functional Area
VENQ	WSMR PWE	Prescribed Fire and mechanical treatments for ecosystem management and ESA compliance
QDPW-P	WSMR DES/FES	Wildfire prevention tasks including inspections of grounds, structures, infrastructure and facilities for fire hazards and for educating the public about fire prevention
QEMS	WSMR DES/FES	Preparing for wildfire suppression including equipment maintenance and purchase, and training
QMUN	WSMR PWO	Firebreak maintenance and construction, prescribed fire and mechanical fuel treatments to reduce wildfire hazards and for the protection of human resources
	WSMR PWO appropriated AMS code and/or the military unit causing the fire	Wildfire suppression activities

Wildland fire management activities conducted for the purpose of ecosystem management and for compliance with environmental laws and regulations will be supported by MDEP: VENQ and includes recurring activities associated with mechanical fuels treatments and the use of prescribed burning for (a) conserving a species under the Endangered Species Act (ESA) when required by a biological opinion or Endangered Species Management Component (ESMC) when part of an approved INRMP and (b) invasive species control as required for ecosystem management. Wildland fire management for ecosystem management includes the use of wildland fire under prescribed conditions and the management of wildfires under prescribed conditions.

Funding for Fuels Management for the protection of human resources and infrastructure (MDEP-QMUN) comes to PWO. Fuels Management funding, provided to both PWO and PWE, can be used for mechanical fuels treatments including thinning using chainsaws, hand piling, the use of various light and heavy machinery for mulching, grinding and/or chipping, and for prescribed fire projects (DA 2002).

WSMR wildland fire management programs have identified funding needs in order to meet NWCG standards for adequate personal protective equipment, training and protection of personnel and other human resources and are described below:

- WSMR FES has need for funding in order to train FES personnel to NWCG standards for wildland firefighters and also to obtain higher NWCG qualifications for Crew Boss/Engine Boss, Prescribed Fire Burn Boss and Incident Commander Type 4 and Type 3.
- WSMR FES has need for funding to purchase and replace wildland fire gear, clothing and equipment such as next generation fire shelters, Wildland Nomex pants and shirts and specialized hand tools.
- WSMR FES firefighters receive specialized training for fighting structure fires and wildfires, but battling wildfires is secondary to protecting lives and saving structures. WSMR FES currently staffs four fire stations: Main Post, HELSTF, Nike Road and Stallion Range. Currently, when wildfires are burning, WSMR FES personnel often have to shut their stations down to go and battle wildfires. There are not enough firefighters to fight both wildfires and protect structures. There is a need for additional funding to hire and train more firefighters that can specialize in wildland firefighting while

maintaining their structural firefighting capabilities and certifications.

- PWE has need for funding to implement prescribed burns throughout the San Andres and Oscura Mountains to enhance wildlife habitat and improve ecosystem health, and also to implement prescribed burns to protect desert and piedmont grassland habitats for federal candidate and sensitive bird species and improve ecosystem health on Stallion Range, in Helm's Valley, and in the montane grasslands of the San Andres Mountains and foothills.
- PWE has need for funding to send one or two employees to a Resource Advisor Training course administered through the NWCG. This training will enable employees that are already knowledgeable in natural and cultural resources protection to safely accompany firefighting resources and help them avoid damage to WSMR's important natural and cultural resources. See http://www.nwcg.gov/pms/pubs/RAguide_2004.pdf for the guide (PMS 314) for this position.

WSMR will continue to implement improvement projects to its land and infrastructure that will help to protect Range facilities from harmful wildfire effects and will help to keep wildfires within Fire Management Unit (FMU) boundaries. Many improvements have been completed or are under way and will continue under the scope of this plan. Projects include improving roadways to firebreak standards (i.e., road surfaces kept vegetation-free for at least 8' width and road shoulders kept vegetated but mowed or brushed to keep vegetation short), clearing, mowing or maintaining green belts around range structures for about 30' out from the building, thinning, piling, chipping, grinding or removing fuels in targeted areas and planning and implementing prescribed fire projects to reduce hazardous fuel loads, improve wildlife habitat and promote ecosystem sustainability, resiliency and diversity.

1.7 National Environmental Policy Act (NEPA) Compliance

Implementation of this IWFMP includes an assessment of its environmental effects as required by 32 CFR 651, *Environmental Analysis of Army Actions*, dated 29 Mar 02. An environmental assessment was completed for the White Sands Missile Range Integrated Wildland Fire Management Plan, March 2004. The preferred alternative was selected and a Finding of No Significant Impact was signed by the WSMR Garrison Commander on 15 April 2004. The 2018 IWFMP is an updated version of the 2004 IWFMP and incorporates all of the proposed actions of the selected preferred alternative. These actions include:

- Implementing the approved, signed WSMR IWFMP.
- ***Adaptive wildland fire management*** to meet fire management goals and objectives.
- Use of mechanical treatments as alternatives to the use of fire to achieve natural resource benefits
- Following federal, state and local environmental regulations and laws.
- Use of prescribed fires to meet management objectives.

New actions in this plan include:

- Use of an interdisciplinary Team approach when considering whether or not to allow human-caused or natural-caused wildfires to burn for safety reasons, or for natural resource or Range fuel reduction benefits. Team components should include, at
- minimum the GC, WFPM, PWE Division Chief, Director-Range Operations and the Public Affairs Office with overall approval from the GC. The Team should create a short, written document that explains the decision-making process that led to the conclusion that allows the wildfire to burn after having

considered the following: firefighter and public safety, fuel conditions, terrain/topography, long-term weather forecasts, WSMR structures and infrastructure, Range mission schedule, smoke impacts and long-term drought.

- Designation of new Fire Management Units (FMUs) that provide a simplified, easier to understand management approach for suppressing WSMR wildfires and that is in line with NWCG guidelines and naming protocols. Boundaries of FMUs are now designated as firebreak roads and should receive added emphasis for maintenance and funding for PWO.
- Establishing a one-quarter mile buffer zone inside and along the entire Range boundary that requires immediate fire suppression tactics to be used to keep wildfires inside WSMR boundaries rather than the one mile buffer from the 2004 IWFMP.

This IWFMP is integral to the WSMR Integrated Natural and Cultural Resources Management Plan (INCRMP) and Environmental Assessment 2015-2019. The 2004 WSMR IWFMP was analyzed for its environmental effects at the time and was incorporated within the WSMR INCRMP's programmatic Environmental Assessment (EA) 2015-2019.

This update to the 2004 IWFMP does not propose new land management activities that would trigger new detailed analysis of environmental impacts for NEPA compliance such as an EA or EIS. However, WSMR PWE has determined that 32 CFR 651.5 (g) (2) applies to this document which states: "There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impact." Accordingly, a Record of Environmental Consideration (REC) is in process of being prepared for the 2018 version of the IWFMP.

The 2018 IWFMP streamlines and condenses much of the science and analyses of the earlier version and emphasizes tactical and strategic processes for managing wildland fires. The 2018 version succinctly presents important fire-related information and creates new Fire Management Units (FMUs) which are more in line with NWCG guidelines and interagency practices. FMU boundaries are based on following existing road footprints to the extent possible. This strategy increases the defensibility of these boundaries and provides impetus for maintaining these roads. Each prescribed fire project and mechanical fuels project on WSMR will go through the Army's environmental review process with the desired end result being a REC. If, during the environmental review process, it is determined that a more detailed analysis is needed, such as an EA, then PWE will be the lead on the documentation and analysis and the completion of a new EA. Until such time as a new EA is completed for the 2017 IWFMP, each prescribed fire REC and mechanical fuels treatment REC will tier to the 2004 EA and to the 2015-2019 INRMP.

2 Environment of White Sands Missile Range

2.1 Location

WSMR is the largest overland military test range in the United States, occupying some 3,200 square miles (2.14 million acres/923,358 hectares) in south-central New Mexico (Figure 2.1) (WSMR 2015). WSMR is a roughly rectangular-shaped installation that is approximately 40 miles wide by 100 miles in length. Outside of the WSMR boundary are buffer zones or extension areas termed FIX (Fired in extension) areas, also termed the northern and western call-up areas which refers to WSMR calling the land tenants to make sure they vacate the area during certain test missions (Figure 2.2). The FIX areas exist to provide additional safety buffers during missile tests, are off-limits to the public during missile tests, and are located on the northern and western boundaries of WSMR. Land owners within the FIX areas are primarily BLM, state and private. Nearly all of these lands are used for livestock grazing.

WSMR and associated tenants and landowners (i.e., San Andres National Wildlife Refuge, the NASA Test Facility; White Sands National Monument, Jornada Experimental Range, Holloman Air Force Base) together with US Army-Fort Bliss Training Center lie within the northern extent of the Chihuahuan Desert Ecoregion and form the largest undeveloped expanse of land in the southwestern U.S. (WSMR 2015).

Figure 2.1 Regional Setting of WSMR

2.2 Military Mission and Organization of Team WSMR

WSMR is managed by the U.S. Department of the Army in support of DOD readiness programs, including research, development, testing and evaluation of weapons and space systems, and military training. As the largest all-overland test range in the Western Hemisphere, WSMR's expansive and varied terrain is ideally suited to serve as the United States' premier military testing site (WSMR 2015).

The varied terrain and diverse natural environment on WSMR provides a realistic setting for testing and training exercises (Figure 2.2). The mild climate allows year-round testing, and clear skies provide the long-range visibility necessary for observing missile flights and other activities. The large size of WSMR provides ample space for impact areas and mountain ranges provide suitable backstops and backdrops for certain laser and missile tests. The large size, restricted access, and no-flight zones minimize mission impacts on adjacent properties and local populations (WSMR 2015).

WSMR is a subordinate organization of the Army's Test and Evaluation Command (ATEC), which is a direct reporting unit under the Chief of Staff, Army. The general officer position is the senior commander on the installation and serves as the Commanding General (CG) of WSMR. Staff organizations that report to the CG include the Executive Director, the Chief of Staff, Installation Safety/Nuclear Surety Director, equal opportunity, the Staff Judge Advocate and the White Sands Test Center Commander/Director (WSMR 2015).

U.S. Army Garrison, White Sands (USAG-WS) provides WSMR the capabilities and services that support expeditionary operations, provides the facilities and services to allow the tri-services testing and integration of the nation's weapons and sensors, and provides for the quality of life for Soldiers and their families. The Garrison Commander (GC) has the responsibility for the administration of day-to-day and ongoing functions of the entire range, including administration, human resources, public works, resource management, planning, emergency services, and infrastructure maintenance. As such, the GC is also responsible for maintaining compliance with military requirements, environmental, cultural, and hazardous materials laws and policies, equal opportunity employment, law enforcement, fire services, religious services, and legal services (WSMR 2015).

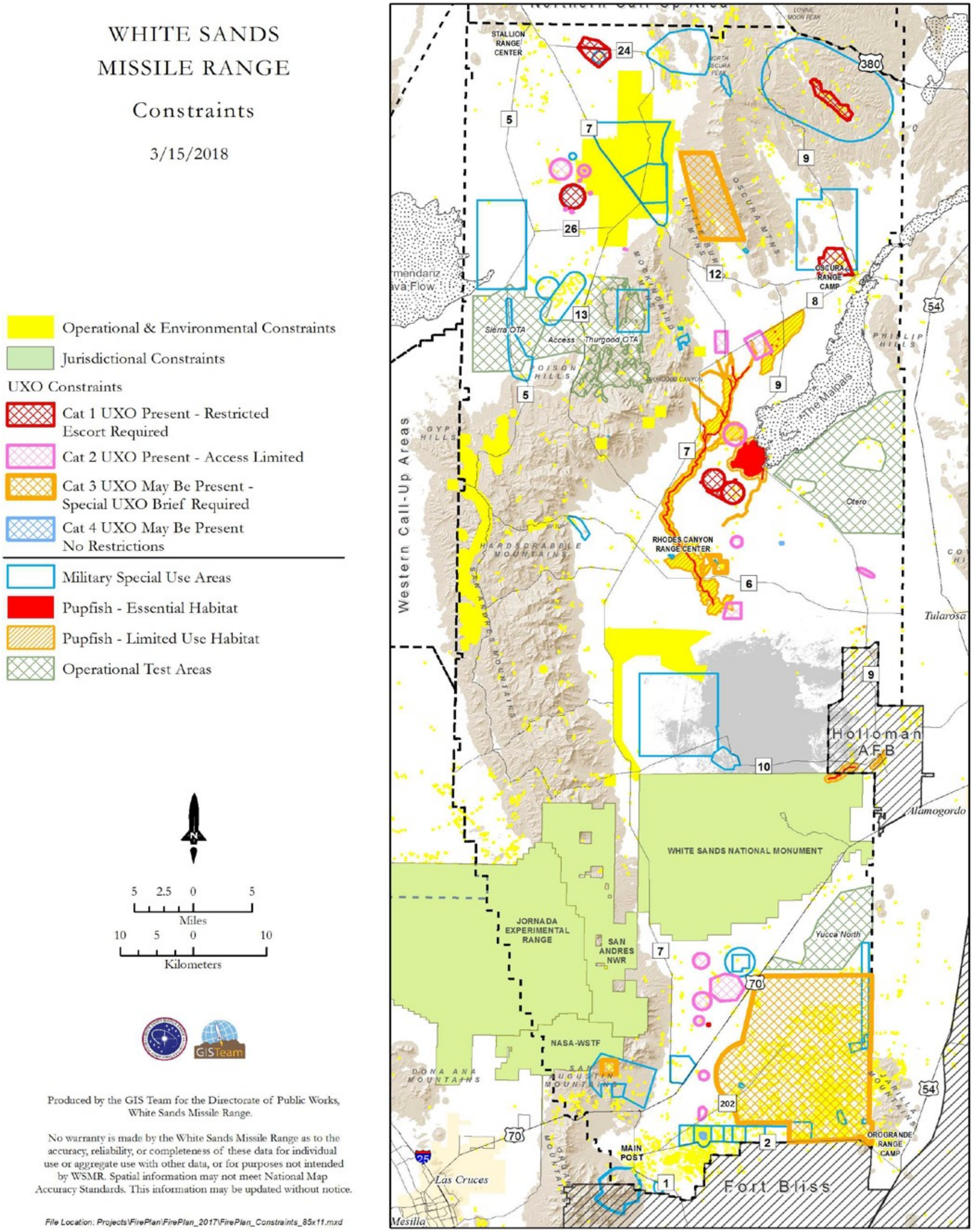
Overall direction, management and operations of WSMR is currently enveloped under the umbrella of Team WSMR, which is comprised of the above-mentioned leadership, the Deputies for the U.S. Navy and the U.S. Air Force, and includes representatives from the many civilian and military organizations using the testing facilities, airspace and grounds of WSMR (WSMR 2015).

WSMR main post contains military testing, research and support facilities, housing, recreation areas and community support services within a footprint of @2,500 acres. There is an airfield (Condron Airfield) east of the main post that can support a variety of fixed-wing aircraft and there is a concrete helipad capable of supporting large helicopters located east of Building 335 between Nike Road and Aberdeen Avenue.

The 2.2 million acres of WSMR are used for tests and evaluations that include tri-service missile systems, high energy laser and directed energy systems, air-defense fire-distribution systems, space systems, and surface-to-surface missile systems (Figure 2.2). Specialized facilities located on WSMR include: special target areas (*e.g.*, Aerial Cable, penetrator warhead tunnels), impact areas, chemical and materials storage, information operations laboratories, electromagnetic, electronic warfare, high energy laser, launch, nuclear effects, and warhead test facilities. Structures on the Range are generally situated in small clusters on sites with local names. Over 150 site names are used in the real property inventory, though many of these are sites are outdated, in disrepair and unused (WSMR 2015).

Particularly relevant for wildland fire, WSMR has 10 Warhead Impact Target (WIT) sites that total approximately 0.7% of WSMR (Figure 2.2). These are categorized by the Department of the Army-Materiel Test Directorate, Warheads Branch as Phase I and Phase II sites. Phase I WIT sites (Category 2 UXO present in Figure 2.2) are used exclusively for testing nonlethal sub-munitions where recovery in the area is allowed. These sites are maintained in a mowed grassland condition. Phase II WIT sites (Category 1 UXO present in Figure 2.2) are used for testing lethal (live) sub-munitions. Recovery within these areas is not permitted. These sites are maintained in a bladed (bare ground) condition (WSMR 2015).

All WIT sites (Category 1 and 2 UXO present as shown in Figure 2.2) are closed to entry by firefighters because there is potential for Unexploded Ordnance (UXO) that could explode in the heat from a wildfire. Wildfires in WIT areas are monitored until the wildfire burns itself out due to lack of fuels or continues to burn and spreads outside the WIT boundaries. Safety buffers have been built into WIT boundaries so it is generally safe for firefighters to engage wildfires immediately outside WIT boundaries. However, it is probably safer for firefighters to remain on the nearest set of roads and let the wildfire come to them or let it burn out on its own. See **Appendix A, Fire Management Units** for locations of WITs and other areas of special concern.



2.2 Operational Constraints

2.3 WSMR Cooperators in Wildland Fire Management

WSMR contains lands within its perimeters that are used and shared by other federal agencies (Figure 2.2). These agencies are participants in wildland fire management on the installation and are considered internal cooperators. Internal cooperators have different missions on WSMR and can also contribute to the frequency and duration of wildfires occurring on WSMR. Internal cooperators can supply firefighting assets to assist WSMR firefighters. Some of these cooperators have fire management responsibilities on the WSMR lands that they use.

Interagency agreements exist as Mutual Aid Agreements (MAAs) for suppression of wildfires where agencies can benefit each other by reciprocal fire suppression activities. Formal MAAs exist between WSMR FES and the BLM, White Sands Test Facility, US Fish and Wildlife Service, Jornada Experimental Range, the counties of Doña Ana and Socorro and the cities of Las Cruces, Organ and Socorro (See **Appendix B**, **Mutual Aid Agreement**s). The first three entities listed below do not have signed MAAs, Fort Bliss is an adjoining Army training facility and will respond to WSMR wildfires when they are called upon. Holloman AFB and White Sands National Monument are completely enclosed within WSMR boundaries and, as such, do not provide wildland fire suppression resources, but rather rely on WSMR FES or other nearby Volunteer Fire Departments for wildfire suppression.

Fort Bliss Training Center (FBTC)-FBTC adjoins WSMR and comprises the majority of the southern boundary of WSMR (Figure 2.2). FBTC consists of approximately 1.12 million acres and is an Army installation dedicated to training Army troops in maneuver and gunnery requirements. Units stationed at Fort Bliss use WSMR ranges and airspace for tactical training and military tests. In combination, WSMR and Fort Bliss create an arena of more than 3 million contiguous acres of dedicated DOD land and exclusive-use airspace for training purposes and testing weapons (U.S. Army 2000).

Wildfires have crossed the WSMR/Fort Bliss boundary in the past, mostly within the rugged confines of the Organ Mountains. Fort Bliss FES has wildland fire equipment and firefighters that will respond to wildfires on WSMR if they are near WSMR borders. The same goes for WSMR firefighters, as they will respond to Fort Bliss wildfires near their shared boundary. Fort Bliss FES and WSMR FES have mutual interests and a shared responsibility in keeping wildfires small near their mutual boundary.

Holloman Air Force Base (HAFB)-HAFB utilizes the Red Rio and Oscura Bombing Ranges for air-to-ground target training and also utilizes WSMR airspace and the extension areas for aerial maneuver training (Figure 2.2). The Range Operations Center (ROC) located at HAFB monitors all USAF training activities on WSMR and can also monitor wildfires on Red Rio and Oscura Bombing Ranges through the use of remote cameras in strategic perimeter locations. Wildfire ignitions are common within the Red Rio Bombing Range due to a ready ignition source from munitions and the abundance of light, flashy fuels. Wildfires are mostly held in check inside Red Rio Bombing Range by a system of bladed firebreak roads around the perimeter of the Range. When wildfires burning inside Red Rio Bombing Range threaten to burn across the firebreak boundaries, the ROC will notify WSMR FES for wildfire suppression support. The Oscura Bombing Range does not normally contain sufficient wildland fuels to warrant wildfire escapes. Further, HAFB maintains a Type 6 engine with contract firefighting personnel and a water tender on Oscura Range that will handle wildfires within that area of responsibility.

White Sands National Monument (WSNM)-The WSNM is enclosed within WSMR boundaries (Figure 2.2). The US National Park Service has responsibility for the administration and management of WSNM and, as such, they have wildland fire management responsibilities for the lands they manage. WSNM has very little wildland acreage that is burnable, the exception being small pockets of burnable fuel in between dune areas that consist of cottonwood galleries and patches of salt grass. WSNM does not have wildland fire protection equipment nor any firefighters in their employ. WSNM fire history shows car fires on the main access road to be the primary source of wildfires, but due to sparse fuel conditions, are not considered a threat to WSMR lands.

San Andres National Wildlife Refuge (SANWR)-SANWR is administered by the US Fish and Wildlife Service (USFWS) and serves primarily as a refuge and home for a growing population of Desert bighorn sheep *(Ovis canadensis nelsoni).* SANWR contains 57,215 acres, is entirely enclosed within WSMR boundaries and is not open to the public (Figure 2.2, 2.3). A USFWS prescribed fire program has burned substantial acreage on SANWR over the past three decades for the purpose of reducing shrub and tree densities which serve as hiding cover for predators and also to stimulate the growth of quality forage for Desert bighorn sheep. The USFWS New Mexico Fire District employees have the expertise, fire experience and equipment necessary to aid WSMR with prescribed fires and wildfires. USFWS fire resources will respond to wildfires burning on the SANWR and will be there to help manage wildfires that may cross refuge boundaries and burn onto WSMR. However, due to declining agency budgets, there has been increasing reluctance on the part of the USFWS Fire District to provide wildland fire resources for off-refuge wildfires and other agencies' prescribed fire projects. This is a problem for WSMR because they have relied on USFWS in the past for wildfire support and for accomplishing prescribed fire projects.

Jornada Experimental Range (JER)-JER is a US Department of Agriculture research facility and livestock range encompassing 193,483 acres (Figure 2.2). Some of this acreage includes shared lands administered by WSMR and SANWR. The purpose of JER is to conduct arid lands research and create best management practices for compatible livestock management and ecosystem sustainability. JER has conducted experiments and research over many years involving the controlled burning of vegetative plots to measure plant responses to fire. As such, they have provided guidance and direction to land managers who desire to manage and sustain Chihuahuan desert ecosystems through the use of tested grazing practices and prescribed fires.

National Aeronautics and Space Administration (NASA) and the White Sands Test Facility (WSTF)-WSMR provides NASA, as a leased tenant, the land necessary to conduct experiments and tests on materials and components used in today's space vehicles (Figure 2.2). The WSTF is a diverse facility used in support of NASA, other government agencies, the U.S. military and private industry. Located on 28 square miles in the southwest corner of WSMR, the WSTF is a self-contained and remote testing facility. NASA maintains a small fire department that includes one Type 6 engine for wildland fires (4x4, 350 gal. with foam and three personnel). This engine and crew is available upon request for support on WSMR wildfires under guidelines established in a mutual aid agreement between WSMR and WSTF found in **Appendix B** (pers. comm. JR Heimbecker).

2.3.1 External Cooperators

The regional land ownership surrounding WSMR includes private, State and Federal lands (Figure 2.3). WSMR is mostly surrounded by public land administered by the Bureau of Land Management (BLM) and by the state of New Mexico. There are scattered blocks of private land on the eastern boundary, north of Highway 70, small parcels directly west of the main post on the San Augustin Ranch and a few sections adjacent to the western boundary at isolated ranches. Wildfires can cross WSMR boundaries and impact private and public lands. External cooperators have firefighters and equipment to assist WSMR firefighters when wildfires threaten to cross boundaries.

Bureau of Land Management (BLM) has offices in Las Cruces, Socorro and Roswell that administer lands which are adjacent to WSMR boundaries. BLM jurisdictions are divided by county lines. Las Cruces District Office administers adjoining BLM lands in Doña Ana, Otero and Sierra counties; Socorro Field Office administers adjoining BLM lands in Socorro County; and Roswell District Office administers adjoining BLM lands in Lincoln County. These offices maintain a fleet of wildland fire engines that can respond to wildfires near and within WSMR borders.

The state of New Mexico's **Energy, Minerals and Natural Resources Department (EMNRD), New Mexico State Forestry Division (NMSF)** retains the lead responsibility for wildland fire management on non-federal and non-municipal lands within the state of New Mexico. NMSF is responsible for wildfire suppression on 43 million acres of private and state lands within New Mexico but has limited numbers of firefighters and engines available for fighting wildfires. During the wildfire season, the Socorro and Capitan Districts of NMSF maintain engines and crews that can respond to WSMR boundaries if wildfires nearby are threatening state or private lands. Primarily, NMSF relies on agreements with the state's Volunteer Fire Departments (VFDs) and with the federal land management agencies for wildfire suppression assistance on state and private lands in New Mexico.

The United States Forest Service (USFS) administers lands in southern New Mexico under their jurisdiction within the Gila National Forest and the Lincoln National Forest. These two National Forests maintain and support considerable firefighting resources for protecting their lands and other agencies lands under an interagency zone concept. Interagency firefighting resources, available to their respective zones, include multiple wildland fire engines, hotshot crews, helicopters, air tankers, smokejumpers, lead planes and air attack fixed-wing aircraft. These assets can be used for wildfire suppression near or within WSMR boundaries. WSMR is a part of the Pecos Zone which is controlled by Alamogordo Interagency Dispatch Center (ADC). ADC controls the movement and use of interagency federal and state firefighting resources including aviation resources throughout southeastern New Mexico and West Texas and are available to WSMR if needed. However, if the fire season is a busy one, then prioritization for these resources is made by the Southwest Interagency Coordination Center (SWCC) in Albuquerque, NM. Regional priorities are based on values at risk, particularly structures inhabited by humans, high-value timber and recreation resources. It is possible WSMR may not get resources ordered due to higher priorities elsewhere.

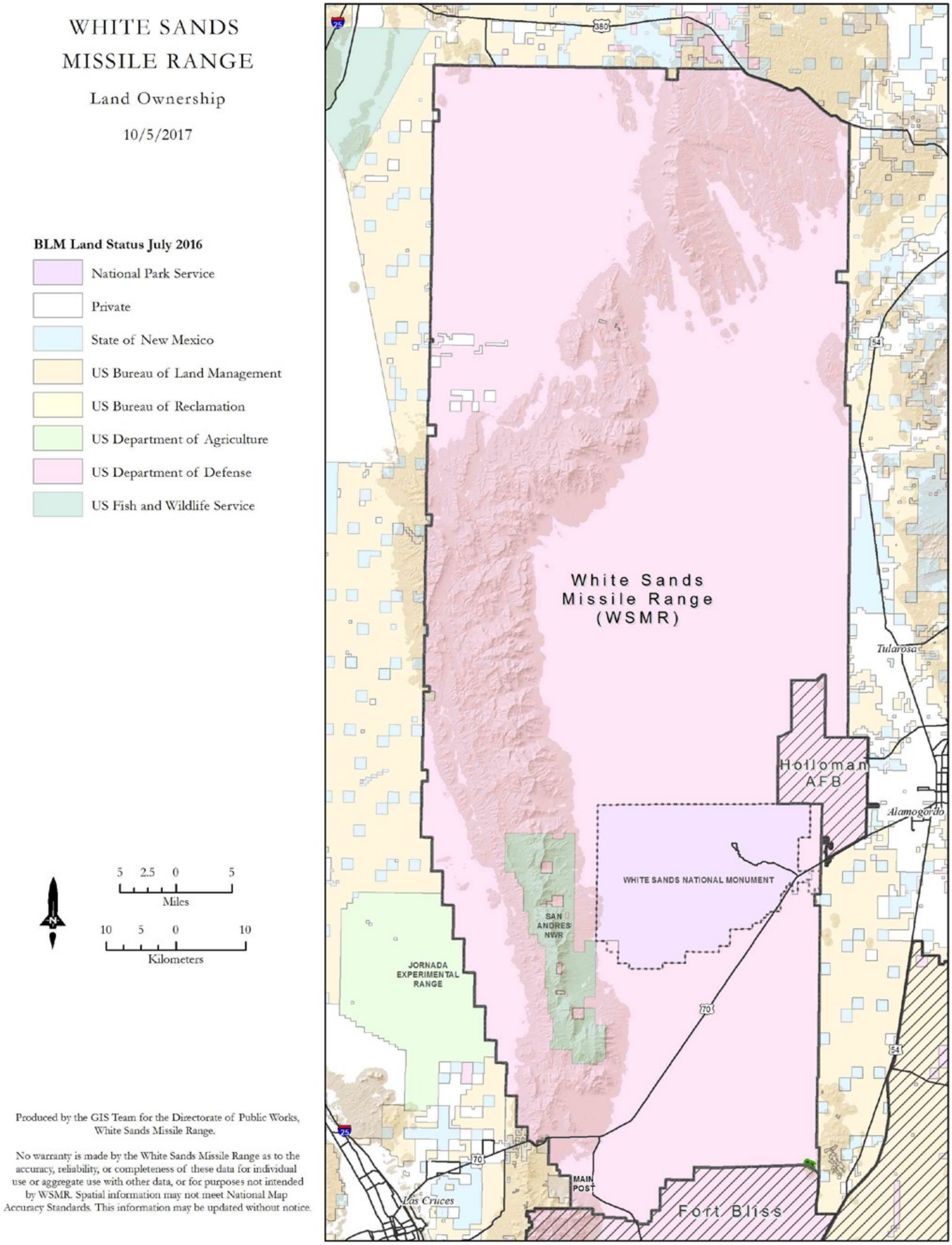


Figure 2.3 Land Ownership Within and Surrounding WSMR

2.4 Cultural Resources

WSMR and the surrounding area represent a landscape rich with evidence of a long human occupation. Human habitation on WSMR is represented by prehistoric hunting and gathering camps, ranches, railroads, trails, late 20th century buildings, and military-related buildings and structures from World War II through the Cold War (WSMR, 2015). Human activities continue to shape the landscape through the various missions of WSMR. These activities leave imprints on the landscape for future generations to interpret and manage. These records collectively form the present-day cultural landscape and warrant protection from the effects of severe wildfires. There are thousands of cultural sites located on WSMR. Prehistoric sites include lithic scatter, pueblo structures, encampments, cave dwellings and rock art. Historic sites include ranches, homesteads, corrals and mine features. See Section 4.1.4 and particularly, **Appendix J** for further information on protecting cultural resources from wildland fire damage.

2.5 Topography and Physiographic Resources of WSMR

WSMR lies within the Mexican Highland Section of the Basin and Range Physiographic Province (Hawley 1986). Extension of the earth's crust throughout this province during the past 30 million years has produced characteristic short, linear mountain ranges separated by intervening valleys (Stewart 1978). WSMR's present-day terrain includes rugged mountain peaks and canyons, rolling grass-covered hills, sand dunes, lava flows, semi-arid yucca and grassland basins, and large playas with scattered springs and ponds (Figure 2.4) (Muldavin et al. 2000). WSMR includes the northern end of the Tularosa Basin with a low elevation of 3,885 ft. (1,184 m) on WSMR's eastern side. The Jornada Basin lies on the northwest side of WSMR and is higher with a low elevation on WSMR of 4,574 ft. (1,394 m). Dividing these two desert basins is the San Andres Mountains which reach a height of 8,962 ft. (2,732 m) at Salinas Peak and the Oscura Mountains, reaching 8,639 ft. (2,633 m) at Oscura Peak (WSMR 2015).

The San Andres and Oscura mountain ranges are fault-block escarpments. The San Andres Mountains rise abruptly with steep slopes and escarpment cliffs facing eastward toward the Tularosa Basin. West-facing slopes of the San Andres Mountains gradually descend from the escarpment edge to the floor of the Jornada Basin. The Oscura Mountains to the north has steep, cliff faces along its escarpment, but unlike the San Andres, the escarpment faces west and the Oscura Mountain range gradually descends to the east from the escarpment edge. To the north, the Oscura Mountains descend into Chupadera Mesa at the northern edge of WSMR. In between the Oscura Mountains and the San Andres Mountains are the Mockingbird Mountains and the Little Burro Mountains (Figure 2.4).

The Tularosa Basin contains numerous ephemeral playa lakes and alkali gypsum flats. Lake Lucero Playa is the lowest depression within the Lake Otero plain and holds brackish water throughout much of the year. Big Salt Lake is the terminus of Salt Creek and contains valuable wildlife habitat.

Gypsum dunes in the center of WSMR are redeposited lake bed evaporates whose gypsum crystals are carried by the wind. Gypsum sands, originating from the dried-up Pleistocene Lake Otero, were deposited into the lake by runoff from surrounding gypsum-rich formations of the Pleistocene mountain ranges. Gypsum sand dunes occur in the south-central portion of WSMR and extend south into White Sands National Monument. The dunes comprise the largest gypsum dune field in the world and cover 432 mi^2, most of which lies within WSMR (WSMR 2015).

The center of the Jornada del Muerto basin on WSMR is believed to be the Pleistocene-age Lake Trinity. The lake evaporated with the onset of a drier, warmer climate. Dune sands that dominate the western portion of the Jornada del Muerto were probably deposited in the Rio Grande channel during the wetter Pleistocene and have since been blown here by prevailing southwest winds and deposited in this basin along the western shore of the Lake Trinity playa (Neal *et al*. 1983). Alluvial deposits from surrounding slopes of the San Andres and Oscura mountains have encroached from the south and the east onto Lake Trinity playa deposits (WSMR 2015).

The Tularosa Basin and the Jornada Basin are closed watershed basins for hydrologic functions. The surrounding mountains catch most of the available precipitation and when it is sufficient to run off the mountains, water is collected in the Basins' desert floor within shallow playas. Soils on the Tularosa Basin floor are highly calcareous due to the deposition of dissolved calcium from limestone rock carried by water down from the mountains (WSMR 2015).

The Carrizozo lava flows originated from Little Black Peak northeast of WSMR and have been dated at 5,200 ±700 years B.P. There were two distinct basaltic flows that erupted within 1,000 years of each other. The flows are well preserved, and they have retained some pahoehoe rope-flow top structures (Dunbar 1999).

The southwest corner of WSMR contains a small portion of the steep-sided Organ Mountains whose elevations on WSMR range from 4,400 ft. (1,341 m) to 6,525 ft. (1,989 m) on the ridgeline to the east of Texas Canyon. While the Organ Mountains are a very small part of WSMR's geography, they are important in terms of wildfires and their effects. WSMR main post sits at the base of the Organ Mountains and has been affected on numerous occasions by wildfires burning within the Organ Mountains, mainly in terms of smoke impacts. Wildfires in the Organ Mountains can grow large and smoke impacts may last for several days.

Most soils on WSMR are aridisols (58%), which are characteristic of desert soils as they are more alkaline and less developed than non-desertic soils. Organic matter is mostly lacking in aridisols, which limits the soils ability to hold water and nutrients and resist compaction. Aridisols typically have <1% organic matter as compared to >3% in adjacent soil types. Entisols (30%) and mollisols (12%) make up the remaining soil groups present on WSMR (WSMR 2015). Entisols are young, usually recently established and weakly developed soils found within the basin bottoms of WSMR. Mollisols are usually formed beneath grasses and occur at high elevation, mesic sites on WSMR. All soils on WSMR are associated with climates showing at least moderate seasonal or annual moisture deficits and tend to be highly vulnerable to erosion.

WSMR's soils are prone to both water and wind erosion. Exposed rock is common, and soils themselves can be non-absorbent because of hydrophobic properties. When wet, hydrophobic soils tend to expand, sealing subsurface layers. Because of this, overland flow across the surface is common. Consequently, flash flooding resulting in excavation of arroyos and sheet erosion that removes finer particles and organic matter are common (Sowell 2001). Wildfires can exacerbate soil erosion by removing the organic layer on the surface which normally acts to absorb rainwater.

Increases in soil erosion can be exacerbated by drought which leads to loss of grasslands over time and the consequent increase in shrub species such as mesquite, creosote and piñon-juniper. Creosote shrublands can become homogeneous and act to limit understory vegetation causing increased cycles of run-off during rain events due to less water percolation into the soil bed. The lack of herbaceous growth beneath these shrubs limits fire spread and helps perpetuate shrub species. Piñon-juniper woodlands, mesquite coppice dunes and creosote monocultures need disturbance, other than fire, in order to increase understory vegetation and help slow erosion of topsoil.

WHITE SANDS

MISSILE RANGE

Physiographic Resources

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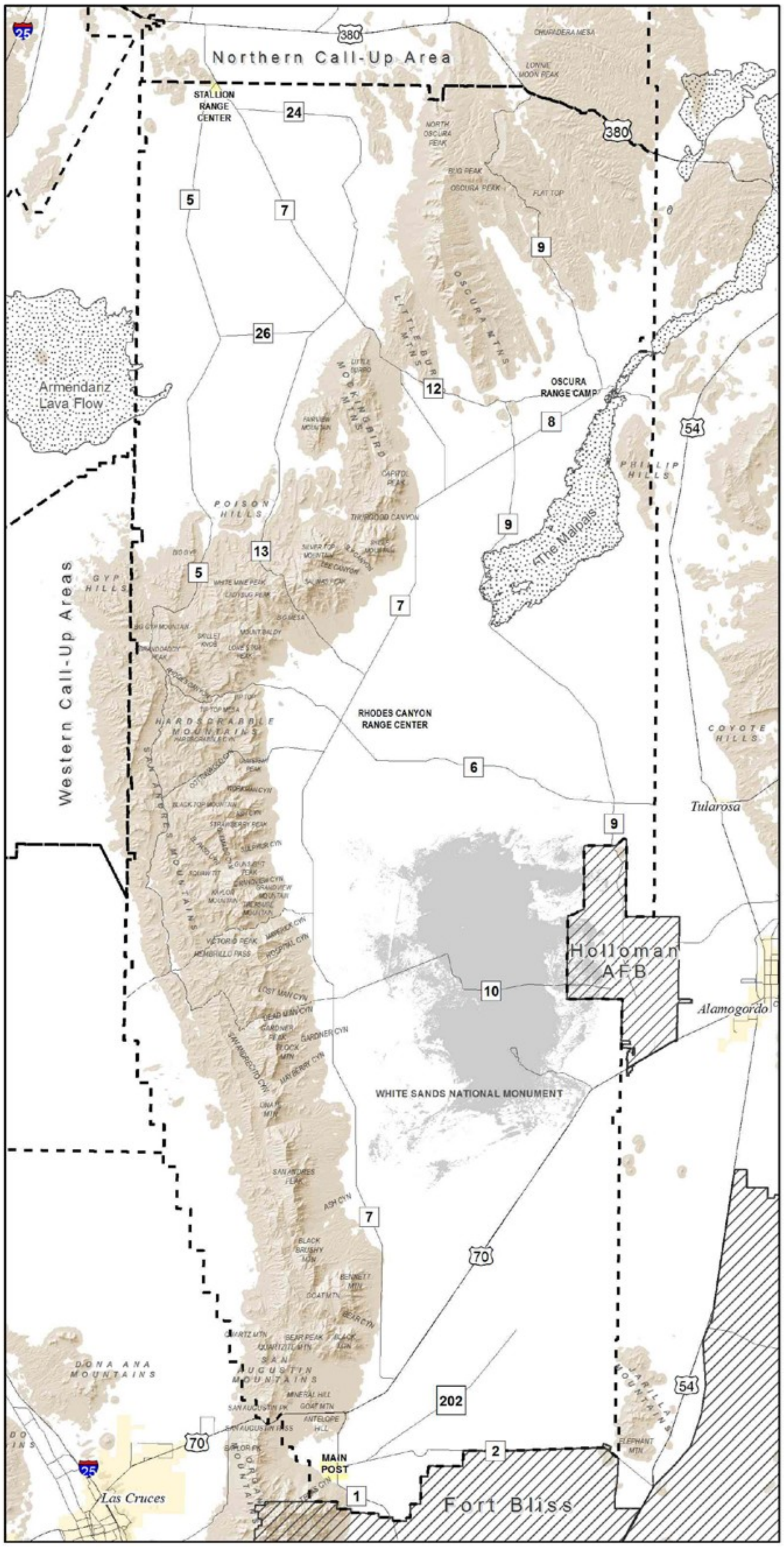

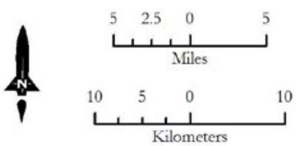

Produced by the GIS Team for the Directorate of Public Works, White Sands Missile Range.

No warranty is made by the White Sands Missile Range as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by WSMR. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notice.

Figure 2.4 Physiographic Resources of WSMR

2.6 Climate and Weather

WSMR lies at the northern extent of the Chihuahuan Desert Ecoregion, the easternmost of the North American deserts. The Chihuahuan Desert is a function of the horse latitudes, found between 32-37^0 above and below the equator. This is where air masses that originate at the equator descend, warm, and dry, resulting in little precipitation and is where most of the warm deserts around the world are found (Sowell 2001). In the northern Chihuahuan Desert, this drying effect is enhanced by the rain shadow effect of the Sierra Madre Oriental and Occidental Ranges in Mexico and the southern Rocky Mountains in the US. Like other North American deserts, summers are long and hot, but due to its interior location and high elevations (mostly >4000 ft.), winters are cool and result in frequent below freezing temperatures during nighttime (Barlow *et al.* 1983).

More than half of the total average annual precipitation occurs during the months of July, August, and September. During the summer months, beginning at the end of May and lasting through mid-October, convective cells are formed by the intersection of moist tropical air from the Gulf of Mexico with local air masses uplifted by intense surface heating. The resulting summer precipitation is localized and generally concentrated in short, high intensity thunderstorms in the mid-afternoon and evening that often produce substantial runoff water in arroyo drainages and standing pools of water in playas (WSMR, 2015). Precipitation on WSMR averages 7.9–20 in. (20–35 cm) annually, with >60% occurring as short, intense convective rainstorms from July through September (Barlow *et al.* 1983). Average annual precipitation in arid high desert basins is less than 10 in. (25.4 cm); semiarid foothills 10-16 in. (25.4 cm-40.6 cm); and highest mountain elevations are almost temperate (average 20 in.) (50.8 cm) (Muldavin *et al*. 2000). Snowfall averages less than 3.9 in (10 cm), is short-lived, and occurs at higher elevations. Mean annual temperature at WSMR is 63^{o}F (17.2 C). Average low temperature in January is 29^{o}F (-1.66 C); in July the average high is 95^{o}F (35 C). Temperature extremes range from 112^{o}F (44.4 C) recorded at Orogrande in June 1994 to -25^{o}F (-31.6 C) recorded at White Sands National Monument in January 1962 (WSMR 2009). Records indicate daily fluctuations of up to 50^{o}F (10 C) (Muldavin *et al*. 2000).Three principal seasons occur across WSMR: warm-wet (July–October); cool-dry (November–February); and warm-dry (March–June). April and May are the driest months (WSMR 2009).

Westerly winds prevail throughout much of the spring; winds become more southerly in July and August during the summer monsoon and wind speeds drop to their lowest levels of the year (less than 8.0 mph) (U.S. Army 2009). The combination of relatively strong sustained winds and low precipitation in the spring contribute considerably to the occurrence of wildfires and to sand/dust storms in the area. The topography of WSMR also affects wind direction and velocity. The San Andres and Oscura Mountains help to increase the speed of wind gusts and alter primary wind directions through orographic lifting. Wind speeds are accelerated further by the chimney effect of steep, narrow canyons. Orographic lifting and adiabatic cooling also make higher elevations wetter and cooler than adjacent desertic basins, while shading makes northern aspects wetter and cooler than southern aspects.

Wildfire season on WSMR and the surrounding area can last from the first frost in November until the onset of the monsoons in July, but always reaching a peak during the spring to early summer (March-June) when winds and temperatures are at their peaks and relative humidity is lowest. Most lightning strikes occur between June and September. See Ch. 3, Sec. 3.5 for more on the effects that climate and weather have upon wildland fires on WSMR.

2.7 Vegetation Communities of WSMR

Historical accounts from the mid-1800s describe the Chihuahuan Desert ecoregion as lush, shrub-free grasslands. Over the past century and a half, the ecoregion has been heavily degraded by overgrazing and deprivation of natural fire regimes. WSMR, heavily grazed prior to 1945, was also severely impacted by drought from 1942 to 1956. Reported findings show that the principal ground cover, grass and forbs, declined substantially during this period (Gao and Reynolds 2003). Jornada Experimental Range research shows shifts from grass vegetation cover types to shrub vegetation cover types over the previous century (Fredrickson, *et al.* 2005). WSMR contains large areas that have been affected by man's and nature's influences over time, yet there are still relatively intact, albeit smaller, grassland, riparian and montane vegetation communities on WSMR (Figure 2.5). The diversity of habitats and the quality of vegetation communities found on WSMR provide environments supportive of great biotic diversity. WSMR contains some of the last, best remnants of healthy, functioning Chihuahuan Desert ecosystems and are worthy of conservation (WSMR 2015).

Among desert ecoregions, the Chihuahuan Desert has particularly high biodiversity. It is widely recognized for its cactus diversity and endemism (i.e. found no other place in the world). Four other plant families, grasses, euphorbs, asters, and legumes, are also highly speciose and show high levels of endemism in the ecoregion. Plant endemism may be lower on WSMR than in other parts of the Chihuahuan Desert because endemism tends to be greater in the center of the Chihuahuan Desert than at its margins (VanDevender 1987), and WSMR is located on the northern edge of the ecoregion (WSMR 2015).

The New Mexico Natural Heritage Program (NMNHP) described vegetative land cover for WSMR and lists 34 vegetation communities grouped from the >1,000 plant species found on the installation (Muldavin et al. 1997) (Figure 2.5).

Vegetation communities at WSMR generally follow an elevational gradient. At highest elevations, open ponderosa pine occurs with deciduous oak (*Quercus gambelii*) woodlands. Lower montane elevations support a combination of piñon (*Pinus edulis*) and juniper woodlands, intermixed with evergreen oak (*Q. grisea* and *Q. turbinella*), mountain mahogany *(Cercocarpus montanus*), and wavy-leaf oak (*Q. undulata*) (Muldavin *et al*. 2000). Mountain valleys and mid-elevation slopes contain grasslands dominated by blue, hairy, and sideoats grama grasses (*Bouteloua gracilis, B. hirsuta,* and *B. curtipendula*), western wheatgrass (*Pascopyrum smithii*), and New Mexico needle grass (*Stipa neomexicana*) with a significant component of the above mentioned shrubs as well as Buck brush *(Ceanothus fendleri),* skunkbush sumac *(Rhus trilobata),* cacti *(Opuntia spp.)* and agaves *(Agave spp.)*. Foothills and alluvial fans support Chihuahuan Desert grasslands dominated by various grama grasses, but particularly black grama *(Bouteloua eriopoda)*, along with curly leaf muhly *(Muhlenbergia setifolia*). These grasslands have a distinctive and conspicuous tall and dwarf shrub component represented by such species as common sotol (*Dasylirion wheeleri*), sacahuista (*Nolina microcarpa*), soap tree yucca (*Yucca elata*), mariola (*Parthenium incanum*), ocotillo (*Fouquieria splendens*), and Torrey's joint fir (*Ephedra torreyana*). Major drainages contain riparian forest and shrubland vegetation, especially where water is semi-permanent (Muldavin *et al*. 2000).

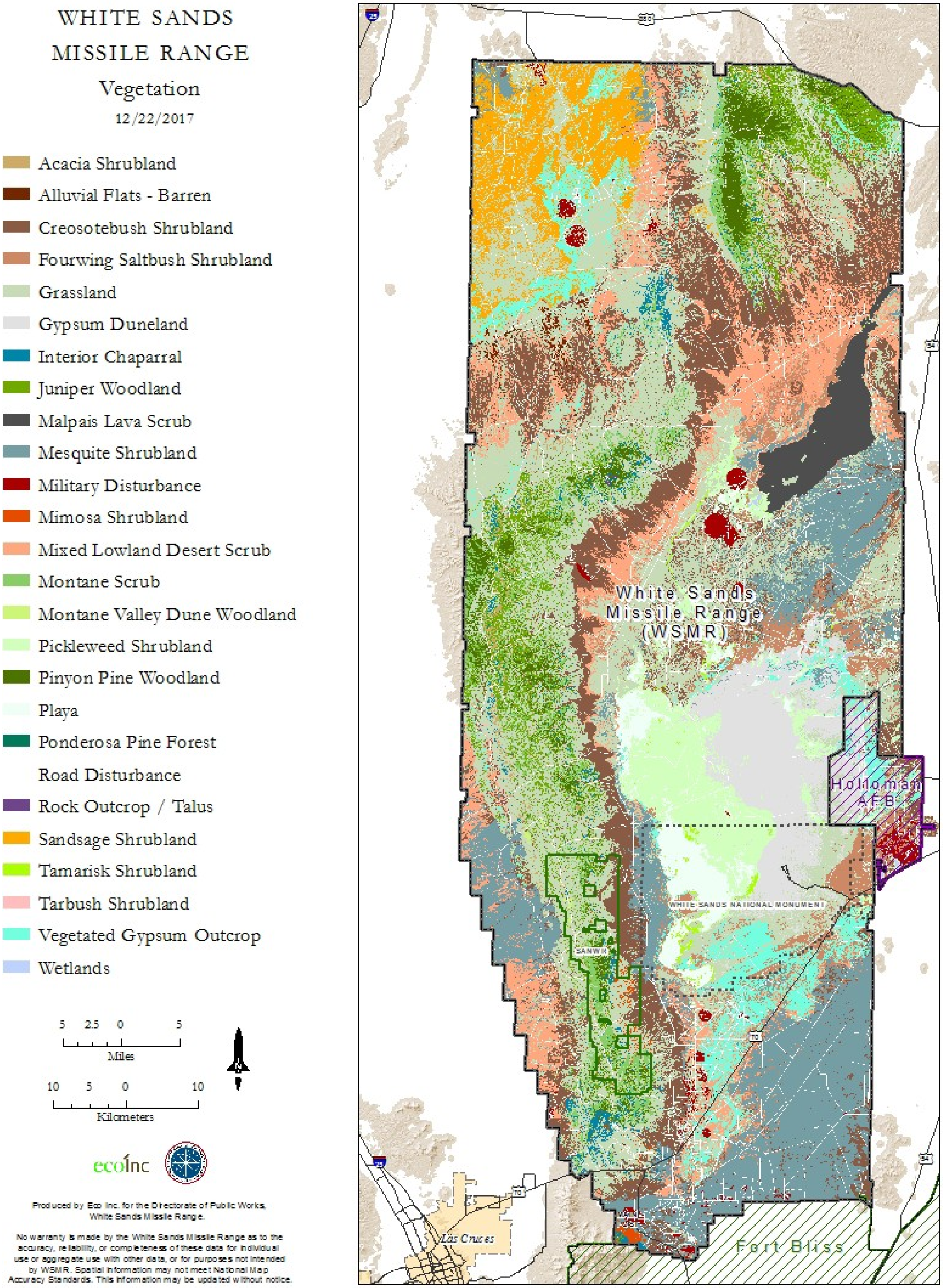

Figure 2.5 WSMR Vegetative Communities

Chihuahuan Desert shrublands are found interspersed with desert grasslands at the bases of the mountains on foothills and bajadas. Shrublands are also significant components of deserts, usually found along arroyos and in low-lying pockets, as well as on the margins of gypsum dunes and playa lakebeds. Viscid acacia (*Acacia neomexicana*) communities occur on lower mountain slopes of canyons and escarpments. Large stands of creosotebush (*Larrea tridentata*), catclaw *(Acacia greggii)* and honey mesquite *(Prosopis glandulosa)* extend away from mountain fronts. Rolling sandy plains support sand sage (*Artemesia filifolia*) shrublands, and large alluvial flats are dominated by four wing saltbush (*Atriplex canescens*) communities. In the Tularosa and Jornada basins, honey mesquite, tarbush (*Flourensia cernua*), snakeweed *(Gutierrezia sarothrae),* soaptree yucca and creosote prevail. Lowland or basin grasslands containing tobosa (*Hilaria mutica*) and alkali sacaton (*Sporobolus airoides*) intermix with low elevation shrubs. Gypsum dunes and outcrops in basins support unique vegetation communities dominated by gyp dropseed (*Sporobolus nealleyi*), gypsum grama (*B. brevista*), pickleweed *(Salicornia bigelovii),* and hairy coldenia (*Tiquilia hispidissima*). Waterways, springs, basin bottoms, and dirt tanks may contain mixtures of wetland species including American bulrush (*Scirpus americanus*), common reed (*Phragmites australis*), broadleaf cattail (*Typha latifolia*), and salt cedar (Muldavin *et al*. 2000).

As wildfires occur across WSMRs landscapes, PWE has been conducting a series of vegetation monitoring studies to determine how vegetation responds to wildfires. Currently, WSMR has a total of 20 100-400 meter transects covering vegetation response from 7 wildfires that burned starting in 2011 to 2015. Data gathering is still occurring on these transects. Summaries and database information is available from PWE, Building 162, WSMR main post.

2.8 Wildlife Resources of WSMR

The borderland region of New Mexico and Texas is a center of biodiversity in temperate North America for birds, mammals, and herpetofauna (Parmenter *et al*. 1995, Parmenter and Van Devender 1995). The diversity of terrestrial vertebrates on WSMR is high, but few warm-blooded vertebrates are centered in or limited in their distribution to the Chihuahuan Desert (Brown 1994). Many vertebrates found on WSMR are those generally found in the Intermountain West or in the Great Plains (Parmenter *et al*. 1995, Parmenter and Van Devender 1995).

Invertebrates, enormously variable in shape, size, abundance, and environmental adaptations, make up 95% of all animals in the world (Barnes 1987). However, there has been only a few surveys conducted for invertebrates on WSMR. It is likely that species new to science will be found at WSMR. The total number of invertebrate species living on WSMR is expected to be in the thousands. Species listed in the WSMR INCRMP account for perhaps a quarter of that estimate.

Native fish fauna consists of a single, endemic species, the White Sands pupfish (*Cyprinodon tularosa*). The species is restricted to the Tularosa Basin, where found in Malpais Spring and the Lost River in Otero County, Salt Creek in Sierra County, and in Mound Springs in Lincoln County; these are the key habitat areas for the species (Figure 2.2) (Propst 1990).

WSMR contains habitat that supports diverse herpetofauna; 7 species of amphibians (6 toad species-3 spadefoot toads and 3 true toads, 1 salamander species), and 47 species of reptiles, representing 3 orders and 12 families, (1 turtle species, 27 snake species, and 19 lizard species) (Burkett 2000, 2008).

Avifaunal diversity on WSMR is high; of approximately 500 species of birds known to occur in New Mexico, about 60% are documented on WSMR. This percentage includes 290 species representing 17 orders and 55 families. Over half are residents during summer, winter, or year-round. There are 99 transient species (including migrants). Three exotic, invasive bird species are common on WSMR; the rock pigeon (*Columba livia*), house sparrow (*Passer domesticus*), and European starling (*Sturnus vulgaris*) (WSMR 2015).

A total of 73 species of mammals have been recorded on WSMR (WSMR 2009). Three species are extirpated from the entire region; gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos*), and black-footed ferret (*Mustela nigripes*), and one is extirpated from WSMR, black-tailed prairie dog (*Cynomys ludovicianus*) but persists in adjacent areas. In addition, WSMR (2007) contains six non-native mammalian species; house mouse (*Mus musculus*), Norway or brown rat (*Rattus norvegicus*), feral cat (*Felis catus*), feral horse (*Equus caballus*) (one stallion alive on WSMR as of 2018), Barbary sheep or aoudad (*Ammotragus lervia*), and oryx or gemsbok (*Oryx gazella*).

A few of the most recognizable mammal species found on WSMR are common and include gray fox (*Urocyon cinereoargenteus*), coyote *(Canis latrans),* black bear (*Ursus americanus*), mountain lion (*Puma concolor*), elk (*Cervus elaphus*), mule deer *(Odocoileus hemionus)*, pronghorn *(Antilocapra americana),* desert bighorn sheep *(Ovis canadensis nelsoni),* kit fox *(Vulpes macrotis),* American badger *(Taxidea taxus*), bobcat *(Lynx rufus),* jackrabbit *(Lepus californicus)* and the American cottontail *(Sylvilagus audubonii).*

2.9 Threatened, Endangered and Sensitive Plant and Animal Species of WSMR

One plant species, Todsen's Pennyroyal (*Hedeoma todsenii)* is found on WSMR and is federally listed by the US Fish and Wildlife Service (USFWS) as endangered under the Endangered Species Act (ESA) (WSMR 2009). Todsen's pennyroyal habitat is located adjacent to the western boundary of WSMR just east of the Western Call-up Area in the Gyp Hills, Hardscrabble Mountains and the San Andres Mountains (Figure 2.2).

The Northern aplomado falcon *(Falco femoralis septentrionalis)* is listed as Endangered but has been designated by the USFWS as a Nonessential Experimental Population within the states of New Mexico and Arizona (WSMR 2009). The Northern aplomado falcon occurs occasionally as a transient visitor on the Jornada grasslands and the central grasslands east of the San Andres Mountains of WSMR. Two federally endangered species, the Southwestern willow flycatcher *(Empidonix traillii extimus)* and the least tern *(Sterna antillarum athalassos)* have been rarely sighted on WSMR. Both species inhabit riparian areas, are transient within the area and are not known to nest on WSMR (WSMR 2015). One federally threatened species, the yellow-billed cuckoo *(Coccyzus americanus)* is also a rare, transient visitor, inhabits riparian areas and is not known to nest on WSMR.

The White Sands pupfish is a state-listed Threatened species, and Army listed as a Species at Risk (SAR) and is endemic to the Tularosa Basin (Figure 2.2).

Appendix G provides information on the effects that wildland fires may have on the threatened, endangered or rare plant and animal species of WSMR. This information is valuable to those proposing prescribed fires or fuels treatments because it indicates specific areas or periods of the year to avoid in order to minimize impacts to these species.

3 Wildland Fire Factors and Wildfire History of WSMR

Wildland fires are shaped by the interactions of natural or human-induced combustion, terrain, climate and fuel. ***Fuel*** for wildland fires can be natural vegetation or combustible man-made materials. Chapter 3 explains how the interactions of wildland fire factors of fuel, topography and climate affect fire frequency and fire behavior and, correspondingly, how wildfires may affect the human environment. An understanding of these interactions coupled with a knowledge of historic and current ecosystem components and wildfire history (Figure 3.1) can help wildland fire managers make decisions as to where, when and how wildfires are suppressed or managed on lands administered by WSMR. This management approach, called '***Adaptive Fire Management'*** consists of suppressing wildfires where necessary to protect human life and structures and allowing other wildland fires to burn in the fire-adapted ecosystems found throughout WSMR.

3.1 WSMR Fire Regimes and Basic Fuel Types

WSMR natural resource managers use information from wildfire history records, including the frequency and severity of wildfires in a given area along with historic vegetative community composition as a baseline for comparison with current vegetation and fuel loads. This information is used to develop a ***reference condition*** or a desired ecological state. The analysis of historic and current conditions provides the basis for making informed land management decisions for protecting testing and training lands and implementing beneficial ecosystem projects.

Wildland fires may burn across many of the landscapes of WSMR. However, wildfires will differ widely in terms of frequency, size and spread pattern, fire intensity, and burn severity. Over time, we can measure fire return intervals *(**FRI**),* and see similarities in fire patterns among ecosystems and regions (Table 3.1). These patterns are what constitute ***fire regimes***. A fire regime characterizes the historical features of wildland fires that have been typical for a particular ecosystem (Kennard, 2008). Hardy et al. (2000) mapped fire regimes of the Western United States using fire severity and fire frequency and combined them into five fire regime classes (Table 3.1). The five natural (historical) fire regimes are classified based on average number of years between fires *(**fire frequency**)* combined with the amount of replacement *(**fire severity**)* of the fire on the dominant overstory vegetation. The five standard fire regimes were developed primarily for forests, shrublands and prairie grasslands where natural vegetative succession is easily measured and wildfires burn in ways that are predictable in terms of severity and frequency.

On WSMR, wildfire frequency, wildfire severity and fuel loads are highly variable and do not fit neatly into the standard fire regime groups. Most wildfires on WSMR are spread by flammable grass fuels inter-mixed with desert and woodland shrubs which tend to inhibit wildfire growth. This is true on the grassland areas of the Jornada Basin (Stallion Range) where shrubs are intermixed but not dominant allowing for a frequent fire regime that helps maintain the grasslands. It is also true in the grasslands of the Tularosa Basin where there are many areas of shrubs intermixed with grasses and in the mountains of WSMR where piñon and juniper intergrade with grasses. Fire history records show that some areas of Stallion Range have burned 3-4 times in the last thirty years while other areas of these grasslands have not burned at all. Woodland communities, found in the San Augustin, Organ, Oscura and San Andres Mountains also exhibit highly variable fire frequencies, fuel continuities and fire severities and thus exhibit widely variable fire regimes. Much of the Organ Mountains have burned one-three times in the past 34 years after not having burned significantly in the previous 75 years. Today, much of the Organ Mountains are experiencing early successional stages of vegetative growth after having much of the timber and shrub overstory removed by wildfires in the 1990s and by the Abrams Fire in 2011. In contrast, the northern Oscura Mountains have not experienced a large wildfire in several decades.

Table 3.1 Five Historic Natural Fire Regime Groups

Fire Regime Group	Frequency (Fire Return Interval)	Severity
I	0-35 years	low severity
II	0-35 years	stand replacement severity
III	35-100+ years	mixed severity
IV	35-100+ years	stand replacement severity
V	>200 years	stand replacement severity

This writer took a look at Muldavin's 34 plant community alliances (Figure 2.5) and found similarities that can be condensed and generalized for purposes of firefighting. These 34 plant community alliances can be grouped into four basic fuel types: desert, grassland, shrubland and woodland (Figure 3.1). All of these types intergrade with each other and there exist many small occlusions of other fuel types within each major type. The important point here is: deserts do not contain the arrangement or continuity of flammable fuels to allow for large wildfire growth. The other three fuel types will carry fire during certain times of the year and given the right combinations of wind, temperature and humidity will lead to large wildfire growth. Characteristics of fire regimes within each of these fuel types are presented in the following paragraphs..

Desert-(Fire Regime Group III) About 60% (1,275,430 acres) of WSMR is desert and does not commonly support large wildfire spread (>500 acres) due to the lack of continuous fuels. There are occlusions of grasslands scattered throughout the deserts of WSMR, particularly in basin and swale bottoms and along ephemeral watercourses. These areas may support wildfire growth over a period of several hours, but will die out at night or when the grass pocket runs out of fuel. Desert areas include mesquite coppice dunes, mesquite shrublands, salt playas, pickleweed scrublands, gypsum dunes, four-wing saltbush scrublands and creosote-dominated piedmonts and basins. The contemporary period (after 1900) had a mean FRI for Chihuahuan desert ecosystems of 50 years (Poulos *et al.* 2013). Fire frequency before this period is unknown and was likely highly variable. Periods of extended drought, grazing practices and climate change has contributed to lengthening of the FRI. The mean FRI for the Chihuahuan Desert now stands at 60-80 years (LANDFIRE 1.1.0 2010).

Grasslands-(Fire Regime Group II) About 27% (569,989 acres) of WSMR is covered by grasslands. On WSMR, grasslands nearly always have a shrub component intermixed, ranging from yucca, mesquite, sand sage, littleleaf sumac *(Rhus microphylla),* and creosote in basins to mahogany, apache plume, sacahuista *(Nolina microcarpa),* agave, and ocotillo on lower hills to sotol, piñon, oak, ceanothus and juniper in varying densities on mountainsides. The majority of wildfires on WSMR occur within grass dominated ecotypes. Grasslands recover quickly after being burned and some areas are capable of burning again within three-five years depending upon annual precipitation. Frequent wildfire plays a significant role in nutrient recycling and favors grassland propagation by reducing or eliminating less fire-tolerant shrub species (McPherson, 1995). Research suggests that the mean FRI for Southwestern grasslands throughout the seventeenth to early nineteenth centuries was five to 10 years (Swetnam *et al.* 1996). Recent fire history indicates that the grasslands of WSMR have an FRI of 10-35 years. This increase in FRI is due, in part, to increased desertification from past grazing practices and changes in precipitation patterns which has led to an increase in the numbers and kinds of shrubs, cacti and bare ground within grasslands.

Shrublands-(Fire regime Group III) About 12% (246,283 acres) of WSMR is shrublands, with scattered piñon-juniper, oak *(Quercus spp.)*, mountain mahogany, sumac *(Rhus spp.)*, and buckbrush *(Ceanothus spp.)* on north-facing slopes, intergrading with shrubs of apache plume, sotol, sacahuista, catclaw, ocotillo, mariola, agave, cacti and oak on south-facing slopes and ridgetops. Shrubs typically burn with high intensity, but due to scattered arrangement and high variability of grass continuity, such as are found across the hills and mountains of WSMR, these shrublands are highly variable in their contributions to wildfire spread. Grasses must be contiguous with shrubs in order to create flammability and the opportunity for large wildfire growth.

Woodlands- (Fire Regime Group III and IV) (54,562 acres) This fuel type makes up about 3% of WSMR, is found in the Organ, San Andres and Oscura Mountain chains and is dominated by piñon pine and two juniper species, alligator juniper *(Juniperus deppeanna)* and one-seed juniper *(Juniperus monosperma)*. The extent of historic piñon-juniper savannas has decreased while piñon-juniper woodlands have increased. This is due to the disruption of frequent, low severity fire regimes at these sites which has resulted in widespread tree regeneration (Poulos, *et al.* 2013). In general, the higher the density of piñon and juniper the less likely the fuel type is to carry wildfire. Based on historic fire and prescribed fire records, about 50% of this fuel type on WSMR (including acreage within SANWR) has burned in varying severities at least once in the past 50 years. This is mostly due to an increase in military-caused wildfires which in combination with the use of prescribed fires and mechanical fuels treatments have served the purpose of maintaining much of this fuel type in open, savanna-like conditions.

Woodlands of WSMR also include mixed stands of Ponderosa pine *(Pinus ponderosa),* Gambel oak *(Quercus gambelii)* and piñon pine and are found within the highest elevations of the San Andres Mountains (>8,000') on Salinas Peak and Silvertop Mountain. Much of the woodland area on Salinas Peak and Silvertop Mountain has burned with a mixture of severities within the last 100 years (Muldavin et al. 2003). An analysis of tree ring fire scars on Ponderosa pine on Salinas Peak and on Silvertop Mountain showed that prior to 1900, the FRI was 20-30 years. The last major wildfire recorded by tree-ring analysis was in 1910, but there have been a number of small wildfires in this fuel type since then (Muldavin et al. 2003).

The woodland fuel type is also found within an unusual relict piñon pine stand of mixed age, intermixed with One-seed juniper *(Juniperus monosperma)* and oak spp. on the east facing slopes of the northern end of the

Oscura Mountains. Analysis of fire history by Muldavin et al. (2003) for the persistent piñon pine-juniper woodland of the Oscura Mountains revealed patches of varying ages with some fire scarring. Limited fire-scar data suggests a FRI of 30-100 years or more. Muldavin used historical photo analysis and concluded that about 12% of the Oscura piñon-dominated woodland had burned in fires in the last century. The same analysis in the woodlands of the northern San Andres Mountains indicated that 17% to 49% of the woodlands there had burned in the previous century (Muldavin et al. 2003). The persistent piñon pine woodland of the North Oscura Mountains is unique in that it is a rare example of a relatively undisturbed, closed canopy woodland. Some of the old-growth piñon trees have died recently and many more are showing indications of dying, possibly due to old age. Whether recent mortality will lead this closed canopy woodland to become more open or more fire-prone is unknown as there are sufficient ladder fuels underneath the canopy to either potentially fill in the open spaces over time or provide a ladder for fire to move into the overstory and create a large wildfire.

The nature of this persistent woodland is that wildfire has not played a significant role as an agent of disturbance here in the last hundred years or so. We know that lightning provides a ready ignition source and that many trees in this woodland have been lightning-struck. Yet there is little evidence of persistent fire scarring throughout this relict woodland. This is partly due to the fact that little sunlight penetrates the dense canopy inhibiting ladder fuel and understory growth and partly due to the nature of piñon and one-seed juniper which regularly shed their small, compact needles, contributing to a surface layer of organic material rich in compact, uniform, decomposing needles which readily absorb moisture but inhibit air circulation. This organic surface layer inhibits wildfires from burning beyond the smoldering stage due to its moisture content and its uniform surface properties. The east-facing aspect of the Oscuras means that these stands are somewhat protected from pre-dominant southwest winds and since wildfires do not spread well downhill, may further help to inhibit wildfire spread. In order for this fuel type to experience some sort of major fire impact, it requires a combination of alignment of wind, low live and dead fuel moistures, low relative humidity, high ambient air temperature and a strong ignition source. If a large wildfire were to occur in the north end of the Oscura Mountains, it is unlikely that the entire stand would burn, as crown fires in this fuel type become head-driven, plume-dominated fires that tend to not spread well laterally. Fires in this fuel type generally burn in a conical shape, terminating crown fire spread at the apex of the mountain or where fuels become discontinuous.

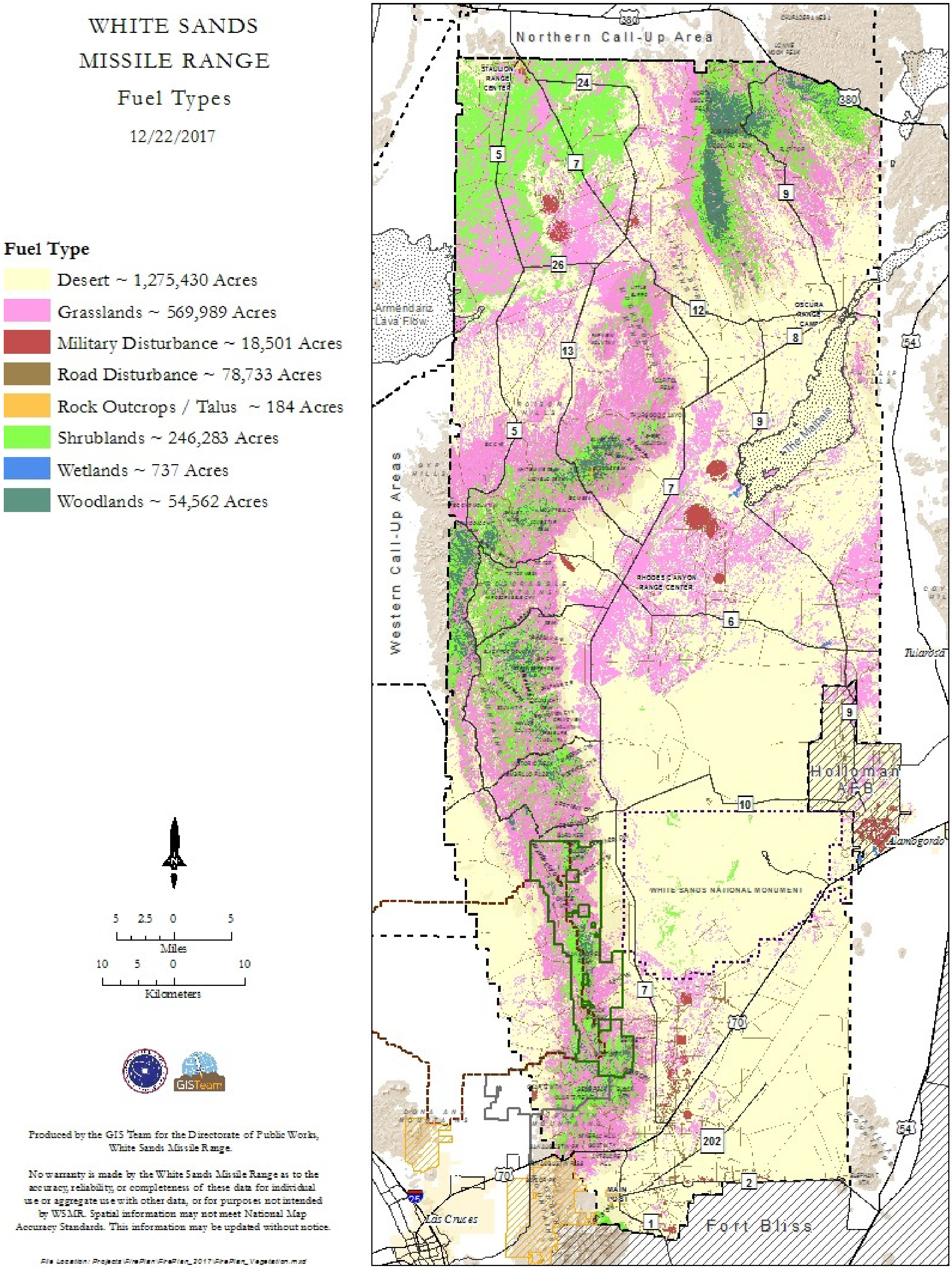

Figure 3.1 WSMR Major Fuel Types

3.2 WSMR Wildfire History

Wildfire history is used by wildland fire managers as a tool to help direct management focus towards locations where prescribed fires, mechanical fuel reduction treatments, fire use and firebreaks are most needed and cost-justified (Figure 3.2).

From 1959 to 2017, 422 wildfires have been recorded in the Natural Resources Wildfire database on WSMR and approximately 434,000 acres have burned, though records are incomplete for this period. Large wildfire events (>500 acres) occur on WSMR every few years. The highest concentration of large wildfires recorded for WSMR burned during the drought years of 1993 and 1994. Most large wildfires are military mission-caused or lightning-caused. Most wildfires on WSMR occur between March and September with the largest wildfires usually burning prior to the onset of the monsoon season from April to mid-July. Fire season in southern New Mexico is traditionally considered to be from March to mid-July but wildfires can occur any time of the year on WSMR.

Wildfire history has only been systematically documented and recorded on WSMR for about 35 years. Figure 3.2 depicts large wildfires that have been digitized since the mid-1980s as well as a WSMR fire frequency map that shows where wildfires have been concentrated. It illustrates the fact that Stallion Range and Red Rio Range have the highest frequency of wildfires, mainly because this is where live-fire military training and testing activities occur year round. Some areas within grassland fuel types on WSMR have burned 1-5 times in the last 35 years.

Most fire ecologists agree that prior to 1850, frequent wildfires within the Chihuahuan Desert grasslands and associated sky island mountain ranges limited the accumulation of woody vegetative biomass and favored the perpetuation of grassland vegetation (Swetnam et al, 1996). The indigenous Apache people purposely burned woodland areas of the Organ and San Andres Mountains to maintain open areas for ease of hunting and to attract game to the fresh new growth of forbs and grasses that grew prolifically after fire (Morino et al. 1996). Woodlands were characterized by savannas of scattered mature piñon, ponderosa and juniper trees surrounded by dense grasses. The historic FRI, prior to 1850, was measured from tree-ring studies and found to be an astonishing 2.4 years in the Organ Mountains (Morino, et al. 1996). Under these conditions the majority of fuels consisted of dried grasses so that heat generated by burning was not enough to adversely affect soils or the roots of grasses. These fires only killed the seedlings of woody plants and allowed for the quick recovery of grasses. Fires did not contribute to soil erosion and served to maintain the dominant vegetation of grasses and widely spaced trees. This high frequency, low burn severity fire regime was maintained throughout the forests and woodlands of the Southwest until European settlers arrived with their grazing animals in the mid-nineteenth century, and subsequently, displaced the native Americans (Morino 1996) (Swetnam 1990) (Pyne 1982).

Although European influence in the area began prior to 1600, it wasn't until the advent of the railroad in the mid-nineteenth century that large-scale changes began to occur on Southwestern landscapes. With the ability to drive livestock to nearby railheads, grazing pressure on rangelands in New Mexico increased dramatically in the late nineteenth century (Drewa and Havstad 2001). Wildfires that occurred were suppressed to save grass for grazers. The combination of grazing and fire suppression ultimately led to a decrease in grass biomass and a corresponding increase in woody vegetation within formerly grass dominated sites. Long intervals between wildfires coupled with grazing animals' preference for mesquite beans allowed for the establishment and spread of honey mesquite *(Prosopis glandulosa)* to previously unknown levels across vast areas of the Chihuahuan Desert (Drewa and Havstad 2001). Shrubs completely replaced grasses in drier lowland areas while higher elevations were occupied by increasingly dense mixtures of trees and shrubs. Today, when wildfires occur at these higher altitude sites, they tend to be stand-replacing fires which burn the litter, surface and crowns of mature trees and shrubs. When wildfires burn at high intensities, roots and soil organic material are consumed which leads to wide-spread soil erosion. High-intensity wildfires destroy several age classes of trees and shrubs and require decades to recover, particularly within the arid ecosystems of the Southwest (Swetnam *et al*. 1996).

Fire history studies conducted in several fuel types in southeast Arizona, which are similar to fuel types found on WSMR, found that widespread fires were significantly associated with the prior occurrence of two consecutive years of wetter-than-average conditions (Baisan and Swetnam 1990). They interpreted these findings as indicating the importance of precipitation for producing fine fuels, *e.g.,* grass, which facilitates the occurrence of widespread fires. In the Chihuahuan Desert, summer precipitation in particular, plays an important role in fuel accumulation. Warm-season grass species found in the northern Chihuahuan Desert respond strongly to monsoonal precipitation, *i.e.* July to September, when up to 90% of their growth occurs (McClaran 1995). A study of tree ring growth and wildfire history in the San Andres Mountains by Muldavin (2003) showed a cyclical pattern of wet years followed by years of drought. Most of the wildfire scars measured by Muldavin from ponderosa pines on Silvertop Mountain and on Salinas Peak were correlated to the earlier years of the onset of drought conditions.

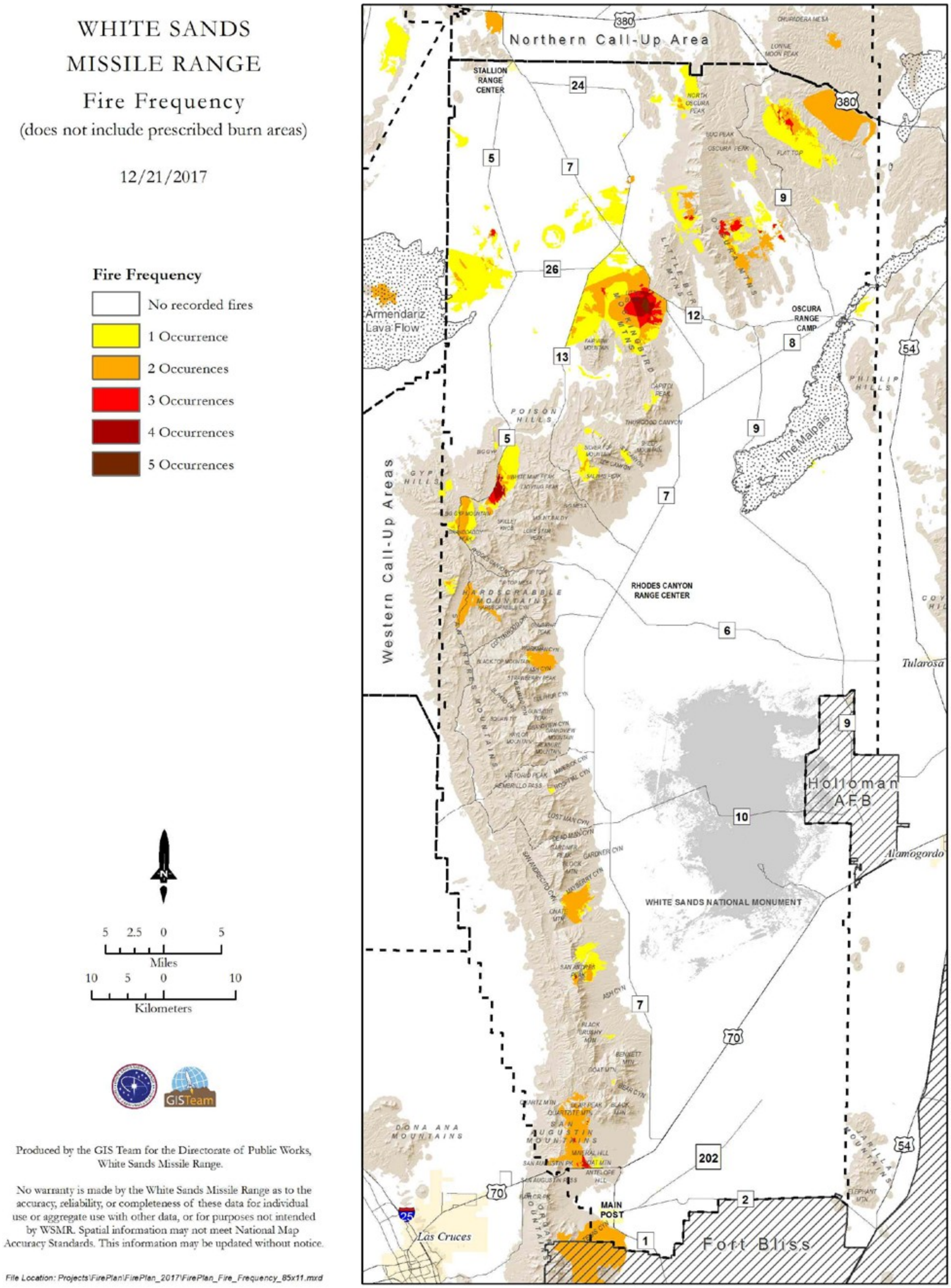

Figure 3.2 Large Wildfire Frequency and Occurrence on WSMR 1984-2017

3.3 WSMR Fuel Considerations

In the NWCG Glossary of Wildland Fire, ***fuel*** is defined as any combustible material, especially petroleum-based products and wildland fuels. Fuel is one leg of the fire triangle at which fuel, heat and oxygen combine to create fire. Remove any one of the three legs of the fire triangle and fires cannot burn. ***Fire behavior*** is influenced by fuels, topography and weather. Wildland fire managers cannot control the weather or topography in any meaningful way but fuels can be manipulated in several ways. ***Fuels management*** and ***fire prevention*** thus become the means for reducing fire suppression costs and acres burned by implementing mechanical fuels treatments, conducting prescribed fire treatments and by educating property owners and land stewards on the values of reducing flammable fuels within their areas of responsibility.

WSMR's four fuel type descriptions (Section 3.1) portray fuels within geographical areas where wildfires can and cannot generally spread and thus point to focal areas for wildland fire management activities. WSMR's four basic fuel types are a mixture of many species of vegetation that burn in a characteristic manner. Many areas within each basic fuel type have inclusions of other fuel types. For example, mesquite coppice dunes, four-wing saltbush-dominated alluvial fans and creosotebush bajadas inhabit much of the desert ecosystems of WSMR and surround flammable pockets of grasses. However, there is little potential for wildfire spread outside the areas of grass within these desert shrub fuel types.

Vegetation in the Chihuahuan Desert Eco-region is fire-adapted and usually recovers quickly following wildfires under normal rainfall patterns. There is a strong association between annual precipitation and the annual level of perennial and annual plant growth but, because rainfall is highly variable from year to year, so also is wildfire frequency and intensity. In years with higher than average annual precipitation, fuel loads can convert a fuel type that is not normally flammable to one that is highly flammable and therefore subject to wildfire spread. This is partly due to prolific annual grasses and forbs that grow in the summer when there is sufficient rainfall. Annuals are better adapted for growing amongst shrubs. In fact, many annuals are protected by shrubs and have much more biomass underneath shrubs than out in the open. These light, flammable fuels are one of the primary carriers for wildfire spread until later in the spring, when the relentless spring winds have the effect of breaking off and removing these cured fuels, effectively lessening the potential spread of wildfires as the year progresses. Cured perennial grasses are the other primary carrier of wildfires on WSMR. Native warm-season perennial grasses are fire-receptive from November until July when they finally green-up and grow with the onset of the monsoon season. Perennial grasses can carry fire any time of year once they are cured and the weather is dry.

The grasslands of the Jornada del Muerto, foothill and piedmont grasslands and piñon-juniper savanna grasslands have the highest concentrations of large wildfires (>500 acres) on the installation. The Mountain Ranges of WSMR have the second highest concentration of wildfires and are more complex in terms of fire management due to the greater topographic relief and the higher variety of flammable fuels. Still, grass fuels are the primary carrier for wildfire spread anywhere on WSMR. Shrubs like sumac, sotol, buck brush and mountain mahogany such as are found on the rocky south-facing slopes of the mountains, and woodland fuels including oaks, piñon and juniper found on ridgetops and north-facing mountain slopes will not sustain wildfire spread on WSMR without a grass component underneath. Grasses grow well at all elevations of WSMR including at lower elevations within basins, arroyos and around playas.

3.4 **Live and Dead Fuel Classifications for Predicting Wildland Fire Behavior**

Live and dead fuel moistures are important calculations for designing prescriptions for prescribed fires, for making determinations about whether to allow a wildfire to burn and for determining fire danger rating (FDR) levels. See https://gacc.nifc.gov/swcc/predictive/fuels_fire-danger/fuels_fire-danger.htm for more information and for interpreting fire danger values from Remote Area Weather Stations (RAWS) or from area dispatch centers. Local RAWS are located at Dripping Springs, Chupadera Mesa and on the San Andres National Wildlife Refuge and are 'owned' by the BLM and by the USFWS (Figure 4.2, pg.58). ***Live fuel moisture*** is measured from live shrubs and trees and are at their highest values when plants are actively growing and are at their lowest during winter dormancy. ***Dead fuel moistures*** respond solely to ambient environmental conditions and are critical in determining fire potential. Dead fuel moistures are classed by ***timelag***. A fuel's timelag is proportional to its diameter and is loosely defined as the time it takes a fuel particle to reach 2/3's of its way to equilibrium with its local environment. Dead fuels fall into four timelag classes:

- 1-hour timelag fuels, less than 1/4" diameter. One-hour timelag fuels are fine flashy fuels (particularly cured grasses, dried pine needles on the forest floor and dried weeds/forbs) that respond quickly to weather changes. Computed from observation time temperature, humidity, and cloudiness.
- 10-hour timelag fuels, 1/4 to 1" diameter. Computed from observation time temperature, humidity, and cloudiness. Can be an observed value, from a standard set of "10-Hr Fuel Sticks" that are weighed as part of a fire weather observation.
- 100-hour timelag fuels, 1 to 3" diameter. Computed from 24-hour average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges (usually composed of the dead, larger branches of shrubs or small trees).
- 1000-hour timelag fuels, 3 to 8 " diameter. Computed from a 7-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges (composed of large, dead tree branches or trunks of smaller dead trees).

One way to describe and to model fire behavior is by the use of a common set of fire behavior fuel models. Scott and Burgan (2005) developed forty flammable fuel models designed to cover the entire country. These fuel models are important to understand as they are what drives fire behavior predictions and parameters for the BEHAVE program, which is one of the necessary components of an interagency prescribed fire plan and can also be used to predict and calculate large wildfire growth. WSMR is roughly covered by five of Burgan's fuel models which are:

- GR1 (Grasslands): Short, sparse (patchy), dry climate grass with average depth <1 ft. Flame length 1–4 ft. This model includes most grasslands and herbaceous understory fuels on WSMR. However, grass cover on WSMR is generally less contiguous than assumed by this fuel model, and hence actual fire intensity and spread will be lower than predicted by the model. Fuel loading in grasslands is determined largely by variations in annual precipitation on WSMR. Many years, fuel loads are too low to carry and spread a wildfire if ignition occurs. Gramas, dropseeds, muhlys and sacaton grasslands dominate this fuel model on WSMR, and open pinyon-juniper woodlands or savannas are considered GR1.

- GS1 (Grass-Shrub mixed): Low grass load, dry climate grass-shrub mix. Shrubs <50% cover and approximately 1 ft. in height. Grass < 1 ft. in depth. Flame length typically 1–4 ft. In the San Andres Mountains, south-facing slopes are represented by this fuel model. Sandsage shrublands and very limited areas of grama grasslands comprise this fuel model on WSMR.

- SH1 (Low desert Shrublands): Light load, dry climate shrubland. Shrubs >50% cover with a shrub height of approximately 1 ft. with low grass load. Flame length 1–4 ft. Most shrublands on WSMR poorly fit standard fuel model definitions. Cover of shrubs is generally <50% (Hoenes and Bender 2012) but shrublands also lack the herbaceous understory assumed present in GR1/GS1 fuel models, thus limiting the likelihood of fire and resulting in overestimation of fire intensity.

- SH2 (Large Shrub and Grass intermix): Moderate load, dry climate shrub. Shrubs >50% in cover and about 3 ft. tall or shorter with moderate grass load. Flame length 4–8 ft. Most shrublands on WSMR span the definitions for SH1 and SH2. Cover of shrubs is generally less than 50% but height of shrubs is generally >1 ft. and often 3+ ft. (Hoenes and Bender 2012). This model includes denser oak-mountain mahogany, other shrublands, and pinyon-juniper shrublands on WSMR. These stands typically have canopy cover >20% and heights >3 ft. (Hoenes and Bender 2012). For juniper woodlands, growth form is a shrub rather than a tree (i.e., multi-stemmed basal branching).

- TU1 (Timber with Understory): Light load, dry climate, and timber-grass-shrub. Fuel is primarily trees and/or shrubs and litter. Flame length 1–4 ft. This type includes ponderosa pine woodlands and tree-form pinyon-juniper woodlands. However, herbaceous understory is limited in the latter, often containing a significant juniper understory that may act as a ladder fuel. These stands are primarily located in the Oscura Mountains but also occur in the San Andres and Organ Mountains.

As noted previously, WSMR fuels do not fit neatly into standard model descriptions. Rarely will the predictions for fire behavior match what actually occurs on the ground. Within fuel models found on WSMR, the BEHAVE fire modeling program, almost always over-predicts rates of fire spread, flame lengths and scorch heights on vegetation, so on-the-ground results are almost always less severe than predicted.

3.5 **WSMR Climate and Weather Effects on Wildland Fires**

WSMR is located in the northern Chihuahuan Desert eco-region, an area where naturally occurring wildfires are an integral part of the environment. Chihuahuan desert grasslands and sky islands historically burned under a low-intensity surface fire regime where the fire frequency is correlated to climate (Swetnam *et al.* 1996). Natural resource managers desiring to use prescribed fire as a treatment to reduce fuel loads or to improve wildlife habitat must consider climate and weather variables when developing their prescriptions for a prescribed fire.

Prescribed fires are relatively easy to ignite and control in the fall and winter because fuels are dry, relative humidity is moderate and winds are usually light. However, vegetation may not respond favorably after being burned if there is a lack of moisture following the burn or if it burns hot enough to alter soil conditions. Managers need to factor long-term drought indices and weather forecasts into their planning and try not to burn during extreme drought conditions. Burning closer to the onset of the monsoon season can induce higher mortality in targeted vegetative species and favors regrowth of desirable grass and shrub species. However, this is the season when winds are strongest and most variable, relative humidity is lowest and temperatures are highest making control problems more likely for prescribed burners.

The significant amount of variability across WSMR in terms of topography, aspect, and elevation results in substantial variations in local microclimates that can significantly affect fuels, weather, and wildfire behavior. Climate ranges from extremely arid in the Tularosa and Jornada Basins to semi-arid in the San Andres and Oscura Mountains. Because of the mountainous terrain and the much lower Tularosa and Jornada Basins, there are significant diurnal and regional fluctuations in humidity. Typical of desert climates, rapid cooling from nighttime re-radiation causes increases in relative humidity. Average daily relative humidity increases to about 40 percent at midnight and to 51 percent by 6:00 a.m. At least partial sunshine is present >85% of the time contributing to strong solar heating of air, soils and fuels (WSMR 2009).

WSMR climate is characterized by moist summers and dry fall, winter, and spring seasons. This pattern can lead to large amounts of cured annual and perennial vegetation from fall through winter and spring until early summer. In dry years this makes for a long fire season potentially beginning in November and continuing until July. In the Chihuahuan desert, perennial grasses are adapted to the summer heat and low moisture regime and will remain dormant until adequate moisture arrives. After that happens, perennial grasses grow quickly and produce about 75% of their total annual foliage in about 60 days (Dick-Peddie 1993) and about 90% of their total growth in about 90 days (McClaren 1995). These perennial grasses retain a high amount of live fuel moisture, even in the absence of additional rainfall, until the arrival of the first frost, typically in November. After that, their energy reserves are fully stored within their root systems while the above-ground biomass cures and is readily available to be consumed by fire.

High amounts of fine fuels from cured grasses are necessary to transport wildfires in WSMR's desert and mountain ecosystems. Consequently, the frequency, duration and size of wildfires are determined largely by precipitation during the preceding summer months. Further, high precipitation in the summer is usually followed by greater numbers of wildfires than normal during the following spring and early summer. Conversely, low precipitation in the monsoon season means fewer wildfires than normal during the following spring and summer months.

Weather patterns have a large influence on how wildfires behave on WSMR. The nature of fine dead fuel moisture in grasses (1-hr. timelag fuels) is that cured grasses respond quickly to even minor changes in relative humidity and air temperature. What this means for fire suppression efforts is that a wildfire may burn readily during daylight hours and be difficult to contain but with nightfall and a corresponding increase in humidity with falling temperatures, that same wildfire will rapidly diminish in intensity and allow for direct suppression efforts to be successful.

The effect of wind on wildfire behavior makes it the most volatile weather variable for firefighters to deal with. Winds that are variable in speed and direction, in combination with wildfires burning in grass fuels are especially dangerous for firefighters. **More wildland firefighter deaths are attributed to engaging wildfires in light, flashy fuels than in any other fuel type.** Minor increases in wind speed make vast differences in overall fire size, particularly in grass fuels. Winds associated with thunderstorms and frontal passages can increase wind speeds rapidly and change directions frequently. These sudden changes can make a relatively benign grass fire with fire front flame lengths of 1' to 2' at the head grow into a fast-moving wildfire spreading in multiple directions with flame lengths suddenly ranging from 8' to 20'.

Fire weather forecasters issue ***red flag watches*** and warnings during periods of critical dryness and high speed wind events to inform the public of the high potential for large, wind-driven wildfires and to caution users within the wildlands to be extra cautious with fire. ***Red flag warnings*** can occur anytime during the fire season but are most frequent in the months of April-June.

3.5.1 Predicted Effects of Climate Change and Long-Term Drought

Long-term drought and climate change are issues for the entire Southwest and may lead to an overall decrease in plant abundance and biomass. WSMR precipitation records show that since 1990 more years have been below average than above average in annual rainfall totals. However, from 1970-1990 there were more years of above average annual rainfall than there were below average. These trends follow a pattern of cyclical drought that is prevalent in the current state of the climate for this region.

Many scientists and climatologists today agree that the overall climate for this area is changing due to an increase in global temperatures caused by increasing amounts of greenhouse gases in the atmosphere (Bachelet et al, 2001). A majority of climate scientists predict that the southwestern US will experience increased drought and higher ambient air temperatures for the next several decades. A majority of climatologists also predict increasingly severe thunderstorms have potential to lead to more episodic monsoonal flooding throughout the American Southwest. Climate scientists expect that these changes may eventually lead to increased desertification for this area throughout this century (Nemani, et al, 2003). For wildfire management, the implications are that wildfires have the potential to increase in severity and size in areas where wildfires can be sustained due to sufficient biomass.

3.6 WSMR Terrain Influences on Wildland Fires

Higher elevations of WSMR see a higher occurrence of wildfires than lower deserts and basins. This is because higher precipitation, lower temperatures and lower evaporation rates at higher elevations lead to greater amounts of vegetative biomass. The Organ, San Augustin, San Andres and Oscura Mountains and their associated foothills are mostly at elevations above 5,000'. This is an elevation gradient where larger, more complex wildfires begin to occur.

Topographical effects on wildfire growth are not as pronounced as weather effects, but can still make a significant difference in how fast wildfires spread. The physical effects of radiation and convection mean that heat is transferred ahead and upwards of a flaming fire front. This effect of preheating and drying upon upslope fuels means that wildfires on slopes burn uphill 2-3 times faster than they do on flat ground. Canyon bottoms, narrow chutes and saddles, all found in the rugged country of WSMR's mountains and foothills have a funneling effect upon winds causing them to swirl and are places where wildfire spread can increase and create intense wildfire behavior.

The mountains of WSMR create barriers for wind and moisture. The effects of orographic lifting over the mountains create higher wind speeds across mountaintops and aid in the formation of thunder clouds which tend to form over the mountains and then drift over the basins and valleys below. Frequent lightning occurs from these thunder cells during the monsoon season and aid in starting wildfires. Lightning fires can spread quickly under the influence of thunderstorms, but will usually begin to die out with the passage of these storms. Coupled with an increase in nighttime humidity levels, falling wind speeds and the discontinuous nature of fuels due to rocky and steep terrain, wildfires in the mountains generally die down through the night. However, wildfires often rekindle the next day as temperatures and winds increase.

Aspect is an important factor for wildfire spread and intensity within the Chihuahuan Desert eco-region. South and southwest facing slopes have considerably less vegetation than north and east facing slopes. Generally speaking, southern aspects within the foothills and at lower elevations act to slow wildfire spread due to discontinuous fuels while northern aspects have the fuel loads to promote wildfire spread. In deep or steep canyons or in the high country this effect is less pronounced and all aspects support wildfires.

4 Wildland Fire Management

4.1 Adaptive Wildland Fire Management

Wildland fire management is the application of scientific principles and land management activities necessary for the prevention of harmful wildfires, for the sustainment of ecosystems and for the suppression of wildfires. ***Adaptive wildland fire management*** is an iterative process that includes the full array of fire management options in order to meet land management objectives. These options include:

- Direct initial attack to keep wildfires small near valuable human assets and to keep firefighting costs low
- Indirect attack tactics that allow firefighters to contain wildfires within defensible barriers by back burning or blacklining
- Indirect attack tactics of monitoring and waiting for the wildfire to consume fuel and burn up to defensible barriers and then suppressing the wildfire from defensible positions
- Allowing natural fires (lightning fires) to burn (***wildland fire use***) for ecosystem benefits
- Utilizing prescribed fires and mechanical fuels treatments to reduce hazardous fuel loads and to create additional wildlife habitat

By adopting an adaptive, integrated fire management approach on WSMR, land stewards acknowledge that WSMR landscapes are fire-adapted ecosystems and that it is no longer acceptable to mandate a policy of total wildfire suppression. The former approach of 'all fires are bad' has dictated aggressive suppression policies that have led to an unnatural and excessive build-up of flammable fuels in shrublands and forests across the western U.S. On WSMR, this policy has led to the invasion and degradation of grasslands by shrubs and other woody species.

Today, wildland fire managers across the West, recognize that most wildfires benefit fire-adapted ecosystems. Wildfires need to be suppressed if human or cultural resources are threatened or if long-term weather predictions are unfavorable (i.e. long-term drought is ongoing). But when wildfires start in remote locations, fire managers understand that this may be an opportunity to benefit the ecosystem.

WSMR land managers must weigh a number of variables when deciding to let a wildfire burn. Decisions that allow wildfires to burn can affect military missions with smoke impacts or create short-term health alerts due to smoke volume. Ecosystems can be harmed by wildfires if long-term drought is ongoing. Soils can lose their productivity if fires burn hot and deep. Wildland fire managers must be able to articulate, document and defend their decision to allow wildland fires to burn, particularly when many well-intentioned people see wildfire as a destructive force rather than as a necessary component of fire-adapted ecosystems.

The goals for effective wildland fire management on lands managed by WSMR are:

- Firefighter and public safety is always the first and highest priority on every wildland fire response.
- WSMR military and civilian assets, structures, infrastructure, sensitive cultural and natural resources are protected to the extent possible from harmful effects of wildland fires by an annual fire prevention process of reducing nearby fuel loads through mowing, trimming, brush removal and/or tree thinning from October through February (outside the breeding and nesting seasons of migratory birds) .
- PWE is notified whenever wildfire suppression is occurring in the wildlands (outside of right-of-ways,

infrastructure and structures) due to protection concerns for the vast amounts of cultural resources located throughout WSMR and also due to natural resource concerns for rare, threatened and endangered species habitats.

- In the Tularosa Basin, both man-caused and natural wildfires can be managed by firefighters from roads or other defensible positions as long as they are not threatening structures.
- In order to create fire-resilient landscapes, wildfires that are ignited by lightning on WSMR should be considered for fire use and allowed to fulfill their natural role in the ecosystem. The decision for allowing a natural fire to burn, or in some cases, a man-caused wildfire to burn, should be made by consensus between the GC, PWE, Range Operations, Range Safety and WSMR FES, and may include other agency partners if wildfires are burning near boundaries. Considerations for allowing a wildfire to burn will include:
    - Risk analysis of firefighter safety,
    - Cost concerns,
    - Long-term weather forecasts,
    - Current fuel conditions and moistures (live and dead),
    - Long-term drought, and
    - Anticipated and observed fire behavior.

  The analysis and decision to allow a wildfire to burn will be documented and include a written justification summary that is signed by the GC and the decision-makers.

- Prescribed fires can be used to improve the effectiveness of fire breaks and firebreak roads by blacklining alongside roads and by burning accumulations of wildland fuels within designated areas to protect WSMR's valuable human assets, structures and infrastructure.
- Prescribed fires can be used to improve wildlife habitat and improve the resiliency and diversity of ecosystems on WSMR.
- Firefighters will use Minimum Impact Suppression Tactics (MIST) on all wildfires on WSMR (See **Appendix H** for MIST guidelines).

The following defines the current situation and constraints for managing wildland fires on WSMR (Figure 4.1).

4.1.1 Mission Assumptions and Constraints

- Live-fire training and testing missions are a continual source of potential wildfire ignitions that can lead to large wildfire growth. However, military test missions are the priority for the Range and will occur regardless of the wildfire danger rating.
- In an average year, about 50% of WSMR contains sufficient vegetation to allow for the growth of wildfires. These grassland, shrub, woodland, and arroyo/basin fuel types will burn frequently and rapidly when atmospheric and fuel conditions are right, but usually in a patchy, uneven manner. The remaining 50% will not ordinarily burn (mesquite coppice dunes, creosote bajadas, gypsum playas and basins, bedrock and bare ground) and are places where live-fire exercises and testing missions can be conducted year-round even during Red Flag warnings and/or when the fire hazard is rated as Extreme.
- WSMR FES should strive to maintain up-to-date Mutual Aid Agreements with neighboring wildland fire jurisdictions, particularly USFWS, BLM and the State of New Mexico. Agreements dictate how and when

reimbursement costs are paid for wildfires that may cross WSMR boundaries. These agreements can save the Army money in the long run by allowing other agencies' firefighters access to cross WSMR boundaries and suppress wildfires where it makes sense in terms of safety and for utilizing natural, defensible or artificial barriers that may occur on either side of an agencies' boundary.

- Only when wildfires are threatening humans, man-made improvements, structures or infrastructure should DOD missions on WSMR be scrubbed in order to allow for wildfire suppression.
- FES resources are best used for providing point protection when structures are threatened and should keep their vehicles on roads rather than engaging wildfires off-road in the wildlands. In many cases on WSMR, wildfires will burn out on their own. If vegetation near structures is kept short, there is almost no risk of wildfire damage to these improvements. Firefighters can safely provide structure protection in these conditions and may even decide that they are safe enough to leave, freeing up firefighters to be used in places where there may be higher needs.
- Unexploded ordnance (UXO) can be anywhere on WSMR and is especially hazardous to firefighters in the wildlands, as some UXO can be detonated by heat from a wildfire (Figure 4.1). Firefighters are safer when engaging wildland fires from the safety of their engines or when parked on roads or firebreaks and engaging wildfires from defensible positions.
- Mission-related wildfires are most likely to be caused by military test activities that involve aerial target intercepts by missile systems or deployment of flares from aircraft during testing or training exercises. WSMR personnel conducting testing and training activities need to be sensitive to wildfire concerns and delay or adjust activities to areas with low potential for wildfire.

4.1.2 Firefighting Constraints

- No fire suppression is allowed within impact areas/WITs (Figure 4.1) due to potential exposure to unexploded ordnance (UXO). Impact areas are marked on maps, WITS are fenced but other impact areas are not marked on the ground. UXO may be found anywhere on WSMR but is especially prevalent in or near impact areas. Other Special Use Areas (Figure 4.1) may have other firefighting restrictions. See **Appendix A** for the specific Fire Management Unit (FMU) these areas are within and the firefighting considerations for them.
- UXO safety protocol requires that any encounters with UXO in the field be communicated to Range Control so that Explosive Ordnance Disposal (EOD) contractor personnel can respond and remove or detonate the potential hazard. UXO should never be disturbed, but should be photographed from a safe distance with the location recorded on a map or with a hand-held GPS using UTM coordinates. Firefighters battling wildfires in the wildlands of WSMR are at higher risk for injury than others because wildfire heat can trigger UXO to explode. Remember the 3Rs for UXO safety: Recognize, Retreat, Report. See **Appendix F** for more information on UXO hazards and protocols.
- The magnitude of WSMR, the lack of passable roads in the wildlands and the difficulty of the terrain increases travel times from fire stations to wildfire incidents. Long response times may contribute to large growth of wildfires in grass and shrub/woodland fuel types. Roads designated as FMU boundary firebreak roads need to be added to PWO maintenance schedules for regular maintenance. Fire engines need four wheel drive capabilities with high clearances to be effective in the wildlands of WSMR.

- The Organ, San Augustin, San Andres and Oscura Mountains have potential for large wildfire growth under climatic conditions of dry, hot and windy weather. These mountain ranges may exhibit extreme fire behavior due to topographic factors of steep, rocky and rugged terrain and abundant combustible fuels that are highly variable in terms of species composition, fuel loading and fuel continuity. Due to numerous safety concerns, ground troops and engines must ensure they have uncompromised escape routes, adequate safety zones and adequate communications established before deploying to fight wildfires in these mountain ranges. Wildfire managers must analyze the risks and consider allowing these wildfires to burn or consider the use of aerial firefighting assets if wildfire suppression is the highest priority for wildfire management.

4.1.3 Natural Resources Constraints

In compliance with environmental laws and regulations, restrictions have been placed on several areas of WSMR (Figure 4.1). Environmental constraints include Special Natural Areas (SNAs) which harbor biological, cultural, or physical elements that are important both locally and regionally. There are 16 SNAs, including eight biologically sensitive (three of which are candidates), six geologic type locations for stratigraphic units, and two geologic (WSMR 2015). SNAs on WSMR are not marked in the field. SNAs help protect sensitive plant and animal species habitat, highly unique soils and paleontological resources, including White Sands pupfish habitat, sensitive black grama grasslands, critical habitat for Todsen's pennyroyal, Salinas Peak ponderosa pine, playa lakes, and the Carrizozo lava flow (WSMR 2015). Allowing wildfires to burn within SNAs may be an acceptable practice but the use of heavy equipment or retardants in these areas is not acceptable. The use of bulldozers should not be considered in SNAs. Use of hand tools for scraping fireline and extinguishing flames and driving brush engines on-road only in SNAs are acceptable practices when fighting wildfires. Post wildfire monitoring should occur in SNAs to measure fire effects and to ascertain if mitigations such as soil stabilization and erosion control needs to occur. See **Appendix A** for firefighting constraints by FMU.

4.1.4 Cultural Constraints

Wildfires burning across WSMR landscapes do not normally create extensive damage to prehistoric artifacts as fuel loads are generally light to moderate. See **Appendix J** for further, detailed information on fire effects to cultural resources. Prehistoric cultural artifacts generally consist of non-burnable materials such as rock or pottery. Many prehistoric sites have likely been burned by wildfires over previous centuries. Prehistoric artifacts can be affected by wildfires including charring and discoloration from excessive heat. Wildfires can cause damage to historical sites because their primary structural material is wood. Wildfire suppression efforts, including fire-break construction, vehicle and foot traffic, digging and trenching, can be more destructive to cultural resources than the wildfires' effects (WSMR 2015). Firefighting resources will consult with WSMR PWE archaeologists if planning ground disturbing activities such as fireline construction, as these specialists maintain records of cultural sites and can provide this information to firefighters so that these sites are left undisturbed.

There are thousands of known cultural sites on WSMR, some are eligible to be listed by the State Historic Preservation Office (SHPO). All listed sites by SHPO and eligible sites are to be protected from damage from wildfires to the extent possible. Obviously, wildfires will burn and cultural sites will be within the footprint of wildfires. Firefighters will not jeopardize their safety to save cultural sites, but they will try to protect sites given the time to do so. WSMR PWE archaeologists will work with firefighters and PWO to provide timely information on cultural locations so that firefighters can reduce fuels around sites and attempt to ensure that cultural features are protected. Fuels reduction may include thinning and removing vegetation and scraping a fire line with hand tools around a site. Wildfires can act as an agent to clear away underbrush. This becomes an opportunity for archaeologists to find artifacts that otherwise might not be locatable.

In cases of prescribed fires, all known eligible cultural features will be protected before fires are lit.

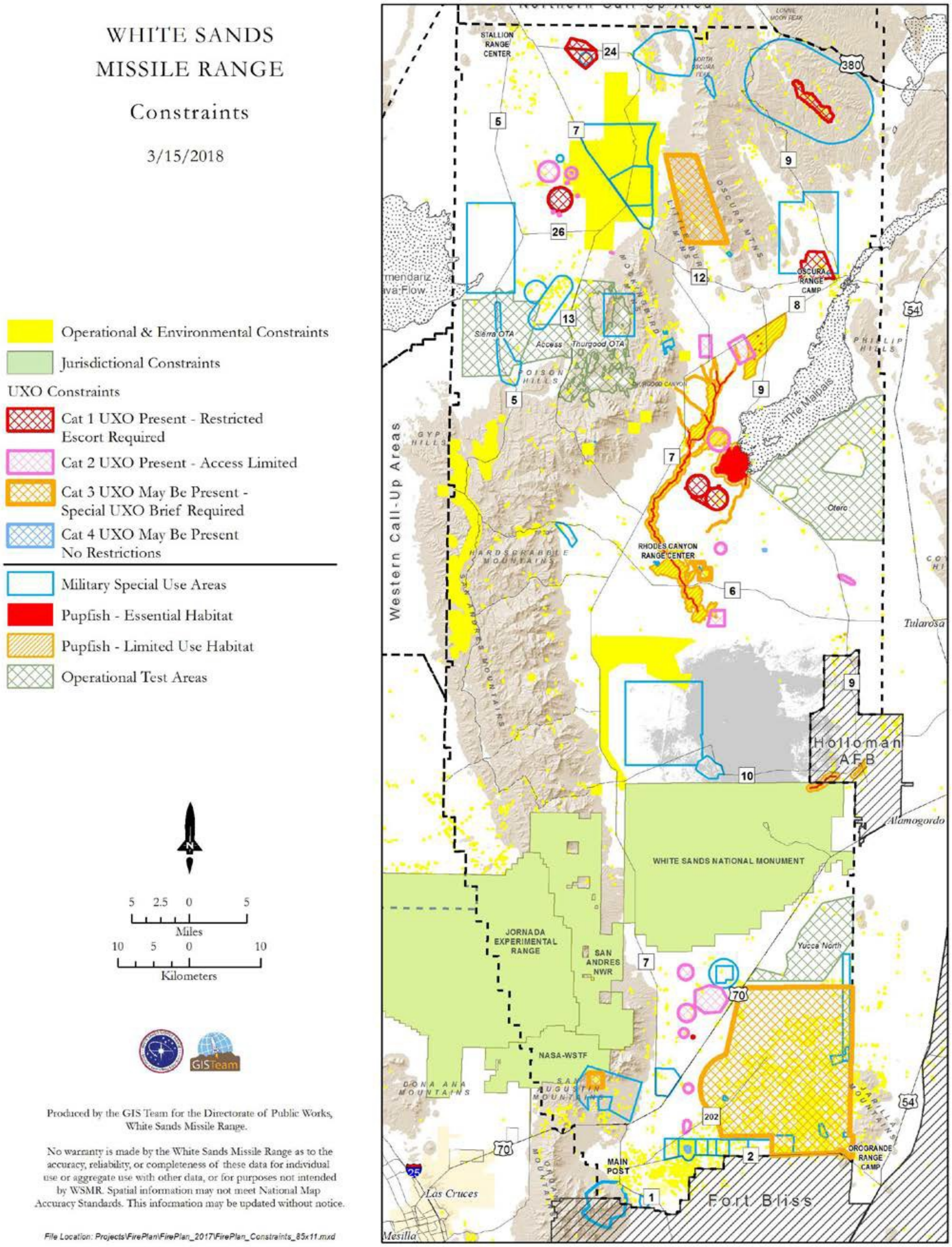

Figure 4.1 Operational Constraints on WSMR

4.1.5 Fire Weather Considerations

WSMR's primary mission as a testing facility for missiles and weapons systems should not be constrained by fire weather concerns. Due to high costs and time-sensitivities, missile and advanced weapons testing should occur on schedule and, if wildfires are started, they will be suppressed as soon as possible. However, wildland fire managers and firefighters operating on fires in the wildlands need to pay close attention to forecasted and current weather and its effects on fire behavior, especially when ***red flag*** conditions are occurring or may occur.

Fire weather forecasts and weather criteria for ***fire weather watches*** and ***red flag warnings*** for the WSMR area are issued by the Santa Teresa and the Albuquerque, NM offices of the National Weather Service (NWS) and are based on data from local RAWS. Fire weather forecasts include expected afternoon high temperature, afternoon minimum relative humidity and a range of wind speeds. The NWS offices employs specially trained fire meteorologists who produce the daily fire weather forecasts for the fire weather zones (FWZs) that cover the expanse of WSMR (Fig.4.2). The FWZs serviced by the Santa Teresa and Albuquerque offices are divided by topographic and climatic differences. During the fire season (March-July) fire weather forecasts, specific to each FWZ, are issued twice daily, once @ 0700 and once @ 1330. These are the most accurate weather forecasts available to WSMR wildfire managers. See the Santa Teresa/NWS website at http://www.srh.noaa.gov/epz or the Albuquerque site at http://www.weather.gov/abq/ and click on the fire weather icon at the bottom of the page. The fire weather page also has long-range forecasts which are useful for planning purposes for the upcoming weeks.

Daily fire danger ratings for WSMR and the surrounding area are posted at the following location: https://www.wfas.net/images/firedanger/subsets/fdc_f_sw.png. This information is updated daily and is available to firefighters, range managers, and Soldiers, among others. The National Fire Danger Rating System (NFDRS) daily FDR takes into account current and antecedent weather, fuel types, and both live and dead fuel moistures (Bradshaw et al 1984). NFDRS uses a method of normalizing risk rating classes across different fuel models through data capture from local RAWS (red dots in Fig. 4.3). Values between stations are estimated with an inverse distance squared technique on a 10-km grid. NFDRS uses an adjective rating to communicate the daily wildfire risk of Low, Moderate, High, Very High and Extreme (Figure 4.3). The daily forecast fire danger from NFDRS is based on 1300 hours (midday) weather expected and is always the worst case scenario for the day. Use of NFDRS and the daily fire weather forecast from the NWS provides direction and instructions that should be used together to determine fire danger and fire probabilities on WSMR. All users of the range should be aware of wildfire potential. FES, PAO and Range Operations should help to disseminate fire weather information, particularly on extreme fire condition days.

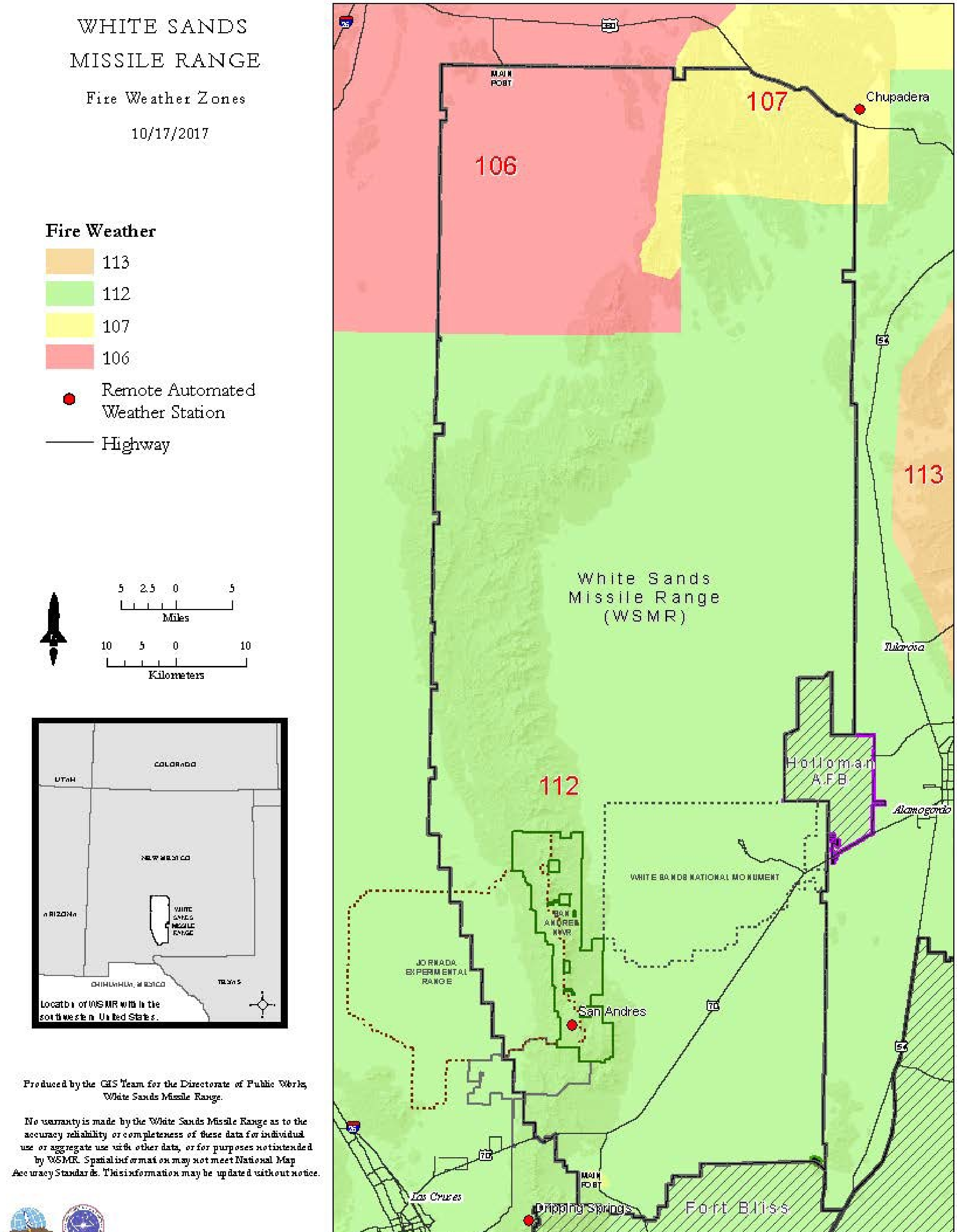

Figure 4.2 Fire Weather Zones of WSMR

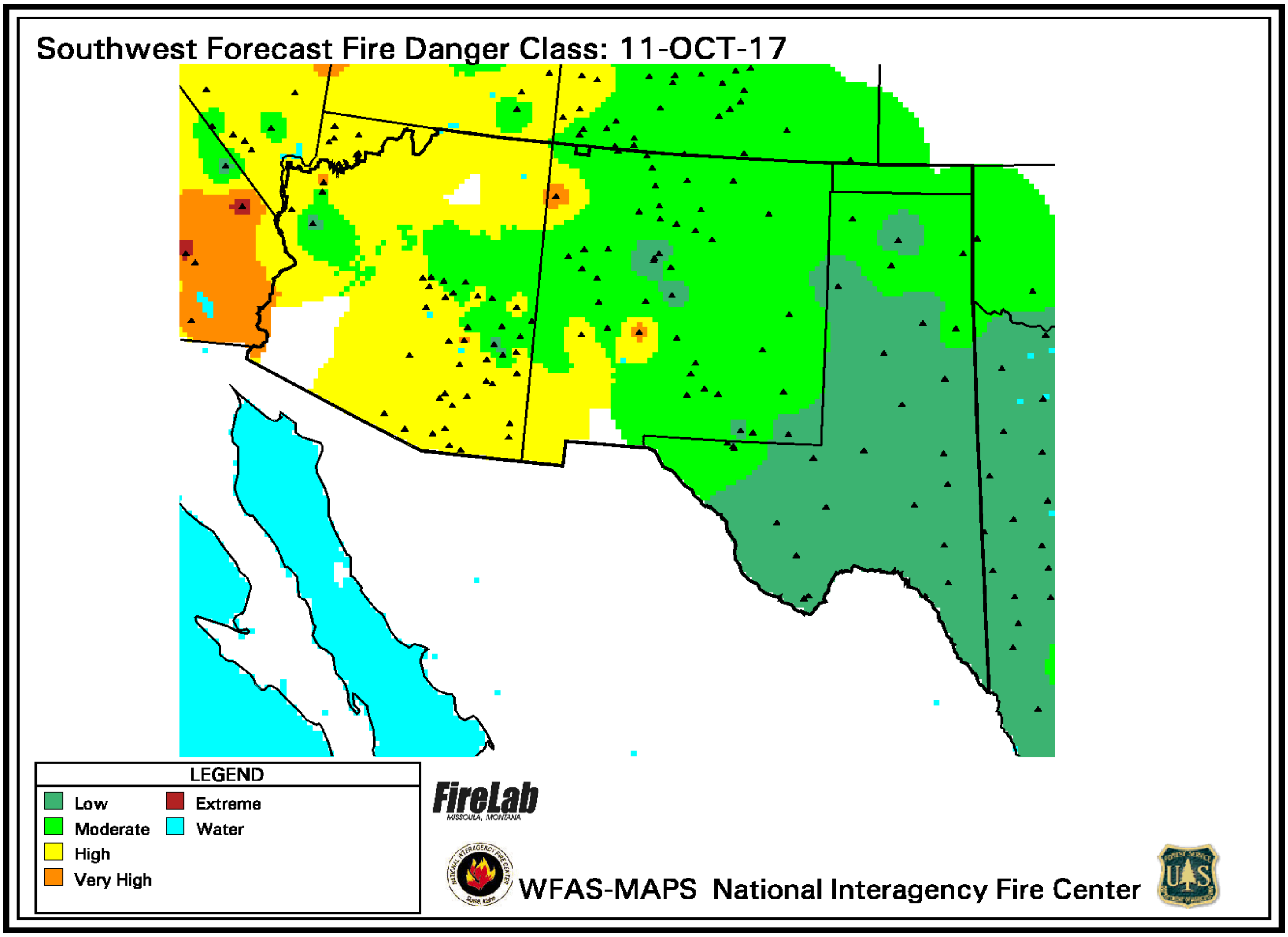

Figure 4.3 Southwest Area Current Day Fire Danger Class (example from 11 Oct. 2017)

4.1.6 WSMR Wildfire Hazard Ratings

WSMR is divided into areas of High and Low wildfire hazard ratings based primarily on fuel loads (Fig. 4.4).

HIGH hazard areas are those areas of WSMR that contain sufficient fuel loads and fuel continuity to promote large wildfire growth and therefore receive the maximum focus and efforts for suppression of wildfires by firefighters (Yellow areas in Fig. 4.4). In general, the fuels adjacent to the main post and the Organ Mountains, the grasslands of Stallion Range, the San Andres Mountains, the San Augustin Mountains and the Oscura Mountains and surrounding foothills have the quantities, continuity and arrangement of live and dead fuels to sustain large wildfire growth.

LOW hazard areas include the Tularosa Basin and the surrounding uplands and are areas where wildfire suppression is a lower priority because fuel loading and fuel continuity is insufficient to support large wildfire spread (Blue areas in Fig. 4.4). Within the Tularosa Basin and surrounding uplands are inclusions of hills, playa lakebeds and arroyos where grass can grow, sometimes in abundance. However, these inclusions are not continuous, are surrounded by mesquite coppice dunes, bare ground and/or creosote bajadas and do not support large wildfire growth (wildfires >500 acres).

WHITE SANDS MISSILE RANGE

Fire Management Units (FMUs)

2/7/2018

FMUs & Suppression Strategy

- Monitor and suppress from roads/firebreaks and defensible positions
- Suppress immediately

FIRE MANAGEMENT UNITS		
Unit #	Unit Name	Acres
1	Main Post	2,572
2	Organ Mountains	11,964
3	Launch Complex Area	159,272
4	Foster Lakes	39,070
5	White Sands National Monument	172,785
6	HELSTF	44,888
7	HTA	35,492
8	NASA/WSTF	23,326
9	Jornada Experimental Range	50,325
10	San Andres NWR	59,294
11	East San Andres Foothills	38,479
12	Hembrillo Canyon	50,165
13	West San Andres Foothills	59,027
14	Grandview Mountain	41,843
15	Strawberry Peak	41,944
16	Hardscrabble	40,526
17	Space Harbor	195,986
18	Otero Maneuver Area	101,472
19	Denver WIT	99,896
20	Malpais	109,479
21	Salinas Peak	53,827
22	Ladybug Peak	69,966
23	Cain	65,347
24	Zumwalt	55,712
25	Capitol Peak	34,966
26	Mockingbird	50,473
27	Red Hill	27,415
28	Red Canyon	27,795
29	Oscura Range	20,890
30	Oscura Mountains South	81,705
31	Little Burro Mountains	29,699
32	Stallion WIT	124,312
33	Grandjean	45,955
34	Trinity	34,288
35	North Oscura Peak	22,240
36	Red Rio	67,457

5 2.5 0 5
Miles
10 5 0 10
Kilometers

Produced by the GIS Team for the Directorate of Public Works, White Sands Missile Range.

No warranty is made by the White Sands Missile Range as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by WSMR. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notice.

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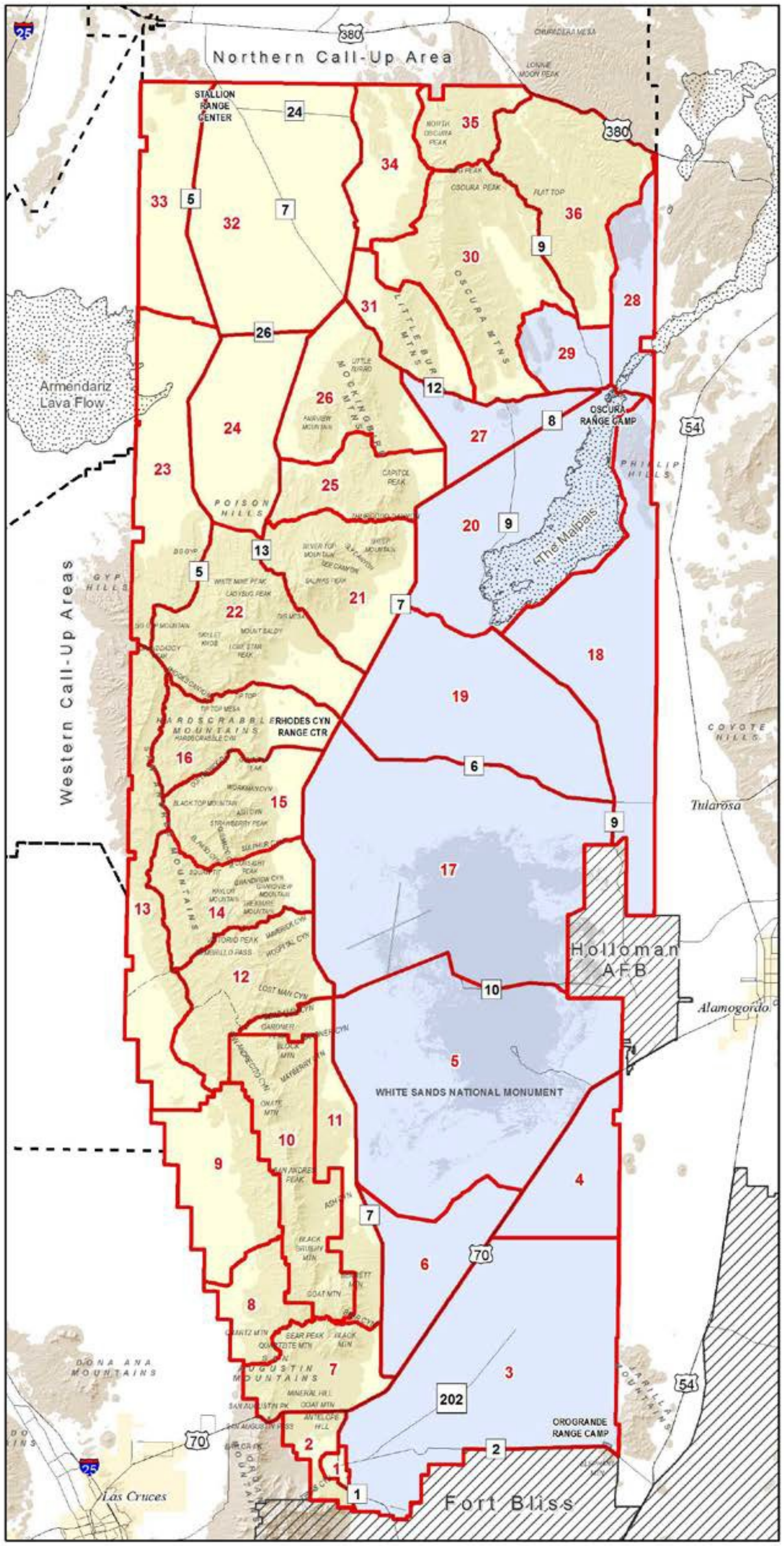


Figure 4.4 WSMR Fire Management Units and Suppression Strategy

4.2 WSMR Wildfire Suppression Strategy

WSMR is divided into 36 Fire Management Units (FMUs) to facilitate firefighter response across the installation (Fig. 4.4). **Appendix A** contains specific instructions for managing wildfires and protecting resources within each FMU and also contains a detailed map of each FMU. Each FMU is distinct, named and designed to the extent possible, to be surrounded by defensible firebreaks and end at WSMR boundaries. Currently there are 25 FMUs that are designated as Immediately Suppress FMUs and 11 FMUs designated as monitor and suppress from boundaries. The FMU boundaries and the wildfire suppression strategy reflect the LOW and HIGH wildfire hazard areas described above in Figure 4.4.

The wildfire suppression strategy to be employed by WSMR firefighters is as follows:

1. If the wildfire is located within one of the Immediately Suppress FMUs or is threatening any humans or man-made structures anywhere on WSMR, then the wildfire is immediately suppressed using all available resources at the disposal of the designated Incident Commander. If the wildfire cannot be contained within 24 hours by WSMR firefighters and their cooperators or is located in an area that is difficult to access and may compromise firefighter safety, then WSMR wildfire managers need to decide whether to continue an all-out suppression effort utilizing interagency resources, both ground and air, or to allow the wildfire to burn within the confines of the FMU boundary. The latter decision means that on scene firefighting resources fall back to defensible boundaries and initiate blacklines or burnouts as necessary to eventually contain the wildfire.
2. If the wildfire is within one of the FMUs that have the option to monitor and suppress from roads or firebreaks and is not actively threatening any man-made structures or facilities or is within an impact area or is within a UXO contaminated area, then the wildfire is monitored. All wildfires are monitored by WSMR FES or by PWE or other personnel as designated by the WFPM until the fire either extinguishes itself or the fire burns to an FMU boundary or other defendable position such as a firebreak road, or other area devoid of fuel. At that point the wildfire is suppressed by firefighters.

All wildfires require a suppression response from WSMR FES resources. Firefighting efforts should be commensurate with the values at risk. If lives are in danger, boundaries are threatened or military structures or infrastructure is at risk then an all-hands suppression effort will be made to contain and control the wildfire. This will be accomplished after considering the safety of firefighters first. LCES must be in place prior to engaging wildfires.

WSMR FES firefighters will respond when wildfires are detected, and once on scene they will make the determination to engage in active wildfire suppression or to monitor wildfire spread. This determination will be made based on risks to firefighter safety such as proximity to escape routes and safety zones, flame lengths under 4', ease of access to the fire edge (steepness of terrain, wildfire a long way from the nearest road, etc.) and the ability to suppress quickly and efficiently. If there is any question as to the suppression response, FES will attempt to contact PWE resource advisors to determine if the wildfire can continue to burn in order to meet ecosystem objectives. In the absence of feedback from resource managers, the IC should continue to direct suppression of the fire. If it is determined that suppression efforts are not likely to control the wildfire within 24 hours, then the course of action is to fall back to defensible positions such as a firebreak road and monitor and eventually suppress from there.

FMUs are designed to contain wildfires within firebreak boundaries. Many wildfires on WSMR will burn out and extinguish as they run out of fuel. If a wildfire approaches an FMU boundary and the wildfire is burning intensely, then firefighters may initiate a backfire from a defensible position and move toward a more secure location. If the wildfire intensity is low enough to allow firefighters to stand at the flaming front and make an attack, then firefighters will engage in directly fighting the wildfire from defensible boundaries using water and hand tools.

All wildfires starting on ***Red Flag*** warning days are immediately suppressed anywhere on WSMR, except within impact areas. Red flag warnings mean that wind, temperature and humidity are aligned at critical thresholds for potentially extreme wildfire behavior and large wildfire growth.

WSMR has a network of roads for accessing different parts of the installation. Designating the roads that surround FMUs as firebreak roads means that they require annual maintenance by PWO road maintainers and that road surfaces are kept vegetation free for at least an 8’ width and road shoulders are kept mowed or vegetation-free to the extent possible. Firebreak roads should be considered the primary places to initiate suppression actions. Suppression actions may include: blacklining the road; laying down a wetline alongside the road; or actively fighting fire from the road and engaging a wildfire using water, foam and dirt.

If a wildfire is not endangering life or equipment, then training or military testing missions that are scheduled should continue. This allows for wildfires to consume as much fuel within the road system as possible, so that the next wildfire that starts here will not have any place to burn and may also help to meet ecosystem management and natural resource objectives.

Areas surrounding man-made improvements on WSMR must be regularly maintained (mowed and/or kept green by watering) for a minimum of 30’ away from the structure or kept vegetation-free in order to minimize the risk of wildfire damage.

Wildfires, in the fuel conditions and terrain such as found on WSMR, will normally die down after sunset as winds die down, temperatures fall and relative humidity rises. This typical nighttime weather pattern allows for firefighters to use direct attack tactics on the wildfire’s edge as necessary and gain containment and control under cover of darkness. However, wildfires may not diminish in intensity at night if a frontal passage, or low pressure area is moving through the area bringing strong winds. Firefighters must use local predicted weather forecasts for their area in decision-making as to how and when to directly engage in wildfire suppression (i.e. engage now while wildfire is small and before weather system moves in, or, if weather forecast is favorable, wait for night and engage when conditions are most favorable for suppressing wildfire).

4.3 WSMR Fire Management Units

WSMR is divided into 36 Fire Management Units (FMUs) (Fig. 4.4) that were created based on the defensibility of their boundaries, common fuel types and common fire management priorities. Appendix A contains detailed descriptions, strategies, constraints and maps for each FMU. Appendix A is designed to be a usable tool for firefighters and is meant to be reproduced and kept as a guide within fire vehicles for easy reference or downloaded to a laptop. Each of the 36 FMUs listed in Appendix A has a name, physical description, location, size in acres, improvements/structures to be protected, fuel characteristics, along with a suppression strategy section that includes specific risks, hazards, tactics and special considerations for firefighters. Each FMU description and text is followed by a full-page map showing boundaries, roads, firebreaks, impact areas, structures, power lines, and topography and fire history.

4.3.1 General Firefighting Strategies for FMUs on WSMR

- Whenever wildfires are ignited anywhere on WSMR, WSMR FES must be contacted so that a wildfire suppression response can begin immediately.
- The primary tactic for suppressing wildfires within immediate suppression FMUs (yellow areas in Fig. 4.4) is to engage in suppression efforts as close to the fire edge as possible, extinguishing flames using handtools and water. This is called ***direct attack*** (See Section 4.5.3 for additional information). This tactic works best on wildfires with flame lengths less than 4 feet. This tactic may involve driving wildland engines and/or UTVs off-road, initiating engagement of the wildfire from an anchor point and working along both flanks of the wildfire towards the head. If areas are too rough to drive, then firefighters on foot will use the same tactics using bladder bags and hand tools.
- ICs have discretion on tactics to use even in 'Immediate Suppression FMUs' (yellow areas in Fig. 4.4) as these areas may not always require immediate suppression. FMUs are designed to contain wildfires within firebreak boundaries. Many wildfires will burn out, even in the mountains, depending on fuel loads. Firefighters may not need to immediately suppress a wildfire if conditions are not favorable for burning, weather is unpredictable, or there are significant human safety risks.
- Wildfires that occur in any FMU that exhibits intense fire behavior (flame lengths >4 feet) may be suppressed by firefighters utilizing ***indirect attack*** tactics from roads/firebreaks and/or natural barriers (See Section 4.5.3 for additional information). Indirect attack on intense, fast moving wildfires is accomplished by burning out fuels ahead of the wildfire along or parallel to firebreaks or roads. Burnouts are conducted by qualified and experienced wildland fire personnel (i.e. completed taskbook for FIRB). If burning out is not feasible due to time constraints or lack of qualified personnel, then firefighters will allow the wildfire to come to the fuel or fire break rather than attempting to construct new firelines with hand tools or heavy equipment (bulldozers). See **Appendix H Minimum Impacts Suppression Tactics (MIST) Guidelines** for tactical considerations for minimizing impacts to natural resources and using natural features for firelines and safety zones.
- Prescribed fires will be used, prior to onset of wildfire season, to reduce hazardous fuels and to create black lines in strategic areas where fuels are concentrated.

4.3.2 Fire Management Goals Common to all FMUs on WSMR

- Contain wildfires within FMU and installation boundaries to every extent possible.
- Live-fire military training and testing missions continue on WSMR even when wildfires are burning, because the wildfire threat has been abated by keeping structures and infrastructure brush and weed free to the extent possible.
- Man-caused wildfires (i.e., missiles, rockets) will have a suppression strategy because of the liability that these types of wildfires have.

- FMU boundaries are effective barriers to wildfire spread because they are maintained by a system of annual road and firebreak maintenance that includes road surface scraping, road shoulder mowing, and water bar and drain dip maintenance.
- Range infrastructure (structures, facilities) are protected from wildfire effects by an established program of timely fire prevention inspections followed by actions of fuel reduction or removal.
- Prescribed fire treatments are used to strengthen FMU boundaries and consume available fuels and are only conducted within a prescribed fire plan's prescription parameters.

4.3.3 Best Management Practices Common to all FMUs on WSMR

1. Pre-fire season fuels management and wildfire containment:

- Maintain defensible space around range infrastructure. Mow living vegetation to 3-6 inches in height within 30 feet of structure. Mowing should occur outside the migratory bird nesting season which is from March 1- August 31. Any live vegetation within 30 feet of structures that is not mowed or cut to near ground level should be watered regularly to maintain greenness. Clear dead accumulations of vegetation for 30' from structures. Do **not** scrape to mineral soil around buildings if possible, as this creates a dust problem and allows for noxious weed invasions (primarily tumbleweeds) to occur (Table 4.1).
- Consult with PWE cultural staff before doing vegetation removal around historic structures. Even vegetation can have historical context (Table 4.1).
- Maintain designated firebreak roads by removing all vegetative and organic material down to mineral soil on road surfaces for a minimum of 8' width, and by mowing roadway shoulders where practical and by maintaining erosion control features. Mowing should occur outside the migratory bird nesting season which is from March 1-August 31.
- Use prescribed fires or ***backfires*** to strengthen fire break effectiveness for stopping a wildfire by ***blacklining*** (burning combustible fuels in long parallel strips) alongside roads and firebreaks where fuels are concentrated and where it is feasible and practical to do so.
- WSMR firefighters should familiarize themselves with their areas of responsibility (AOR) within WSMR by driving roads. Firefighters should have first-hand knowledge of structure locations and associated infrastructure, impact areas, firebreak roads, WSMR boundaries and how to access them, water fill sites, and sensitive cultural and natural resources and FMU boundaries. Firefighters need to recognize the different types of flammable wildland fuels found on WSMR (See Section 3.3 WSMR Fuel Types) and how those fuels affect fire behavior and intensity.

2. Wildfire Suppression:

- Due to safety and resource considerations, the main fire suppression strategy to be implemented by WSMR firefighters in the Low hazard FMUs (Identified with light blue shading in Fig. 4.4) is to monitor wildfires within FMU boundaries from firebreak roads and suppress wildfires if they advance to firebreak roads. These firebreaks can be burned out in advance of a flaming fire front if it is deemed advantageous by the Incident Commander and provided there are trained personnel available and in place to do so. In most cases, firefighters will allow wildfires to consume combustible fuels within the confines of the FMU boundaries. The majority of these wildfires will die on their own as they run out of fuel (See **Appendix A**).

- In the High hazard FMUs (yellow shaded areas in Fig. 4.4) wildfires will be suppressed at the earliest opportunity unless communication with PWE occurs and allows for wildfires to burn to meet ecosystem management objectives. Direct attack is the preferred tactic for fighting wildfires, but in areas where the fire intensity is too high (>4 foot flame lengths) or terrain too rough then indirect attack tactics will be used.
- Interagency firefighting crews are often the best and safest resources for fighting wildfires in the rugged portions of WSMR. For safety purposes, a WSMR employee that is familiar with military operations, impact area boundaries, UXO, and the installation should accompany interagency fire crews as a resource advisor.
- The decision to utilize helicopters on WSMR wildfires should be based on an assessment of values at risk (See Section 4.5.4). Most wildfires burning on WSMR will not require helicopter support. Helicopters equipped with buckets shall be used when requested by the Incident Commander and when wildfires threaten to cross WSMR boundaries or when structures or infrastructure are threatened by wildfires.
- WSMR FES will contact PWE for guidance on avoiding cultural and sensitive natural resources when wildfires are burning outside established firing ranges and suppression efforts are planned.

4.4 WSMR Wildfire Prevention Program

The WSMR wildfire prevention program is focused on reducing or eliminating the unintentional ignitions of wildfires and on reducing the risks and hazards that can contribute to a severe wildfire (Table 4.1). Prevention efforts require an analysis of risks, hazards, and values, and require education, awareness and preparation. Wildfire prevention requires actions to be taken to reduce the potential impacts of identified risks and hazards. ***Risks*** are ignition sources that can start wildfires, including live-fire testing, use of pyro and flares, maintenance activities like welding, vehicles traveling across wildlands and troops bivouacking in the wildlands. ***Hazards*** are fuels that burn, including the natural vegetation growing across WSMR and the flammable structures located on WSMR.

WSMR FES has an Assistant Chief for Fire Prevention that is responsible for fire prevention and inspections on facilities across WSMR. This effort should be in coordination with PWO because their road maintenance program can accomplish much of the identified fire prevention tasks (Table 4.1). Many of the maintained Range roads are normal access roads for military and civilian activities and are now designated as firebreak roads. Additional maintenance needs for firebreak roads include mowing road shoulders in areas where it is feasible and fuels loads are high. This is an additional expense but is an important part of the WSMR wildfire prevention program. Areas of fuel accumulations where mowing needs to be done shall be identified and made known after each growing season.

Another primary task for FES wildfire prevention is to identify the areas, facilities and infrastructure that are vulnerable to wildfire damage and translate that vulnerability into actions needed to reduce the hazards (Table 4.1). FES Fire Prevention Officer should note structures and other man-made barriers that have fuel accumulations against them and attempt to contact the building users as to the specific fire hazards. PWO does not have the staff to conduct fire prevention actions around all of the structures on WSMR. It is the responsibility of the owners, users or lessors of those buildings to maintain them in a fire-safe condition. Generally, mowing around structures is sufficient to prevent wildfire damage. Maintaining a green belt around structures is another way to prevent wildfire damage but may use a lot of water to maintain greenness. Cultural sites require coordination with PWE archaeologists as some vegetation has historical context and may not be removed. Table 4.1 summarizes the annual wildfire prevention actions to be completed on WSMR before fire season gets active in March.

Since live-fire testing is a priority mission for WSMR, reducing hazardous fuels is the preferred management activity for preventing wildfires. Actions to reduce hazardous fuels include prescribed fire to reinforce fire breaks, creating defensible space around improvements by mowing vegetation or watering to keep green, mowing road shoulders in the fall or winter, maintaining road surfaces to be vegetation-free and removing combustible fuels accumulations (tumbleweeds) from around structures.

Maintained dirt firebreak roads are used as FMU boundaries in most areas of WSMR and are places where firefighters can stop the advance of wildfires. However, not all FMU boundaries are firebreaks. FMU boundaries in some locations like the Oscura Mountains follow canyon bottoms and rocky ridgelines and while these features may help slow wildfire spread they are not barriers to wildfire spread. The installation boundary of WSMR is a fence line in some places, is non-existent in other places and is not always a barrier to wildfire spread. The perimeter of WSMR has many areas that are not protected by firebreak roads. Wildfires can easily burn across boundaries in these areas and are areas of emphasis for the use of direct attack methods, possibly using aerial resources, and other agencies' firefighters.

Table 4.1 WSMR Wildfire Prevention Actions to be taken before Fire Season

Responsible Party	Hazard Reduction Tasks to be completed before Fire Season	Time frame	FMUs Identified with the Task
WSMR Fire and Emergency Services Asst. Chief Fire Prevention/Operations, PWE Cultural Staff and PWO	Inspection of Historic Cultural sites for accumulations of brush and weeds. Clearing of weeds and brush around historic cultural sites by mowing, clearing or crushing	Nov- Feb	All areas as identified by Asst. Chief Fire Prevention
WSMR Fire and Emergency Services Asst. Chief Fire Prevention/Operations w/Range facility owners, lessees, tenants, users	Inspection of WSMR facilities for accumulations of brush, weeds and grass. Clearing of weeds and brush around facilities by mowing, clearing or crushing or being kept green by watering	Year-round	All facilities of WSMR that are currently being used

WSMR Fire and Emergency Services Division	Prescribed burning along fire breaks within areas identified in prescribed fire plans	Nov-Feb or as necessary to reduce fuel loads (may be once every few years)	
PW Operations and Maintenance Division and FES Asst. Chief Fire Prevention/Operations	Fire break road maintenance and mowing of roadway shoulders as identified by FES Fire Prevention/Operations	Bi-annually	

4.5 WSMR Wildfire Suppression Program

An up-to-date, practical reference for use by wildland fire suppression programs is the NWCG publication: PMS 210, Wildland Fire Incident Management Field Guide and is available for downloading at: http://www.nifc.gov/nicc/logistics/references/Wildland%20Fire%20Incident%20Management%20Field%20Guide.pdf (NWCG 2013). The field guide has chapters on basic firefighting safety, wildland fire operations, incident positions and responsibilities and includes guidelines for managing incidents of increasing complexity. The field guide has charts and tables for fireline production rates, engine operations, heavy equipment usage and a host of other information that is pertinent to firefighters, incident commanders and wildland fire program managers.

More specific to WSMR FES firefighters is the WSMR FES **Standard Operating Procedures: Wildland Fire Responses** (SOP 6.20 dated 28 Sept. 2015) located in **Appendix D** of this document. This is an excellent reference for all firefighters to use when responding to and managing WSMR wildland fire incidents. There are sections on establishing Incident Command, Safety and Environmental Factors, Initial Reporting, Initial Attack, Strategy and Tactics, and Hotspotting, Coldtrailing and Mop-up.

The following sections of the WSMR Wildfire Suppression Program are not in-depth, as there are excellent basic wildland fire courses and reference materials (see above field guide, IRPG, etc.) offered by DOD and NWCG that every firefighter certified for wildland firefighting duties utilizes. Rather, the following sections are meant to capture the sequence of events for wildfire responses and highlight important safety and tactical information particular to the WSMR wildfire suppression program.

4.5.1 Wildfire Detection

Early wildfire detection is part of an effective initial response to wildfires on WSMR. Any agency, unit leader, Soldier, contractor or individual noticing a wildfire is responsible for reporting it as soon as it is detected. Contact 911 Dispatch Center at (575) 678-1234 or communicate with 911 Dispatch Center (Call sign for FES is Rescue Control), Police Services or Range Control at (575) 678-2222 or via two-way radio to report wildfires.

4.5.2 Dispatch Procedures

Rescue Control will dispatch appropriate available wildland fire resources to a wildfire burning on WSMR based on the following criteria and then will contact the Assistant Fire Chief for Operations or the designated duty officer in WSMR FES for further guidance:

1. Imminent threats to lives or structures.
2. Red Flag Alert or Extreme FDR.
3. Wildfire is burning in an FMU that requires an immediate suppression response.

Rescue Control will dispatch appropriate wildland firefighting resources, ordinarily two Type 6 wildland fire engines and one UTV to a wildfire burning on WSMR based on the following criteria:

1. There are no immediate threats to life or structures.
2. Wildfire is burning within an FMU that is designated control from a road or a firebreak.
3. Wildfire smoke is visible but the location of the wildfire has not been determined.
4. Wildfire is burning within an FMU that is designated for immediate suppression response but it is outside of the primary wildfire season or the Fire danger is rated as Low or Moderate.

Scheduled WSMR test and evaluation missions have priority over wildfire operations. If there are active missions occurring on WSMR, Rescue Control will contact Range Control at 575 678-2222 or by radio in order to determine when the Range will be open for fire traffic.

4.5.3 Initial Attack Procedures

Initial attack begins with the dispatch of pre-arranged personnel and equipment by WSMR FES. WSMR FES personnel, while enroute to the incident should observe and note the following in order to anticipate fire behavior, firefighter safety, tactics and resource protection:

- Fuels and topography
- Weather conditions
- Smoke column characteristics
- Access routes
- Fire barriers (natural and constructed)
- Potential water sources
- Capabilities of responding resources
- Unusual human activity or suspicious behavior

The safety and security of responding personnel is the first priority throughout the duration of the incident. Response personnel will have an appropriate awareness of the **10 Fire Orders, LCES and the 18 Watch-out Situations (Appendix C).** Responding personnel will incorporate their knowledge of the fire area and observe how current wildfire conditions compare to past experiences with similar wildland fuels and weather conditions.

Initial attack forces should designate an Incident Commander (IC) to take charge at the scene before arrival at the incident. The initial attack IC should be among the first to arrive at the incident. Upon arrival at the incident, the designated IC will size-up the wildfire before engaging firefighters and report back to station or to WSMR Rescue Control the following information:

- size of the wildfire
- fuel type burning
- fuel types ahead of the wildfire
- terrain or slope features
- observed hazards, including nearby structures

- current weather conditions including wind speed and direction, relative humidity, temperature and cloud cover
- anticipated equipment, supplies and resources needed to bring the wildfire under control including the need for a cultural/natural resource advisor if wildfire is burning outside impact area boundaries

Initial attack procedures involve either direct or indirect attack tactics depending on FMU designation. Other factors that may influence the method of attack include flame lengths, rate of wildfire spread and proximity to human improvements, difficulty of terrain and heavy concentrations of fuels. When using ***direct attack*** tactics, firefighters engage the wildfire directly along the flaming perimeter (flame lengths are generally < 4'). The direct attack method of engaging wildfire is the simplest and safest method to bring a wildfire under control. This is the safest suppression method because firefighters can have "one foot in the black." The ***'black'*** or previously burned areas are the best places for safety zones on a wildfire in light fuels and are easily reachable when fighting fire on the fire's edge. The primary strategy for direct attack is to establish an anchor point and then proceed with firefighters along each flank, directly extinguishing flames with hand tools, swatters or water from engines or backpack pumps and progressing towards the head of the wildfire, eventually pinching the head and meeting the firefighters from the other flank. See **Appendix H Minimum Impacts Suppression Tactics (MIST) Guidelines** for tactical considerations for minimizing impacts to natural resources and using natural features for firelines and safety zones.

Indirect attack methods should be used when fire behavior is such that direct attack is not feasible (flame lengths > 4') or when wildfire is within an FMU designated as monitor and suppress from FMU boundaries. The firefighting strategy for indirect attack is to fall back to a defensible position, establish an anchor point and burn out fuels ahead of the advancing wildfire as necessary while moving the operation towards an identified safety zone. Tactics include burning out along roads or firebreaks eventually halting the spread by removing burnable fuel ahead of a wildfire. Indirect attack tactics should be led by wildland firefighters experienced and qualified in burning techniques. There should also be adequate engine and firefighter resources on scene to hold the line and extinguish hotspots and spot fires that may ignite from embers crossing their fireline.

On all wildfire incidents, it is required that lookouts are posted and safety zones and escape routes are scouted and marked and made known to everyone on the incident to make sure they are viable options for firefighters. Engaging in indirect attack tactics means that there will be unburned fuels between the fire break and the advancing fire front. Visibility of the wildfire and changes in fire behavior or direction of spread may be obscured or limited. Winds can change at any time, causing wildfire to rapidly blow across firelines and potentially compromising firefighter access to escape routes and safety zones leading to an entrapment situation.

Once perimeter containment of a wildfire has been achieved, fuels within the interior of the wildfire will be allowed to burn out. Mop-up will only be conducted on the perimeter to bring the wildfire under control. Keep enough resources to patrol and monitor the wildfire until it completely burns out.

Firefighters will use a handheld GPS to record a final fire perimeter before leaving the incident. The coordinates will be downloaded and e-mailed to PWE or the GPS unit may be brought to PWE in Building 163, Environment Office on WSMR for downloading and recording wildfire information. FES GPS units need to have mapmaking and area calculating capabilities. PWE can provide GPS training for firefighters and will maintain a GIS database for all wildland fires on WSMR.

4.5.4 WSMR Aerial Firefighting Options

Army helicopters may be available to WSMR FES, but will not automatically respond to WSMR wildfires. Aerial assets are ordered as needed by the IC onsite or by the WSMR WFPM. The request for helicopters to aid in wildfire suppression operations on WSMR should be based on a risk analysis that considers the potential for a wildfire to escape WSMR boundaries, the proximity of the wildfire to structures or infrastructure and the potential for hazardous exposure to ground-based firefighters from multiple risk factors including steep slopes, ingress/egress, escape routes, safety zone accessibility and potential for wildfire entrapment. Helicopter bucket support may be necessary for suppressing wildfires located in remote, inaccessible terrain such as that found in the Organ, San Andres and Oscura Mountains.

Helicopters from the 1st Armored Division Combat Aviation Brigade (CAB) located at Fort Bliss may be available to WSMR. 1 AD helicopters have bambi buckets (collapsible soft-sided bucket with electric motor-driven release and fill gate) which can deliver thousands of gallons of water for the purposes of extinguishing wildfires. An estimated 790,000 gallon storage tank with an open top to allow for helicopter bucket fill has been built on Doña Ana Range on Fort Bliss and is located just east of the junction of NM 213 (War Road) and the southern terminus of Firing Line Road (UTM coordinate 13S 368,224E 3,566236N). 1AD CAB helicopters have been training with the bambi buckets at the Doña Ana dipsite. Currently 1 AD CAB has two 2,000 gallon collapsible "bambi" buckets for the CH-47s (Chinooks) and two 660 gallon bambi buckets for the UH-60s (Blackhawks).

Contract firefighting helicopters can be ordered from the Alamogordo Interagency Dispatch Center (ADC) for wildfires on WSMR and are the best option in terms of bucket delivery of water and working helicopters around firefighters already on the ground. These aerial resources are managed by the USFS. However, it may take hours, or even a day or more, from the initial order to actually have a USFS contract firefighting helicopter over a WSMR wildfire. A fire-contract helicopter will usually come with 1-2 pilots, bucket, long line, fuel truck and an agency-certified helicopter manager. Fixed-wing aerial observation (air attack) or an aerial supervision module (ASM) can also be ordered from ADC and is a quick way to get eyes in the sky for gathering intelligence from remote, back-country wildfires. These aircraft can also serve to help lead ground crews in to remote parts of a wildfire and can also provide traffic control for other aircraft that may be arriving such as retardant planes or helicopters.

All aircraft attempting to access WSMR airspace must contact Cherokee Control on VHF frequency 126.95 or UHF frequency 305.5. Cherokee Control maintains total control of the air space. Range activities will dictate request approvals. Cherokee Control is not staffed on a 24-hour 34 basis. If there is NO response from Cherokee Control, then the pilot is advised to contact Holloman Approach (RAPCON) on VHF frequency 120.6 or UHF frequency 269.225.

A recommended resource for aviation users and anyone involved or interested in helicopter operations within the wildland fire environment is the Interagency Helicopter Operations Guide (IHOG). The IHOG and the IHOG Supplemental Forms Package are available for viewing and downloading at:

http://www.nwcg.gov/publications/interagencyhelicopter-operations-guide. An excellent guide for pilots is http://www.fs.fed.us/fire/aviation/av_library/professional_helic_pilot_guide.pdf.

4.5.5 Extended Attack Procedures

Extended attack wildfires are wildfires that have escaped initial attack and that are still burning after 24 hours. WSMR will continue to manage these incidents using FES firefighters, including mutual aid resources, as long as the required expertise and personnel are in place to accomplish safe and effective wildfire management.

The National Wildfire Coordinating Group (NWCG) recognizes 5 levels of wildland fire incident command (See below for descriptions of each level of incident command). The smallest wildfires or initial attack fires require a Type 5 Incident Commander (ICT5). Most WSMR FES firefighters with wildland fire experience will qualify as ICT5. Type 4 ICs (ICT4) require more training but WSMR has experienced and qualified firefighters who can fill this position. If the ICT4 decides that the current incident complexity calls for the next higher level of incident management (Type 3 IC or ICT3) and that ICT4 is not qualified, nor is there one within WSMR FES ranks, then an outside agency ICT3 will need to be ordered. The order for an ICT3 or higher is placed through ADC. If mutual aid resources are already involved in the suppression efforts, it is possible that there may be an ICT3 within their ranks. If so, a name request is then placed with the order to ADC to facilitate the transition to the higher level IC.

WSMR FES should work towards qualifying at least 4 ICT4 firefighters and as many as 8, so that there is at least one for every station at any given time. WSMR FES should work toward qualifying one or two firefighters as ICT3 also.

Use of outside ICs for WSMR wildfires requires that a delegation of authority be given to the IC for the management of the incident. A ***delegation of authority*** is a written document from the GC to the incoming IC granting the IC the authority to expend funds and order all necessary resources to bring the wildfire under control. See **example of a delegation of authority in Appendix E.** WSMR can help facilitate the transition of wildfire management to an outside, incoming IC and his/her team by providing a short team of WSMR resource professionals that can advise the incoming team as to the location of sensitive natural and cultural resources, WSMR special safety concerns, including areas of UXO contamination, impact area boundaries, military mission concerns and other logistical and operational needs. This short team should consist of a WSMR Archaeologist, Wildlife Biologist, Range Safety Officer, and an FES Operations Chief.

The types of IC levels and the corresponding incident complexity are provided below:

Type 5 Incident

- Resources required are local and typically vary from two to six firefighters.
- The incident is generally contained with initial attack resources and often within a few hours after resources arrive on scene.

Type 4 Incident

- Resources are local and vary from a single module to several resources.
- The incident is usually limited to one operational period in the control phase.
- No written Incident Action Plan (IAP) is required. An operational briefing will be completed for all incoming resources not involved in the initial attack.

Type 3 Incident

- Resources are usually local and some overhead positions may be activated, usually at the division/group supervisor and/or unit leader level. These resources may be called upon to fill key positions such as Operations, Logistics, Safety and Plans Section Chiefs. These positions in wildland fire organizations are called command and general (C and G) staff positions. Incoming ICT3s may have a predetermined Type 3 Organization with qualified C and G staff positions filled.
- Type 3 organizations manage initial attack fires with a significant number of ground and air resources and manage extended attack wildfires until containment/control is achieved.
- Initial briefing and closeout are more formal and more critical.
- Resources vary from several resources to several task forces/strike teams.
- The incident may be divided into divisions.
- The incident may involve multiple operational periods prior to control, and requires some form of a daily, written IAP.
- A documented operational briefing will be completed for all incoming resources, and before each different operational period.

Type 2 Incident

- Resources are usually from the regional area. Type 2 teams are filled by qualified personnel who are preselected annually for that team. All C and G staff positions are filled as well as positions at the Branch, Division, Task Force and Strike Team Leader levels.
- Type 2 organizations manage extended attack wildfires that have exceeded the complexity of a Type 3 team. Type 2 fires usually have significant outside resources involved in air and ground operations. There is typically significant public and political interest and there are usually multiple land ownerships and government agency jurisdictions involved.
- Only the most complex wildfires on WSMR will need the larger Type 2 Incident Management Teams (IMT). The decision to call in a Type 2 IMT should be a joint decision between the ICT3 at the time, the WFPM and the GC.

Type 1 Incident

- Resources are national in scope and are used on the most complex and largest fires in the nation. It is unlikely that WSMR would have need of a Type 1 IMT.

4.5.6 Water Sources

Water sources for firefighting purposes are rare commodities across WSMR. This is a logistical problem for firefighters needing to refill wildland fire engines or water tenders and return to the fireline in a timely manner (Table 4.2 and Figure 4-6 list water sources for firefighter use on WSMR).

The main post, Rhodes Canyon Range Center, Oscura Range Center, Stallion Range Center and Orogrande Range Center have hydrant systems that are available for wildland engines and water tenders. Overhead stand pipes are located at Stallion Range Center and at two locations on the main post. Water storage tanks are located throughout WSMR (Figure 4.6). However, these storage tanks are the property of various contractors and they have to pay for water to be stored in these locations (listed in Table 4.2 as Remote Hauled Water Tanks). Some of these tanks may be locked and unavailable without permission from the contractor. Firefighters should make reasonable attempts to locate and/or contact contract personnel in the area for water access. If unable to contact anyone and the water is available and necessary for meeting wildfire containment objectives, then firefighters should go ahead and fill their engines, while keeping track of gallons taken from the storage tank for possible reimbursement.

There are several wildlife water systems located throughout WSMR (Figure 4.6), consisting of solar wells and drinkers with storage tanks that are available to firefighters for filling engines and bladder bags. Many of these facilities may not be accessible for direct engine fill due to piping and plumbing configurations. Firefighters may have to draft water to fill their engines at these locations. Many WSMR wells have decreased output over the years and some may even be dry, so scout out and check reliability before sending engines to these sites.

At certain times of the year, water may be available for draft into engines at the dirt tanks located throughout WSMR. However, these locations may not be reliable, especially during drought, and the water may be too muddy or dirty to be put into fire engine tanks. Dirt tanks will need to be scouted by firefighters prior to sending engines to those locations.

Table 4.2 Potential Water Sources for Engine Fill and Firefighting on WSMR

	County and FMU	**UTM Easting** Zone 13S	**UTM Northing**	**Notes**
Construction Wells				
13. Tula Gate (NMOSE T-04087)	Otero FMU 19	392653	3660552	Installed July 2002. Approx. 30,000-gal storage tank at well head. Construction well near Tula Gate. This well not working currently (2017 10-31).
17. Herbie Well (aka Rhodes C or well 6) (NMOSE T-5570)	Sierra FMU 16	357993	3672093	Installed March 2009. Approx. 30,000-gal storage tank at wellhead. Water first encountered at 190 ft. bgs, but static water level after construction was 143 ft. bgs.
9. NW30-1 (aka "NW-30)	Dona Ana FMU 11	359144	3637581	Approx. 500-gal tank at well. In Bolson fill located off RR 7 just west of intersection w/ RR 10, just west of Pony site.
38. Murray Well (Construction) (RG 80492)	Socorro FMU 31	365434	3715434	Installed August 2003. Approx. 30,000-gal tank at wellhead. Construction well at Murry well site. Yield-80 gpm. Site visit on 1/8/15 confirmed well still in place and is in good working order. Well feeds into nearby tank and is used for construction water. Well inside locked gate area.

32. Martin Ranch Construction Well	Sierra FMU 24	349926	3705132	Dirt storage tank at well. Construction well at Martin Ranch site. Adjacent old windmill well nearby. Well also used as wildlife watering well instead of old ranch well listed with wildlife wells below.
7. Thel-1 (aka THEL Well)	Otero FMU 6	373236	3607374	No info.
36. ORC Fire (AKA Oscura Range Ctr.)	Lincoln FMU 20	391082	3707293	Dirt storage tank at well. Located at Oscura Range Center. Used previously as a fire protection and general non potable supply well. Yields 125 gpm. DTW about 90' bgs.
31. Range Road 5 well	Socorro FMU 23	343409	3706614	Installed in 2014. Unknown if tank at well. Newest construction well.
Water Systems for truck filling				
<u>Stallion Range</u>				
49. SRC Non-potable water filling station	Socorro FMU 32	346872	3743302	Tanker fill station at 20,000-gallon non-potable water tank next to water plant. This water is pre-production and not potable.
<u>Main Post</u>				
1. Water Point #1	Dona Ana FMU 1	360848	3582324	Tanker fill station along Headquarters Rd. on Main Post. No tank, water directly from potable water lines.
3. Water Point #2	Dona Ana FMU 3	371166	3585681	Tanker fill station along Nike (Range Road 2) east of Main Post. No tank, water directly from potable water lines.
Remote Hauled Water Tanks - most hauled water facilities are gated				
39. Aerial Cable	Socorro FMU 31	367916	3719692	Occupied during the week
43. Atom Peak SST	Socorro FMU 35	373667	3734131	Not occupied all week
44. NOP Barracks (Hilton)	Socorro FMU 35	373898	3734048	Rarely occupied
45. NOP (North Oscura Center Range)	Socorro FMU 35	372896	3735572	Not currently occupied - tank used only for boiler
37. Oscura RC Bombing Range	Lincoln FMU 29	387404	3710637	Occupied during the week

35. Oscura RC Commo	Lincoln FMU 20	390431	3707467	Rarely occupied
40. PHETS/DTRA	Socorro FMU 32	357246	3725130	Occupied during the week
29. Phillips Hill	Lincoln FMU 18	394787	3701222	Occupied during the week
26. Russ Site	Otero FMU 18	396161	3686997	Occupied during the week
25. Salinas Commo	Sierra FMU 21	357411	3685417	Periodically occupied
24. Salinas New Tec	Sierra FMU 21	357274	3685464	Periodically occupied
14. Tularosa (MINDA)	Otero FMU 18	392672	3660527	Occupied during the week
10. Andre	Dona Ana FMU 5	360374	3637562	Rarely occupied
5. EMRE	Dona Ana FMU 7	358946	3593360	Occupied during the week
8. Frequency (Holloman)	Otero FMU 5	392754	3631501	Occupied during the week
2. Frequency WS (Oasis Site)	Dona Ana FMU 3	368762	3582830	Occupied during the week
12. J-9	Otero FMU 17	392099	3658875	Rarely occupied
18. Rhodes Commo	Sierra FMU 16	361124	3670077	Occupied during the week
11. Tula G	Otero FMU 17	389595	3660535	Rarely occupied
15. Tula Gate	Otero FMU 18	394111	3660393	Periodically occupied
33. Ben Site	Socorro FMU 31	368149	3711082	Rarely occupied

Wildlife Water Developments Available for Engine Fill

46. Baca Well	Socorro FMU 35	379240	3736205	Solar well w/8' dia. tire trough (500 Gal.) railroad car storage tank-10,000 gal.
34. Ben Site Well	Socorro FMU 31	368257	3711127	Solar well w/earthen holding tank

20. Buckhorn Well	Sierra FMU 23	338593	3685630	Solar well w/earthen holding tank
28. Burris Well	Sierra FMU 25	365513	3700606	Solar well w/8' dia. tire trough (500 gal.) polyethylene storage tank-1550 gal.
6. Emre Well	Doña Ana FMU 7	357668	3593897	Solar well w/fiberglass tank (1,000 gal.) railroad car storage tank-10,000 gal.
41. Greens Babber Well	Socorro FMU 32	356629	3727213	Solar well w/earthen tank and polyethylene storage tank-1550 gal.
19. Hardin Ranch Well	Sierra FMU 22	339294	3679224	Solar well w/earthen tank and Storage tank-polyethylene-1550 gal.
22. John Woods Well	Sierra FMU 22	345894	3686139	Solar well w/fiberglass 10' tank (1,000 gal.) and polyethylene tank-1550 gal.
23. L.W. Well	Sierra FMU 21	352233	3689614	Solar well w/earthen tank and railroad car storage-10,000 gal.
4. Lena Cox Well	Doña Ana FMU 7	356618	3592269	Solar well w/8' dia. Tire trough (500 gal.) and railroad car storage-10,000 gal.
30. Marcial/Anderson Well	Socorro FMU 23	343401	3705770	Solar well w/earthen tank and railroad car storage-10,000 gal.
27. Martin Well	Sierra FMU 25	354841	3696603	Solar well w/tire trough-8' dia. (500 gal.) and polyethylene storage tank-1550 gal.
48. NECI Well	Socorro FMU 32	351405	3741571	Solar well w/tire trough 8' dia. (500 gal.) and polyethylene storage tank-1550 gal.
21. Pete Woods Well	Sierra FMU 22	342695	3682051	Solar well w/earthen tank and polyethylene storage tank-1550 gal.
16. Potter Ranch/Towner Well	Sierra FMU 16	344048	3671718	Solar well w/tire trough 8' dia (500 gal.) and railroad car storage-10,000 gal.
42. Red Canyon Well	Socorro FMU 28	395177	3731129	Solar well w/tire trough 8' dia. (500 gal.) and polyethylene storage tank-1550 gal.
47. Red Rio Well	Socorro FMU 36	382476	3738675	Solar well w/tire trough 8' dia. (500 gal.) and polyethylene storage tank-1550 gal.

WHITE SANDS MISSILE RANGE

Firefighting Water Sources

11/6/2017

Water Source Type

- Construction Well
- Hauled Water Tank
- Truck Filling
- Wildlife Water Tank

NUM	TYPE	NAME
1	Truck Filling	Main Post Water Point #1
2	Hauled Water Tank	Frequency WS (Oasis Site)
3	Truck Filling	Main Post Water Point #2
4	Wildlife Water Tank	Lena Cox Well
5	Hauled Water Tank	EMRE
6	Wildlife Water Tank	EMRE Well
7	Construction Well	Thel-1 (aka THEL Well) (NMOSE T-03654)
8	Hauled Water Tank	Frequency (Holloman AFB)
9	Construction Well	NW30-1 (aka NW-30)
10	Hauled Water Tank	Andre
11	Hauled Water Tank	Tula G
12	Hauled Water Tank	J-9
13	Construction Well	Tula Gate (NMOSE T-04087)
14	Hauled Water Tank	Tularosa (MINDA)
15	Hauled Water Tank	Tula Gate
16	Wildlife Water Tank	Potter Ranch/Towner Well
17	Construction Well	Herbie Well (aka Rhodes C or Well 6)
18	Hauled Water Tank	Rhodes Commo
19	Wildlife Water Tank	Hardin Ranch Well
20	Wildlife Water Tank	Buckhorn Well
21	Wildlife Water Tank	Pete Woods Well
22	Wildlife Water Tank	John Woods Well
23	Wildlife Water Tank	L.W. Well
24	Hauled Water Tank	Salinas NewTec
25	Hauled Water Tank	Salinas Commo
26	Hauled Water Tank	Russ Site
27	Wildlife Water Tank	Martin Well
28	Wildlife Water Tank	Burris Well
29	Hauled Water Tank	Phillips Hill
30	Wildlife Water Tank	Marcial/Anderson Well
31	Construction Well	Range Road 5 Well
32	Construction Well	Martin Ranch Construction Well
33	Hauled Water Tank	Ben Site
34	Wildlife Water Tank	Ben Site Well
35	Hauled Water Tank	Oscura RC Commo
36	Construction Well	ORC Fire (aka Oscura Range Ctr.)
37	Hauled Water Tank	Oscura RC Bombing Range
38	Construction Well	Murray Well (RG 80492)
39	Hauled Water Tank	Aerial Cable
40	Hauled Water Tank	PHETS/DTRA
41	Wildlife Water Tank	Greens Baber Well
42	Wildlife Water Tank	Red Canyon Well
43	Hauled Water Tank	Atom Peak SST
44	Hauled Water Tank	NOP Barracks (Hilton)
45	Hauled Water Tank	NOP (North Oscura Center Range)
46	Wildlife Water Tank	Baca Well
47	Wildlife Water Tank	Red Rio Well
48	Wildlife Water Tank	NECI Well
49	Truck Filling	SRC Non-Potable water filling station

5 2.5 0 5 Miles

10 5 0 10 Kilometers

Produced by the GIS Team for the Directorate of Public Works, White Sands Missile Range.

No warranty is made by the White Sands Missile Range as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by WSMR. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notice.

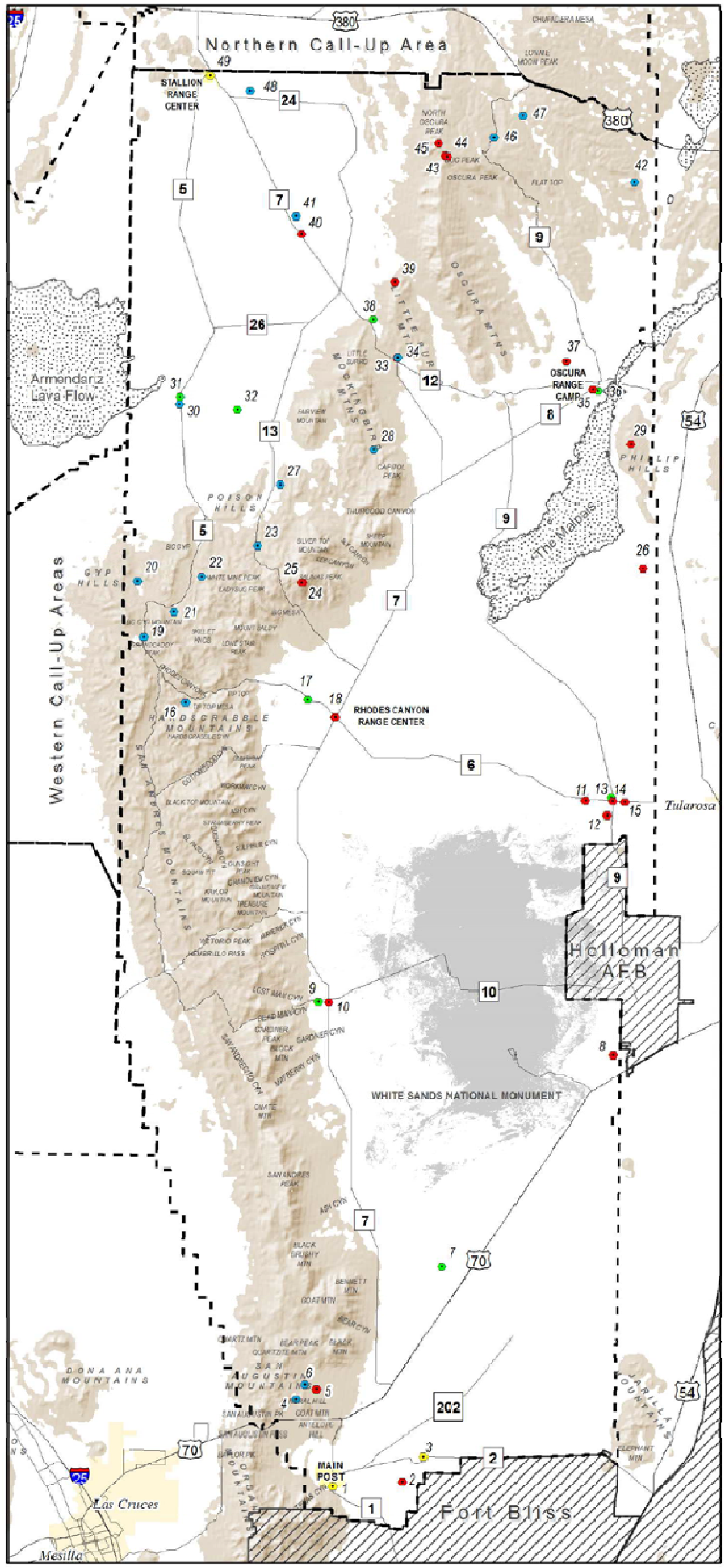


Figure 4-5 Potential Water Fill Sites for Firefighting Purposes on WSMR

4.5.7 Rehabilitation Needs and Procedures

Very few areas within WSMR will require rehabilitation after a wildfire. Seeding of burned areas with native grass seed is common practice in many areas but is generally unnecessary on WSMR. The vegetation found across WSMR has evolved with wildfire and, in general, recovers quickly after being burned (3-5 years is typical for native grasslands).

Ground disturbances such as hand lines or bulldozer lines caused by firefighting efforts should be restored, as much as possible, back to original condition. Firelines that were created should be covered back up with previously cut brush, rocks and sticks. Waterbars should be placed on disturbed slopes. Place waterbars at a 30 degree angle to the scraped fire line so that water is carried off of the disturbed area and into undisturbed vegetation. Place waterbars so that there is one for every 6' rise in elevation. Use of bulldozers should be discouraged except around structures, as the disturbance caused by heavy equipment usually is more pronounced and lasts far longer than the disturbance caused by a wildfire. See **Appendix H** for rehabilitation guidelines.

Soil erosion can be a problem after a severe wildfire if it burns through steep country. Water diversions made by placing sticks or logs parallel to the contours of the slope are useful in trapping sediment and limiting soil erosion. Aerial or hand seeding of native grasses can help severely burned areas recover more quickly but costs can be prohibitive. Be careful using seed. Minimize the chances of introducing non-native or invasive weeds or grasses and only order seeds from sources that certify their seeds to be at least 98% weed-free and are mixtures of plants that are adapted to this area and elevation. Canyon and arroyo bottoms can benefit from gabion structures designed to slow down water flow. Place boulders, logs and cut brush into gullies to help slow down the movement of water and trap sediment.

4.5.8 Communications

Handheld and mobile two-way radios are the most common form of communications on wildland fires. WSMR has programmable radios for WSMR FES firefighters that are compatible with local Fire Departments and Volunteer Fire Departments (VFDs), BLM, NM State Forestry, USFWS and US Forest Service in order to communicate with these and other agencies. Cell phones should not be strictly relied on in the wildland environment of WSMR as coverage is unavailable in many areas. The following are communication SOPs for wildland firefighters:

- All WSMR personnel assigned to wildfire suppression duties will carry a radio or they will remain in vocal contact with someone that has a radio.
- All fire-assigned personnel will be familiar with the controls of the radio and must be able to communicate common wildfire principles, tactics and operational procedures in clear text.
- Radio communications on each wildfire incident will have an assigned frequency that will be made known to all fire-responding personnel.
- Radios should be checked for battery charge and proper frequency set before engaging in wildfire operations.
- Over-the-air transmissions should be kept short and messages should be transmitted in a clear, methodical tone.

- Important safety and tactical messages should receive affirmation and acknowledgement.
- WSMR FES Rescue Control will monitor fire-assigned frequency and be able to transmit information to fire resources at all times.

4.5.9 Equipment

Table 4.3 WSMR FES Wildland Firefighting Equipment

Equipment Call Sign	Water Tender	Type 6	Structure
Engine 1	NA	NA	**1,000 GPM,* 300 gal.*, 4 personnel**
Engine 2	NA	NA	**1,000 GPM, 300 gal., 4 personnel**
Engine 3	NA	NA	**1,000 GPM, 300 gal., 4 personnel**
Engine 4	NA	NA	**1,000 GPM, 300 gal., 4 personnel**
Wildland 1	NA	**150 GPM 250 gal. 2 personnel**	NA
Wildland 2	NA	**150 GPM 250 gal. 2 personnel**	NA
Wildland 3	NA	**150 GPM 250 gal. 2 personnel**	NA
Wildland 4	NA	**150 GPM 250 gal. 2 personnel**	NA
Attack 1 (Humvee)	NA	**150 GPM**	

		250 gal. **2 personnel**	NA
Attack 2 (Humvee)	NA	**150 GPM** **250 gal.** **2 personnel**	NA
Attack 3 (Humvee)	NA	**150 GPM** **250 gal.** **2 personnel**	NA
Attack 4 (Humvee)	NA	**150 GPM** **250 gal.** **2 personnel**	NA
Tender 1 (tactical Type 2)	**500 GPM, 1,800 gal.**	NA	NA
Tender 2 (support Type 2)	**1,250 GPM, 3,000 gal.**	NA	NA
HEWATT 3 (tactical Type 1)	**500 GPM, 2,500 gal.**	NA	NA
HEWATT 4 (tactical Type 1)	**500 GPM, 2,500 gal.**	NA	NA

*GPM-Gallons per Minute *Numbers are in US gallons

Support Vehicles	**4x4**
Chief 1	YES
Chief 2	YES
Fire Prevention	YES
Training	YES
HELSTF panel truck	NO

Table 4.4 contains a list of mandatory personal equipment, clothing and gear to be worn or carried by all firefighters when engaged in wildland fire operations on WSMR.

Table 4.4 Mandatory Personal Protective Equipment for Wildland Fires

Equipment	Required when...
Hard hat.	On the fireline.
All leather, 8" high boots with slip and melt-resistant soles and heels. No steel toes.	On the fireline.
Flame resistant clothing (Nomex pants and shirt). Sleeves should be rolled down.	On the fireline, in helicopters.
Leather gloves.	On the fireline.
Eye (safety glasses), face (Nomex shroud), and neck protection (shroud or bandanna).	On the fireline.
Fire Shelter.	On the fireline
Hearing protection. ANSI approved ear plugs or ear muffs	When working with high noise-level firefighting equipment, such as helicopters, air tankers, chain saws, portable pumps, etc.
Chaps (required for chain saw operators and swampers).	When operating or swamping for chain saws.
Dust/smoke mask.	When necessary.

4.5.10 Records and Reports

Guidance from AR 420-1 and DODI 6055.06 requires that a fire report be completed by WSMR FES personnel and forwarded to the National Fire Incident Reporting System (NFIRS). The Emergency Reporting System (ERS) is the automated software system that WSMR FES uses to record fire reports, record training and report fires to NFIRS. Contact the DOD NFIRS Program Manager at the Naval Safety Center, 375 A Street, Norfolk, VA 23511-4399 or at https://nfirs.fema.gov/ for technical assistance. PWE Branch should receive a copy of each wildfire report along with any other data including GPS points in order to update and maintain the wildfire database for WSMR.

The WFPM is responsible for tracking NFPA/NWCG standards for WSMR FES firefighters.

4.5.11 Public Relations and Cooperator Notifications

The WSMR Public Affairs Office (PAO) will be notified at 575 678-1134 and integrated into the incident operations whenever wildfires escape initial attack, when wildfires are in close proximity to WSMR boundaries or near dwellings and whenever prescribed fire events are planned. WSMR PAO maintains a contact list of media outlets in order to get information out to the public quickly. This helps to inform and assure the public that the incident is under control or that efforts to control the incident are under way.

Whenever wildfires threaten to cross installation boundaries, close coordination between WSMR FES and WFPM, WSMR PAO, the federal wildland firefighting agencies, municipal and volunteer fire departments, the affected public and private landowners must occur. Table 4.5 lists cooperators that can assist WSMR with wildland fire management both on and off-range (list may not be all-inclusive).

Table 4.5 WSMR Wildland Fire Cooperators

WSMR Fire Dispatch (Rescue Control) and Police	575 678-1234
WSMR PAO	575 678-1134
WSMR Fire Station #1-Main Post	575 678-0470
WSMR Fire Station #2-LC-38	575 678-9128
WSMR Fire Station #3-Stallion Range Center	575 679-4434
WSMR Fire Station #4-HELSTF	575 679-5167
WSMR FES	575 678-5105
WSMR FES Fire Chief	575 678-0314
WSMR Fire Prevention and Inspections	575 678-3585
WSMR Range Control	575 678-2222/2221
WSMR Range Scheduling	575 678-6141/6142/6144
Holloman AFB Fire Dept.	575 752-7228
Holloman AFB PAO	575 572-5406
Gary Atwell, Deputy Range Manager	575-572-5074
Holloman Range Operations Center (ROC)	575 572-5716
Fort Bliss PAO	915 744-8435/8406
Fort Bliss Fire Dispatch	915 744-1283/2115
McGregor Range Control/Range Operations	915 744-9546/9547/9548/9554
Silver City Interagency Dispatch Center	575 538-5371/5372
Alamogordo Interagency Fire Dispatch Center	575 437-2286 or 877-695-1663
Las Cruces District-BLM	575 525-4300
Pecos District-BLM Roswell	575 627-0272
Carlsbad Field Office-BLM	575 234-5972
Socorro Field Office-BLM	575 835-0412
Lincoln NF-US Forest Service	575 434-7200
Cherokee Range Control	575 678-8000
San Andres National Wildlife Refuge	575 382-5047
USFWS NM Fire District	575 835-0040
Jornada Research Center	575 646-4842
NASA-WSTF Emergency Management Coordinator	575 524-5338
NASA-WSTF Fire Department	575 524-5641
NM State Police	575 827-9309

NM Air Quality Bureau	800 224-7009
NM State Forestry-Capitan District	575 354-2231
NM State Forestry-Socorro District	575 835-9452
El Paso Municipal Fire Department	915 485-5600
Alamo West Volunteer FD	575 434-3686
Las Cruces Municipal Fire Department	575 528-3473
Talavera sub-station (LCFD)	575 532-5532
Organ Volunteer FD	575 382-5411
Mescalero Forestry-BIA	575 464-4410
Dona Ana County Fire and Emergency Services	575 647-7921
Otero County Emergency Svc Dispatch	575-885-2111
Sierra County Emergency Management	575 894-6215
Socorro County Emergency Management	575 835-2700
Lincoln County Emergency Management	575 336-8600
National Weather Service-Santa Teresa Office	575 589-4088

4.5.12 Wildland/Urban Interface (WUI) Responsibilities for Team WSMR

The ***wildland/urban interface*** (WUI) is described as areas where wildlands meet or intermix with structures or other human developments (NWCG 2012). Suppressing wildfires as well as providing structure protection within a wildland environment presents significant safety and operational challenges to firefighters. **Appendix J Wildland/Urban Interface/Intermix (WUI) Wildfire Safety Considerations and Operations** details common safety considerations, tactics and strategies for firefighters operating in the WUI environment. Within WSMR, there are numerous areas of WUI, including Range Complexes, missile testing and development facilities, training area facilities, advanced weapons and laser testing facilities and missile launch facilities. These areas on WSMR are described more specifically in **Fire Management Units-Appendix A** along with specific actions to prevent or mitigate wildfire threats where they exist within each FMU.

The importance of maintaining adequate defensible space around WSMR's structures cannot be over-emphasized. Keeping brush removed and all flammable fuels around structures either kept green by watering or mowed to keep fuels short or kept bare of vegetation for a minimum of 30' away from the structure is a responsibility of PWO, the facility owners and lessees or users. WSMR FES personnel do not have the resources, time or money to maintain defensible space across WSMR even though they will be the ones trying to save those structures in the event of a nearby wildfire. WSMR PWO maintains firebreak roads and facility grounds in a fire safe condition to the extent that they can. However, they do not have the manpower, time or resources to keep all of WSMRs facilities fire safe. All organizations using the facilities at WSMR have a responsibility to maintain those facilities in a fire-wise and fire safe condition.

WUI areas outside WSMR boundaries that can be threatened by wildfires occurring on the installation include the unincorporated community of Organ, the NASA facility at WSTF, the BLM's Aguirre Springs Recreation Area and Campground, as well as isolated ranches and dwellings occurring on WSMR's western, northern and eastern boundaries.

Holloman AFB and the community of Orogrande are situated within the Tularosa Basin and do not have the fuel loads, within the surrounding area, to support large wildfires. However, during fire seasons that are preceded by seasonal monsoons with above normal precipitation, the proliferation of annual weeds and grasses can be sufficient to allow for the growth of wildfires in some of these locations.

Facilities located on WSMR main post could be threatened by wildfires started on WSMR, Fort Bliss or BLM lands. There are high fuel loads within the Organ Mountains and wildfires can easily spread here under the right conditions. However, the main post of WSMR is well protected from wildfires due to its location on the desert floor and due to firebreaks that have been put in place on the west, south and north sides of the main post.

4.5.13 WSMR Mutual Aid Agreements

Mutual Aid Agreements (MAAs) are signed documents that allow for resources from one agency to aid another agency without being ordered through a dispatch center. The agencies agree to aid each other during initial attack and can cross respective boundaries to render aid without the need for written authorization for every incident. WSMR FES maintains mutual aid agreements (MAAs) with Las Cruces BLM, Socorro BLM, Organ Volunteer Fire Department, NASA Fire Department, Fort Bliss FES and the San Andres National Wildlife Refuge. WSMR FES firefighters are available to fight wildfires outside WSMR boundaries on a case-by-case basis as determined by the WSMR WFPM.

An MAA with New Mexico State Forestry (NMSF) would be beneficial to WSMR in that NMSF has jurisdiction over the local VFDs when responding to wildland fires. The VFDs of Organ, Alamo West, Boles Acres, Jackrabbit Flats, Tularosa, Carrizozo, and San Antonio are small and scattered departments, but can provide engines, water tenders and firefighters to remote locations within their respective jurisdictions and can provide protection to ranches and other remote infrastructure near WSMR boundaries.

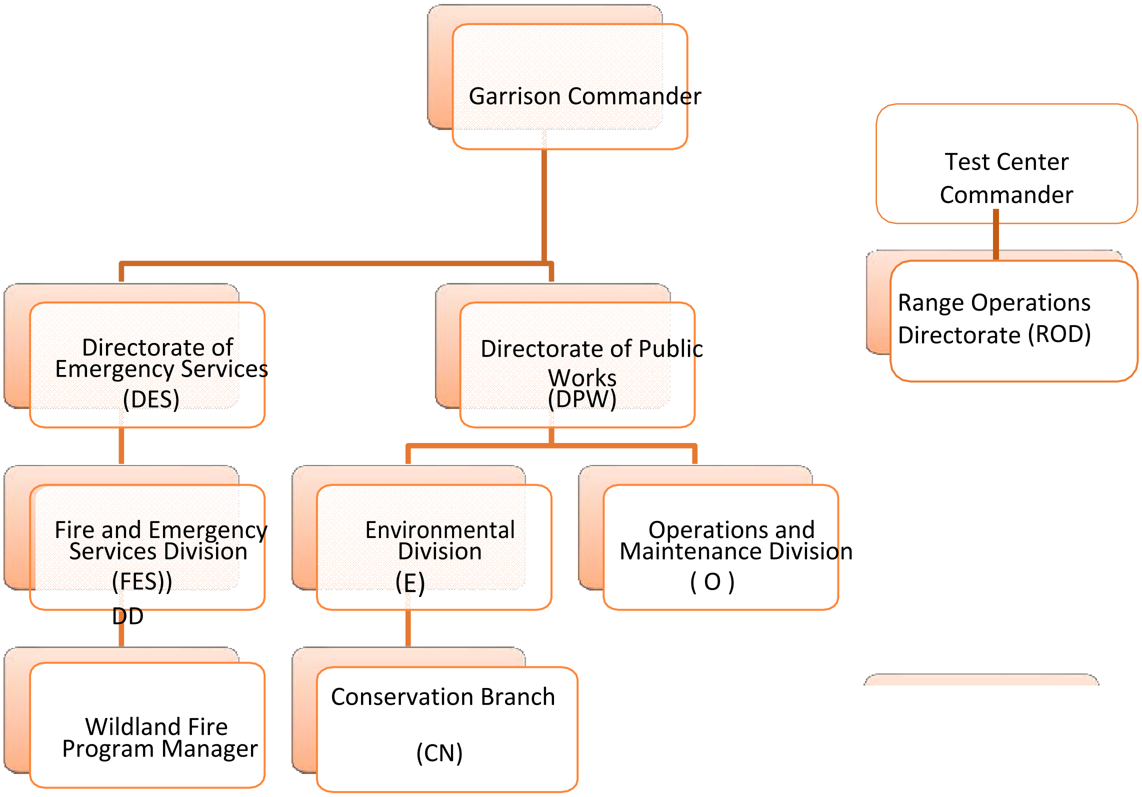
4.6 WSMR Wildland Fire Organizational Structure and Responsibilities

- WSMR FES firefighters have direct responsibility for suppression of all human-caused fires within WSMR boundaries including structure fires and wildfires. The Wildland Fire Program Manager (WFPM) position falls within the management of WSMR FES (Table 4.6). The WSMR FES Fire Chief is designated as the WFPM. The WFPM is responsible for ensuring that the components of the IWFMP are implemented. The WFPM is responsible for review, approval and execution of prescribed fire burn plans, and for maintaining records of FES individuals' wildland fire trainings, PT tests and experience.
- WSMR will use the standards established by the NWCG for issuing Position Task Books (PTBs). PTBs are used for evaluating individual's performance in NWCG positions above Firefighter Type II (FFT2) and are documentation for obtaining higher qualifications common to the federal wildland fire community. PTBs and requisite trainings and qualification standards and procedures can be found within the NWCG handbook PMS-310-1 located at https://www.nwcg.gov/publications/310-1. The WSMR WFPM will report annually, the installation's staffing requirements for the tasks associated with wildland fire management activities.
- At present, WSMR FES is in the process of developing wildland firefighters that will meet National Wildfire Coordinating Group (NWCG) standards pertaining to command structure, equipment and training. One goal is to eventually have 4-8 qualified Incident Commanders (IC) Type 4 that can lead teams of certified wildland firefighters using wildland fire engines, UTVs and water tenders on initial and extended attack wildfires. Use of PTBs will help to progressively elevate firefighters from Firefighter Type II to Firefighter

Type I to Crew Boss and Engine Boss to IC Type 4. Currently, wildfire suppression resources are located at Main Post (Station 1), Nike Avenue or LC-38 (Station2), Stallion Range Center (Station 3) and at HELSTF (Station 4).

- WSMR's wildland fire management program is rated as Moderate in overall complexity based on an analysis using the Interagency Fire Program Management (IFPM) guidance found at https://www.ifpm.nifc.gov. Eventually, the use of this interagency standard will help to ensure that an appropriately qualified organization is funded and available for wildfire response and overall wildland fire program implementation at WSMR.
- For prescribed fire operations, WSMR firefighters will use NWCG standards and the appropriate level of Burn Boss will be assigned based on the complexity of the project as described in the approved Prescribed Fire Plan. Subordinate positions used on most prescribed fires are Firing Boss and Holding Boss. Firing and Holding Boss are not mandatory positions for all prescribed fires (PMS 484). However, Ignition Boss (FIRB) and Holding Boss (Minimum Qualification ENGB) if needed, will be qualified for their position as per NWCG PMS 310-1 and PMS 484.
- PWE is responsible for managing the natural resources of WSMR in such a manner that the military mission is sustained and there is no net loss of testing/training lands or capabilities (WSMR 2015). This responsibility includes the management of wildfire and prescribed fire for sustaining and enhancing testing/training land environments. PWE and FES personnel will work together to implement fuels projects including prescribed burns for ecosystem benefits and for fuels reduction. PWE designs and proposes projects which help sustain ecosystem components. These projects may include prescribed burning, or mechanical treatments such as tree thinning and piling. PWE is responsible for ensuring that all prescribed burn projects meet NEPA requirements, that monitoring is conducted for meeting burn objectives and for maintaining a database of all wildfires and prescribed fire projects on WSMR.
- PWE creates, maintains and updates this IWFMP. The IWFMP is integrated with the combined WSMR Integrated Natural and Cultural Resources Management Plan (INCRMP)) which was created and maintained by PWE.
- PW Operations and Maintenance Division (PWO) is responsible for the construction and maintenance of access and firebreak roads throughout WSMR as well as the reduction of hazardous fuels around facilities.
- The Range Operations Directorate is responsible for implementing policies, programs and procedures related to range operations and has complete flight safety control for all missiles, rockets, munitions, and other devices launched from or into WSMR. The directorate conducts flight safety management, schedules and controls all testing on the range and operates a vast array of instrumentation used in the test and evaluation of missile systems and weapons. Range operations have priority over wildland fire incidents. Whenever missions are occurring on WSMR, FES firefighters receive their instructions from Rescue Control, who obtains permission from Range Control before dispatching firefighters onto the Range.

Table 4.6 WSMR Hierarchy for Wildland Fire



4.6.1 Team WSMR Consensus and Documentation Requirements for Allowing Wildfires to Burn

- The IC on the ground, in communication with wildfire managers including the WFPM and the GC, make the decision to fall back to FMU boundaries and allow the wildfire to burn within those boundaries. A decision document needs to be completed within a few hours as a way to document and justify and reduce Army liability. The decision to allow wildfires to burn on WSMR should be made with consensus from the GC, the Director of the Range Operations Directorate, the Fire Chief of WSMR FES and the Division Chief PW-Environment. Considerations for allowing a wildfire to burn will include:
  - Risk analysis of firefighter safety,
  - Risk analysis of fire threat to installation property, installation boundaries and private property,
  - Cost concerns of minimal wildfire management versus large-scale wildfire suppression operations,
  - Potential of test missions to be hampered by wildfire smoke if wildfires are burning for several days
  - Long-term weather forecasts,
  - Current fuel conditions and fuel moistures (live and dead),
  - Long-term drought,

If consensus is reached for allowing a wildfire to burn, then a wildland fire use decision document, signed by the GC and the principal decision makers should include the bulleted analysis of issues listed above as a justification for allowing the wildfire to burn and include a map showing a ***maximum manageable area*** (MMA) with ***management action points*** (MAPs) that would trigger suppression actions to the wildfire. Usually, the MMA is the nearest set of firebreak roads (bladed roads) that surround the wildland fire area. MAPs are pre-determined points or lines within the MMA that, as the wildfire approaches, firefighters initiate suppression operations (i.e., igniting backfires to contain the wildfire or suppressing fire using hand tools and/or water from engines and backpack pumps).

4.6.2 Personnel Training and Certification Standards and Recordkeeping

All WSMR FES personnel engaged in wildfire suppression and prescribed fire duties will meet NFPA 1051 *Standard for Wildland Fire Fighter Professional Qualifications* requirements for the positions they are assigned. An Army goal is for all firefighters involved in wildfire suppression and prescribed fire operations to meet NWCG standards. All firefighters on the fireline will be certified, at a minimum, as Firefighter Type II under NWCG standards or as Firefighter 1 under NFPA 1051 standards. Requirements for all wildland firefighter positions are established in the NWCG Publications Management System (PMS) *310-1, Wildland Fire Qualifications Guide* https://www.nwcg.gov/publications/310-1 and in NFPA 1051. Use of the cross-walk for structural firefighters to qualify in wildland fire positions is encouraged. The cross-walk can be found in PMS 310-1 and outlines “gap” course requirements and field training necessary to qualify as Firefighter II and above in order to meet NWCG standards. There is a current effort at IMCOM G4 ENV to provide central authority and establish a mechanism for issuing Red Cards to installation civilian firefighters.

Per NFPA and NWCG requirements, all courses of instruction shall be taught by an NWCG or NFPA certified instructor experienced in the skills being taught. WSMR provides its own instructors for basic level courses (100/200 level) but will bring in outside qualified personnel to teach more advanced courses as necessary (NFPA 1051).

The WFPM is responsible for selecting potential trainees, scheduling courses, proper use of Position Task Books (PTBs), documenting course completion, maintaining accurate records, certifying firefighters and trainees and issuing red cards.

The WFPM will develop an annual schedule of wildland fire course instruction and a training plan. The WFPM coordinates the training plan with FES and outside agencies for cross-leveling and sharing of training opportunities (NFPA 1051).

Individuals will not be assigned to duties for which they lack training and/or certified experience. All personnel dispatched or assigned to wildfires or prescribed fires will be qualified for their assigned position unless assigned as trainees under the direct supervision of higher qualified personnel. Each firefighter is responsible for showing proof of qualifications and completed training. This is usually in the form of an Incident Qualifications Card, or 'Red Card'. NWCG utilizes Position Task Books (PTBs) to document trainee’s on-the-job performance. PTBs will be used by WSMR FES managers and supervisors to help keep track of each individual's training experience. It is the responsibility of the trainee to maintain their PTBs and to carry it with them on wildfire assignments (NFPA 1051).

All required training courses will be completed prior to completion of a PTB. The training courses are required to prepare the employee to perform in the position. The WFPM has sole discretion over which individuals will be provided training courses. Certification of courses and PTBs completed will be documented and tracked by the WFPM or his/her designee.

Currency requirements follow NWCG protocols. The maximum time allowed for maintaining currency is three (3) years for air operations and dispatch positions and five (5) years for all others (NWCG PMS 310-1). Currency for a position can be maintained by meeting any of the following requirements (NFPA 1051):

- By successful performance in the position qualified for within the given timeframe.
- By successful performance in a position identified in PMS 310-1 as Other Position Assignments That Will Maintain Currency.
- By successful performance in a higher position(s) for which that position is a prerequisite, providing the individual was previously qualified in that position.

All primary and secondary wildland firefighters will be certified, as a minimum requirement, in Cardio-Pulmonary Resuscitation (CPR) and Standard First Aid by the American Red Cross or a comparable certification authority.

It is the responsibility of the WFPM to annually certify the qualifications of all WSMR wildland firefighting personnel. An annual fireline safety refresher (NWCG course RT-130) is required for most Incident Command System (ICS) positions, including all fireline positions. The NWCG Work Capacity Test (WCT) or NFPA equivalent is an annual requirement for wildland firefighting (See Sec. 4.6.3).

Under certain circumstances WSMR personnel, both FES and non-FES personnel, may be requested to assist in wildland fire operations off-post. Requests for WSMR personnel to assist in off-post assignments must be within the guidelines established by an MAA or other Inter-Agency Agreement with the agency requesting the aid, especially if it involves reimbursement of expenses. The decision to send qualified personnel to incidents off-post is at the discretion of the individual's supervisor, the WFPM and the GC.

4.6.3 Physical Fitness Standards

All WSMR FES firefighters will meet criteria for physical fitness standards for wildland firefighters as contained in NFPA 1500-*Standard on Fire Department Occupational Safety and Health Program* and receive a physical examination as specified in NFPA 1582-*Standard on Medical Requirements for Fire Fighters*. All other personnel assigned to fireline duties on WSMR must pass the NWCG WCT at the arduous level (walk three miles carrying a 45-lb. pack within 45 minutes) if qualifying for a fireline position, or at the moderate or light level if qualifying for non-fireline positions, must possess documentation of qualifications for positions assigned and attain a red card. NWCG fitness categories are defined in PMS 310-1 as well as the required fitness level for each ICS position.

4.7 Interagency Cooperation

Wildland firefighters require the cooperation of multiple agencies. In particular, the National Weather Service whose local offices produce daily fire weather forecasts; the US Forest Service which maintains a fleet of aerial firefighting resources including lead planes, aerial supervision platforms, air tankers, smokejumper aircraft and helicopters; the Bureau of Land Management which usually has the nearest available engines and overhead; the Alamogordo Interagency Dispatch Center (ADC) which is open year-round for aid in ordering crews, overhead, equipment and aircraft. These assets are available to all wildland fire management agencies. The IC has the authority to order interagency resources as needed for WSMR wildfires. The order is placed through Rescue Control who will contact ADC as appropriate

ADC covers wildfire responses throughout southeast New Mexico and most of west Texas and is also called Pecos Zone and includes all WSMR lands. A common FM frequency monitored by ADC and a good frequency for WSMR firefighters to use when attempting to contact ADC is (FM RX freq. 168.575, channel guard 192.8, TX freq. 166.875, and channel guard 136.5).

Interagency aircraft dispatched by ADC and responding to wildfires on WSMR or requesting to enter WSMR airspace must contact Cherokee Range Control at 575 678-8000 or by radio on VHF frequency 126.95 or UHF 305.5. If no answer call Holloman Approach (RAPCON) on VHF 120.6 or UHF 269.225 for clearance to access WSMR airspace.

WSMR will pursue an MOA (Memorandum of Agreement) with ADC. This agreement would include guidance and protocols for communicating with ADC and ordering equipment, manpower and aircraft. This MOA could aid WSMR when wildfires threaten the installation's resources or boundaries by quickly being able to obtain outside firefighting resources, including engines, hand crews, air tankers, helicopters, lead planes, and ***aerial supervision modules*** (ASMs).

4.7.1 Coordination between WSMR FES and Holloman AFB

Holloman Air Force Base (HAFB) controls ground access and air operations at the Red Rio Bombing Range and at Oscura Bombing Range, both of which are located in the northeast portion of WSMR. HAFB maintains bladed firebreaks around both of these impact areas. HAFB relies on WSMR FES personnel for any fire suppression activities outside their system of maintained firebreaks. As mentioned previously, wildfires are not fought within impact area boundaries. HAFB maintains a contract for a Type 4 engine with two personnel along with a 1,000 gallon tactical water tender at Oscura Range when bombing missions are occurring. These assets are available for firefighting outside the boundaries of Oscura Range.

Stallion Range Complex Station #3 personnel respond to wildfires at Red Rio Range. Gates are locked by HAFB at the two primary access points to Red Rio Range. There is a telephone in a box at each of these gate locations that connects directly to HAFB Range Operations Center (ROC). The telephones have to be turned on before a call can be made to ROC for the gate combination and permission to enter Red Rio Bombing Range. The ROC is manned 100 hours/week on average and always when missions are occurring on Red Rio Range. HAFB maintains a camera network around the two Bombing Ranges that can be helpful in spotting wildfires in their vicinity. The camera network has both visible and infra-red detection cameras. HAFB employs a Range Officer that is Type 4 Incident Commander qualified and drives a 100 gallon Type 6 engine that can be used for wildfires at Red Rio Range (Contact Gary Atwell, Deputy Range Manager 575-572-5074).

It is recommended by Atwell that HAFB ROC give WSMR FES their radio frequency for maintaining direct radio communications at Red Rio. WSMR FES should utilize this frequency whenever they are responding to wildfires at Red Rio in order to facilitate safety, for ensuring Red Rio Range is closed to AF flight missions and open for wildfire operations, and for coordinating their wildfire response (Pers. comm. Gary Atwell 2017).

4.8 WSMR Prescribed Fire Management

Prescribed fire is the controlled application of fire to wildland fuels under specified conditions that limits the fire spread to a predetermined area and at the same time produces the desired intensity necessary to achieve resource management objectives. WSMR prescribed fires are ignited and conducted only if environmental conditions are within the parameters of an authorized prescribed fire plan. Prescribed fire plan prescriptions can be used to establish connections between ecosystem management objectives, military objectives and firefighting objectives. This process helps to achieve mutual goals and objectives and improves program efficiency. Prior to implementing a prescribed fire, WSMR burn plan preparers must have ensured compliance with National Environmental Policy Act (NEPA), National Historical Preservation Act (NHPA) and Endangered Species Act (ESA) requirements.

On WSMR, there are two recognized types of prescribed burns. The first falls under the guidance of the Sustainable Range Program Activities for Environmental Programs (MDEP VENQ) and is for the purpose of ecosystem management and for the protection or benefit of listed or proposed threatened or endangered species. The second type of prescribed burn falls under the guidance of the Sustainable Range Program Activities for Facilities (MDEP QMUN) and is for the purpose of vegetation control and fuels reduction in order to protect people, property, equipment or mission capability (SRP 2005).

WSMR has completed prescribed fire (RX) projects including the Strawberry Peak RX, Trail Canyon RX, Cain Well, Helm's Valley, Big Gyp and the Bingham Smith RX (See Table 4.7). These burns were completed for the purpose of meeting ecosystem management objectives. Future prescribed fire projects for meeting ecosystem management goals and objectives, including more burning in the aforementioned RX areas, are being planned for Rhodes Canyon, the Hunter's Lodge area on the northern boundary, and the Oscura Mountains and Foothills (Table 4.7). Future prescribed fires for fuels reduction projects designed to protect people and facilities are planned and are listed after the San Andres Wildlife burn in Table 4.7.

The *Prescribed Fire Planning and Implementation Procedures Guide* (PMS 484) provides interagency prescribed fire plan guidance and a burn plan template https://www.nwcg.gov/publications/484.

Table 4.7 WSMR Prescribed Fire Projects

Prescribed Burn (RX) Projects	Frequency	Size (Acres)	Comments	FMU
Trail Canyon	10-15 Yrs.	1000	Three engines, 1 water tender, 2 UTVs, 12-15 personnel needed; 1 day to implement.	34
Cain Well	5-10 Yrs.	1,500	Two engines, 1 water tender, 2 UTVs, 12-15 personnel needed; 1 day burn.	33
Helm's Valley	10-12 Yrs.	150	Three engines, 1 water tender, 2 UTVs, 10-15 personnel needed; 1 day burn.	30
Big Gyp	10-15 Yrs.	2,500	Three engines, 1 water tender, 2 UTVs, 10-15 personnel needed to burn along roads, firebreaks and hand lines; multi-day project(2-4 days to implement fully).	23
Strawberry Peak	15-20 Yrs.	2,500	Three engines, 1 water tender, 2 UTVs, 10-15 personnel needed to burn along roads, firebreaks and hand lines; multi-day project(2-4 days to implement fully).	15
Bingham Smith	10-12 Yrs.	200	Two engines, 1 water tender, 2 UTVs, 8-12 personnel needed; 1 day burn.	34

Hunter's Lodge	5-15 Yrs.	12,000	Three engines, 1 helicopter, 1 water tender, 2 UTVs, 12-20 personnel needed; 1-3 days to implement.	30,35, 36
Rhodes Canyon	10-12 Yrs.	200	Two engines, 1 water tender, 2 UTVs, 6-10 personnel needed; 1 day burn.	22
Oscura Mountains and Foothills	As Needed	100	Piled or lop and scattered fuels for extending fire break around facilities. Two engines, 1 water tender, 2 UTVs, 10-15 personnel needed; 1 day burn.	30,35
Silvertop Mountain	As Needed	3,500	Two engines, 1 helicopter, 1 water tender, 2 UTVs, 12-15 personnel needed; 1-3 day burn.	21
Sheep Mountain	As Needed	6,000	Two engines, 1 helicopter, 1 water tender, 2 UTVs, 12-15 personnel needed; 1-3 day burn.	21
San Andres Mountains Mule Deer habitat Enhancement	10-15 Yrs	10,500	This is a multi-year project of prescribed burning in strategic locations to reduce decadent shrubs and increase browse. Two engines, 2 UTVs, 10-15 personnel are needed for 3 days over 3- 5 years to fully implement.	12-16
WUI fuels reduction (programmatic prescribed fire plan to include all of the facilities on WSMR)	As Needed		This will be an annual fire prevention program to lessen hazardous fuels around structures, compounds with fences, historical sites, and outside of impact areas. Activity will include scraping around improvements, piling of hazard fuels and burning those piles and/or burning along firelines and fence rows as needed.	ALL
Totals		40,650		

4.8.1 Prescribed Fire Objectives

- Prescribed fire program will support WSMR's primary military test mission. The program would result in no net loss of mission time from a prescribed burn. All prescribed fires would use firebreak roads and reduce combustible fuels within the designated area by 60-90%.
- The prescribed fire program will support ecosystem management goals. Prescribed fire would be used to restore natural fire regimes on 2,000-12,000 acres/year for a total of 40,000 acres of various vegetation cover types over 15 years to control encroachment of shrubs in grasslands, and regenerate tree and desirable shrubs in woodlands, etc. without altering soil chemistry or natural fire regimes.
- Use prescribed fire to assist in the control of undesired invasive/exotic plant species.
- Enhance forest health dynamics and reduce potential for crown-driven wildfires by mechanical fuels reduction and prescribed burning within piñon-juniper woodland ecosystems to diversify age structure and reduce closed stand densities while creating mosaic patterns of burned and unburned patches that are important to both wildlife and vegetative diversity.
- Establish a professional wildland firefighting contingent within WSMR FES that can manage WSMR prescribed fires as part of their duties. The use of outside resources to implement prescribed burns is costly and creates logistical problems when needing to feed, transport and house extra firefighters. The use of trained WSMR FES personnel will enhance their training opportunities and will also open windows of opportunity to implement prescribed burns because FES personnel are available when WSMR is

mission-free. WSMR FES personnel will also be available when prescribed burning weather and fuel moisture conditions are favorable and within burn plan prescriptions.

4.8.2 Prescribed Fire Constraints

The following are factors that may limit, may require additional mitigations, or may delay the use of prescribed fire on WSMR.

- Military and contractor testing is the priority for WSMR over all other projects. Getting the project into the Range Schedule and blocking out a few days is imperative. Burning within the required weather and fuel conditions dictated by a burn plan prescription while working within a limited window around testing missions is a challenge. Flexibility is important for burn managers and firefighters as weather and testing missions will change frequently and suddenly. Small prescribed fire projects with simple logistical needs that can be executed in a single burning period are more likely to be completed than large complex multiple-day burns.
- Long-term drought conditions put additional stress on plants to the point that prescribed fire treatments may cause undesired mortality within vegetative communities. This is particularly true in grassland ecosystems where moisture must be sufficient either pre or post-prescribed fire to enable desirable native grasses to recover. Burn managers use long-term weather forecasts and do not burn when there are long-term drought indications.
- WSMR complies with all EPA regulations and adheres to the state of New Mexico Air Quality Bureau (AQB) requirements for air pollution and smoke generation. All prescribed burns planned on WSMR must be registered with the New Mexico AQB. http://www.nmenv.state.nm.us/aqb. The AQB relies on smoke ventilation forecasts from the local offices of the National Weather Service (NWS) and upon the smoke mitigation techniques that are written into prescribed fire plans to base decisions on whether or not permitted burns will be allowed to occur. WSMR must request a waiver from the New Mexico AQB if attempting to burn during NWS forecasts for poor or fair smoke ventilation conditions. Waiver requests are more likely to be granted when WSMR prescribed burns are located far from human populations and when smoke mitigation techniques are included within the prescribed fire plan. Many days in the wintertime on WSMR have NWS ventilation forecasts calling for poor or fair smoke ventilation.
- Prescribed fire projects usually require months of preparation, coordination and planning prior to implementation. All prescribed fire projects require a detailed written plan. WSMR prescribed fire plans must meet compliance with NEPA, the National Historical Preservation Act (NHPA) and the Endangered Species Act (ESA) (NWCG 2014). WSMR PWE resource professionals have the expertise in archaeology, wildlife biology and NEPA requirements to help ensure that prescribed fire plans meets mandated environmental regulations.
- Required contingency resources (usually wildland fire engines) from other agencies must be available in order to execute a prescribed fire, but they may not be available due to higher needs in other places. If contingency resources are unavailable for the planned prescribed fire then the project will be delayed until contingency resources are available.
- In order to implement and lead WSMR prescribed fire projects, a Prescribed Fire Burn Boss is required. Burn Bosses must meet NWCG requirements for the position. It generally takes at minimum 3-4 years of prescribed fire experience and additional prescribed fire training for an individual to obtain the necessary abilities, skills and knowledge to qualify as an RXB2. Optimally, WSMR would have two RXB2 qualified individuals for implementing future prescribed fire projects

4.8.3 Prescribed Fire Plans

The Prescribed Fire Plan is the site-specific implementation document. It is a legal document that provides the WFPM and the GC the information needed to approve the plan and provides the Prescribed Fire Burn Boss with all the information needed to implement the prescribed fire. Prescribed fire plans describe the project area, burn objectives, fuel loads and vegetative conditions, desired outcomes and the conditions (prescription) necessary to achieve the desired results. The level of detail in a burn plan is commensurate with the project complexity (NWCG 2014).

An interagency template for prescribed fire plans will be used for prescribed fire plans implemented on WSMR. See https://www.nwcg.gov/publications/484 for the *Prescribed Fire Planning and Implementation Procedures Guide* (PMS 484) and for the fill-able format Interagency Prescribed Fire Plan template. Each element must be addressed and then assembled in the sequence identified in the template. Should an element not apply to a specific prescribed fire plan, not applicable (N/A) may be utilized. Programmatic plans for multiple burns under like conditions may be appropriate. Additional information may be added as appendices. Use of the Prescribed Fire Plan template assures that WSMR burn plans will meet the criteria required for other agencies personnel to be used in the implementation of the project, including the use of other agencies' burn bosses.

When changes to a prescribed fire plan are necessary, the plan must be amended to identify the affected sections; the reason for the change(s); and have the changes clearly identified. Amendments take place before ignition. Amendments to the prescribed fire plan require GC approval and signature. Prescribed fire plan amendments must consider affects to the complexity of the prescribed fire, and therefore the final complexity rating must be reviewed and a new complexity analysis performed if the proposed amendment(s) will result in a change to the Risk or Technical Difficulty of one or more elements in the complexity analysis. Common reasons for amending the prescribed fire plan may include:

- Changes or corrections to objectives.
- Changes in the prescribed fire plan that may affect complexity determinations.
- Changes to fire behavior prescription parameters.
- Changes to project area boundaries resulting in either an increase or decrease in the project area.
- Changes in the minimum required resources or capabilities identified in the plan

4.8.4 Notifications and Coordination

WSMR prescribed fire proponents will coordinate with the WFPM for project management and implementation. The WFPM will work with the proponent and PWE to complete a prescribed fire plan for the proposed project. The WFPM will notify and inform the GC of the proposed prescribed fire project. If the proposed project is near the boundaries of WSMR, adjoining fire departments, landowners and land management agencies will be notified for their input into the prescribed fire plan. WSMR PWE and FES will work together to make these notifications. Neighboring fire departments that have existing MAAs with WSMR should be requested to help with the implementation of the project. This fosters good working relationships and helps to train them in wildland fire operations.

Coordination through Range Operations (575 678-2400) and their subordinate commands, Range Control (575 678-2222) and Range Scheduling (575 678-6141/6142/6144) must occur. 1-3 months advance notification is necessary for Range Scheduling to be able to block time for implementing the prescribed burn project.

Land management agencies such as the USFS and the BLM will often provide technical assistance and technical review of the fire plan and can also provide engines and overhead to help manage the burn. At the very least, outside agency engines can usually be listed as contingency resources to be called in the event the prescribed fire escapes its allowable burn perimeter and cannot be contained by onsite resources.

Every prescribed fire plan must receive a technical review. The technical reviewer and prescribed fire plan preparer must be qualified or have been previously qualified as a prescribed fire burn boss at an experience level equal to or higher than the complexity being reviewed. Either the technical reviewer or the prescribed fire plan preparer must be current in their qualification, minus the physical fitness requirement. The plan preparer and the technical reviewer may not be the same person. Army installations may coordinate with external agencies to attain plan technical reviews. If an external agency is used to provide technical reviews of Army prescribed fire plans, they must meet the appropriate RXB level based on the outcome of the complexity analysis (NWCG 2014).

The WSMR PAO (575 678-1134) must be notified once a prescribed fire is scheduled. They, in turn, will provide pre-burn, burn day and post-burn information to installation command, the local media and other external interested parties. ADC will receive a copy of the prescribed fire plan as part of the pre-burn notifications.

Signage on local highways stating a ‘prescribed fire is in progress and smoke may be encountered’ should be utilized as needed.

4.8.5 Smoke Management and Air Quality

Federal regulations specified by Section 118 of the Clean Air Act of 1997 as amended, require that all prescribed fire projects must comply with all applicable pollution control requirements. In New Mexico, the Clean Air Act is administered by the New Mexico Environment Department’s (NMED) Air Quality Bureau (AQB) (http://www.nmenv.state.nm.us/aqb). NM AQB requires prescribed fires to be conducted under specific conditions and to be registered with the state of New Mexico. Prescribed burns in excess of 10 acres per day or 1,000 cubic feet vegetation pile per day require upfront notification to NMED Air Quality Bureau by 10 AM one business day prior-to the planned burn. The notifications are submitted electronically to NMED, using the forms located at http://smoke.state.nm.us/. The Prescribed Fire Burn Boss should complete the form and submit it to NMED, as applicable, with a paper-copy or scanned-copy of the form provided to the WSMR PWE-EC Air Quality Program Manager (Jorge A. Uribe, 575-678-7020). Regulatory reference: Smoke Management, NMAC 20.2.65 (NMED resource Rich Naden, 505-476-4330).

The only smoke sensitive area on WSMR is the main post where schools and a hospital exist. Prescribed fire managers will consider wind direction and not allow ignitions if smoke could impact the main post or other populated areas outside of WSMR. Generally, on WSMR, prevailing wind direction is from the southwest to northeast which allows for smoke generation from most prescribed fires to be transported away from populated areas of Las Cruces, the Rio Grande corridor and the main post area of WSMR. In order to assure that winds will be favorable for burning, prescribed fire Burn Bosses will request a spot weather forecast prior to ignitions. The National Weather Service Office in Santa Teresa, NM (575 589-3972) accepts online requests for spot weather forecasts and will provide, in about an hour’s time, a site specific fire weather forecast covering the next 24 hours https://www.weather.gov/epz/fireweather. This applies to WSMR lands in the following counties: Doña Ana, Sierra and Otero. The north end of WSMR in Socorro County and Lincoln County is covered by the NWS office in Albuquerque and can be reached at (505 243-0702) or https://www.weather.gov/abq/forecasts-fireweather.

Outside of the main post area, WSMR has few limitations on the use of prescribed fire due to its remote nature. Still, WSMR fire managers must consider and mitigate smoke impacts when burning in the vicinity of the following areas:

- Communities, due to their proximities to WSMR boundaries. This includes the communities of Organ, Orogrande, Holloman Air Force Base, Tularosa and the main post at WSMR.
- The main travel corridors through WSMR, primarily US 70, US 380 and US 54 where travelers could be affected by smoke.
- WSMR military and contractor facilities, Range Centers, and testing complexes in the Tularosa Basin and Jornada del Muerto Basin.
- Scattered ranches, recreational facilities and residences near WSMR's boundaries.

Prescribed fire burn bosses will utilize numerous mitigation techniques to reduce emissions and impacts of smoke to humans from prescribed fires. These mitigation techniques include:

- When burning near smoke receptor sites of communities, highways, facilities or residences use weather forecasts to predict wind direction and only burn when winds are favorable to carry smoke away from populated areas.
- Check the burn area for combustible human trash and refuse. Remove, when possible, to minimize toxic emissions.
- Be aware of conditions capable of creating higher levels of emissions such as high fuel moistures, high ground-level wind speeds, temperature inversions, and stable atmospheric conditions.
- Rotate burn crews in and out of high smoke exposure situations.
- Keep crews upwind of fire and smoke whenever possible.
- Limit burns during inversions and stable atmospheric conditions to a few hours during the middle of the day.
- Utilize spot weather forecasts on the day of the burn and update forecasts throughout the burn.
- Utilize backing fires to lessen the impacts of smoke.
- Monitor dispersal of smoke throughout the burn.
- If smoke becomes problematic, initiate termination of the burn.
- Utilize WSMR PAO to contact local and regional agencies, newspapers, radio stations, etc., before the burn. This gives those individuals with respiratory ailments the opportunity to leave the vicinity before the burn begins.
- If the burn is near major roads or facilities, initiate mop-up as soon as possible to lessen the impacts of smoke on visibility and human health.
- Keep records on smoke direction, thickness, and dispersion during and after the burn until all smoke has dissipated.
- Minimize nighttime burning.
- Conduct awareness training for firefighters on the dangers of smoke exposure.

4.8.6 Use of Fire Breaks

Fire breaks and fuel breaks are the best places to begin igniting prescribed burns because they facilitate egress along an escape route to a safety zone and they facilitate wildland fire engines ability to move up and down the fire's edge and keep the burn under control. Fire breaks are man-made or natural barriers to wildfire spread. WSMR has a system of roads, many of which meet firebreak road standards of bladed or scraped road surface devoid of any flammable fuel for at least 8 feet across the top of the road. Two-track roads can act as fire breaks in light fuels such as grass and as long as the winds are favorable. Two-track roads need to be blacklined in order to be effective fire breaks.

4.8.7 Contingencies for Escapes

The Prescribed Fire Burn Boss has authority and responsibility to declare when a prescribed fire escapes its allowable burn perimeter and becomes a wildfire. Minor slopovers and small spot fires will not generate a declaration of a wildfire if contained quickly. However, if any slopovers or spot fires occur, all ignitions will be halted and all resources necessary to bring the slopover or spot fire under control will be utilized. Prescribed burning can resume, with added caution, once the slopover or spot fire is declared controlled by the Burn Boss.

A critical part of the planning process for utilizing prescribed fire is to have contingency resources identified and available in the event that the prescribed fire escapes pre-planned boundaries. Contingency resources needed to bring the escaped burn under control must be aware of their pre-planned role. These resources do not need to be on scene but they must be committed to being available to respond if needed. Land management agencies with wildland fire responsibilities are usually willing to provide contingency wildland engine resources. The Lincoln National Forest, Las Cruces District-BLM, Carlsbad Field Office-BLM, Socorro Field Office-BLM and Mescalero BIA are good sources for WSMR contingency resources. Two to three engines are sufficient contingency resources for WSMR prescribed fires. These resources must be within the regional geographic area and be listed in the burn plan.

Burn managers can contact ADC to enlist their aid in locating contingency resources and also to find out what types and numbers of ground and aerial assets are available in the region during the time of the planned burn, just in case they are needed.

4.8.8 Prescribed Fire Monitoring

Prescribed fire monitoring is the collection and analysis of observations or measurements to evaluate changes in vegetation and to help determine whether management objectives are being met. Rx fires on WSMR should include funding for long-term monitoring. This means there should be plans for a pre-burn monitoring assessment that captures current fuel loads and vegetative composition and details the methods needed to capture post-fire vegetation composition and fuel load changes over a period of specific time.

During the prescribed fire, monitoring is required to assure the project stays within prescription. Assigned personnel monitor weather, fire behavior, and smoke dispersal during all phases of the project. Observed weather indices are also recorded and broadcast to prescribed fire personnel throughout the duration of the burn.

Pre and post-fire vegetation monitoring methods range from the utilization of advanced technology (GIS, GPS, and remote sensing) to standard field monitoring methods such as transects, quadrats, and photo points. WSMR currently has an established program that utilizes standard 100-m. fixed ***line-intercept*** range transects that measure species composition or bare ground at one-meter intervals both pre and post prescribed fire.

At a minimum on simple burn projects, WSMR natural resources staff should utilize fixed photo points to document changes in vegetation biomass, composition and structure. Monitoring and documenting post-burn results and fire effects helps to determine if the prescribed fire objectives were met. Long-term monitoring (post burn to 5 years) for vegetation response after prescribed fires helps to determine if habitats are degrading or progressing towards a desired management objective.

4.8.9 Scheduling

Fall, winter and early spring are ideal times to schedule prescribed burns. Fuels are dormant and cured after the first heavy freeze and will help to carry the burn. Winds are usually lighter in the fall and winter when compared to spring and prolonged moisture events are rare. Firefighting resources are not usually committed to wildfires at this time of year and should be available to assist or list as contingency resources.

Prescribed fire projects are scheduled for implementation with input from Range Scheduling (Phone # 575 678-6141, 6142, 6144) several weeks before the burn is planned. The best opportunities for scheduling prescribed fire projects and receiving authorization is on weekends, as there will be fewer conflicts with WSMR test missions. Many of WSMRs test missions can occur simultaneously with the prescribed fire depending on fire location and the type of test being evaluated. If possible, schedule a block of at least 5 days to implement the burn. This will allow for burning around weather events that may take the prescribed fire out of prescription for a day or two.

4.8.10 Post Prescribed Fire Reporting Requirements

The Prescribed Fire Burn Boss has the authority to declare the prescribed fire as "out" and reports this information to Rescue Control and Range Control. For WSMR prescribed fire projects, it is usually safe to declare the fire out 24 hours after the last smokes have been observed. Declaring the prescribed fire as out opens the area to normal traffic.

Every prescribed fire project that is accomplished on WSMR requires a post-burn narrative and report. The narrative is a concise record of what was accomplished; what was not accomplished that had been planned for; and a summary of the after-action review of what went right and what could have been done better from the firefighters point of view. Along with the narrative there will be a report that includes the following quantifiable information:

- Planned perimeter of prescribed burn in acres (taken from the burn plan)
- Actual perimeter of the prescribed burn in acres (computed from a GPS that recorded points around the actual burned perimeter)
- percentage of planned burn that actually burned
- ***fire or burn severity*** estimate that includes a combination or percentage of the classes given below:
    1) **Unburned.**
    2) **Scorched.** Foliage is yellow; litter and surface vegetation are barely burned or singed.
    3) **Low severity.** Small diameter woody debris is consumed; some small twigs may remain. Leaf litter may be charred or consumed, and the surface of the duff may be charred. Original forms of surface materials, such as needle litter or lichens may be visible; essentially no soil heating occurs.
    4) **Moderate severity.** Foliage, twigs, and the litter layer are consumed. The duff layer, rotten wood and larger diameter woody debris is partially consumed; logs may be deeply charred; shallow ash layer and burned roots and rhizomes are present. Some heating of mineral soil may occur if the soil organic layer was thin.
    5) **High severity.** Deep ash layer is present; all or most organic matter is removed; essentially all plant parts in the duff layer are consumed. Soil heating may be significant where large diameter fuels or

duff layers were consumed. The top layer of mineral soil may be changed in color; the layer below may be blackened from charring of organic matter in the soil.

Documentation for each prescribed fire implemented on WSMR will be maintained as project files for reference and review with recurring fire effects monitoring, routine program audit, and for potential legal or investigative review in the instance of an incident or loss resulting from prescribed fire implementation. Project files may be maintained electronically, as on a shared drive or SharePoint, and/or hard copies in an office filing system. The NWCG standard (reference PMS 484) for minimum project file archive documentation includes the following:

- Prescribed fire plan (and amendments)
- Monitoring data including weather, fire behavior, fire effects, and smoke dispersal observations
- Weather forecasts
- Notifications
- Documented prescribed fire organization(s)
- Any written agreements related to implementation
- All *Agency Administrator Ignition Authorization(s)*, ref. PMS 485
- All *Prescribed Fire Go/No-Go Checklist(s)*, ref. PMS 486
- After Action Review
- Incident action plans (if used as installation SOP)
- Unit log (ref ICS form 214)
- Actual ignition patterns and sequences used (can be included on ICS 214)
- Permits – air, burn, etc.
- Any installation-specific forms/records
- Final burn perimeter, progression and/or accomplishment maps

4.9 Wildland Fire Safety and Risk Analysis

Appendix A Fire Management Units contains specific safety considerations for each of the 36 FMUs on WSMR and these should be incorporated into risk analyses when wildfires occur.

The risk analysis process incorporates the number 1 priority for all wildland fire management activities which is a commitment to provide for public and firefighter safety. With that commitment firmly in mind, risk management is the process used to assess the potential safety risks and hazards and weigh them against the potential benefits of any fire management activity. ***Risk management*** is defined as the process whereby management decisions are made and actions taken concerning the control of hazards and the acceptance of remaining risk. The risks involved with any fire activity must be identified, assessed, and mitigated (or eliminated) when possible and practicable. The remaining risk must be considered acceptable to everyone involved and also be weighed for potential benefits during the management decision of continuing or discontinuing the activity.

WSMR should incorporate this five-step risk analysis and mitigation process:

Step 1 – Establish situation awareness.
Step 2 – Identify hazards and benefits and assess the risk.
Step 3 – Control, mitigate, or eliminate hazards.
Step 4 – Make go/no-go decision based on acceptability of remaining risk.

Step 5 – Evaluate effectiveness of hazard controls and continuously re-evaluate.

Always practice risk management to minimize firefighter exposure to inherent hazards in wildland fire operations while still accomplishing management objectives. The following list includes common hazards faced by wildland firefighters on WSMR:

- smoke inhalation
- burns from flames
- burns from skin contact with smoldering vegetation
- sharp cutting hand tools
- chainsaws
- mobile apparatus
- heavy equipment
- aircraft
- uneven footing on steep slopes
- loose, rolling rocks
- vegetation that has thorns or spines
- unseen stump holes filled with ash
- fire-weakened roots of trees that may fall at any time
- poisonous insects and reptiles
- daytime/nighttime air temperature extremes
- dusty conditions
- night operations with limited visibility
- long working shifts leading to physical and mental fatigue
- low humidity and hot temperatures leading to dehydration
- Unexploded ordnance (UXO)
- toxic waste and hazardous materials on fire
- structures surrounded by wildland fuels

Wildland fire safety is a process and a culture that must be promoted and communicated at every operational level. All wildland firefighters have a responsibility to provide for their own personal safety and have the right to refuse an assignment if they do not feel it is safe. All wildland firefighters should carry a red card which certifies that they have received basic wildland fire safety and operational training. Wildland firefighters receive training that teaches them to use a common set of guidelines to help communicate important safety-related information. The first set of guidelines that every wildland firefighter must know and understand is called ***LCES*** **(L**ookouts, **C**ommunications, **E**scape Routes, and **S**afety Zones**)**. Along with **LCES**, the "***Standard Fire Orders***", the "***18 Watch Out Situations***" and the "***Downhill Fireline Construction Checklist*"** are common practices and safety considerations for all red-carded wildland firefighters. See **Appendix C** for further information or go to https://www.nwcg.gov/sites/default/files/publications/pms461.pdf for a copy of the latest Incident Response Pocket Guide (IRPG) which contains these safety guidelines. The IRPG is now an NWCG requirement for all wildland firefighters to have in their possession while on the fireline. Special safety and tactical considerations for fighting wildfires within the wildland/urban interface are detailed in **Appendix I.**

4.9.1 Unexploded Ordnance Safety

See **Appendix F:** 3Rs for Explosives Safety for Firefighting Safety (Recognize, Retreat, and Report) for further information or go to http://www.denix.osd.mil/uxo/SafetyTopics/Firefighting.cfm.

Firefighters will treat all unexploded ordnance (UXO) as if it were explosive. UXO poses a potential risk of injury or death to anyone in the vicinity (DOD 2004). UXO has the potential to be encountered anywhere on WSMR. However, UXO is much more likely to be encountered near impact areas

Situation Awareness

- Early identification of potential UXO is the first and most important step in reducing risks posed by UXO.
- Many types of UXO may be encountered: Small arms munitions; projectiles; grenades; rockets; mortars; guided missiles; bombs; sub-munitions.
- UXO may be found fully intact or in fragments. All UXO, whether intact or in fragments, presents a potential hazard and should be treated as such.
- Deteriorated UXO presents a particular hazard because it may contain chemical agents that could become exposed.

Hazard Control

- If you see UXO, stop and do not move closer.
- Isolate and clearly mark the area, take a GPS point and take a photograph.
- Deny entry to others.
- Never transmit radio frequencies near UXO.
- Never remove anything near UXO.
- Never touch, move, or disturb UXO.
- Keep a minimum of 750 meters away from areas on fire that may contain suspected UXO of 155mm or larger shells.
- Aircraft must maintain a minimum altitude of 550 meters AGL or more above IAs that have received 155mm munitions including their associated safety buffer areas when wildfires are burning within their footprint.
- Report discovery of UXO to Range Operations and to your immediate supervisor.

4.10 Annual Wildland Fire Program Reporting Requirements

For general oversight of the program and safety measures, WSMR will report annually on amount of acres burned by wildfire and prescribed burning; costs/impacts of fire on training/testing mission; amount of claims/asset loss/ complaints; IWFMP compliance status; number and qualifications/level of certification of personnel available to support installation wildland fire management program; annual training; known critical resource requirements; status of firebreak maintenance; other information as needed.

- OACSIM-ISE and ISL will establish a uniform, consolidated annual reporting requirement that will be tasked through commands to installation Wildland Fire Program Managers for annual program accomplishment reporting, needs assessment, and monitor progression to attaining NWCG training standard for personnel. Information gathered will inform POM development and prioritization of resource allocation.
- Installation Wildland Fire Program Managers shall report the quantity, type, and status of wildland fire equipment available at the installation annually through commands to OACSIM-ISL.

- Installations Wildland Fire Program Managers shall report the number and certification level of personnel comprising the wildland fire organization and specifically identify gaps in staffing and certification based on the organizational structure standard.
- Each wildfire and prescribed fire is a reportable incident regarding burn extent and personnel/equipment support requirements. Army will provide a database of record, such as the Wildland Fire Management Information System (WFMIS), to provide a central data collection, query, and information distribution system. Until such time that a centralized system is established, operational, and accessible, the installation Wildland Fire Program Manager will ensure that all wildfires continue to be reported in the NFIRS and that prescribed fire information is maintained within the installation database (DA 2002).

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6 Glossary of Terms

Activity fuel Burnable fuel that originates from human activity such as logging, thinning, and herbicide use.

Adaptive wildland fire management A way to remain flexible and cope with surprises while making necessary management decisions. It is an approach to managing fire in the wildlands that recognizes uncertainties, embraces multiple problem-solving strategies, and allows for adjustments to be made along the way. By combining research and active management, adaptive management allows the lessons from current work to be applied to future projects.

Aerial Supervision Module (ASM) – An ASM is a two person crew functioning as the Lead and Air Tactical Group Supervisor (ATGS) from the same aircraft. The ASM crew is qualified in their respective positions and has received additional training and authorization. An ASM can be utilized as a Lead, ATGS, or both, depending on the needs of incident management personnel. An ASM consists of an Air Tactical Pilot and Air Tactical Supervisor.

Air quality A term to describe the relative concentration of airborne particles and gases which may affect the health and well-being of organisms.

Airshed A geographical area where local topography and meteorology limit the dispersion of pollutants. Also, is considered a geographical boundary for air quality standards.

Anchor point Advantageous location, usually a barrier to fire spread, from which to start constructing a fireline.

Aspect The direction that a slope faces (e.g. North or South). Aspect can determine potential plant communities, fuel moisture and potential fuel loading.

Backfire (or back burn) A fire set along the inner edge of a fire control line to stop a spreading wildfire by reducing available fuel or a prescribed fire set to burn against the wind, resulting in a slow burn.

Belt transect A field data collection method where sampling is done along transects of a specified width.

Best Management Practices Environmental resource management practices designed to prevent or reduce undesirable side-effects of management actions.

Black An area of previously burned fuel that is usually an accepted safety zone (i.e. does not have re-burn potential).

Blackline Purposely burning fuels, normally adjacent to a control line before igniting the main prescribed fire - blackline denotes a condition or area in which there is no unburned fine fuel.

Burn Boss The person responsible for managing a prescribed fire from ignition through mop-up.

Canopy The overhead branches and leaves in a forest, shrub or brush land.

Conservation The protection, improvement, and wise use of natural resources to provide the greatest social and economic value for the present and future.

Containment (fire) Fire management strategy used to keep a wildfire within a particular area.

Control (a fire) Extinguish a fire by completing control lines, burning out unburned areas, and monitoring hotspots until fire threat under prevailing conditions has been eliminated.

Control line An inclusive term for all constructed or natural fire barriers; a treated (fire) edge used to control a prescribed fire or wildfire.

Cover type A natural group or association of different species of plants, which commonly occur together over a large area (e.g., piñon-juniper, grasslands, or mixed).

Crown fire Wildfire that advances from top to top of trees or shrubs, more or less independently of the surface fire.

Cultural resources Historic properties as defined in the National Historic Preservation Act (NHPA); cultural items as defined in the Native American Graves Protection and Repatriation Act (NAGPRA); archeological resources as defined in the Archeological Resources Protection Act (ARPA); and sacred sites as defined in Executive Order (EO) 13007 to which access is provided under the American Indian Religious Freedom Act (AIRFA).

Dead fuel moisture A measure of a dead piece of organic material such as limbs, sticks, duff, dried grass and expressed as one to one thousand hour timelag fuels.

Defensible space Creating a fire safe landscape for at least 30 feet around structures (and out to 100 feet or more in some areas), to reduce the chance of a wildfire spreading and burning through the structures. This is the basis for creating a "defensible space" - an area that will help protect the structure and provide a safety zone for the firefighters who are battling the flames.

Density The quantity of trees, shrubs or grasses basal area, volume, or some other measure, per unit of area. Some common measures are basal area per acre, tons per acre or stems per acre at a given age.

Direct attack Method of wildfire suppression in which suppression activity takes place on or near the fire perimeter.

Dozer line A control line that is mechanically cleared to mineral soil and used to contain wildfires or prescribed burns.

Drip torch A firing device consisting of a fuel tank and wick designed to allow flaming fuel droplets to ignite vegetative fuel for use in a prescribed fire or back-burn.

Dry bulb temperature The air temperature as measured by a standard thermometer usually taken and broadcasted to firefighters every thirty minutes when wildland fire operations are occurring.

Duff Tree, shrub and understory plant needles and leaves that constitute ground surface floor litter and detritus. Duff includes all soil organic horizons from fresh leaf litter to much decomposed organic matter on top of mineral soil.

Ecosystem A spatially explicit, relatively homogenous unit that includes all interacting organisms and components of the abiotic environment within its boundaries.

Ecosystem management An ecological approach to vegetation management; it attempts to maintain the complex processes, pathways, and interdependencies of ecosystems and keep them functioning in a sound state over long periods of time in order to provide resilience to short-term stress and adaptation to long-term change.

Ecosystem sustainability The ability to maintain diversity, productivity, resilience to stress, health, renewability, and/or yield of desired values, resource uses, products, or services from an ecosystem, while maintaining the integrity of the ecosystem over time.

Endangered species Plant or animal species vulnerable to extinction throughout all or a significant portion of its range within the foreseeable future; identified in the federal register in accordance with the Endangered Species Act of 1976.

Erosion The decomposition of land surface by rain, running water, wind, ice, gravity, or other natural or anthropogenic agents, e.g., road construction.

Fire behavior The manner in which a fire reacts to the variables of fuel, weather, and topography as in the shape, direction, and intensity of a fire.

Fire characteristics Rate of fire Spread (ROS) (chains/hour), area perimeter size and growth, flame length (FL) and fire spread direction.

Fire Danger Rating A rating system based on fuel moisture, relative humidity, wind, and temperature that provides guidelines to the military on training and the allowable use of pyrotechnics.

Fire effects Physical, biological and ecological impacts of wildland fire upon the environment

Fire frequency The number of times that a fire occurs naturally within an ecosystem or the prescribed burning rotation applied to an area.

Fire hazard The ease of ignition and resistance to control of the fuel complex, determined by the volume, type, condition, arrangement, and location of fuels.

Fire prevention Activities directed at reducing the number of fires that start, including public and military education and reduction in fuel hazards, i.e., prescribed burning.

Fire season The period(s) of the year during which wildfires are likely to occur, spread, and cause sufficient damage to warrant organized fire control.

Fire severity The amount of replacement of the fire on the dominant overstory vegetation expressed in terms below:

1) **Unburned.**
2) **Scorched.** Foliage is yellow; litter and surface vegetation are barely burned or singed.
3) **Low severity.** Small diameter woody debris is consumed; some small twigs may remain. Leaf litter may be charred or consumed, and the surface of the duff may be charred. Original forms of surface materials, such as needle litter or lichens may be visible; essentially no soil heating occurs.
4) **Moderate severity.** Foliage, twigs, and the litter layer are consumed. The duff layer, rotten wood and larger diameter woody debris is partially consumed; logs may be deeply charred; shallow ash layer and burned roots and rhizomes are present. Some heating of mineral soil may occur if the soil organic layer was thin.

5) **High severity.** Deep ash layer is present; all or most organic matter is removed; essentially all plant parts in the duff layer are consumed. Soil heating may be significant where large diameter fuels or duff layers were consumed. The top layer of mineral soil may be changed in color; the layer below may be blackened from charring of organic matter in the soil.

Fire use The management of wildfires to accomplish specific resource objectives within a pre-defined area (usually within the confines of an FMU boundary). Objectives can include maintenance of healthy forest or woodlands or rangelands or support of ecosystem diversity.

Firebreaks Constructed roads designed to impede or stop wildfires by creating a discontinuity in potential fuels. The term can also apply to natural fire barriers such as rockslides or areas devoid of vegetation.

Fireline The part of a wildfire control line that is scraped to mineral soil.

Fire weather watch Alerts land management agencies to the high potential for development of Red Flag criteria in the next 12-72 hours. The watch may be issued for all, or portions of a fire weather zone or region.

Firing technique Any of the multiple ignition patterns that may be used in a prescribed burn to attain desired fire characteristics for the purpose of accomplishing a specific resource management objective.

Forage Vegetation dominated by non-woody plants that provide food to grazing animals.

Forest health The perceived condition of a forest derived from such factors as its age, structure, composition, vigor, and the resilience to disturbances including insects, disease, animals, various abiotic factors, and other environmental stressors (e.g., lightning, wind, fire).

Forest and rangeland management The practical application of biological, physical, quantitative, economic, social, and policy principles to the administration and working of a forest or rangeland for specific objectives including maintaining forest or rangeland health, vigor, production, and other values such as soil condition, water quality, wildlife preservation, and, specifically, to support the military training mission on Fort Bliss.

Fuel(s) Materials, living or dead, which are capable of burning.

Fuel accumulation A condition characterized by the buildup of woody or other vegetation that increases the risk of destructive wildfire.

Fuelbreak Strategically placed, pre-existing, man-made or natural fire control line in a low volume of fuel is maintained as an alternative to dense, mature vegetation.

Fuel loading The oven dry weight of fuels in a given area, usually expressed in tons per acre.

Fuels management The removal or modification of vegetation to restore and maintain healthy, resilient landscapes; has the effects of reducing wildfire risks to communities and other values by reducing the risk of severe and potentially dangerous wildfire behavior; lessens post-wildfire damage; and limits the spread and proliferation of invasive species and detrimental pathogens.

Fuel moisture The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212ºF.

Fuel type An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control.

Fusee A red signal flare that can be used as a firing tool in prescribed burns or wildfire suppression.

Global Positioning System (GPS) A satellite-based navigational device that records X, Y and Z coordinates and other data allowing users to determine their location on the surface of the earth.

Habitat The natural environment where a specific plant, animal, or fungus is found. An area containing all the necessary resources for the plant, animal, or fungus to live, grow, and reproduce. For wildlife, habitat is the combination of food, water, cover, and space.

Handline Firebreak constructed by fireline personnel using hand tools to expose bare mineral soil.

Hazards Fuels that burn, including the natural vegetation growing across WSMR and the flammable structures located on WSMR.

Head fire Wildfire spreading or set to spread with the wind.

Impact Area Areas designated for military training involving live ordnance; the boundaries of these areas are designated with signs and no other activities occur within the boundaries.

Incident Commander (IC) This ICS position is responsible for overall management of the incident and reports to the Agency Administrator for the agency having incident jurisdiction.

Incident Command Post (ICP) Designated area for staging and directing firefighting forces.

Incident Command System (ICS) A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

Incident Management Team (IMT) – The incident commander and appropriate general and command staff personnel assigned to an incident.

Indirect attack – A method of fire suppression in which suppression activities takes place some distances from the fire perimeter, and often takes advantage of fire barriers.

Installation boundaries WSMR property border.

Line intercept A field data collection technique where sampling is done along a defined length or transects. Plant data is collected at measured intervals.

Litter layer Top layer of vegetation debris, composed of loose materials such as fine twigs, leaves, or needles that have not yet decomposed.

Live fuel moisture The water content of live fuels. Woody and herbaceous fuel moisture affect fire behavior, rate of fire spread and fire intensity.

Live-Fire exercise Military training or testing involving live ammunition and occurring on ranges and around impact areas.

Management Action Points (MAPs) Geographic points on the ground or specific points in time where an escalation or alternative of management actions is warranted. These points are defined and the management actions to be taken are clearly described in an approved Prescribed Fire Plan. Timely implementation of the actions when the fire reaches the action point is generally critical to successful accomplishment of the objectives. Also called Trigger Points.

Management prescription A set of management practices, fuels and weather parameters scheduled for application on a specific area to satisfy multiple uses or other goals and objectives.

Maximum Manageable Area (MMA) The maximum geographic limits of spread within which a wildland fire is allowed to spread.

Military Operations Any mission, function, or activity related to military testing and training.

Mixing height The height above mean sea level that vigorous air mixing takes place in the atmosphere.

Mop-up Extinguishing or removing burning material, especially near control lines after an area has burned to reduce fire escape risks or to reduce residual smoke.

Natural fire A lightning fire that is allowed to burn because it meets prescription criteria for ecosystem benefits.

Natural fuel break Naturally occurring breaks in fuel continuity such as recent burn areas, bare ground, rock outcrops or vegetation that is so sparse that it will not carry fire.

NEPA (National Environmental Policy Act) Federal policy enacted in 1969 that established a national Council on Environmental Quality to oversee government activities that could affect the environment, and also required federal agencies to file environmental impact statements before taking any major action.

Nomex clothing Fire-protective garments made of synthetic, fire-resistant material to be worn during prescribed burning or wildfire suppression activities.

Non-Attainment Area Geographic areas in which levels of a criteria air pollutant exceed the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant.

Organic layers Soil layer composed of duff and litter and in varying stages of decomposition. Important in fuel classification and for moisture content in relation to deep burning in this layer.

Physiographic Class/Unit A classification describing the terrain or landform of a management unit as it relates to soil texture, soil structure, and water infiltration.

Predictive Services Those Geographic Area and National-level fire weather or fire danger services and products produced by wildland fire agency meteorologists and intelligence staffs in support of resource allocation and prioritization.

Prescribed fire or burn The application of fire in a predetermined area, usually under specific conditions of weather and fuel moisture, to control or reduce vegetation for optimal military training, enhance wildlife habitat, or to reduce wildfire potential.

Pyrotechnics Devices involved with igniting a rocket or producing an explosion and used in military training simulations.

Red Flag Warning Term used by fire weather forecasters to alert users to an ongoing or imminent critical fire weather pattern

Rehabilitation The activities necessary to repair damage or disturbance caused by wildfire or the wildfire suppression activity.

Reference condition An ecosystem that is in a desired state or condition and used to develop management objectives.

Relative Humidity The ratio of the amount of moisture in a given volume of space to the amount that volume would contain if it were saturated, usually expressed in percent

Residual smoke Produced by smoldering vegetation left behind an actively burning front.

Riparian area Related to or located in conjunction with a wetland, on the bank of a river or stream, or also at the edge of a lake or tidewater; on WSMR it includes low-lying areas, canyon bottoms and arroyos that are normally dry but where water is concentrated during precipitation events and produces a high diversity of plants when compared to the surrounding vegetation.

Risks Ignition sources that can start wildfires, including live-fire training, use of pyro and flares, maintenance activities like welding, vehicles traveling across wildlands and troops bivouacking in the wildlands.

Savanna (Juniper) An area dominated by irregularly scattered, large diameter, open grown trees, with grass understory.

Sensitive species Plant or animal species whose populations are susceptible to habitat changes or impacts from various kinds of disturbance

Shading cover Percent cloud cover. Shading influences fire behavior, along with canopy cover lessens fire behavior and should be noted in fire behavior analysis.

Silviculture The art of producing and tending forest stands by applying scientifically acquired knowledge to control or influence stand establishment, composition, and growth by applying different treatments to make forests or woodlands more productive and useful, and integrating biologic and economic concepts to devise and carry out treatments to meet objectives.

Site preparation An activity intended to make conditions favorable for planting, direct seeding, or for the establishment of natural regeneration by clearing, chemical vegetation control, burning, disking, chopping, bedding, windrowing, raking, or some combination thereof.

Slope (%) A measure of an area's angle of incline. A 45 degree angle is equal to 100% slope; one degree of angle equals approximately 2% of slope.

Slop-over – A fire edge that crosses a control line or natural barrier intended to confine the fire.

Smoke management Conducting a prescribed fire under suitable conditions with firing techniques that keep smoke impacts from violating air quality standards.

Smoke volume A measure of the amount of smoke a wildland fire is producing expressed in general terms such as light, medium or heavy volume.

Snag A standing dead tree from which the leaves and most of the branches have fallen.

Spot fire A small fire that is ahead of the main fire that is caused from hot embers being carried to a receptive fuel bed. Spotting indicates extreme fire conditions.

Stable atmosphere A poor time to burn due to stable, high pressure which usually forms an inversion and mixing heights for smoke dispersal are low to the ground.

Standing fuel Upright fuels such as snags, trees, brush and shrubs.

Surface fuels Vegetative material lying on the ground.

Structural diversity Refers to the variety of horizontal and vertical features of an area including vegetation and topography.

Swamper A person that is a part of a saw team that removes brush, trees and limbs after they are cut by a chainsaw operator.

Timelag An expression of fuel diameters that relate to how quickly they respond to environmental conditions. A one-hour timelag fuel (diameter up to 1/4th of an inch) can go from moist to dry in one hour of sunshine heating.

Understory The lower vegetation layers in a forest, shrublands or woodlands found beneath the canopy (overstory), including shrubs, grasses and forbs.

Unexploded Ordnance (UXO) Explosive devices that have been fired, projected, dropped, or placed in such a way that they could detonate and pose the risk of injury or death to personnel in the vicinity.

Unstable atmosphere Produces optimum smoke dispersion due to winds rising and falling. However, may be an indication of extreme weather unfolding and bears closely watching.

Vegetation encroachment The undesired growth of trees, grasses, or shrubs in designated areas

Vegetation management Treatments such as mowing, chopping and herbicide applied to control undesirable trees, shrubs, and grasses occurring in a natural setting, or, as in the case of prescribed burning, to reduce vegetation densities and increase openings.

Wetlands A transitional area between aquatic and terrestrial ecosystems that is inundated or saturated for periods long enough to produce hydric soils and support hydrophilic vegetation.

Wildfire Any uncontrolled, non-structure fire, other than prescribed fire, occurring on lands covered wholly or in part by timber, brush, grass, or other flammable vegetation.

Wildfire Suppression The act of aggressively restricting the growth or spread of a wildfire occurring within the wildlands

Wildland A natural environment on Earth that has not been significantly modified by civilized human activity.

Wildland fire Any fire, controlled or uncontrolled, occurring on lands covered wholly or in part by timber, brush, grass, or other flammable vegetation. Wildland fire encompasses both prescribed fire and wildfire.

Wildland fire use The management of wildfires to accomplish specific resource objectives within a pre-defined area (usually within the confines of an FMU boundary). Objectives can include maintenance of healthy forest or woodlands or rangelands or support of ecosystem diversity.

Wildland/Urban Interface (WUI) The line, area, or zone where structures and other human development meet or intermingle with wildlands or vegetative fuels.

6.1 Acronyms

AAF	Army Airfield
ACEC	Area of Critical Environmental Concern
ACSIM	Assistant Chief of Staff for Installation Management
ADC	Alamogordo Interagency Dispatch Center
AGL	Above Ground Level
AHPA	Archaeological and Historic Preservation Act
AMS	Army Management Structure
ANSI	American National Standards Institute
AOR	Area of Responsibility
AQB	Air Quality Bureau
AR	Army Regulation
ASM	Aerial Supervision Module
ASP	Ammunition Supply Point
ATACMS	Army Tactical Missile System
ATEC	Army Test and Evaluation Command
ATV	All-Terrain Vehicle
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practices
CAB	Combat Aviation Brigade
CFR	Code of Federal Regulations
CG	Commanding General
COL	Contingency Operating Location
CPR	Cardio-Pulmonary Resuscitation
DA	Department of the Army
DAIM-ISE	Department of the Army-Installation Services-Environment
DAIM-ISL	Department of the Army-Installation Services-Logistics
DBH	Diameter at Breast Height
DES	Directorate of Emergency Services
dNBR	Differenced Normalized Burn Ratios
DOD	Department of Defense
DOI	Department of the Interior
DPTMS	Directorate of Plans, Training, Mobilization, and Security

DPW	Directorate of Public Works
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMNRD	Energy, Minerals and Natural Resources Department
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
EQ	Environmental Quality
ERS	Emergency Reporting System
ESA	Endangered Species Act
ESMC	Endangered Species Management Component
FBTC	Fort Bliss Training Center
FDR	Fire Danger Rating
FES	Fire and Emergency Services Division
FIRECON	Fire Conditions rating
FIX	Fired in extension
FL	Flame length
FMU	Fire Management Unit
FOB	Forward Operating Base
FRI	Fire Return Intervals
FWZ	Fire Weather Zone
GC	Garrison Commander
GIS	Geographical Information System
GLZ	Gila-Las Cruces Zone
GPM	Gallons per Minute
GPS	Global Positioning System
HAFB	Holloman Air Force Base
HELSTF	High Energy Laser Systems Test Facility
HQ	Headquarters
IA	Impact Area
IAP	Incident Action Plan
IAW	In Accordance With
IC	Incident Commander
ICP	Incident Command Post
IGA	Inter-Governmental Agreement
INCRMP	Integrated Natural and Cultural Resources Management Plan
ICS	Incident Command System
IHC	Interagency Hotshot Crew
IHOG	Interagency Helicopter Operations Guide
IMT	Incident Management Team
IRPG	Incident Response Pocket Guide
ITAM	Integrated Training Area Management
IWFMP	Integrated Wildland Fire Management Plan
JER	Jornada Experimental Range

JPA	Joint Powers Master Agreement
KBDI	Keetch-Byram Drought Index
LCES	Lookouts, Communications, Escape routes, and Safety zones
LCTA	Land Condition Trend Analysis
LRAM	Land Rehabilitation and Maintenance
LNF	Lincoln National Forest
MAA	Mutual Aid Agreement
MAP	Management Action Point
MDEP	Management Decision Execution Package
MGRS	Military Grid Reference System
MIST	Minimum Impact Suppression Techniques
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSL	Mean Sea Level
NASA	National Aeronautics and Space Administration
NBR	Normalized Burn Ratio
NEPA	National Environmental Policy Act
NF	National Forest
NFDRS	National Fire Danger Rating System
NFIRS	National Fire Incident Reporting System
NFPA	National Fire Protection Association
NGB	National Guard Bureau
NHPA	National Historic Preservation Act
NMED	New Mexico Environmental Department
NMSF	New Mexico State Forestry
NWCG	National Wildfire Coordinating Group
NWS	National Weather Service
OACSIM	Office of the Assistant Chief of Staff-Installation Management
OIC	Officer In Charge
OLA	Off-Limits Area
PAM	Pamphlet
PAO	Public Affairs Office
PEIS	Programmatic Environmental Impact Statement
PLS	Planning Level Survey
PMS	Publication Management System
PTB	Position Task Book
PWE	Directorate of Public Works, Environmental Division, Conservation Branch
PWO	Directorate of Public Works, Operations and Maintenance Division
RAWS	Remote Area Weather Stations
ROC	Range Operations Center
SDC	Silver City Interagency Dispatch Center
SDZ	Surface Danger Zone
SNA	Special Natural Area

SOG	Standard Operating Guidelines
SOP	Standard Operating Procedure
SRP	Sustainable Range Program
SWCC	Southwest Interagency Coordination Center
USAG-WS	United States Army Garrison White Sands
USAF	United States Air Force
USDA	Unites States Department of Agriculture
USFS	United States Forest Service
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
UTV	Utility Terrain Vehicle
UXO	Unexploded Ordnance
VFD	Volunteer Fire Department
WFPM	Wildland Fire Program Manager
WITS	White Sands Integrated Target Control System
WSA	Wilderness Study Area
WSMR	White Sands Missile Range
WSNM	White Sands National Monument
WSTF	White Sands Test Facility
WUI	Wildland/Urban Interface

Appendices

Appendix A WSMR Fire Management Units and Maps (revised 20 July 2020)

Table of Contents

Appendix A Fire Management Units and Maps (revised 20 July 2020)

This is a stand-alone appendix designed for firefighters and managers to take to the field with them. It can be downloaded onto a laptop or other portable device or printed on paper. FMUs highlighted in yellow on the map on page 5 represent High Hazard areas where wildfires should be directly suppressed in those areas that are accessible to firefighters and their equipment, otherwise firefighters should fall back to FMU or other defendable boundaries and attempt to contain the wildfire within them. FMUs in blue represent Low Hazard areas where wildfires may be monitored and allowed to burn out in discontinuous fuels or suppressed from roads or other defendable boundaries while providing structure and infrastructure protection as necessary.

Disclaimer 1: All maps are derived from the most accurate data available in the WSMR GIS. Coordinate with the GIS staff in Building 163 for updates to FMUs.

Disclaimer 2: Many of the secondary roads shown on FMU and larger maps are not maintained on a regular basis and can be hazardous for travel by engines and tenders. Even some of the designated firebreak roads have significant washouts and eroded places. Use extra caution and maintain situational awareness at all times when driving roads on WSMR.

Best Management Practices Common to all FMUs on WSMR

1. Pre-fire season fuels management for wildfire containment:

a. All Range tenants must strive to maintain defensible space around range infrastructure. Mow vegetation to 3-6 inches in height within 30 feet of structures outside of the migratory bird nesting season which is from March 1 to August 31. Any live vegetation within 30 feet of structures that is not mowed or cut to near ground level should be watered regularly to maintain greenness. Clear dead accumulations of vegetation for 30’ out from structures.

b. Maintain firebreak roads by removing all vegetative and organic material down to mineral soil on road surfaces, by mowing roadway shoulders where practical and by maintaining erosion control features. Mowing should be done after the growing season after the first frost in the fall.

c. Use prescribed fires to increase fire breaks effectiveness for stopping a wildfire by blacklining (burning combustible fuels in long parallel strips) alongside roads and firebreaks where it is feasible and practical to do so.

d. WSMR FES firefighters will familiarize themselves with WSMR by driving roads. Firefighters should have knowledge of locations of natural firebreaks and firebreak roads, Range boundaries, water fill sites, and FMU locations and boundaries. Firefighters also need to recognize the different types of wildland flammable fuels found on WSMR.

2. Wildfire Suppression:

a. Due to safety and resource considerations, the main fire suppression strategy to be implemented by WSMR firefighters in Low hazard FMUs (Identified with blue shading on map on page 5 Appendix A) is to monitor wildfires burning within FMU boundaries from firebreak roads and only suppress wildfires if structures and human improvements are threatened, or if wildfires advance to firebreaks or firebreak roads. These firebreaks and roads can be burned out in advance of a flaming fire front if it is deemed advantageous to do so by the Incident Commander and provided there are trained personnel available and that they are in place. In most cases, firefighters will protect structures and allow wildfires to consume combustible fuels within the confines of the FMU boundaries and also allow wildfires to burn out on their own accord. Most WSMR FMUs are bounded by roads or constructed firebreaks.

b. In the High hazard FMUs (identified with yellow shading on map on page 5 Appendix A), wildfires will be suppressed at the earliest opportunity. Direct attack is the preferred tactic for fighting wildfires, but in areas where the fire intensity is too high (>4 foot flame lengths), use indirect attack tactics. Indirect tactics include falling back to firebreak roads and burning out or blacklining roads, then allowing the wildfire to approach the blackline where it will die due to previous consumption of burnable fuel. Firefighters can also monitor the wildfire from defensible positions and engage the wildfire with water from engines as it approaches.

c. The decision to utilize helicopters on WSMR wildfires should be based on an assessment of values at risk (See Section 4.5.4). Most wildfires burning on WSMR will not require helicopter support. Helicopters equipped with buckets should be used when structures or WSMR infrastructure are threatened by wildfires or when requested by the WSMR Wildland Fire Program Manager.

d. WSMR FES will contact PWE for guidance on avoiding sensitive cultural and natural resources when wildfires are burning outside established impact areas and suppression efforts are being planned. PWE should be contacted whenever cultural resources are involved or affected by wildfires on WSMR so that PWE staff archaeologists can do immediate damage assessments.

WHITE SANDS MISSILE RANGE

Fire Management Units (FMUs)

2/7/2018

FMUs & Suppression Strategy

- Monitor and suppress from roads/firebreaks and defensible positions (blue)
- Suppress immediately (yellow)

FIRE MANAGEMENT UNITS		
Unit #	Unit Name	Acres
1	Main Post	2,572
2	Organ Mountains	11,964
3	Launch Complex Area	159,272
4	Foster Lakes	39,070
5	White Sands National Monument	172,785
6	HELSTF	44,888
7	HTA	35,492
8	NASA/WSTF	23,326
9	Jornada Experimental Range	50,325
10	San Andres NWR	59,294
11	East San Andres Foothills	38,479
12	Hembrillo Canyon	50,165
13	West San Andres Foothills	59,027
14	Grandview Mountain	41,843
15	Strawberry Peak	41,944
16	Hardscrabble	40,526
17	Space Harbor	195,986
18	Otero Maneuver Area	101,472
19	Denver WIT	99,896
20	Malpais	109,479
21	Salinas Peak	53,827
22	Ladybug Peak	69,966
23	Cain	65,347
24	Zumwalt	55,712
25	Capitol Peak	34,966
26	Mockingbird	50,473
27	Red Hill	27,415
28	Red Canyon	27,795
29	Oscura Range	20,890
30	Oscura Mountains South	81,705
31	Little Burro Mountains	29,699
32	Stallion WIT	124,312
33	Grandjean	45,955
34	Trinity	34,288
35	North Oscura Peak	22,240
36	Red Rio	67,457

5 2.5 0 5 Miles

10 5 0 10 Kilometers

Produced by the GIS Team for the Directorate of Public Works, White Sands Missile Range.

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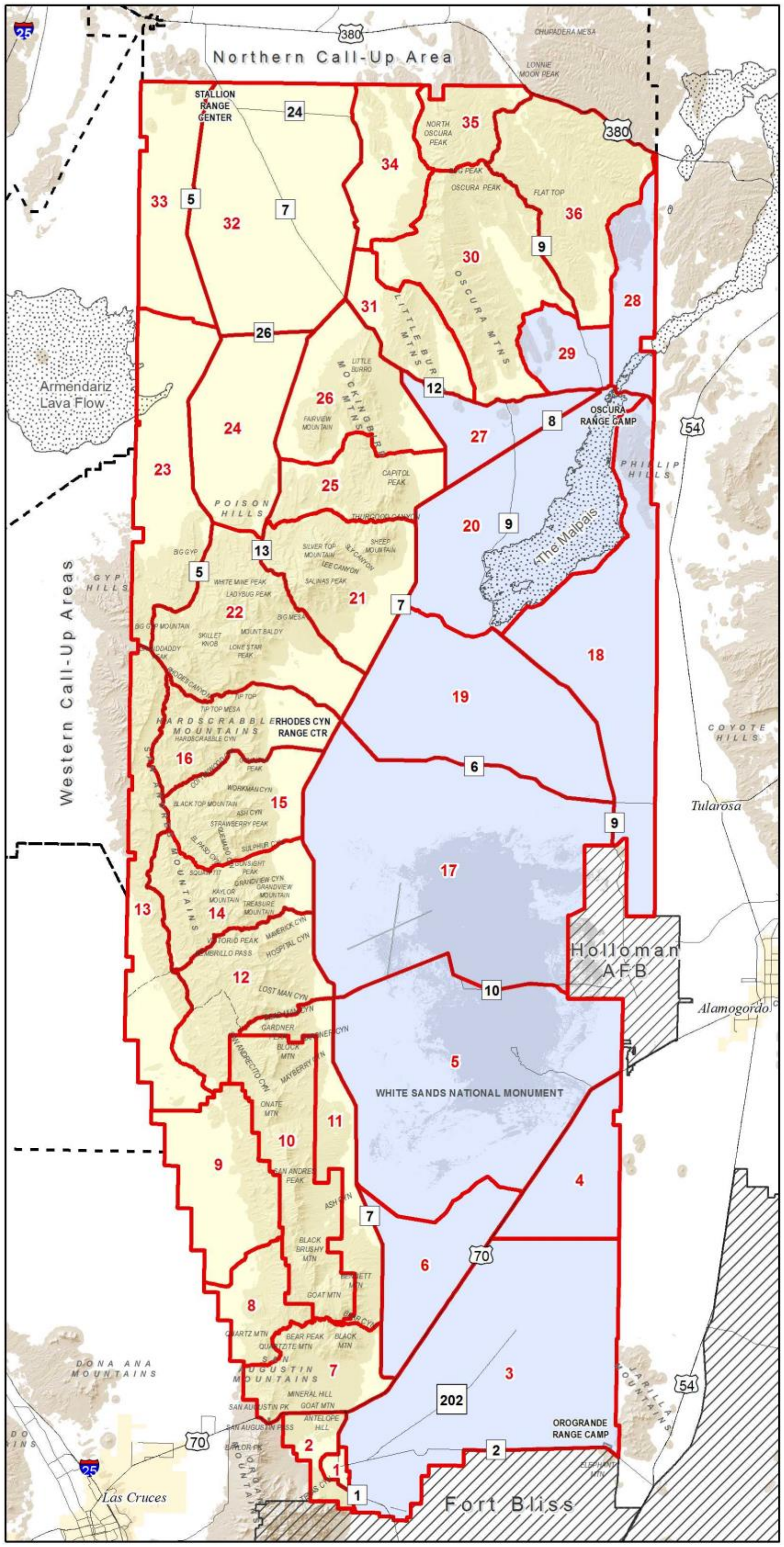

WSMR Fire Management Units with Suppression Strategy

WHITE SANDS MISSILE RANGE

Firefighting Water Sources

11/6/2017

Water Source Type

- Construction Well
- Hauled Water Tank
- Truck Filling
- Wildlife Water Tank

NUM	TYPE	NAME
1	Truck Filling	Main Post Water Point #1
2	Hauled Water Tank	Frequency WS (Oasis Site)
3	Truck Filling	Main Post Water Point #2
4	Wildlife Water Tank	Lena Cox Well
5	Hauled Water Tank	EMRE
6	Wildlife Water Tank	EMRE Well
7	Construction Well	Thel-1 (aka THEL Well) (NMOSE T-03634)
8	Hauled Water Tank	Frequency (Holloman AFB)
9	Construction Well	NW30-1 (aka NW-30)
10	Hauled Water Tank	Andre
11	Hauled Water Tank	Tula G
12	Hauled Water Tank	J-9
13	Construction Well	Tula Gate (NMOSE T-04087)
14	Hauled Water Tank	Tularosa (MINDA)
15	Hauled Water Tank	Tula Gate
16	Wildlife Water Tank	Potter Ranch/Towner Well
17	Construction Well	Herbie Well (aka Rhodes C or Well 6)
18	Hauled Water Tank	Rhodes Commo
19	Wildlife Water Tank	Hardin Ranch Well
20	Wildlife Water Tank	Buckhorn Well
21	Wildlife Water Tank	Pete Woods Well
22	Wildlife Water Tank	John Woods Well
23	Wildlife Water Tank	L.W. Well
24	Hauled Water Tank	Salinas NewTec
25	Hauled Water Tank	Salinas Commo
26	Hauled Water Tank	Russ Site
27	Wildlife Water Tank	Martin Well
28	Wildlife Water Tank	Burris Well
29	Hauled Water Tank	Phillips Hill
30	Wildlife Water Tank	Marcial/Anderson Well
31	Construction Well	Range Road 5 Well
32	Construction Well	Martin Ranch Construction Well
33	Hauled Water Tank	Ben Site
34	Wildlife Water Tank	Ben Site Well
35	Hauled Water Tank	Oscura RC Commo
36	Construction Well	ORC Fire (aka Oscura Range Ctr.)
37	Hauled Water Tank	Oscura RC Bombing Range
38	Construction Well	Murray Well (RG 80492)
39	Hauled Water Tank	Aerial Cable
40	Hauled Water Tank	PHETS/DTRA
41	Wildlife Water Tank	Greens Baber Well
42	Wildlife Water Tank	Red Canyon Well
43	Hauled Water Tank	Atom Peak SST
44	Hauled Water Tank	NOP Barracks (Hilton)
45	Hauled Water Tank	NOP (North Oscura Center Range)
46	Wildlife Water Tank	Baca Well
47	Wildlife Water Tank	Red Rio Well
48	Wildlife Water Tank	NECI Well
49	Truck Filling	SRC Non-Potable water filling station

5 2.5 0 5 Miles

10 5 0 10 Kilometers

Produced by the GIS Team for the Directorate of Public Works, White Sands Missile Range.

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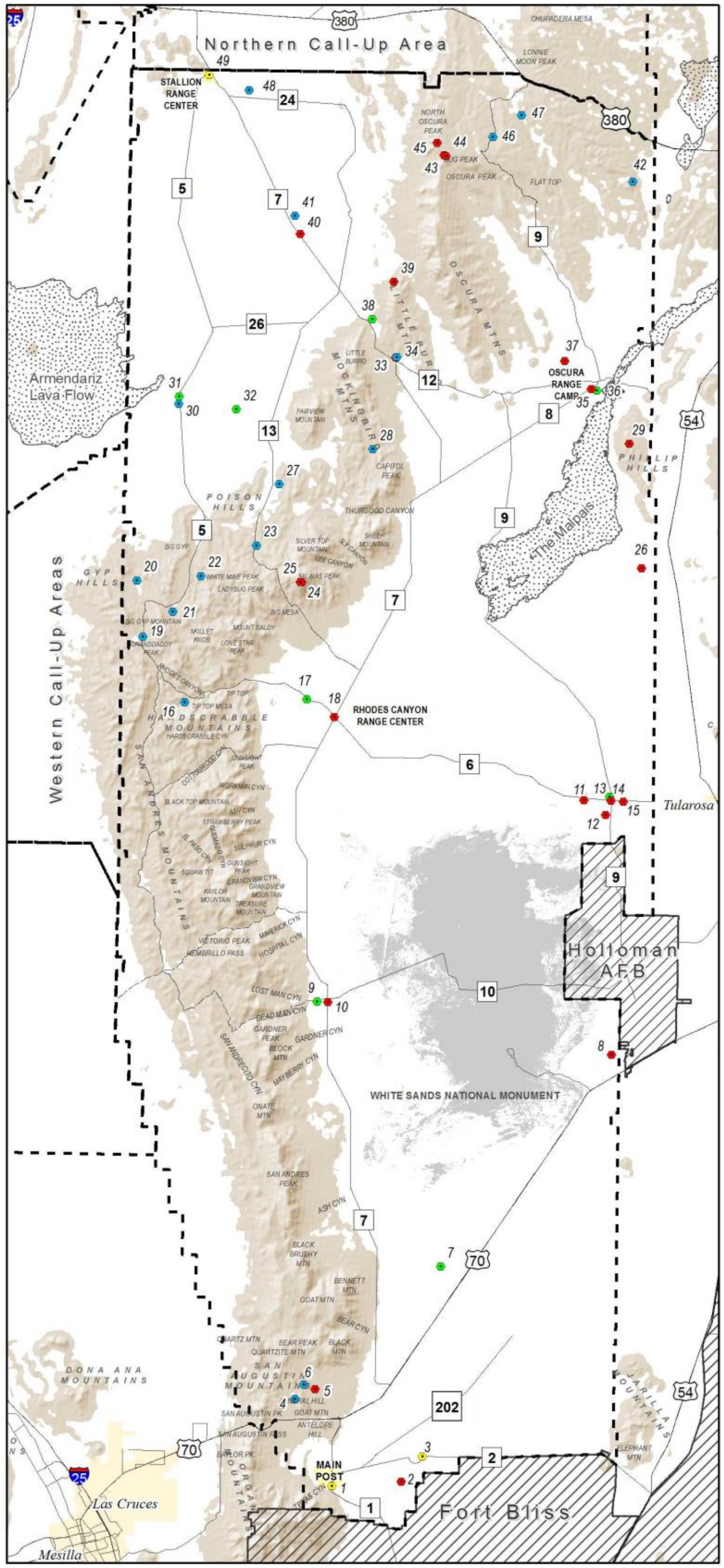


Potential Water Sources for Engine Fill and Firefighting on WSMR

Potential Water Sources for Engine Fill and Firefighting on WSMR

	County and FMU	**UTM E** Zone 13S	**UTM N**	**Notes**
Construction Wells				
13. Tula Gate (NMOSE T-04087)	Otero FMU 19	392653	3660552	Installed July 2002. Approx. 30,000-gal storage tank at well head. Construction well near Tula Gate. This well not working currently (2017 10-31).
17. Herbie Well (aka Rhodes C or well 6) (NMOSE T-5570)	Sierra FMU 16	357993	3672093	Installed March 2009. Approx. 30,000-gal storage tank at wellhead. Water first encountered at 190 ft. bgs, but static water level after construction was 143 ft. bgs.
9. NW30-1 (aka "NW-30)	Dona Ana FMU 11	359144	3637581	Approx. 500-gal tank at well. In Bolson fill located off RR 7 just west of intersection w/ RR 10, just west of Pony site.
38. Murray Well (Construction) (RG 80492)	Socorro FMU 31	365434	3715434	Installed August 2003. Approx. 30,000-gal tank at wellhead. Construction well at Murry well site. Yield-80 gpm. Site visit on 1/8/15 confirmed well still in place and is in good working order. Well feeds into nearby tank and is used for construction water. Well inside locked gate area.
32. Martin Ranch Construction Well	Sierra FMU 24	349926	3705132	Dirt storage tank at well. Construction well at Martin Ranch site. Adjacent old windmill well nearby. Well also used as wildlife watering well instead of old ranch well listed with wildlife wells below.
7. Thel-1 (aka THEL Well)	Otero FMU 6	373236	3607374	No info.
36. ORC Fire (AKA Oscura Range Ctr.)	Lincoln FMU 20	391082	3707293	Dirt storage tank at well. Located at Oscura Range Center. Used previously as a fire protection and general non potable supply well. Yields 125 gpm. DTW about 90' bgs.

31. Range Road 5 well	Socorro FMU 23	343409	3706614	Installed in 2014. Unknown if tank at well. Newest construction well.

Water Systems for truck filling
Stallion Range

49. SRC Non-potable water filling station	Socorro FMU 32	346872	3743302	Tanker fill station at 20,000-gallon non-potable water tank next to water plant. This water is pre-production and not potable.

Main Post

1. Water Point #1	Dona Ana FMU 1	360848	3582324	Tanker fill station along Headquarters Rd. on Main Post. No tank, water directly from potable water lines.
3. Water Point #2	Dona Ana FMU 3	371166	3585681	Tanker fill station along Nike (Range Road 2) east of Main Post. No tank, water directly from potable water lines.

Remote Hauled Water Tanks - most hauled water facilities are gated

39. Aerial Cable	Socorro FMU 31	367916	3719692	Occupied during the week
43. Atom Peak SST	Socorro FMU 35	373667	3734131	Not occupied all week
44. NOP Barracks (Hilton)	Socorro FMU 35	373898	3734048	Rarely occupied
45. NOP (North Oscura Center Range)	Socorro FMU 35	372896	3735572	Not currently occupied - tank used only for boiler
37. Oscura RC Bombing Range	Lincoln FMU 29	387404	3710637	Occupied during the week
35. Oscura RC Commo	Lincoln FMU 20	390431	3707467	Rarely occupied
40. PHETS/DTRA	Socorro FMU 32	357246	3725130	Occupied during the week
29. Phillips Hill	Lincoln FMU 18	394787	3701222	Occupied during the week
26. Russ Site	Otero FMU 18	396161	3686997	Occupied during the week
25. Salinas Commo	Sierra FMU 21	357411	3685417	Periodically occupied

24. Salinas New Tec	Sierra FMU 21	357274	3685464	Periodically occupied
14. Tularosa (MINDA)	Otero FMU 18	392672	3660527	Occupied during the week
10. Andre	Dona Ana FMU 5	360374	3637562	Rarely occupied
5. EMRE	Dona Ana FMU 7	358946	3593360	Occupied during the week
8. Frequency (Holloman)	Otero FMU 5	392754	3631501	Occupied during the week
2. Frequency WS (Oasis Site)	Dona Ana FMU 3	368762	3582830	Occupied during the week
12. J-9	Otero FMU 17	392099	3658875	Rarely occupied
18. Rhodes Commo	Sierra FMU 16	361124	3670077	Occupied during the week
11. Tula G	Otero FMU 17	389595	3660535	Rarely occupied
15. Tula Gate	Otero FMU 18	394111	3660393	Periodically occupied
33. Ben Site	Socorro FMU 31	368149	3711082	Rarely occupied
Wildlife Water Developments Available for Engine Fill				
46. Baca Well	Socorro FMU 35	379240	3736205	Solar well w/8' dia. tire trough (500 Gal.) railroad car storage tank-10,000 gal.
34. Ben Site Well	Socorro FMU 31	368257	3711127	Solar well w/earthen holding tank
20. Buckhorn Well	Sierra FMU 23	338593	3685630	Solar well w/earthen holding tank
28. Burris Well	Sierra FMU 25	365513	3700606	Solar well w/8' dia. tire trough (500 gal.) polyethylene storage tank-1550 gal.
6. Emre Well	Doña Ana FMU 7	357668	3593897	Solar well w/fiberglass tank (1,000 gal.) railroad car storage tank-10,000 gal.
41. Greens Babber Well	Socorro FMU 32	356629	3727213	Solar well w/earthen tank and polyethylene storage tank-1550 gal.

19. Hardin Ranch Well	Sierra FMU 22	339294	3679224	Solar well w/earthen tank and Storage tank-polyethylene-1550 gal.
22. John Woods Well	Sierra FMU 22	345894	3686139	Solar well w/fiberglass 10' tank (1,000 gal.) and polyethylene tank-1550 gal.
23. L.W. Well	Sierra FMU 21	352233	3689614	Solar well w/earthen tank and railroad car storage-10,000 gal.
4. Lena Cox Well	Doña Ana FMU 7	356618	3592269	Solar well w/8' dia. Tire trough (500 gal.) and railroad car storage-10,000 gal. (not operable at this time)
30. Marcial/Anderson Well	Socorro FMU 23	343401	3705770	Solar well w/earthen tank and railroad car storage-10,000 gal.
27. Martin Well	Sierra FMU 25	354841	3696603	Solar well w/tire trough-8' dia. (500 gal.) and polyethylene storage tank-1550 gal.
48. NECI Well	Socorro FMU 32	351405	3741571	Solar well w/tire trough 8' dia. (500 gal.) and polyethylene storage tank-1550 gal.
21. Pete Woods Well	Sierra FMU 22	342695	3682051	Solar well w/earthen tank and polyethylene storage tank-1550 gal.
16. Potter Ranch/Towner Well	Sierra FMU 16	344048	3671718	Solar well w/tire trough 8' dia (500 gal.) and railroad car storage-10,000 gal.
42. Red Canyon Well	Socorro FMU 28	395177	3731129	Solar well w/tire trough 8' dia. (500 gal.) and polyethylene storage tank-1550 gal.
47. Red Rio Well	Socorro FMU 36	382476	3738675	Solar well w/tire trough 8' dia. (500 gal.) and polyethylene storage tank-1550 gal.

WSMR Wildland Fire Cooperators

WSMR Fire Dispatch and Police Services	575 678-1234
WSMR PAO	575 678-1134
WSMR Fire Station #1-Main Post	575 678-0470
WSMR Fire Station #2-LC-38	575 678-9128
WSMR Fire Station #3-Stallion Range Center	575 679-4434
WSMR Fire Station #4-HELSTF	575 679-5167
WSMR FES	575 678-5105
WSMR FES Fire Chief	575 678-0314
WSMR Fire Prevention and Inspections	575 678-3585
WSMR Range Control	575 678-2222
WSMR Range Scheduling	575 678-6141/6142/6144
Holloman AFB Fire Dept.	575 752-7228
Holloman AFB PAO	575 572-5406
Gary Atwell, Deputy Range Manager	575-572-5074

Holloman Range Operations Center (ROC)	575 572-5716
Fort Bliss PAO	915 744-8435/8406
Fort Bliss Fire Dispatch	915 744-1283/2115
McGregor Range Control/Range Operations	915 744-9546/9547/9548/9554
Silver City Interagency Dispatch Center	575 538-5371/5372
Alamogordo Interagency Fire Dispatch Center	575 437-0778/7353 or 877-695-1663
Las Cruces District-BLM	575 525-4300
Pecos District-BLM Roswell	575 627-0272
Carlsbad Field Office-BLM	575 234-5972
Socorro Field Office-BLM	575 835-0412
Lincoln NF-US Forest Service	575 434-7200
Cherokee Range Control	575 678-8000
San Andres National Wildlife Refuge	575 382-5047
USFWS NM Fire District	575 835-0040
Jornada Research Center	575 646-4842
NASA-WSTF Emergency Management Coordinator	575 524-5338
NASA-WSTF Fire Department	575 524-5641
NM State Police	575 827-9309
NM Air Quality Bureau	800 224-7009
NM State Forestry-Capitan District	575 354-2231
NM State Forestry-Socorro District	575 835-9452
El Paso Municipal Fire Department	915 485-5600
Alamo West Volunteer FD	575 434-3686
Las Cruces Municipal Fire Department	575 528-3473
Organ Volunteer FD	575 382-5411
Mescalero Forestry-BIA	575 464-4410
Dona Ana County Fire and Emergency Services	575 647-7921
Otero County Emergency Svc Dispatch	575-885-2111
Sierra County Emergency Management	575 894-6215
Socorro County Emergency Management	575 835-2700
Lincoln County Emergency Management	575 336-8600
National Weather Service-Santa Teresa Office	575 589-4088

FMU 1 Main Post 2,572 Acres

Physical Characteristics

FMU 1 consists of the main post of WSMR, and includes the residential areas, the golf course (now termed Desert Emerald Park), the solar array and the WSMR museum and missile park (Figure 1). The east boundary of FMU 1 is a dirt road that goes north from Owen Road just east of 300K and runs east of the Main Post, becomes Hughes Street then continues northward to encompass the solar array. The north boundary is a dirt road just north of the solar array, then south on Owen Road to a dirt road that heads west under a powerline at UTM coordinate 13S 360,818E, 3,584,924N. The dirt road encompasses the north side of the main post and ties into the dike/firebreak road on the west side of the main post. The west side of FMU 1 is the dike that serves as a flood control dam and a firebreak. The south boundary of FMU 1 is the road to the Small Arms Range Center (SARC) from the dike at the Texas Canyon trailhead to Owen Road.

Topography in FMU 1 is mostly flat. Most of FMU 1 is developed as military and contractor office space, residential subdivisions, and support facilities for those residents. There is lots of open space. During the fire season, from November to July, there can be sufficient fuel accumulations in the form of dried weeds and grasses to sustain wildfire spread in open natural areas.

Infrastructure/Assets to be protected

FMU 1 is a mixture of structures and infrastructure for supporting the military test and evaluation mission on WSMR. There are historic cultural assets in FMU 1 related to early cold war era buildings.

Risk to Firefighters

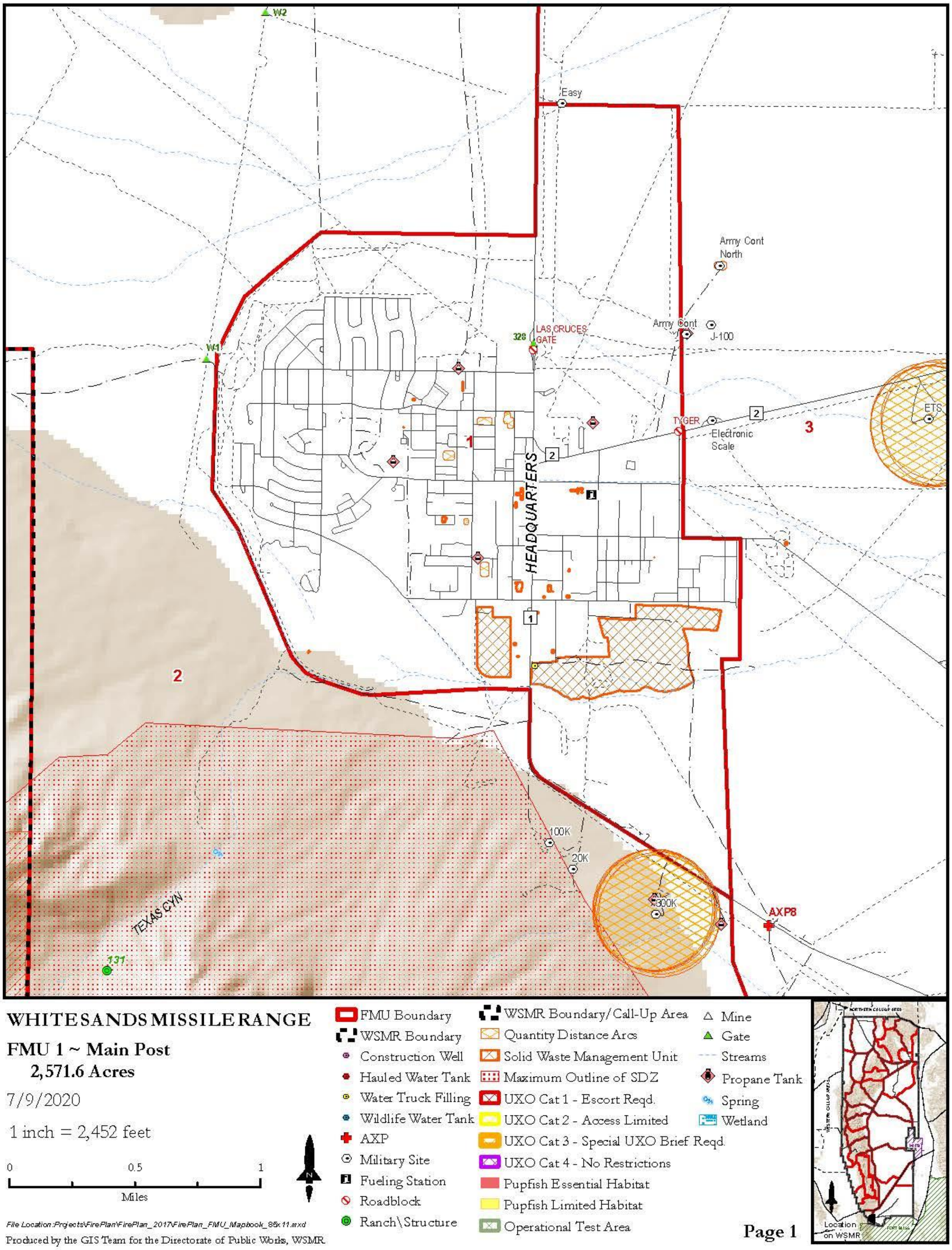
Normal environmental factors of heat, dust, wind and low humidity are here and can contribute to hazardous conditions. Wildfire fuels such as grasses, weeds and shrubs are located in pockets associated with natural open space areas but are not conducive to large wildfire growth within FMU 1. However, any areas where dry, cured brush, weeds or grass has accumulated can burn, spread quickly and threaten nearby wooden structures.

Pre Fire Season Fuels Management Actions

Open spaces in FMU 1 should be assessed by WSMR fire prevention personnel after the monsoon season in the fall. PW-O mows open spaces within the Main Post area and does a good job of keeping fuel accumulations low. The main areas of concern are areas just outside the mowed areas on the periphery of the main post where fuels may be continuous and wildfires can spread. Accumulations of dry, cured tumbleweeds along fences or against structures or other flashy fuels that pose a risk to nearby structures should be removed or crushed and scattered as necessary.

Wildfire Management

All wildfires in FMU 1 are to be extinguished as rapidly as possible using direct attack suppression methods with engines. Engine water fill site is located at Fire Station #1.


W2
Easy
Army Cont North
Army Cont
J-100
LAS CRUCES GATE
326
W1
TYGER
Electronic Scale
ETS
2
3
1
HEADQUARTERS
2
1
2
100K
20K
300K
AXP8
TEXAS CYN
131
WHITE SANDS MISSILE RANGE
FMU 1 ~ Main Post
2,571.6 Acres
7/9/2020
1 inch = 2,452 feet
0
0.5
1
Miles
File Location:Projects\FirePlan\FirePlan_2017\FirePlan_FMU_Mapbook_85x11.mxd
Produced by the GIS Team for the Directorate of Public Works, WSMR.
FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland
Page 1
Location on WSMR

FMU 2 Organ Mountains 11,964 Acres

Physical Characteristics

The east boundary of FMU 2 is a firebreak road that is just east of the Organ Mountains from the south boundary of WSMR and Fort Bliss at the Firing Line Road gate north to Owen Road then northwest on Owen Road to the SARC road, then northwest on the SARC road to the dike/firebreak on the main post's west side, then north around the main post to Owen Road just north of the Las Cruces gate, then north on Owen Road to Highway 70. The north boundary of FMU 2 is Highway 70 west from Owen Road to Aguirre Springs Road. FMU 2's western boundary is the southwest boundary of WSMR from Highway 70 south which borders the BLM's Organ Mountains-Desert Peaks National Monument along Aguirre Springs Road. FMU 2 then stair steps to the southeast around the San Augustin Ranch and ties into the border of the Fort Bliss Military Reservation just north of Granite Peak in Texas Canyon. The southern boundary of FMU 2 is the unmarked WSMR border with Fort Bliss heading east from Texas Canyon to the firebreak road just east of the Organ Mountains at Firing Line Road gate.

Flammable fuels consist of perennial and annual grasses in abundance in FMU 2. Lehmann's lovegrass has proliferated in FMU 2 to the point that this exotic grass is displacing native grasses. There are large areas of black, side oats, hairy and blue grama, bush muhly, three-awn, and bluestem and sacaton grasses throughout FMU 2. Vegetation on the mountains is diverse with a mixture of cool and warm season grasses and diverse shrubs and trees. Agave, prickly pear, catclaw, sotol, yucca, mountain mahogany, apache plume, mesquite, piñon pine, juniper and ocotillo are found on slopes intermixed with diverse grasses. Desert shrubs include sumac, mesquite, prickly pear, yucca, creosote and snakeweed intermixed with grasses.

Infrastructure/Assets to be protected

There are historic assets within FMU 2 including the 100K, 300K and 500K static rocket motor test facilities. The San Augustin Ranch sits just outside WSMR's southwest boundary close to the Main Post. It is protected from wildfires by its location within a dirt compound. Historic ranches or cultural sites in FMU 2 include:

(#130 on map) Cordova Well consists of rock walls and scattered burnable wooden parts and is at **low risk** of burning in a wildfire. Located at UTM coordinates 13S **354,600E** by **3,585,900N**.
(#131) Texas Canyon consists of old metal and some scattered wood in the bottom of the canyon. There is **no risk** of loss from wildfires. Located at UTM coordinates 13S **358,100E**, by **3,580,370N**.

There are buildings in FMU 2 that are active military and contract facilities for all types of testing missions. These facilities are mostly protected from wildfire effects due to their construction materials and the fact that there are parking lots and roads surrounding them and grounds are maintained. There is a domed observation facility atop the hill just east of Antelope Hill that is protected from wildfire effects due to cleared pad area around the facility. There are powerlines, fences, and windmills within this FMU that may need protection from severely burning wildfires.

Risk to Firefighters

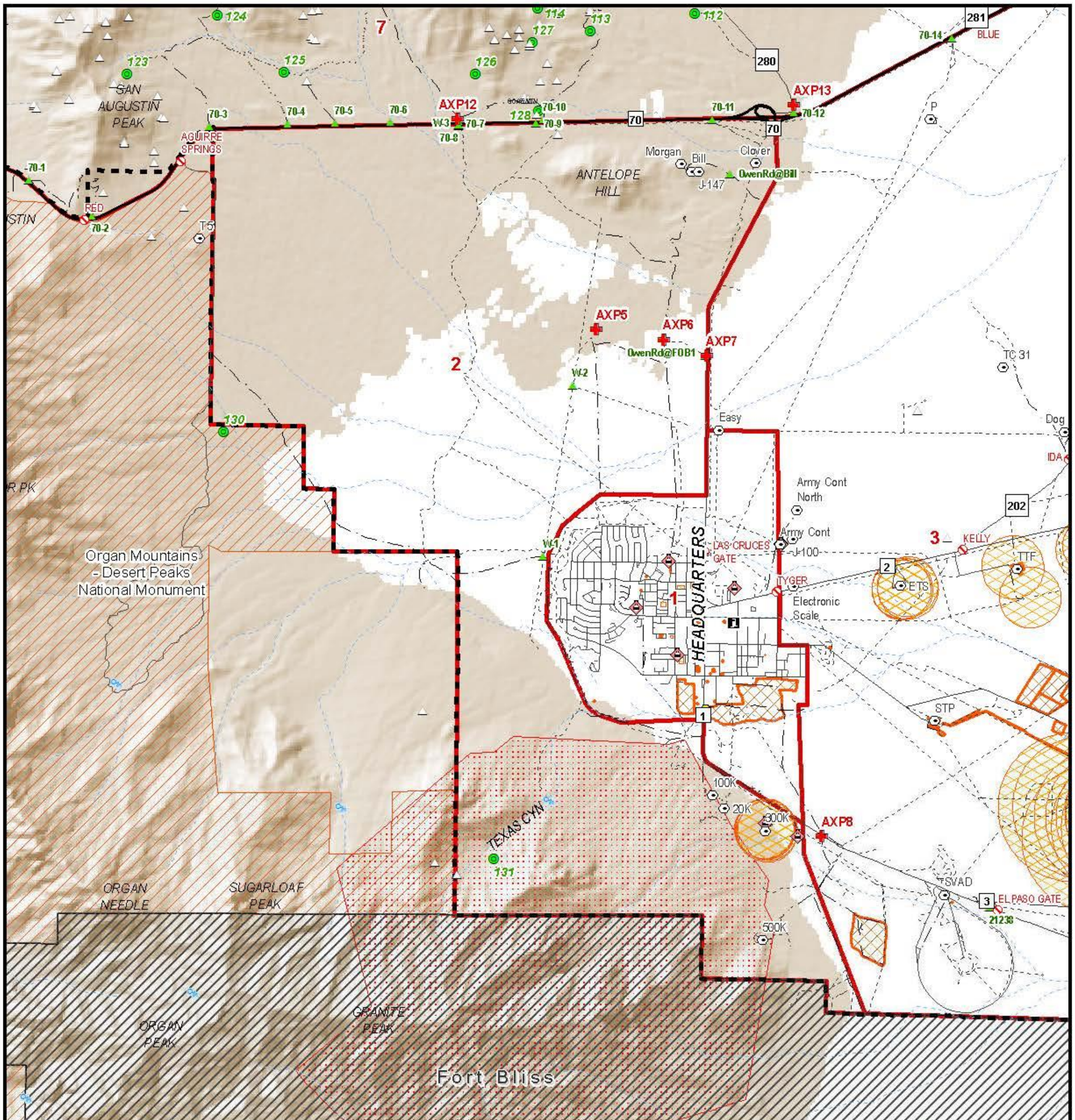
Normal environmental factors of steep terrain, loose rocks, heat, dust, wind and low humidity are here and can contribute to hazardous conditions. Grass fuels are prolific and flammable when cured. Wildfires in the Organ Mountains have exhibited extreme fire behavior with very high rates of spread in the past. UXO is a possibility anywhere in FMU 2.

Pre Fire Season Fuels Management Actions

Range facilities should be inspected annually by firefighters for fuel build-up near structures. Vegetated areas around flammable structures need to be kept mowed out to a distance of 30’ to keep vegetation short. Mowing (brush hog) of vegetation at 6 to 8 inches in height should be done around structures wherever possible, preferably in late October before present year’s vegetative growth dries out. After weeds are cured out in the fall, look for tumbleweed accumulations against fences and structures. Burn them in place as in the past or pile tumbleweeds and burn them in a cleared area or crush them down and scatter as needed.

Wildfire Management

All wildfires in FMU 2 are to be extinguished as rapidly as possible using direct attack suppression methods with engine support where possible. This FMU borders BLM lands and their firefighters will respond to wildfires in this FMU, as needed. Areas in the Organ Mountains in FMU 2 are off the road systems and will require ground troops to hike in to wildfires. Aerial assets may be necessary to control wildfires spreading into the Organ Mountains. WSMR FES firefighters may blackline or burnout along roads inside the installation, when deemed advantageous by the Incident Commander.



WHITE SANDS MISSILE RANGE

FMU 2 ~ Organ Mountains

11,964.2 Acres

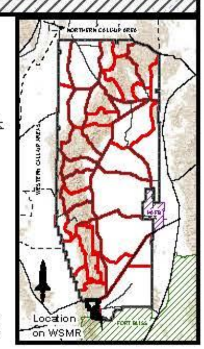
7/9/2020

1 inch = 5,594 feet

0 0.5 1

Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland



Page 2

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Produced by the GIS Team for the Directorate of Public Works, WSMR.

FMU 3 Launch Complex Area 159,272 Acres

Physical Characteristics

The eastern boundary of FMU 3 goes from Range Road 2 (Nike Road) at WSMR's southeast administrative boundary north along the WSMR boundary past the Jarilla Mountains to the boundary intersection of an east-west two-track road ¾ of a mile north of Largo site at UTM coordinate 13S 393,098E, 3,610,028N. The north boundary of FMU 3 is along the east-west two-track road west from the east WSMR boundary to Gate 28 at Highway 70. FMU 3 is bordered on the west by Highway 70 from Gate 28 (E. HELSTF) near Joe site southwest to Owen Road, then south on Owen Road, then east around the main post on dirt roads, then back to Owen Road. Then southeast on Owen Road to the firebreak road that runs south to Firing Line Road on the WSMR/Fort Bliss border. The south boundary of FMU 3 is the Fort Bliss/WSMR boundary west from that firebreak road to Range Road 2 (Nike Avenue), at the Orogrande Gate.

Fuels consist mainly of shrubs of mesquite, yucca, snakeweed, four-wing saltbush, tarbush and creosote intermixed with desert grasses of tobosa, bush muhly, dropseeds, black grama, Lehmann's lovegrass and alkali sacaton. Topography is mostly flat with a few gently, rolling hills.

Infrastructure/Assets to be protected

FMU 3 is a complex mixture of structures, launch complexes and infrastructure for supporting the military testing mission on WSMR. There are numerous historic cultural assets in FMU 3, including a prehistoric pueblo site near Davies Playa. Many of the structures within FMU 3 are early cold war era buildings. Other prominent features include Davies Playa and Condron airfield. There are over 100 structures scattered across this very large FMU. Because of their location in the Tularosa Basin and a corresponding lack of continuous fuels, there is little threat from wildfires to these structures.

There are three historic ranch sites in FMU 3. These are:

(#110 on map) Drift Fence Well is two wooden structures at **moderate risk** of burning in a wildfire due to proximity of light, continuous fuels. Located at UTM coordinates 13S **369,450E** by **3,595,400N**.

(#111) McNew West Camp has **no wildfire risk** and is located at UTM 13S **391,350E** by **3,595,240N**.

(#129) McNew Ranch is a dilapidated structure with no burnable fuels in proximity to the fallen structure and is **not at risk** from wildfires but is located at UTM coordinates 13S **390,600E** by **3,585,950N**.

Risk to Firefighters

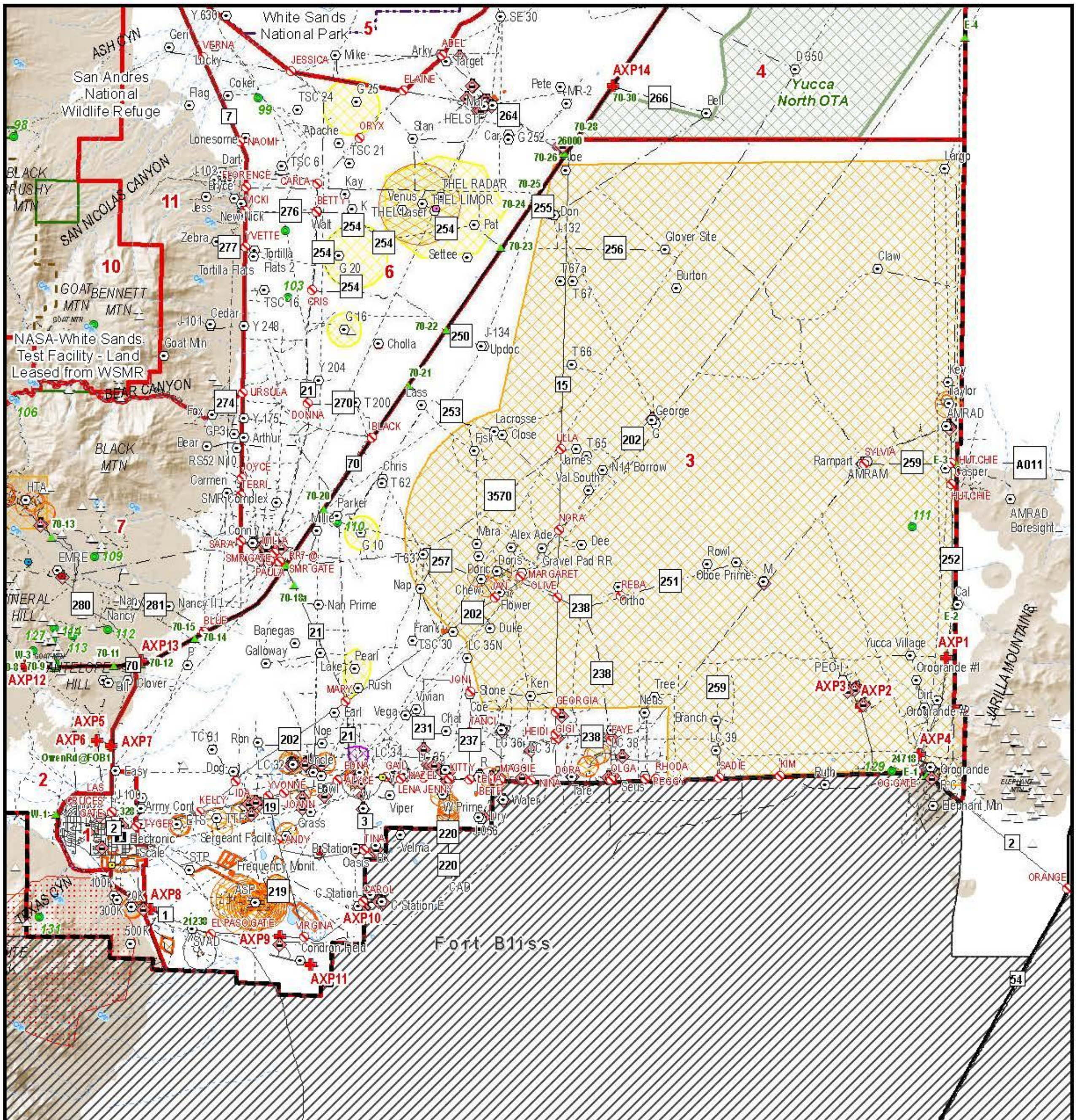
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. Wildfire fuels such as cured annual and perennial grasses and forbs are generally located in low-lying pockets and wildfires can spread here, but due to the surrounding mesquite coppice dunes or creosote flats, wildfires are not conducive to large wildfire spread. However, any areas where dry, cured brush, weeds or grass have accumulated can burn, spread quickly and threaten nearby structures.

The eastern half of FMU 3 contains a large area of potential UXO contamination.

Pre Fire Season Fuels Management Actions
Facilities throughout FMU 3 should be assessed by WSMR fire prevention personnel after the growing season on an annual basis. The main areas of concern are accumulations of dry, cured tumbleweeds along fences or against structures or any other flashy fuels that pose a risk to nearby structures. These dried fuels should be removed or crushed and scattered or burned, as necessary.

Wildfire Management
Allow wildfires off the road system to burn out and die on their own. The Davies Playa area could exhibit significant fire behavior if a wildfire started here. Either suppress quickly or fall back to roads and allow wildfire to burn out on its own. Firefighters should stay on roads in FMU 3 due to UXO concerns and suppress wildfires from defensible positions.

Engine fill sites in FMU 3 are located at Frequency WS site aka Oasis Site and at Fire Station #2.



WHITE SANDS MISSILE RANGE

FMU 3 ~ Launch Complex Area

159,272.4 Acres

7/9/2020

1 inch = 16,488 feet

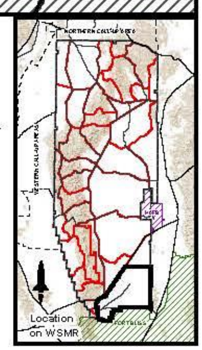
0 0.5 1

Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure

WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area

Mine
Gate
Streams
Propane Tank
Spring
Wetland



Page 3

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Produced by the GIS Team for the Directorate of Public Works, WSMR.

FMU 4 Foster Lakes 39,070 Acres

Physical Characteristics

The eastern boundary of FMU 4 is the WSMR boundary north from Largo site to Highway 70. The boundary here is fenced but is not maintained for vehicle access for several miles. There is a road south along the eastern boundary from Highway 70 that goes to the White Sands Ranch which is on the WSMR boundary three miles south of Highway 70. FMU 4 is triangular in shape, so is bordered on the west by Highway 70 from Gate 70-36 (Frequency monitor) to Gate 70-28 (E. HELSTF) near Joe site. The south boundary of FMU 4 then heads due east along a two-track dirt road from Gate 28 to the eastern boundary of WSMR just ¾ of a mile north of Largo site.

Fuels consist mainly of shrubs of mesquite, yucca, snakeweed, four-wing saltbush, tarbush and creosote intermixed with desert grasses of tobosa, bush muhly, dropseeds, black grama and alkali sacaton. Topography is mostly flat with a few gently, rolling hills.

Infrastructure/Assets to be protected

FMU 4 contains few structures. There are major powerlines that bisect FMU 4 from northeast to southwest and along the eastern boundary. Part of the White Sands National Monument is located in FMU 4 at the north end. The US Border Patrol has a major checkpoint on Highway 70 that is located in FMU 4. However, none of these structures or infrastructure has a wildfire threat due to sparse fuels.

There is one significant historic ranch site in FMU 4:

(#101 on map) Robert's Well has a standing residence and fallen outbuildings but is **not at risk** of burning in a wildfire due to lack of continuous fuels. Located at UTM coordinates 13S **389,400E** by **3,619,975N**.

Risk to Firefighters

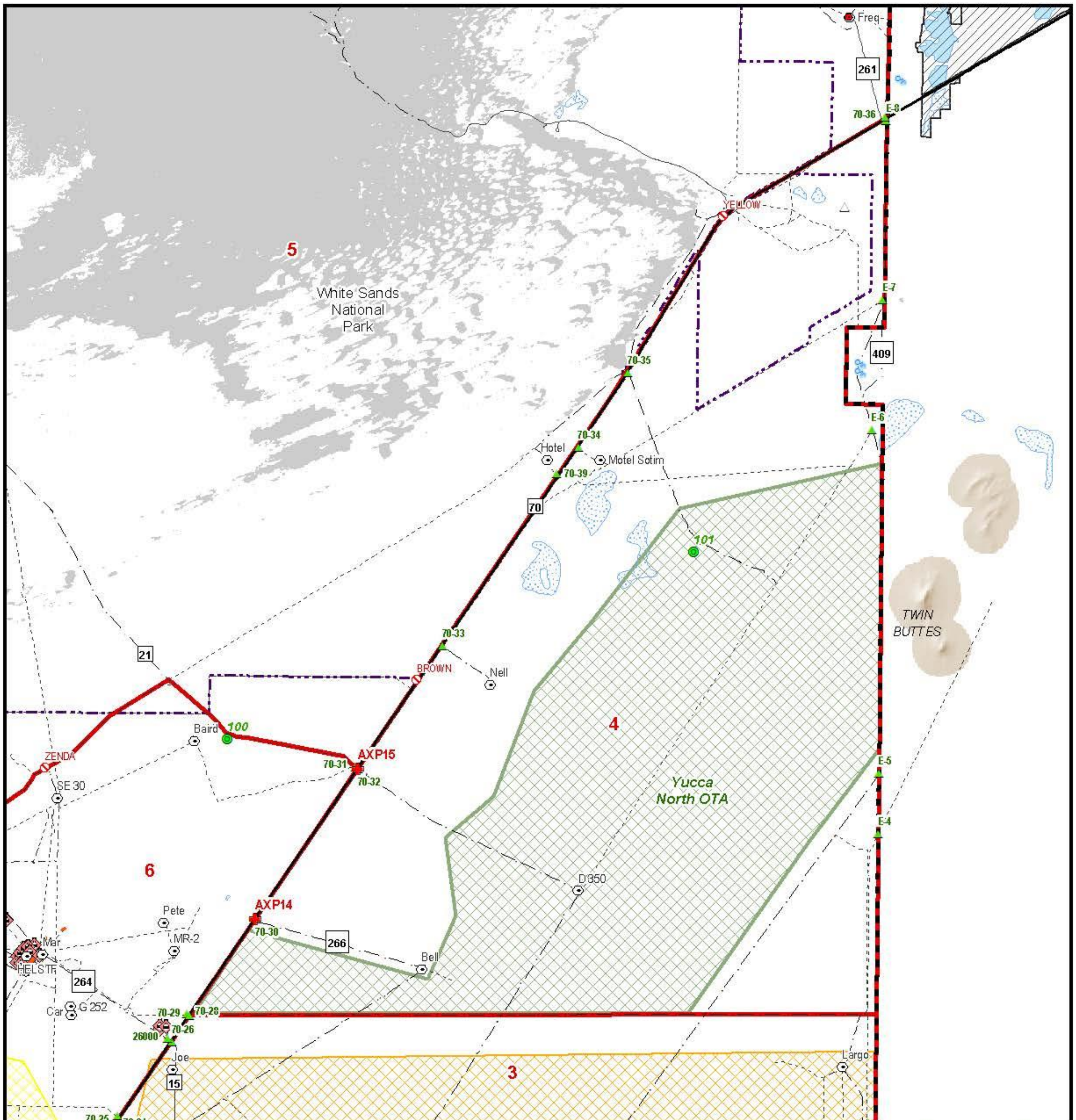
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. Wildfire fuels such as cured annual and perennial grasses and forbs that are located in low-lying basins or in playa lakebeds can spread wildfires here, but due to the surrounding mesquite coppice dunes and creosote flats, FMU 4 is not conducive to large wildfire spread.

Pre Fire Season Fuels Management Actions

There are no WSMR facilities located in FMU 4. The main areas of concern are accumulations of dry, cured tumbleweeds along the east boundary fence or against powerline poles. These dried fuels should be removed or crushed and scattered or burned, as necessary.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Firefighters should stay on roads in FMU 4 and suppress wildfires from defensible positions. There are no engine fill sites in FMU 4. Water may be available with permission from USBP.



WHITE SANDS MISSILE RANGE

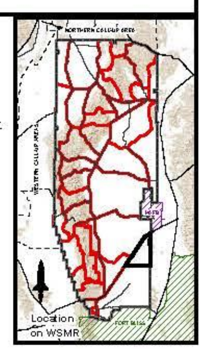
FMU 4 ~ Foster Lakes
39,070.1 Acres

7/9/2020

1 inch = 9,309 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland



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Produced by the GIS Team for the Directorate of Public Works, WSMR.

Page 4

FMU 5 White Sands National Monument 172,785 Acres

Physical Characteristics

The eastern boundary of FMU 5 is the WSMR/Holloman AFB boundary north from Highway 70 at Gate 70-36 (Frequency monitor) to Range Road 10. The northern boundary of FMU 5 is Range Road 10 west from the Holloman AFB boundary to Range Road 7. The western boundary of FMU 5 is Range Road 7 south from Range Road 10 to a dirt road that heads southeast at UTM coordinate 13S 362,940 E, 3,616,572 N. FMU 5 is bordered on the south by this dirt road from Range Road 7 to Jessica Block, then east to Elaine Block, then northeast past Adel Block, past Zenda Block to an intersection of dirt roads at UTM coordinate 13S 378,087 E, 3,617,234 N, then southeast on a dirt two-track to Highway 70, then northeast along Highway 70 from Gate 70-31 to Gate 70-36.

There are large areas in FMU 5 where fuel does not exist due to vast dunes of gypsum. The peripheral areas of the dunes contain mesquite, yucca, snakeweed, four-wing saltbush, tarbush and creosote intermixed with desert grasses of tobosa, bush muhly, dropseeds, black grama, Lehmann's lovegrass and sacaton. Topography is mostly flat with rolling gypsum sand dunes covering the majority of this FMU. Ownership is mostly White Sands National Monument but since WSMR surrounds the Monument, WSMR has the periphery of this FMU which contains the road system surrounding the National Monument and has most of the burnable fuels in this FMU.

Infrastructure/Assets to be protected

FMU 5 contains few structures. The US National Park Service mans the Monument Headquarters located at the Monument entrance on Highway 70. WSMR has a few structures in FMU 5 but they are well protected from wildfire effects.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, but due to the surrounding gypsum lake beds and dunes FMU 5 is not conducive to large wildfire spread.

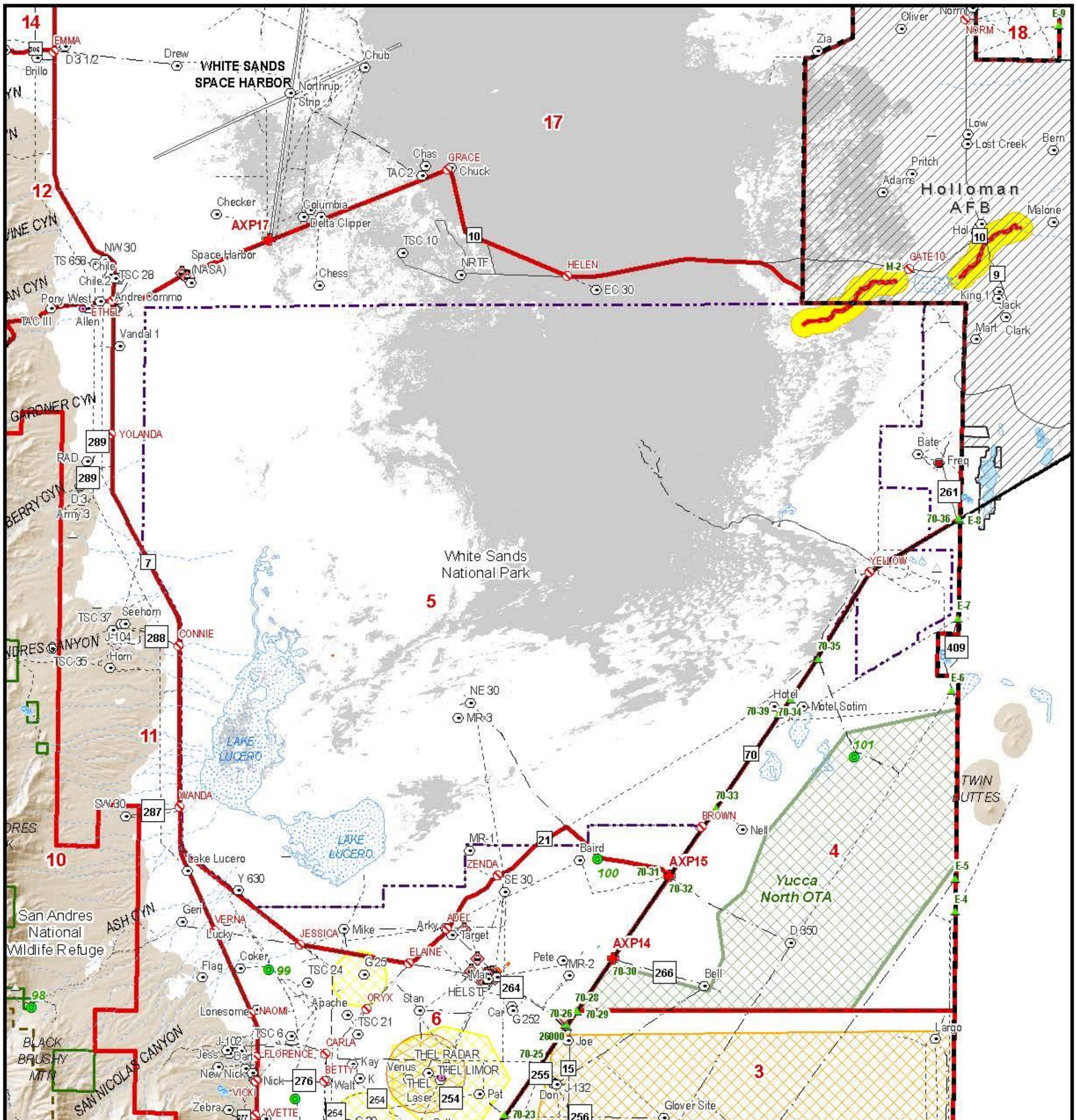
Pre Fire Season Fuels Management Actions

There are no concerns from wildfires for WSMR facilities located in FMU 5. It is possible for dried weeds to collect against structures and fences within FMU 5. These areas should be kept clean by crushing or scattering built up fuels.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Firefighters should stay on roads in FMU 5 and suppress wildfires from defensible positions.

Engine fill site in FMU 5 is at Frequency Site.



WHITE SANDS MISSILE RANGE

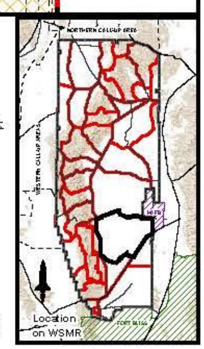
FMU 5 ~ White Sands Nat. Monument
172,784.9 Acres

7/9/2020

1 inch = 16,983 feet

0 0.5 1
Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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Produced by the GIS Team for the Directorate of Public Works, WSMR.

Page 5

FMU 6 HELSTF 44,888 Acres

Physical Characteristics
FMU 6 is triangular-shaped. FMU 6 is bordered on the east by Highway 70 from the Small Missile Range Gate at Range Road 7 to Gate 70-31 (BAIRD). The north boundary of FMU 6 roughly follows the roads just outside of the south boundary of WSMR/White Sands National Monument from Gate 31 west to Range Road 21, then along Range Road 21 past Zenda Block, past Adel Block, past Elaine Block, past Jessica Block to Range Road 7. The west side of FMU 6 is Range Road 7 south to Highway 70.

Fuels in FMU 6 are typical Tularosa Basin vegetation consisting mostly of shrubs such as four-wing saltbush, pickleweed, creosote, mesquite, tarbush, yucca, snakeweed and acacia. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, sacaton, black grama, Lehmann's lovegrass and three-awns. Topography is flat with a few, gently rolling hills.

Infrastructure/Assets to be protected
FMU 6 contains the Small Missile Range facilities and HELSTF. There are numerous missile launch sites connected by a road system that fragments the fuels in this FMU. There is not the fuel continuity or fuel arrangement to carry wildfires far in FMU 6. There are pockets of grass and brush fuels in low-lying areas that will burn and spread but have nowhere to go outside the pocket.

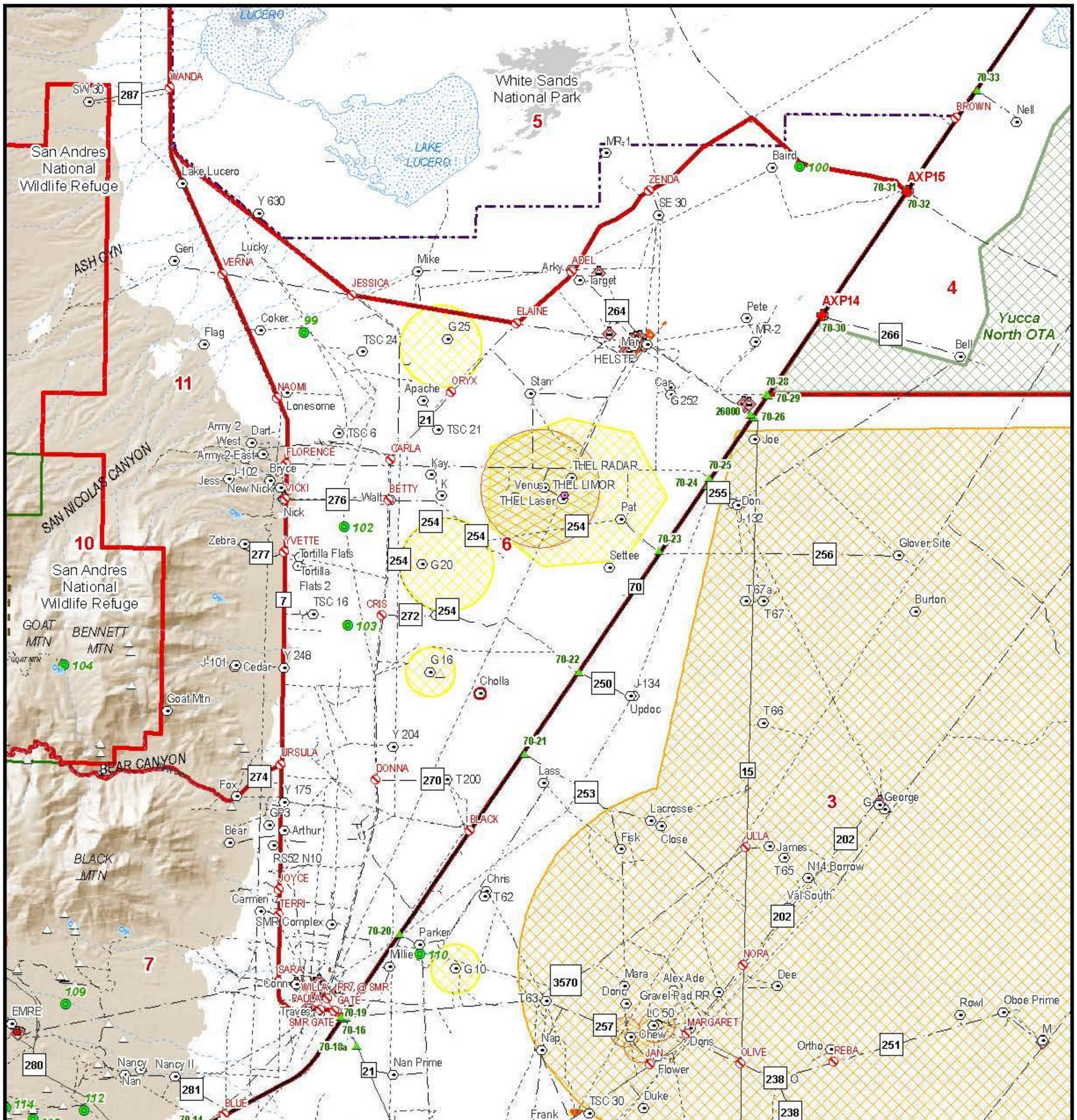
There are three historic ranch structures located in FMU 6:

(#99 on map) Jose Lucero Ranch is a standing adobe structure with wood and is at **moderate risk** of burning in a wildfire and is located at UTM coordinates 13S **366,430E** by **3,611,610N**.
(#102) Felipe Lucero Ranch, aka South Lucero Ranch has standing adobe walls and is **not at risk** of burning in a wildfire due to lack of continuous fuels. Located at UTM coordinates 13S **367,480E by 3,606,540N**.
(#103) White Ranch has standing adobe walls but is **not at risk** of burning in a wildfire due to lack of continuous burnable fuels. Located at UTM coordinates 13S **367,580E by 3,603,980N.**

Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, but FMU 6 is not conducive to large wildfire spread.

Pre Fire Season Fuels Management Actions
There are numerous facilities located in FMU 6. Dried tumbleweeds collect against structures and fences within FMU 6. These areas should be kept clean by crushing, burning or scattering built up fuels.

Wildfire Management
Allow wildfires off the road system to burn out and die on their own. Firefighters should stay on roads in FMU 6, provide structure protection and suppress wildfires from defensible positions.
Engine fill in FMU 6 is located at THEL Well.



WHITE SANDS MISSILE RANGE

FMU 6 ~ HELSTF

44,887.8 Acres

7/9/2020

1 inch = 11,286 feet

0 0.5 1

Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
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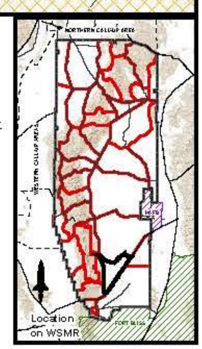
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland



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Produced by the GIS Team for the Directorate of Public Works, WSMR.

Page 6

FMU 7 HTA 35,492 Acres

Physical Characteristics

The east side of FMU 7 is Range Road 7 north from its intersection with Highway 70 at the Small Missile Range gate to Bear Canyon at Ursula Block. The north boundary of FMU 7 follows a dirt road in Bear Canyon to the west to the head of the canyon past Rock House Spring past Divide Tanks and into Bear Creek, then down Bear Creek to New Well, then south from New Well, past West Cottonwood Well to Loman Canyon, then west down Loman Canyon to the west boundary of WSMR. The west side of FMU 7 is a WSMR border fence that runs south from Loman Canyon along the WSMR boundary to Highway 70. FMU 7 is bordered on the south by Highway 70 from about one mile west of San Augustin Pass to the Small Missile Range Gate at Range Road 7.

Fuels in FMU 7 are shrublands and grasslands consisting mostly of skunkbush sumac, ceanothus, mesquite, catclaw, sotol, snakeweed, prickly pear cactus and one-seed juniper. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, sacaton, blue, sideoats and black grama, Lehmann's lovegrass and three-awns. Topography includes the San Augustin Mountains, Bear Peak, Mineral Hill and Black Mountain in the San Andres Mountains. Much of FMU 7 is steep-sided mountains with narrow canyons, but also includes high desertic basins and bajadas just north of Highway 70.

Infrastructure/Assets to be protected

FMU 7 contains the Hazardous Test Area (HTA) facilities, Mountain Village and EMRE facilities as well as several missile launch sites located near Range Road 7. EMRE and HTA sites are cleared around and are well-protected from wildfire harm. Mountain Village consists of con-ex boxes and is not flammable.

There are numerous cultural sites along with several mine adits that contain wooden features. A few of these sites sit in heavy grass fuels and shrubs and are at risk in a wildfire:

(#106 on map) Rock House Spring has adobe, rock and wooden structures and is at **moderate risk** of burning in a wildfire due to proximity of burnable fuels and is located at UTM coordinates 13S **357,200E** by **3,600,060N**.
(#107) Upper Loman Canyon Well sits in dense continuous burnable fuels and is at **high risk** of burning in a wildfire at this location. Located at UTM coordinates 13S **353,360E** by **3,595,550N**.
(#108) Lower Loman Mine Camp has a single stone structure and is **not at risk** of burning in a wildfire due to lack of nearby burnable fuels. Located at UTM coordinates 13S **354,280E** by **3,595,370N**.
(#109) Sunol Mines/Gold Camp has few recognizable features and is **not at risk** of being burned in a wildfire due to lack of nearby burnable fuels. Located at UTM coordinates 13S **360,200E** by **3,594,100N**.
(#110) Drift Fence Well has two wooden, standing structures and is at a **moderate risk** of burning in a wildfire due to adjacent heavy fuels. Located at UTM coordinates 13S **369,450E** by **3,595,400N**.
(#111) McNew West Camp has few recognizable features and is **not at risk** of burning in a nearby wildfire due to lack of burnable fuels in the area. Located at UTM coordinates 13S **391,350E** by **3,595,240N**.

(#112 on map) Hal Cox Ranch has 5 significant structures but is at **low risk** of burning in a wildfire due to the lack of continuous burnable fuels nearby. Located at UTM coordinates 13S **360,700E** by **3,591,320N**.
(#113 on map) Victory Mine has little structure and is **not at risk** of burning in a wildfire. Located at UTM coordinates 13S **359,350E** by **3,591,100N**.
(#114 on map) Victory Mill, Doña Dora Mine, Mill Ruins has multiple rock foundations and little burnable fuel and is at **low risk** of burning in a wildfire. Located at UTM coordinates 13S **358,660E** by **3,591,390N**.
(#115) Lena Cox Ranch has a windmill and rock and wood ruins located in fuels that are at **moderate risk** of burning in a wildfire. Its proximity to an improved road and water at this site makes it easy to defend. Located at UTM coordinates 13S **356,670E** by **3,591,980N**.
(#116) Black Prince Mine is a partial stone structure that is **not at risk** from burning in a wildfire. Located at UTM coordinates 13S **353,910E** by **3,592,300N**.
(#117) Hilltop Mine is a dilapidated wooden structure that is at **moderate risk** of burning in a wildfire. Located at UTM coordinates 13S **353,620E** by **3,592,050N**.
(#118) Near the Top Mine has **no wildfire risk** and is located at **353,500E** by **3,592,130N**.
(#119) Little Buck Mine has **no wildfire risk** and is located at **352,490E** by **3,591,990N**.
(#120) Merrimac Mine has **no wildfire risk** and is located at **352,250E** by **3,591,850N**.
(#121) Excelsior Mine has **no wildfire risk** and is located at UTM coordinates 13S **351,000E** by **3,591,500N**.
(#122) Organ Mine Camp has **no wildfire risk**. Located at 13S UTM coordinates **350,980E** by **3,591,300N**
(#123) Silver King Mine, Henry Heiner Mine, Quicksilver Mine have fallen timbers and dilapidated structures that are at **moderate risk** of burning in a wildfire due to surrounding brush and grass fuels. Located at UTM coordinates 13S **353,350E** by **3,590,540N**.
(#124) Lower Black Prince has **no wildfire risk** and is located at **254,520E** by **3,591,300N**.
(#125) Ridge Mine has **no wildfire risk** and is located at **355,380E** by **3,590,560N**.
(#126) Southwest Mineral Hill has **no wildfire risk** and is located at **357,860E** by **3,590,540N**.
(#127) H & H Mine contains some stone walls and a steam pump. There is **no risk** from wildfire due to lack of burnable features. Located at UTM coordinates 13S **358,600E** by **3,590,950N**.
(#128) Rock of Ages has **no risk** of burning in a wildfire and is located at **358,680E** by **3,590,060N**.

There are numerous structures that are in current use west of Range Road 7 in FMU 7. These facilities are at low risk of harm from wildfires due to their location in desert fuel types.

Risk to Firefighters
Normal environmental factors of heat, dust, wind, and low humidity are here and can contribute to hazardous conditions. There is an abundance of cured annual and perennial grasses, shrubs and forbs and wildfires can spread rapidly here. Steep, rocky slopes and narrow canyons contribute to hazardous conditions. Catclaw can be so thick in spots here that it is nearly impossible to get through on foot. Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, vehicle travel, poor roads, poor visibility, communication problems, and unexploded ordinance are all potential safety problems in FMU 7.

Pre Fire Season Fuels Management Actions

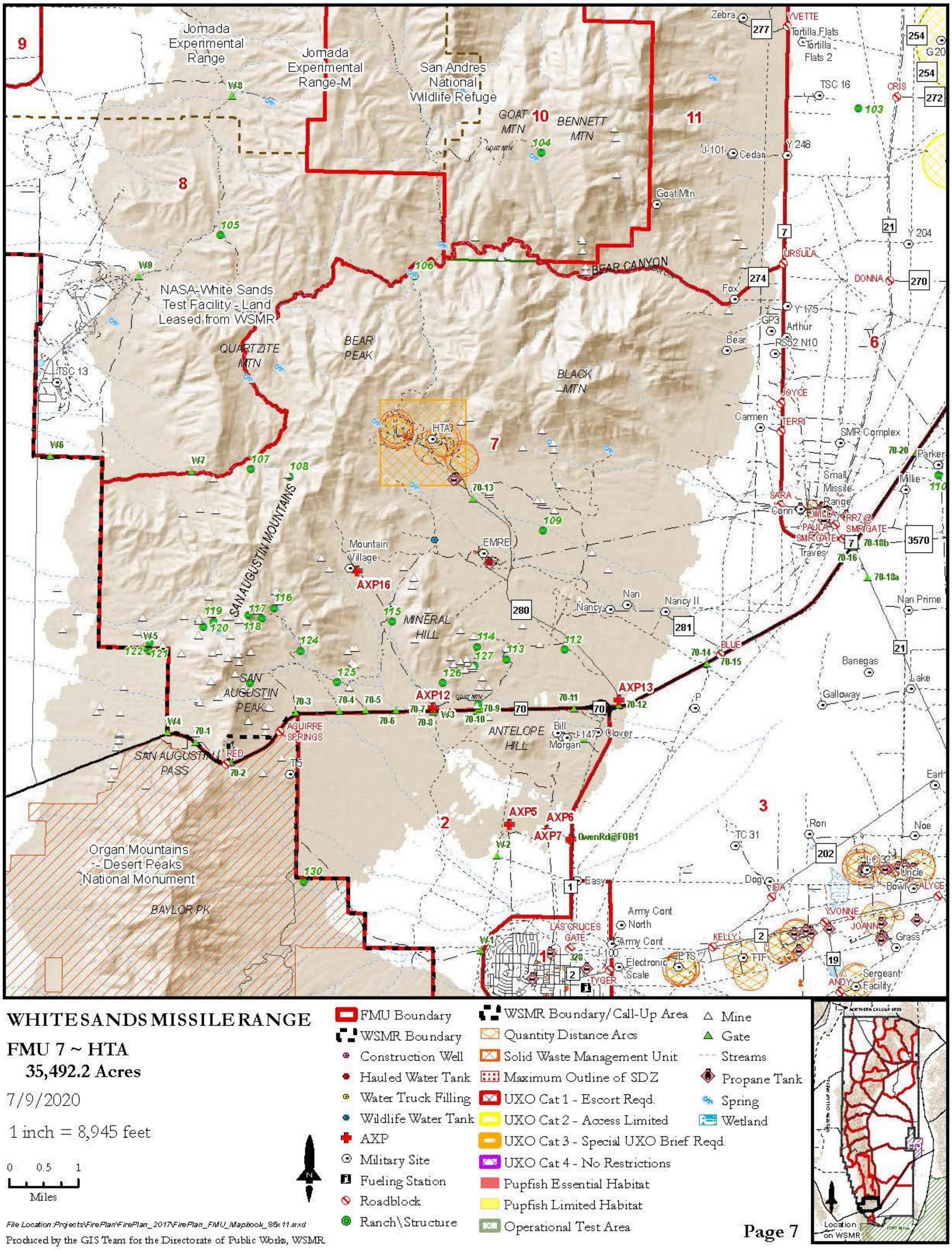
There are active facilities with numerous structures located in FMU 7. Maintain 30' defensible space around buildings by either maintaining a green belt or by removing fuels entirely or by mowing to 2-4" stubble height (preferred fuel treatment as this keeps dust down and keeps tumbleweeds from growing in bare spots). Dried tumbleweeds can collect against structures and fences within FMU 7. These areas should be kept clean by crushing, burning or scattering built up fuels. If necessary, tumbleweeds can be piled in a secure location and burned. Roads throughout FMU 7 should be maintained once yearly in the fall after monsoon season to firebreak standards of bare ground for at least 8 feet across road surfaces and bar ditches and road shoulders maintained to be fuel-free as much as possible.

Wildfire Management

Wildfires need to be attacked rapidly in this FMU. Fuels will burn readily and spread rapidly in many places in FMU 7. Utilize interagency agreements to get BLM, Organ VFD, NASA-WSTF and Las Cruces municipal fire units to respond with wildland units. Much of FMU 7 is remote and wildfires will be hard to suppress within these rugged areas. Fall back to firebreak roads and initiate blacklines or burnouts from defensible positions. Due to safety concerns with placing engines and firefighters in remote, narrow canyons such as Bear Canyon with one-way egress and ingress to safety zones, wildfire managers should consider allowing wildfires on Bear Peak and Black Mountain to burn and attacking wildfires only from strong defensible positions.

At this point, monitoring of the wildfires' progress can be made by other WSMR employees so FES firefighters are freed up to continue normal duties. The WSMR GC, WFPM, Deputy Fire Chief and PWE resource professionals should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions take place.

Engine fill sites are located in FMU 7 at EMRE site, EMRE Well and Lena Cox Well.



WHITE SANDS MISSILE RANGE
FMU 7 ~ HTA
35,492.2 Acres
7/9/2020
1 inch = 8,945 feet
0 0.5 1
Miles
File Location: Projects\FirePlan\FirePlan_2017\FirePlan_FMU_Mapbook_85x11.mxd
Produced by the GIS Team for the Directorate of Public Works, WSMR
FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland
Page 7
Location on WSMR
Jornada Experimental Range
Jornada Experimental Range-M
San Andres National Wildlife Refuge
NASA-White Sands Test Facility - Land Leased from WSMR
SAN AUGUSTIN MOUNTAINS
Organ Mountains - Desert Peaks National Monument
BEAR CANYON
QUARTZITE MTN
BEAR PEAK
BLACK MTN
GOAT MTN
BENNETT MTN
MINERAL HILL
SAN AUGUSTIN PEAK
SAN AUGUSTIN PASS
ANTELOPE HILL
BAYLOR PK
HTA
Mountain Village
EMRE
AXP16
AXP12
AXP13
AXP5
AXP6
AXP7
AGUIRRE SPRINGS
LAS CRUCES GATE

FMU 8 NASA/WSTF 23,326 Acres

Physical Characteristics

The east side of FMU 8 is a dirt two-track road from Stinking Springs into the San Andres National Wildlife Refuge (SANWR) north past San Nicholas Camp, past Salt Canyon to an intersection of two-track roads in the head of Ash Canyon. The north boundary of FMU 8 is a two-track road that bears west from Ash Canyon, past Burro Springs, past Little Wells, past Middle Tank, then bearing south on the Jornada Experimental Range to Ragged Tank Flat then west past an intersection of dirt roads to the WSMR boundary near Taylor Well. The west boundary of FMU 8 is the WSMR western boundary from near Taylor Well south through the middle of the NASA/WSTF, past the NASA/WSTF facilities but north of the security gate on NASA Road to a gravel pit which leads to the road that goes east in to Loman Canyon. The access to Loman Canyon is also the access to a maintained firebreak that runs south to north on the east side of the facilities at NASA/WSTF. FMU 8 is bordered on the south by a dirt road just outside of the south boundary of WSTF that begins at the intersection of the western boundary of WSMR and the southern boundary of the NASA/WSTF. This dirt road goes east up Loman Canyon, then veers north on the east side of Quartzite Mountain over a low pass and in to Bear Creek, then east up Bear Creek past Divide Tanks, past Rock House Springs to Stinking Springs.

Fuels in FMU 8 are shrublands and grasslands consisting of skunkbush and little leaf sumac, ceanothus, mesquite, catclaw, sotol, snakeweed, cacti, agave and juniper. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, sacaton, blue, sideoats and black grama, Lehmann's lovegrass, little bluestem and three-awns. Topography is steep-sided mountains with narrow canyons, but also includes desertic basins and bajadas just west of the San Andres Mountains.

Infrastructure/Assets to be protected

FMU 8 contains the NASA-White Sands Test Facilities. Sites within the NASA facility are cleared around and are well-protected from wildfire harm. There are cultural sites including:

(#105 on map) Love Ranch contains many structures in relatively pristine conditions. Due to prolific grass and brush fuels in direct proximity to Love Ranch there is a **moderate risk** of this site burning in a wildfire. Located at UTM coordinates 13S **352,660E by 3,601,020N**.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, and low humidity are here and can contribute to hazardous conditions. There is an abundance of cured annual and perennial grasses, shrubs and forbs and wildfires can spread rapidly here. Steep, rocky slopes and narrow canyons contribute to hazardous conditions. Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, vehicle travel, poor roads, poor visibility, communication problems, and unexploded ordinance are all potential safety problems in FMU 8.

Pre Fire Season Fuels Management Actions

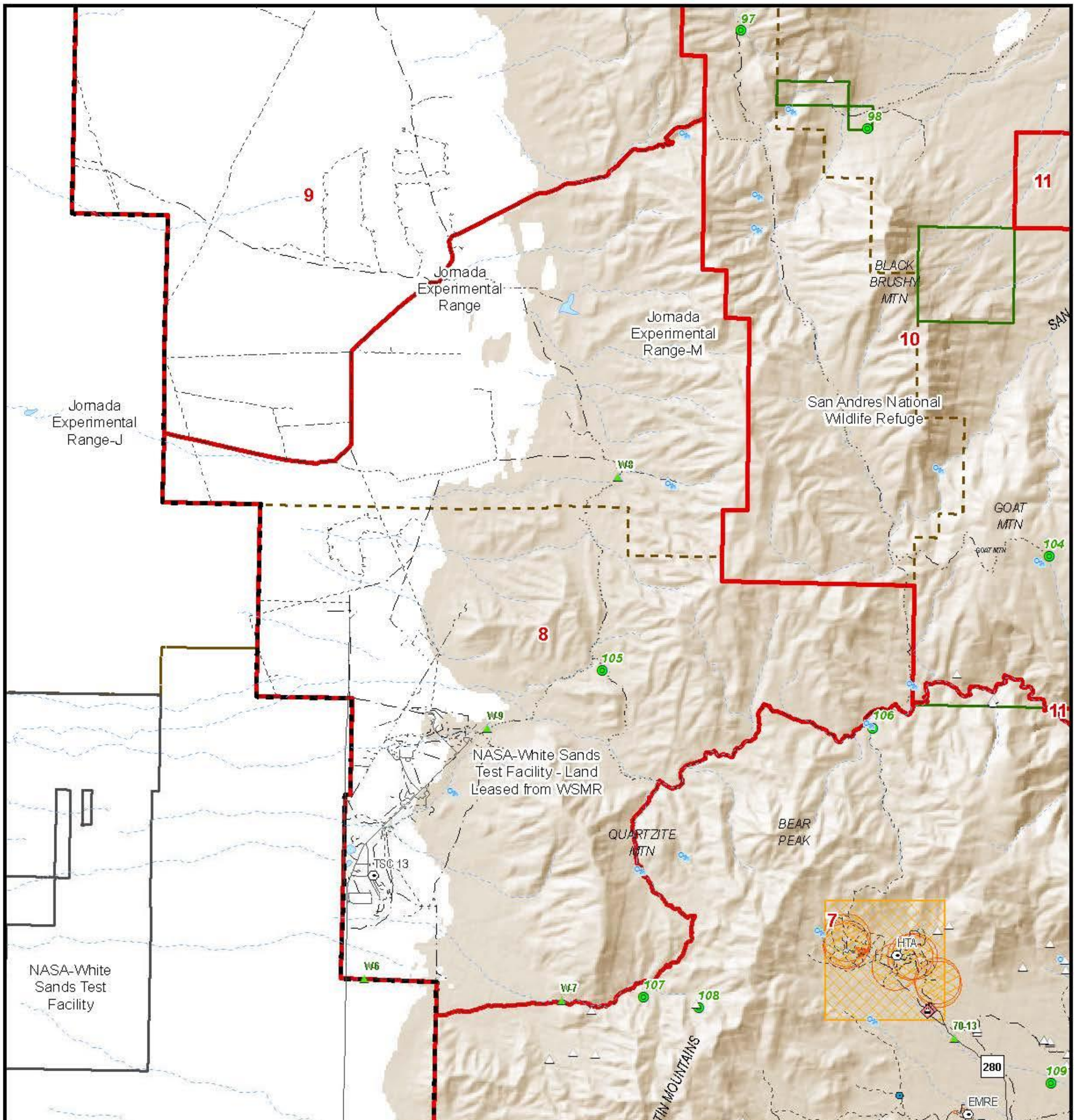
Maintain 30' defensible space around buildings by either maintaining a green belt or by removing fuels entirely or by mowing to 2-4" stubble height (preferred fuel treatment as this keeps dust down and keeps tumbleweeds from growing in bare spots). Dried tumbleweeds can collect against structures and fences within FMU 8. These areas should be kept clean by crushing or scattering built up fuels. If necessary, tumbleweeds scan be piled in a secure location and burned. Roads throughout FMU 8 should be maintained to firebreak standards of bare ground for at least 8 feet across road surfaces and bar ditches and road shoulders maintained to be fuel-free as much as possible.

Wildfire Management

Wildfires need to be attacked quickly in FMU 8. NASA/WSTF has a full-time fire department with a Type 6 wildland engine, as well as numerous UTVs that will respond to wildland fires in this FMU. Fuels will burn readily and spread rapidly in many places in FMU 8. Utilize interagency agreements if needed to get BLM, Organ VFD, and USFWS to respond with wildland units. Much of FMU 8 is remote and wildfires will be hard to suppress within these rugged areas. If initial suppression efforts fail, then fall back to firebreak roads and wait for the wildfire to approach or initiate blacklines or burnouts from defensible positions. Due to safety concerns with placing engines and firefighters in remote, narrow canyons with difficult egress and ingress to safety zones, wildfire managers must consider allowing wildfires within the San Andres Mountains to burn and attacking wildfires only from strong defensible positions or attacking wildfires using aerial resources of helicopters and air tankers.

The WSMR GC, WFPM and deputy chiefs, NASA/WSTF Director, Refuge Manager of SANWR and DPWE resource professionals should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions take place.

There are engine fill locations at the fire department of NASA/WSTF.



WHITE SANDS MISSILE RANGE

FMU 8 ~ NASA/WSTF

23,325.8 Acres

7/9/2020

1 inch = 7,249 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
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UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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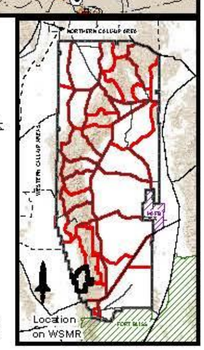
Produced by the GIS Team for the Directorate of Public Works, WSMR.



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FMU 9 Jornada Experimental Range (JER) 50,325 Acres

Physical Characteristics

The east boundary of FMU 9 is the western administrative boundary of the SANWR from where the SANWR boundary meets the two-track road in upper Ash Canyon north to the corner where JER northern boundary leaves the SANWR boundary and heads west from near New Well Draw. The north boundary of FMU 9 is a fenceline and the north boundary of JER heading west from the western boundary of the SANWR to the WSMR boundary at Gate W-10. The west boundary of FMU 9 is a fenceline along the WSMR western boundary from Gate W-10 south to Ragged Tank Flat. FMU 9 is bordered on the south by a dirt road that begins on the WSMR boundary near Taylor Well and heads east to the SANWR boundary at Ash Canyon.

Fuels in FMU 9 are shrublands and grasslands consisting of creosote, little leaf sumac, mesquite, catclaw, sotol, snakeweed, cacti, agave and ocotillo. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, sacaton, blue, sideoats and black grama, Lehmann's lovegrass, little bluestem and three-awns. Topography is Chihuahuan desert bajadas on the west side of the San Andres Mountains and includes some of the west faces of the San Andres Mountains.

Infrastructure/Assets to be protected

FMU 9 contains prehistoric sites and a few historic structures related to ranch life:

(**#96** on map) **Ropes Spring** is an extensive site with several stone, adobe and wood structures. The site is at a **high risk** of damage from a nearby wildfire as the fuel loading of grass and brush is high. Ropes' spring is located at UTM coordinates 13S **353,800E by 3,616,280N**.

There are numerous fences and plots associated with JER projects. Most of these sites are not at risk of burning in a wildfire. Fuels are sparse in many areas, but there are many pockets of dense grass and brush fuels in the east side of FMU 9 and on the west-facing slopes of the San Andres Mountains.

Risk to Firefighters

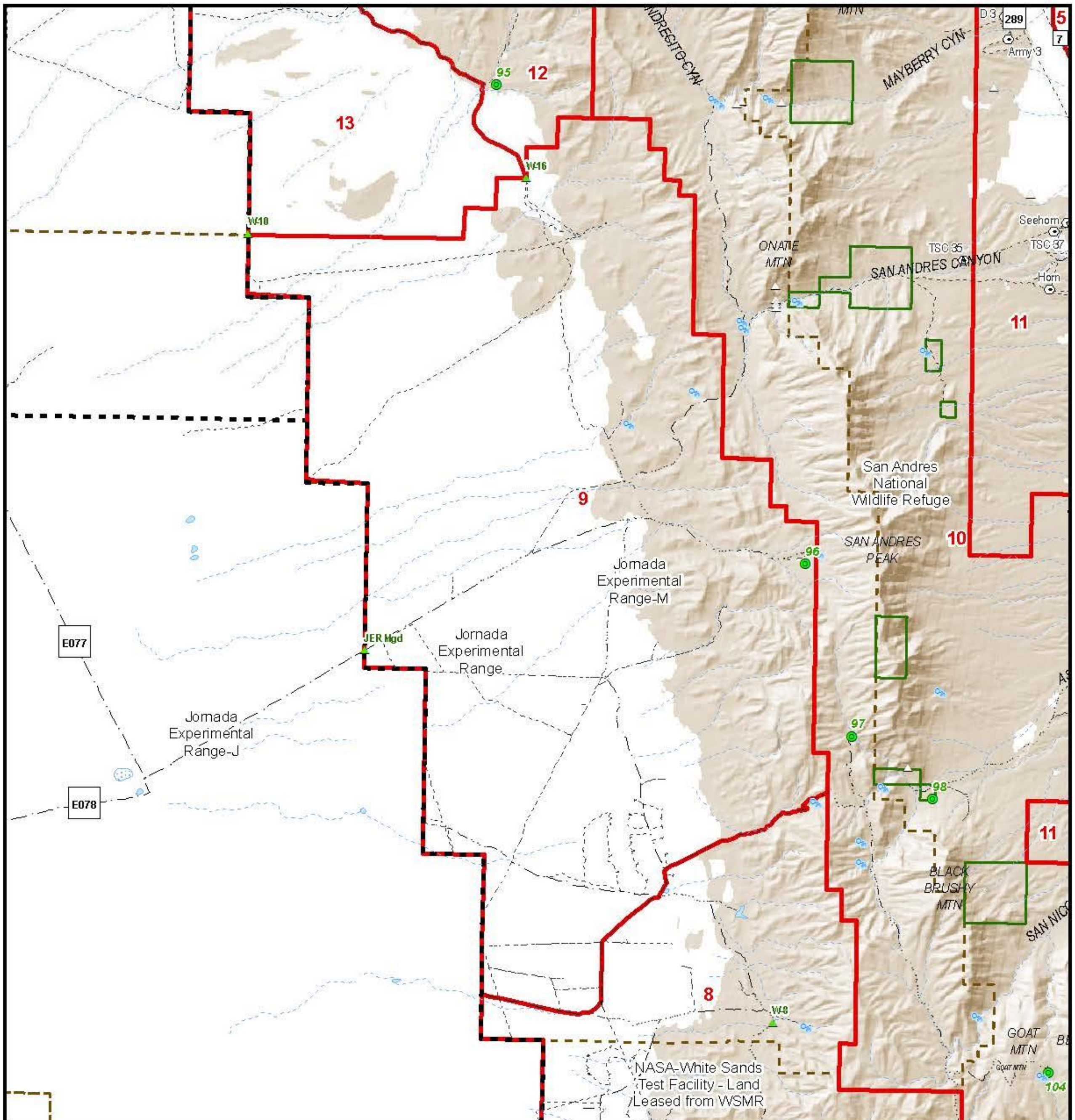
Normal environmental factors of heat, dust, wind, and low humidity are here and can contribute to hazardous conditions. The further FMU 9 gets away from the western slopes of the San Andres Mountains the less likely wildfires will be able to spread. Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, vehicle travel, poor roads, poor visibility, communication problems, and unexploded ordinance are all potential safety problems in FMU 9.

Pre Fire Season Fuels Management Actions

Dried tumbleweeds can collect against fences within FMU 9. These areas should be kept clean by crushing, burning or scattering built up fuels. If necessary, tumbleweeds can be piled in a secure location and burned. Roads throughout FMU 9 are the responsibility of JER and are maintained for access for JER and SANWR.

Wildfire Management

Wildfires are not much of a threat in the west half of FMU 9. This is due to the western portion of FMU 9 being in the desert ecotype. The eastern half is located in the San Andres Mountains and foothills and wildfires can carry here. All wildfires are suppressed in this FMU because multiple jurisdictions overlap on much of the surface area. However, if a wildfire is burning and spreading on the slopes of the San Andres Mountains and access by road does not exist, then the entities that control land management (WSMR, JER and SANWR) should be consulted for agreement that the wildfire be managed for resource benefit. Management actions would include wildfire containment at roads or other natural barriers and allowing wildfires to burn within specific confinement boundaries for firefighter safety and ecosystem benefit reasons such as improving big game habitat.



WHITE SANDS MISSILE RANGE

FMU 9 ~ Jornada Experimental Range
50,324.8 Acres

7/9/2020

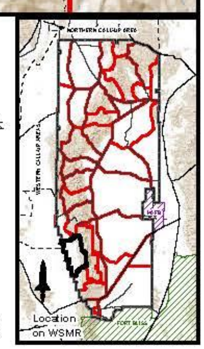
1 inch = 11,308 feet

0 0.5 1
Miles

File Location:Projects\FirePlan\FirePlan_2017\FirePlan_FMU_Mapbook_85x11.mxd

Produced by the GIS Team for the Directorate of Public Works, WSMR.

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



Page 9

FMU 10 San Andres National Wildlife Refuge (SANWR) 59,294 Acres

Physical Characteristics

FMU 10 boundaries are the administrative boundaries of the SANWR with the exception of the southwest corner of the FMU where the boundary follows the road from Stinking Springs up Little San Nicholas Canyon to where the road exits SANWR to the west in the head of Ash Canyon.

Fuels in FMU 10 are shrublands and grasslands consisting of skunkbush and littleleaf sumac, ceanothus, mesquite, creosote, catclaw, sotol, snakeweed, cacti, agave and ocotillo on the bajadas on the east side of the FMU below the San Andres escarpment. Perennial grasses throughout FMU 10 are intermixed with shrubs and include tobosa, dropseeds, sacaton, blue, sideoats, hairy and black grama, Lehmann's lovegrass, little bluestem and three-awns. The tops of the San Andres Mountains and the more gently sloping west side of the mountains is vegetation consisting of a more montane environment. Piñon, one-seed and alligator juniper, oak spp. and mountain mahogany are interspersed with grasses, sacahuista, agave, cacti and sotol.

Infrastructure/Assets to be protected

FMU 10 contains a few historic structures. There are USFWS facilities located at Ropes Spring. There are numerous archaeological sites scattered throughout FMU 10. Historic sites include:

(**#97** on map) **Upper Ash Canyon** is a stone ruin with **no wildfire damage risk** and is located at UTM coordinates 13S **355,000E by 3,611,760N**.
(#98) Fresno site contains well-preserved stone structures and has wood associated with the structures and corrals. Wildfire **risk is low** due to discontinuous fuels surrounding the site. Located at UTM coordinates 13S **357,120E by 3,610,120N**.
(#104) Red Spring consists of several dilapidated structures with wooden components and is **at high risk** of burning in a wildfire due to surrounding heavy burnable fuels and construction materials. Located at UTM coordinates 13S **360,160E by 3,602,940N**.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, and low humidity are here and can contribute to hazardous conditions. The San Andres NWR is rugged and isolated. It takes over an hour of driving on primitive dirt roads to reach most areas of the San Andres NWR. The terrain is generally steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, shifts in wind direction, flashy fuels, vehicle travel, poor roads, poor visibility, communication problems, and unexploded ordinance are all potential safety problems in FMU 10.

Pre Fire Season Fuels Management Actions

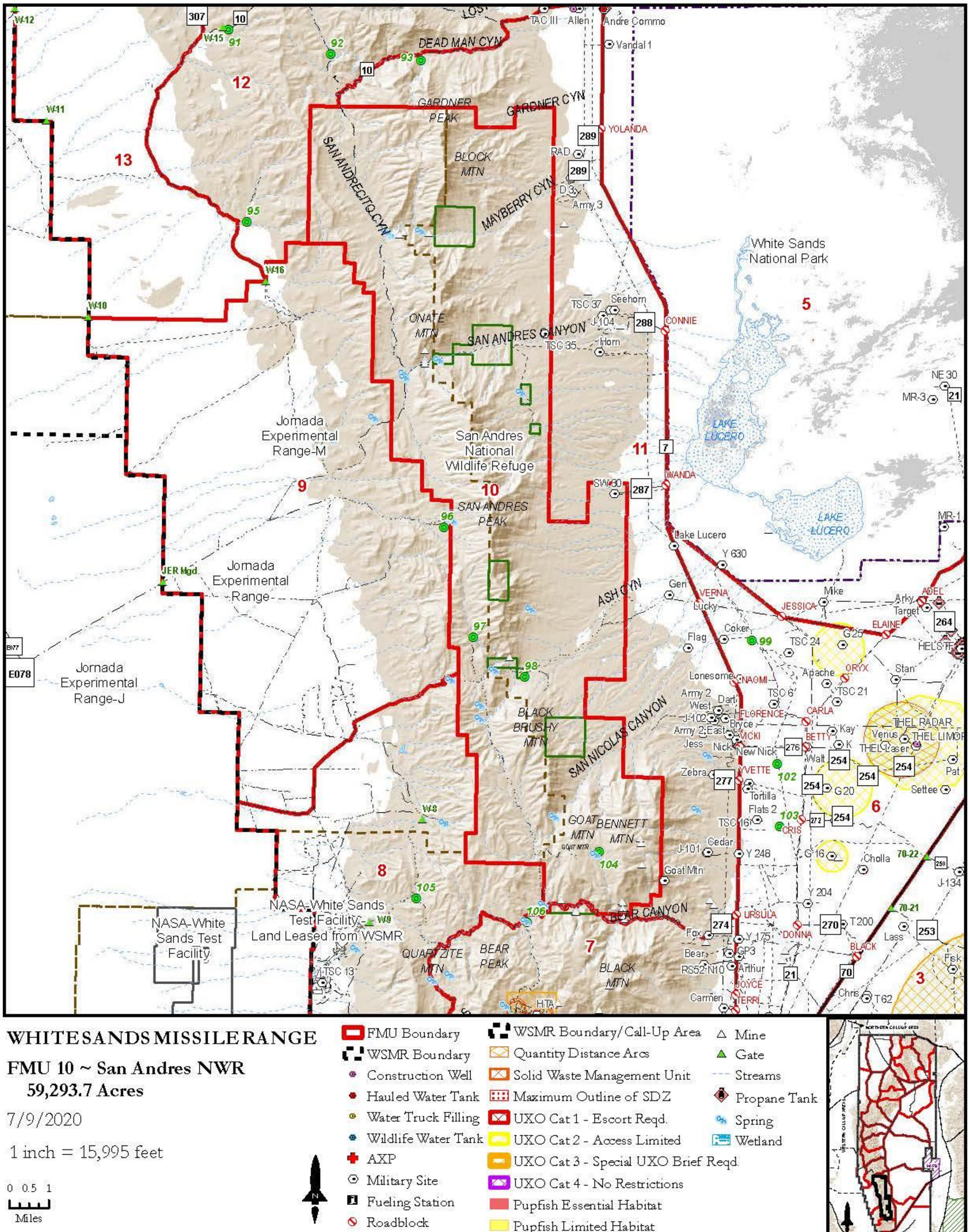
Roads throughout FMU 10 are the responsibility of SANWR and are maintained for access but not to firebreak standards in most places. The Ropes Spring Road and the Loman Canyon road are maintained and serve as good access for the west side of the SANWR. Ropes Spring and San Nicholas Camp have structures that should be inspected yearly for build-ups of tumbleweeds and other fuel next to buildings. Remove and scatter these dried fuels or pile and burn in place.

Wildfire Management

SANWR would prefer wildfires to burn across the landscape. They once had an active prescribed fire program and over 90% of the refuge has seen fire at one time or another. Due to budget cuts and personnel shortages, this is no longer the case. So, if wildfires are ignited, either naturally or accidentally by man, then the SANWR would like to manage these wildfires by letting them burn within the confines of the refuge roads or fuel barriers.

However, before wildfires can be allowed to burn across the landscape, SANWR will consult with WSMR Environmental Office to determine if WSMR is willing to accept some amount of smoke for a prolonged period of time. If WSMR and SANWR agree that a wildfire should be allowed to burn, then a short plan should be formalized that outlines a maximum manageable area for wildfire growth and trigger points that when the wildfire reaches them, management actions will take place.

Engine fill site is located at San Nicolas Camp (not shown on map).


WHITE SANDS MISSILE RANGE
FMU 10 ~ San Andres NWR
59,293.7 Acres
7/9/2020
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Miles
File Location:Projects\FirePlan\FirePlan_2017\FirePlan_FMU_Mapbook_85x11.mxd
Produced by the GIS Team for the Directorate of Public Works, WSMR
FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
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Military Site
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UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
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Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland
Page 10
Location on WSMR
White Sands National Park
San Andres National Wildlife Refuge
Jornada Experimental Range-M
Jornada Experimental Range
Jornada Experimental Range-J
NASA-White Sands Test Facility
NASA-White Sands Test Facility Land Leased from WSMR
LAKE LUCERO
SAN ANDRES CANYON
SAN ANDRES PEAK
SAN ANDRECITO CYN
MAYBERRY CYN
GARDNER CYN
GARDNER PEAK
BLOCK MTN
ONATE MTN
DEAD MAN CYN
ASH CYN
SAN NICOLAS CANYON
BLACK BRUSHY MTN
GOAT MTN
BENNETT MTN
BEAR CANYON
BEAR PEAK
QUARTZITE MTN
BLACK MTN
3
5
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8
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10
11
12
13

FMU 11 East San Andres Foothills 38,479 Acres

Physical Characteristics

FMU 11 is bordered on the east by Range Road 7 north from Range Road 274 at Ursula Block to Ethel Block at the entrance to Dead Man Canyon. The north boundary of FMU 11 follows the firebreak road that goes up Dead Man Canyon from Range Road 7 to the west to its intersection with another dirt road at the head of Dead Man Canyon near the north boundary of San Andres National Wildlife Refuge (SANWR). The west boundary of FMU 11 is the north and east administrative boundary of the SANWR to its intersection on the southern boundary of FMU 11 in Bear Canyon. The south boundary of FMU 11 is the two-track road that follows the bottom of Bear Canyon from the SANWR boundary east to Range Road 274 then along Range Road 274 east to its intersection with Range Road 7.

Fuels in FMU 11 are typical Tularosa Basin bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, mesquite, tarbush, yucca, snakeweed and acacia. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, sacaton, black grama and three-awns. Topography is gently sloping from Range Road 7 west to the steep eastern slopes of the San Andres Mountains. FMU 11 is bisected west to east by many canyons beginning in the San Andres Mountains and terminating in the Tularosa Basin.

Infrastructure/Assets to be protected

FMU 11 contains numerous launch sites, some abandoned and some still in use. Most of these facilities are located near Range Road 7 on the bajadas below the mountains. These facilities are mostly protected from wildfires because they have been cleared around and the desert fuels here are not prone to wildfire spread. There are cultural sites in this FMU associated with mining and ranching:

(#93 on map) Mrs. Anderegg's House is a dilapidated wooden and rock structure that has partially burned. There is **low risk** of damage to the site from a nearby wildfire due to discontinuous fuels. Located at UTM coordinates 13S **352,850E by 3,635,450N**.
(#94) Baird's Horse Camp contains structures with rock, adobe and wood. Lots of large mesquite surrounds the site but grass and other fuels are discontinuous and there is **low risk** of burning in a wildfire. Located at UTM coordinates 13S **359,550E by 3,631,060N**.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are deep canyon bottoms that contain heavy fuel loads of annual and perennial grasses, shrubs and forbs and wildfires can spread up these canyon bottoms to the west. The eastern portions of FMU 11 near Range Road 7 are mostly creosote bajadas and are not conducive to large wildfire spread. The western portion of FMU 11 is the steep east faces of the San Andres Mountains. The terrain is generally steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 11.

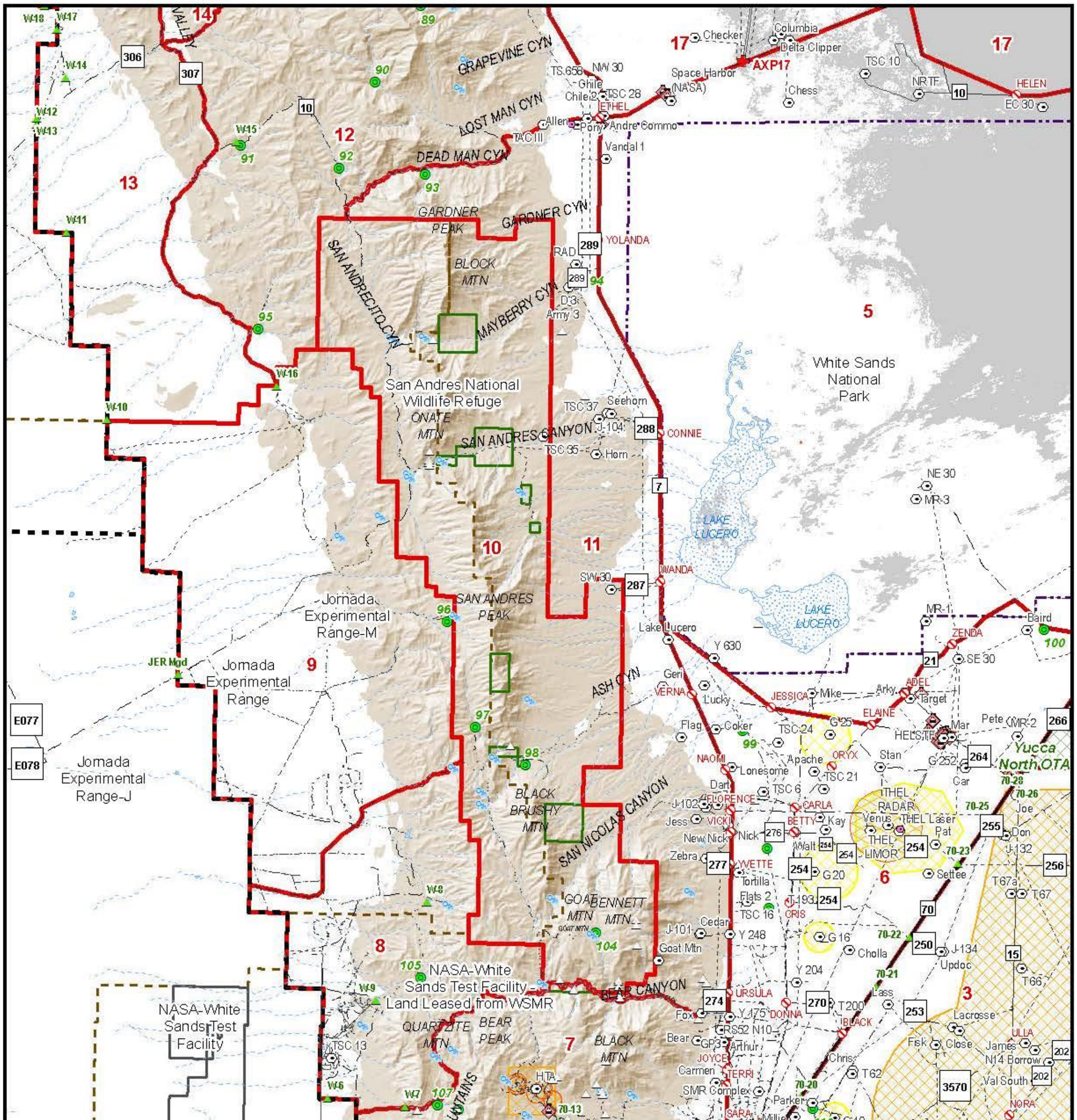
Pre Fire Season Fuels Management Actions

There are numerous facilities located in FMU 11. Dried tumbleweeds collect against structures and fences within FMU 11. These areas should be kept clean by crushing or scattering accumulated fuels. Firebreak roads in Bear Canyon and Dead Man Canyon should be maintained yearly in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 11 as wildfires can spread rapidly up the east faces of the San Andres Mountains if environmental conditions are right. Wildfires that start in the upper reaches of FMU 11 in the mountains should not be attacked by ground troops unless the access is good from nearby roads. Consider using aerial assets or allowing wildfires to burn to defensible positions if wildfires are spreading upslope on the west side of FMU 11. Wildfires that start below the mountain slopes in FMU 11 will probably not spread but they should be immediately suppressed anyway to ensure wildfire does not spread into the mountains.

Engine fill locations are in the far northern end of FMU 11 at NW-30 and at Andre site.



WHITE SANDS MISSILE RANGE

FMU 11 ~ East San Andres Foothills

38,479.3 Acres

7/9/2020

1 inch = 18,533 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure

WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area

Mine
Gate
Streams
Propane Tank
Spring
Wetland

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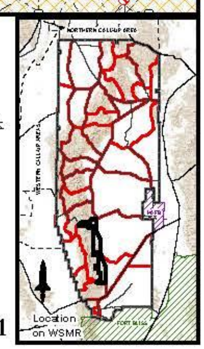


FMU 12 Hembrillo Canyon 50,165 Acres

Physical Characteristics

FMU 12 is bordered on the east by Range Road 7 north from Ethel Block at the entrance to Dead Man Canyon to Emma Block at the intersection of Range Road 7 and Range Road 306. The north boundary of FMU 12 follows Range Road 306 from its intersection at Range Road 7 westward up Hembrillo Canyon, over Hembrillo Pass to Range Road 307 in Green Valley. The west boundary of FMU 12 is Range Road 307 south from its intersection with Range Road 306 to the Jornada Experimental Range north boundary. The south boundary of FMU 12 is the administrative boundary of the Jornada Experimental Range northeast in a stair step fashion to its intersection with the administrative boundary of SANWR, then north along the SANWR boundary to the head of Dead Man Canyon, then down Dead Man Canyon on a firebreak road to the east to its intersection with Range Road 7 at Ethel Block.

Fuels in FMU 12 range from typical Tularosa Basin bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, mesquite, tarbush, yucca, snakeweed and acacia to the montane vegetation of the San Andres Mountains. Montane vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, muhly spp., sacaton, grama spp., and three-awn spp. Topography ranges from gently sloping at Range Road 7 to steep canyons, slopes and peaks of the San Andres Mountains. FMU 12 is remote with limited access for vehicles. There are only a few roads inside of the FMU firebreak road boundaries.

Infrastructure/Assets to be protected

FMU 12 contains a few historic cultural sites associated with prehistoric Native American encampments, as well as historic mining and ranching sites:

(**#89** on the map) **Hospital Canyon** contains a dilapidated wooden structure that is **not at risk** of burning in a wildfire. The structure is located at UTM coordinates 13S **352,650E by 3,642,660N**.
(#90) Anderegg Line Camp consists of three partially standing stone structures that are **not at risk** of burning in a wildfire due to its location in sparse fuels and the lack of wood. The Camp is located at UTM coordinates 13S **350,700E by 3,639,400N**.
(#91) Fleck Ranch contains two wooden and stone structures that are fairly intact. There are wooden corrals but are at **low risk** of burning in a wildfire due to discontinuous fuels. Located at UTM coordinates 13S **344,950E by 3,636,700N**.
(#92) Frank Anderegg Ranch HQ consists of three wooden structures in good condition and is at a **high risk** of burning in a wildfire due to its construction material and its location in grass and brush continuous fuels. The ranch is located at UTM coordinates 13S **349,160E by 3,635,700N**.
(#95) Bruton Horse Camp, Jackson Horse Camp consists of several structures in various states of disrepair and is at **moderate risk** of burning in a wildfire due to its construction materials and surrounding fuel. Located at UTM coordinates 13S **345,700E by 3,628,820N.**

There are also a few military sites located near Range Road 7 on the bajadas below the mountains. These facilities are mostly protected from wildfires as they have been cleared around and the desert fuels here are not prone to wildfire spread.

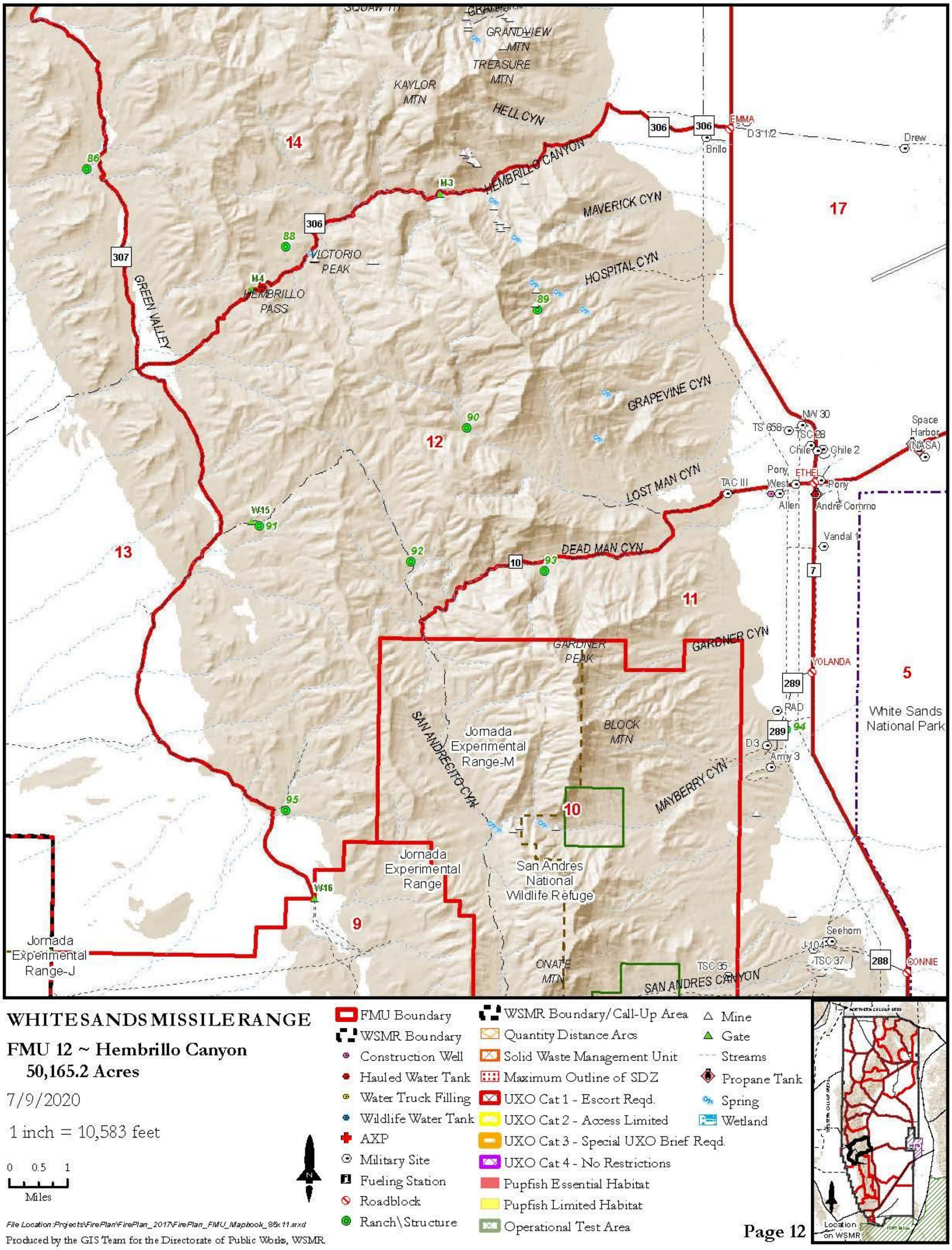
Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The eastern portions of FMU 12 near Range Road 7 are creosote bajadas and are not conducive to large wildfire spread. The western portion of FMU 12 is the interior of the San Andres Mountains. The terrain is steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 12.

Pre Fire Season Fuels Management Actions
Dried tumbleweeds collect against structures and fences within FMU 12. These areas should be kept clean by crushing, burning or scattering accumulated fuels. Fire break roads around the perimeter of FMU 12 in Hembrillo and Dead Man Canyons need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management
Wildfires should be suppressed immediately in FMU 12 as wildfires can spread rapidly in the San Andres Mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 12 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 12 to rough rocky two-track roads that are one way in and one way out. In these instances, the IC should consider using aerial assets if improvements are threatened. If improvements are not threatened, then the IC, in coordination with FES leadership and PWE, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal duties. The WSMR GC, WFPM and DPWE resource professionals and GIS should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions take place.

Engine fill sites for FMU 12 are located at NW 30-1 (aka NW-30) Well and at Allen (aka Andre) Site.



GRANDVIEW MTN
TREASURE MTN
KAYLOR MTN
HELL CYN
HEMBRILLO CANYON
MAVERICK CYN
HOSPITAL CYN
GRAPEVINE CYN
LOST MAN CYN
DEAD MAN CYN
GARDNER CYN
GARDNER PEAK
BLOCK MTN
MAYBERRY CYN
SAN ANDRECITO CYN
VICTORIO PEAK
HEMBRILLO PASS
GREEN VALLEY
ONATE MTN
SAN ANDRES CANYON
Jornada Experimental Range-M
Jornada Experimental Range
Jornada Experimental Range-J
San Andres National Wildlife Refuge
White Sands National Park
Space Harbor (NASA)
14
12
13
11
17
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9
5
306
307
10
7
289
288
EMMA
ETHEL
YOLANDA
CONNIE
Brillo
Drew
D3 1/2
NW 30
TS 658
TSC 28
Chile
Chile 2
TAC III
Pony West
Pony
Allen
Andre Commo
Vandal 1
RAD
D3
Army 3
Seehorn
J-104
TSC 37
TSC 35
M3
M4
W15
W16
86
88
89
90
91
92
93
94
95
WHITE SANDS MISSILE RANGE
FMU 12 ~ Hembrillo Canyon
50,165.2 Acres
7/9/2020
1 inch = 10,583 feet
0 0.5 1
Miles
File Location:Projects\FirePlan\FirePlan_2017\FirePlan_FMU_Mapbook_85x11.mxd
Produced by the GIS Team for the Directorate of Public Works, WSMR.
FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland
Page 12
Location on WSMR

FMU 13 West San Andres Foothills 59,027 Acres

Physical Characteristics
FMU 13 is triangular in shape and is bordered on the east by Range Road 307 from its intersection with a fenceline at Gate W-16 at the Jornada Experimental Range (JER) boundary north to its intersection with Range Road 6 in Rhodes Canyon, then northwest on Range Road 6 to the gate at Engle City Block where Range Road 6 exits WSMR. The West boundary of FMU 13 is the WSMR boundary south from Engle City Block where Range Road 6 exits WSMR to WSMR boundary Gate W-10. The south boundary of FMU 13 follows the fenceline and the administrative boundary of JER from Gate W-10 northeast in a stair step fashion to Gate W-16.

Fuels in FMU 13 range from typical Chihuahuan desert shrub vegetation such as four-wing saltbush, creosote, mesquite, tarbush, yucca, snakeweed and acacia to montane woodland vegetation of piñon, juniper, mountain mahogany and oak spp. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, sacaton, grama spp. and three-awn spp. Topography includes gently sloping Chihuahuan desert in the south to the steeper slopes of the Chalk Hills in the north and includes the western side of Green Valley as Range Road 307 bisects the bottom of Green Valley.

Infrastructure/Assets to be protected
FMU 13 contains historical structures associated with ranching and mining:

(#68 on map) Miller Ranch Headquarters consists of a standing wooden house in very good condition. It is at **high risk** of burning in a wildfire due to its construction material and its location in heavy brush and grass fuels. Located off Range Road 6 at UTM coordinates 13S **339,190E by 3,677,890N.**
(#81) Walson Well North is a concrete structure and is **not at risk** of burning in a wildfire. Located at UTM coordinates 13S **340,560E by 3,660,720N**.
(#82) South Walson is a collapsed wooden structure that is at **moderate risk** of burning in a wildfire due to its construction materials and its location in grass and brush fuels. Located at UTM coordinates 13S **340,500E by 3,660,500N**.
(#86) Blackshire Well consists of a windmill and wooden shed and concrete holding tank and is at **low risk** of burning in a wildfire due to its location in sparse fuels. Located at UTM coordinates 13S **340,184E by 3,646,564N**.

There are private ranches located just outside the borders of FMU 13, next to WSMR's west boundary. The ranches are free of fuel around the structures and are not at risk of damage from wildfires.

Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are deep canyon bottoms that contain heavy fuel loads of annual and perennial grasses, shrubs and forbs and wildfires can spread up these canyon bottoms to the east. The southern portions of FMU 13 are mostly creosote bajadas and mesquite coppice dunes. These areas are not conducive to large wildfire spread. The northern portion of FMU 13 is the steep slopes of the Chalk Hills. The terrain is steep and rocky with flashy grass fuels being the main carrier of

fire. North faces of these hills contain stands of piñon and juniper but there is scant ground fuels underneath these stands and wildfires will not carry well here. Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 13.

Pre Fire Season Fuels Management Actions

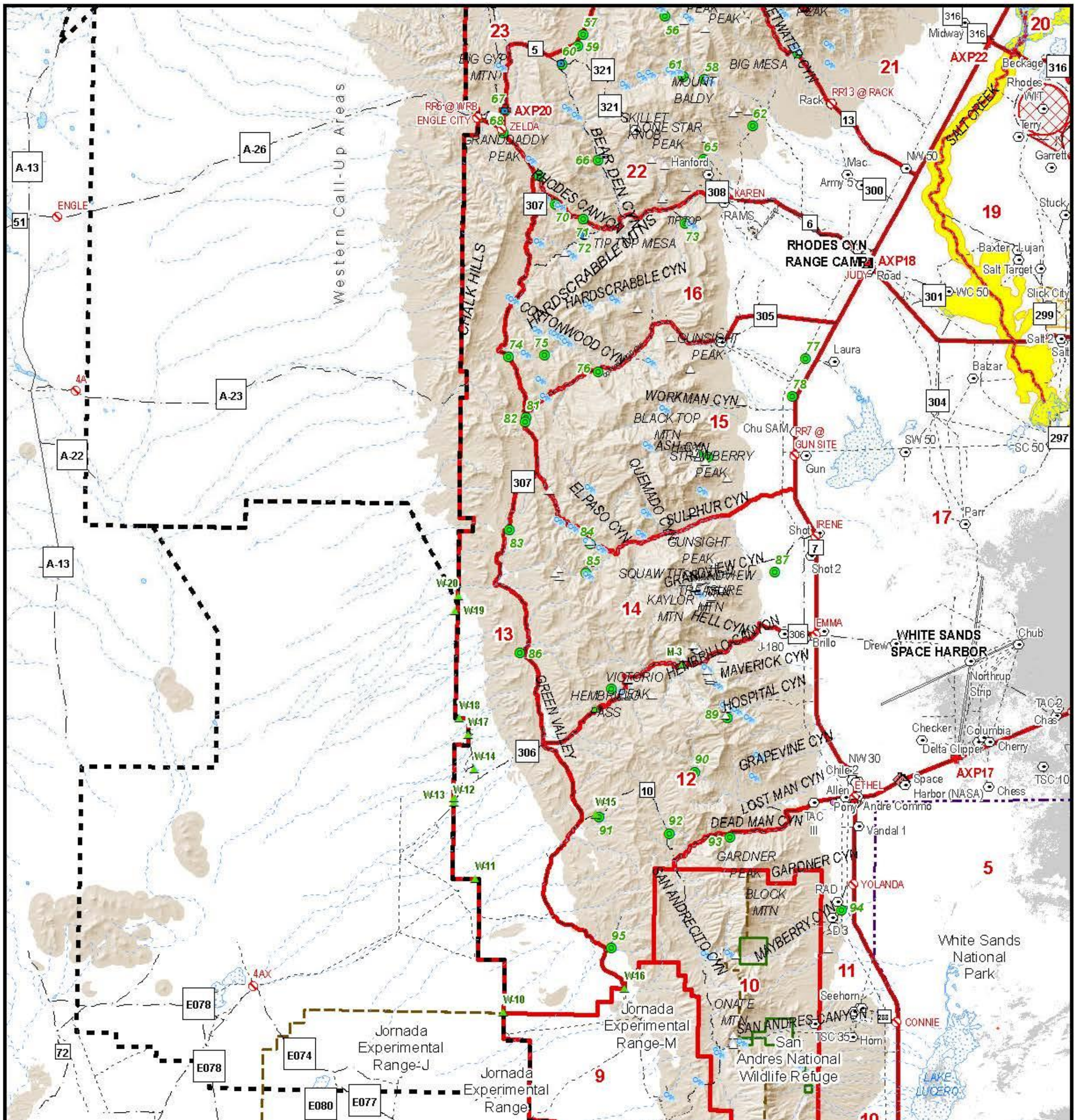
There are a few cultural resources located in FMU 13. Dried tumbleweeds may collect against structures and fences within FMU 13. These sites should be inspected in the fall or winter to determine if preventive measures need to be taken such as removing, crushing or burning accumulations of fuels. Firebreak roads around the perimeter of FMU 13 need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 13 as this FMU contains a lengthy portion of WSMR's western boundary and wildfires can spread across the boundary in the northern and central portions of FMU 13. Consider allowing wildfires to burn to defensible positions along Range Road 307 if wildfires are spreading upslope to the east in FMU 13. Wildfires that start below the mountain slopes in FMU 13 will probably not spread but should be suppressed in areas that are accessible to FES ground forces.

The endangered plant species, Todsen's pennyroyal *(Hedeoma todsenii)* is found in FMU 13. There are 15 colonies on WSMR that need protecting from wildfires. Most of the colonies are in places unlikely to burn or carry fire due to lack of fuel continuity. Other colonies have grass and heavier fuels such as piñon and juniper in close proximity. All of the colonies are located on steep slopes making access for ground troops difficult. When managing wildfires in this FMU consult with WSMR DPWE-CN biologists for the locations of these at-risk populations.

There are no known engine fill sites in FMU 13.



WHITE SANDS MISSILE RANGE

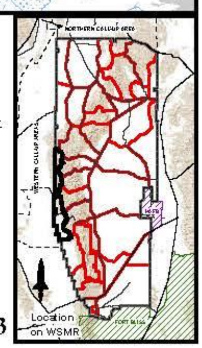
FMU 13 ~ West San Andres Foothills
59,026.6 Acres

7/9/2020

1 inch = 26,027 feet

0 0.5 1
Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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FMU 14 Grandview Mountain 41,843 Acres

Physical Characteristics

FMU 14 is bordered on the east by Range Road 7 north from Emma Block and Range Road 306 to the point where the primitive road in Sulphur Canyon intersects Range Road 7 at UTM coordinate 13S 356,721, 3,656,365N. The north boundary of FMU 14 follows this dirt road from its intersection at Range Road 7 westward up Sulphur Canyon, past Quemado Canyon, past El Paso Canyon to its intersection with Range Road 307. The west boundary of FMU 14 is Range Road 307 from its junction with the primitive road in Sulphur Canyon south over Sulphur Pass to Green Valley to its intersection with Range Road 306. The south boundary of FMU 14 is Range Road 306 from its intersection with Range Road 307 east over Hembrillo Pass and down Hembrillo Canyon to Range Road 7.

Fuels in FMU 14 range from typical Tularosa Basin bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, mesquite, tarbush, yucca, snakeweed and acacia to the montane vegetation of the San Andres Mountains. Montane vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, muhly spp., sacaton, grama spp., and three-awn spp. Topography ranges from gently sloping at Range Road 7 to steep canyons, slopes and peaks of the San Andres Mountains. FMU 14 is remote with few access roads.

Infrastructure/Assets to be protected

FMU 14 contains prehistoric and historic cultural sites. Historic sites are:

(#83 on map) Floyd Crockett Sheep Ranch consists of two standing wooden structures but is in an area of low fuel load and continuity so is at **low risk** of burning in a wildfire. Located at UTM coordinates 13S **339,550E by 3,653,990N**.
(#84) Crockett Headquarters consists of two standing wooden structures at **low risk** of burning in a wildfire due to low fuel loads and discontinuous fuel. Located at UTM coordinates 13S **344,400E by 3,653,130N**.
(#85) Crockett Line Camp consists of a wooden structure with a metal roof and is at **moderate risk** of burning in a wildfire due to house construction materials and surrounding, continuous fuels. Located at UTM coordinates 13S **344,150E by 3,651,401N.**
(#87) Ritch Ranch is a dilapidated wooden structure with corrals. It is at **low risk** of burning in a wildfire due to lack of fuel continuity. Located at UTM coordinates 13S **355,510E by 3,651,430N**.
(#88) Noss House is a standing rock house with wood windows and doors and is at **moderate risk** of burning in a wildfire due to construction materials and continuous fuels. Located at UTM coordinates 13S **345,700E by 3,644,400N.**

There are also a few active military sites located near Range Road 7 on the bajadas below the mountains. These facilities are mostly protected from wildfires as they have been cleared around and the desert fuels here are not prone to wildfire spread.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The eastern portions of FMU 14 near Range Road 7 are mostly creosote bajadas and are not conducive to large wildfire spread. The western portion of FMU 14 is the interior of the San Andres Mountains. The terrain is steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 14.

Pre Fire Season Fuels Management Actions

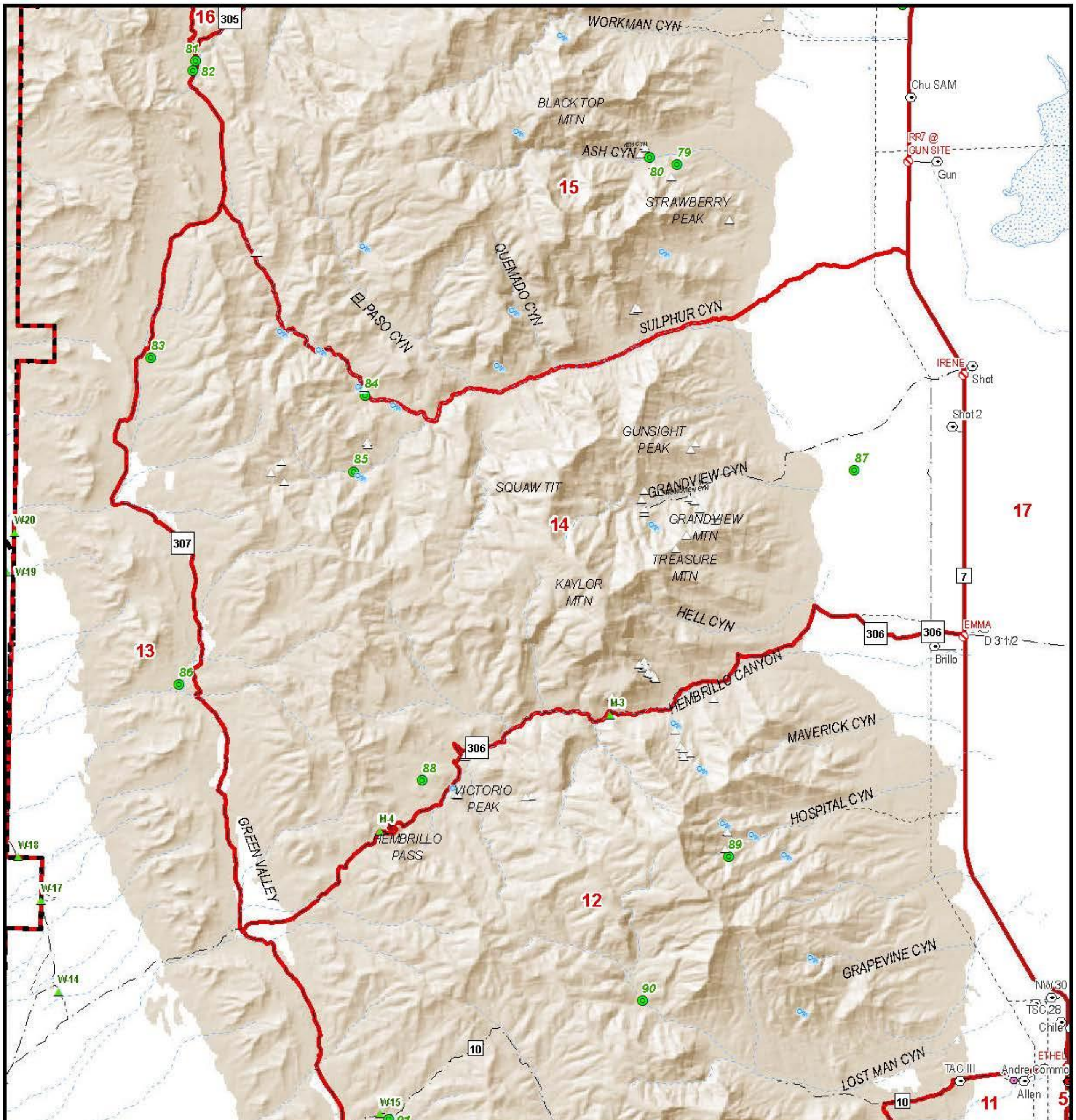
Inspection of historic sites needs to occur in the fall or early winter. Dried tumbleweeds can collect against structures and fences within FMU 14. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Fire break roads around the perimeter of FMU 14 in Hembrillo and Sulphur Canyons need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 14 as wildfires can spread rapidly in the San Andres Mountains if environmental conditions are right. Wildfires that start in the upper reaches of FMU 14 in the mountains should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 14 to rough rocky two-track roads that are one way in and one way out. In these instances, the IC should consider using aerial assets if improvements are threatened. If improvements are not threatened, then the IC, in coordination with FES leadership and DPWE-CN, will fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal duties. The WSMR GC, WFPM and DPWE resource professionals and GIS should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

There are no engine fill sites in FMU 14.



WHITE SANDS MISSILE RANGE

FMU 14 ~ Grandview Mountain

41,843.1 Acres

7/9/2020

1 inch = 9,805 feet

0 0.5 1

Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
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- UXO Cat 1 - Escort Reqd.
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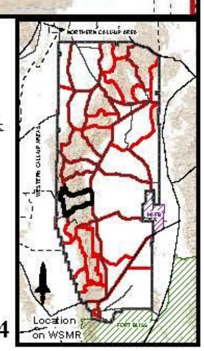
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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FMU 15 Strawberry Peak 41,944 Acres

Physical Characteristics

FMU 15 is bordered on the east by Range Road 7 from Sulphur Canyon road access north to Range Road 305. The north boundary of FMU 15 follows Range Road 305 from its intersection at Range Road 7 westward up Cottonwood Canyon, then up Domijohn Canyon, then up Buckhorn Canyon to its intersection with Range Road 307 near Walson Well. The west boundary of FMU 15 is Range Road 307 from its junction with Range Road 305 south through Sulphur Flats to the road in Sulphur Canyon. The south boundary of FMU 15 is the improved road in Sulphur Canyon from Sulphur Flats southeast through Sulphur Canyon to Range Road 7.

Fuels in FMU 15 range from typical Tularosa Basin bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, mesquite, tarbush, yucca, snakeweed and acacia to the montane vegetation of the San Andres Mountains. Montane vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, muhlys, sacaton, gramas, and three-awns. Topography ranges from gently sloping at Range Road 7 to steep canyons, slopes and peaks of the San Andres Mountains. FMU 15 is remote with limited road access.

Infrastructure/Assets to be protected

FMU 15 contains prehistoric and four historic cultural sites. Historic sites include:

(#76 on map) Rockhouse Well consists of a stone house with wood flooring and roofing. The site is at **moderate risk** of burning in a wildfire due to its construction materials and its location in dense fuels. Located at UTM coordinates 13S **344,900E** by **3,663,500N**.
(#78) Nelson Well consists of a collapsed wooden structure and is **not at risk** of burning in a wildfire due to lack of continuous fuels in the area. Located at UTM coordinates 13S **356,600E** by **3,662,000N**.
(#79) Ash Canyon Mine Camp consists of very little burnable materials and is **not at risk** of burning in a wildfire. Located at UTM coordinates 13S **351,480E** by **3,658,360N**.
(#80) Strawberry Peak consists of dilapidated stone and wooden structures and is at **moderate risk** of burning in a wildfire due to surrounding continuous fuels. Located at UTM coordinates 13S **350,860E** by **3,658,520N**.

There are also a few military sites located near Range Road 7 on the bajadas below the mountains. These facilities are mostly protected from wildfires as they have been cleared around and the desert fuels here are not prone to wildfire spread.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The eastern portions of FMU 15 near Range Road 7 are mostly creosote bajadas and are not conducive to large wildfire spread. The western portion of FMU 15 is the interior of the San Andres Mountains. The terrain is steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 15.

Pre Fire Season Fuels Management Actions

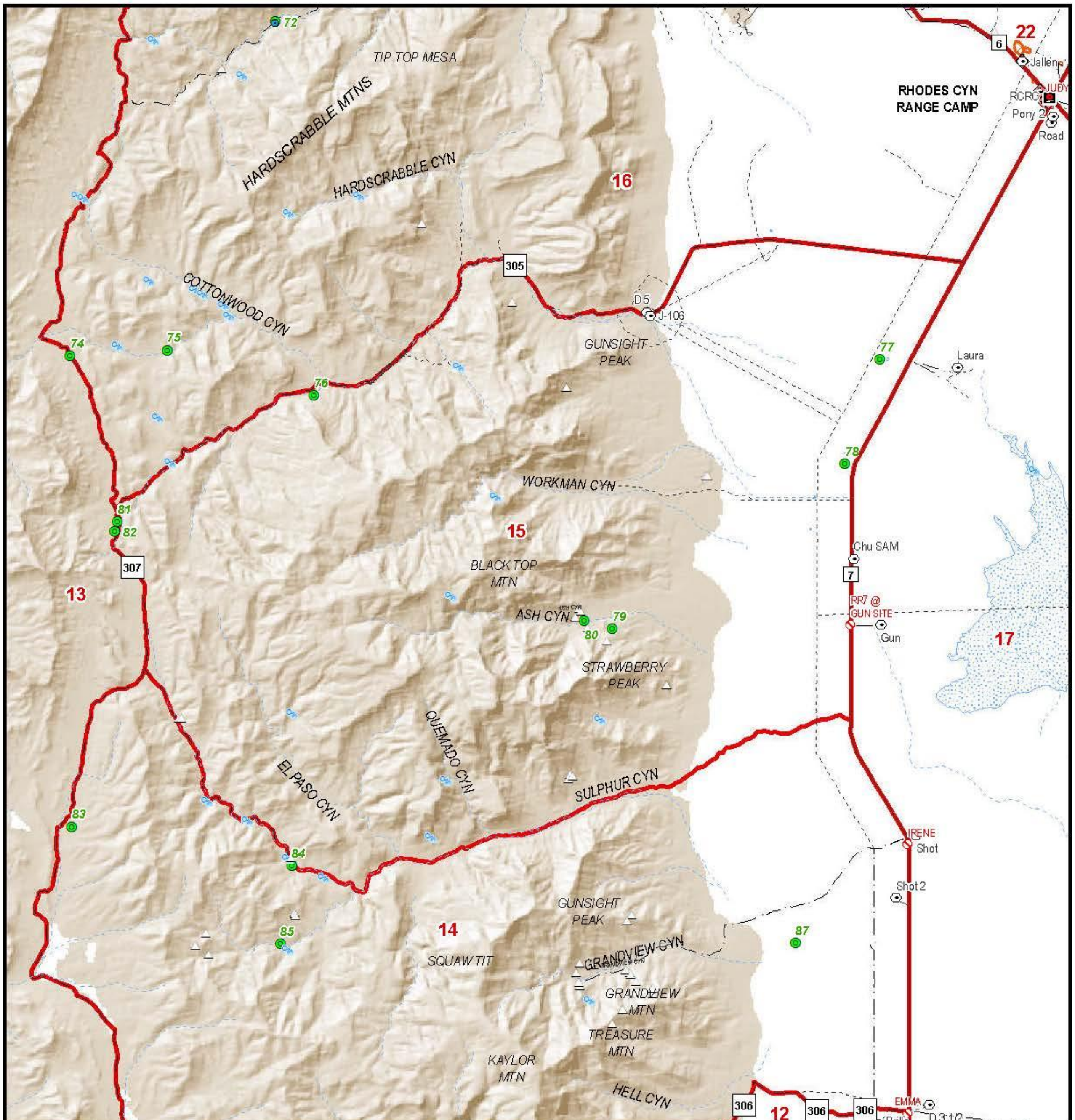
Inspection of historic and military sites needs to occur in the fall or early winter. Dried tumbleweeds can collect against structures and fences within FMU 15. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Fire break roads around the perimeter of FMU 15 in Cottonwood and Sulphur Canyons need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 15 as wildfires can spread rapidly in the San Andres Mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 15 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 15 to rough rocky two-track roads that are one way in and one way out. In these instances, the IC should consider using aerial assets if improvements are threatened. If improvements are not threatened, then the IC, in coordination with FES leadership and DPWE, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal duties. The WSMR GC, WFPM and DPWE resource professionals and GIS should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

There are no engine fill sites located within FMU 15.



WHITE SANDS MISSILE RANGE

FMU 15 ~ Strawberry Peak
41,943.6 Acres

7/9/2020

1 inch = 9,523 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure

WSMR Boundary/Call-Up Area
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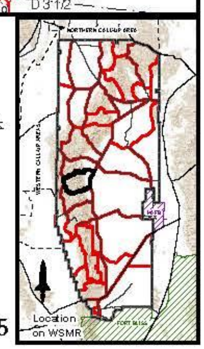

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FMU 16 Hardscrabble 40,526 Acres

Physical Characteristics
FMU 16 is bordered on the east by Range Road 7 from Range Road 305 north to the Rhodes Canyon Range Complex and Range Road 6 intersection. The north boundary of FMU 16 follows Range Road 6 from its intersection at Range Road 7 westward up Rhodes Canyon, past Karen Block, past Bear Den Canyon, past Bosque Canyon to the intersection of Range Road 307. The west boundary of FMU 16 is Range Road 307 from its junction with Range Road 6 south through the head of Cottonwood Canyon and Hackberry Canyon, past the Chalk Hills to the road in Buckhorn Canyon. The south boundary of FMU 16 is Range Road 305 in Buckhorn Canyon east to Cottonwood Canyon to Range Road 7.

Fuels in FMU 16 range from typical Tularosa Basin bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, ocotillo, mesquite, tarbush, yucca, snakeweed and acacia to the montane vegetation of the San Andres Mountains. Montane vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, muhlys, sacaton, gramas, and three-awns. Topography ranges from gently sloping at Range Road 7 to steep canyons, slopes and peaks of the San Andres Mountains. FMU 16 is remote with limited road access

Infrastructure/Assets to be protected
FMU 16 contains prehistoric and historic cultural sites. Historic sites include:

(#70 on map) Rhodes Camp consists of the old CCC Camp and is **not at risk** of loss from a wildfire due to no burnable structures associated with this site. Located at UTM coordinates 13S **342,320E** by **3,673,600N**.
(#72) E. Potter Ranch; Potter Ranch Headquarters consists of wooden outbuildings and an adobe house with wood. This site is at **high risk** of burning in a wildfire due to heavy fuel loads and continuous fuels. Located at UTM coordinates 13S **344,033E** by **3,671,748N**.
(#73) Henderson Tiptop Spring consists of wooden house and barn and is at **moderate risk** of burning in a wildfire due to continuous fuels surrounding the site. Located at UTM coordinates 13S **350,120E** by **3,672,440N**.
(#75) Governor Ritch Ranch consists of a dilapidated wooden structure and rock foundations and walls with wood. This site is at **moderate risk** of burning in a wildfire due to surrounding heavy fuels. Located at UTM coordinates 13S **341,652E** by **3,664,497N.**

There are numerous military facilities located near Range Road 6 and 7 on the bajadas below the mountains. These facilities are mostly protected from wildfires as they have been cleared around and the desert fuels are not prone to wildfire spread.

Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The eastern portions of FMU 16 near Range Road 7 and Range Road 6 are mostly creosote bajadas and are not conducive to large wildfire spread. The western portion of

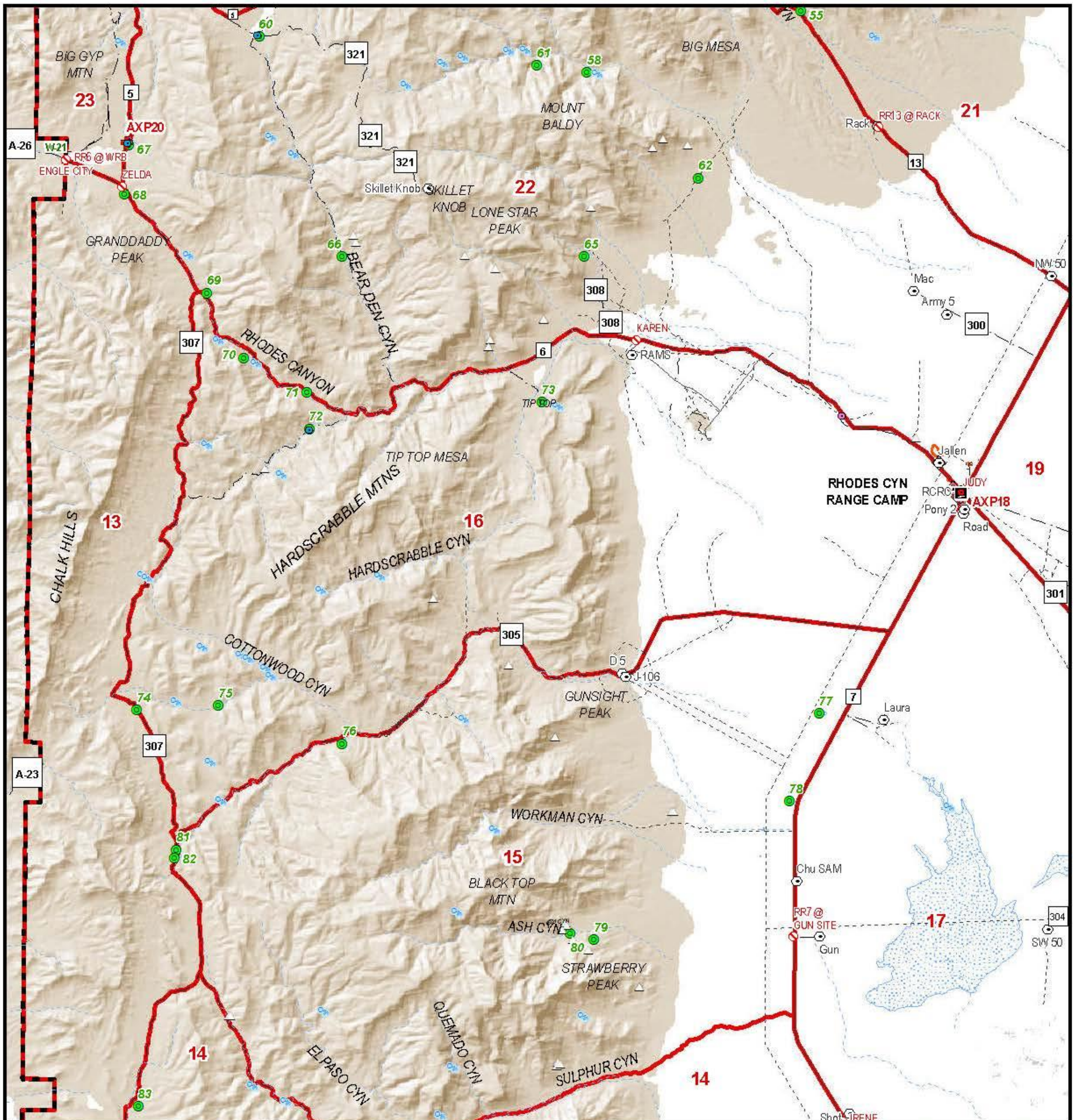
FMU 16 is the interior of the San Andres Mountains. The terrain is steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 16.

Pre Fire Season Fuels Management Actions
Inspection of historic sites needs to occur in the fall or early winter. Dried tumbleweeds can collect against structures and fences within FMU 16. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Fire break roads around the perimeter of FMU 16 in Cottonwood and Rhodes Canyons and Range Road 307 need to be maintained yearly, once in the fall or winter after monsoon season.

Wildfire Management
Wildfires should be suppressed immediately in FMU 16 as wildfires can spread rapidly in the San Andres Mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 16 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 16 to rough rocky two-track roads that are one way in and one way out. In these instances, the IC should consider using aerial assets if improvements are threatened. If improvements are not threatened, then the IC, in coordination with FES leadership and DPWE, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal protection duties. The WSMR GC, WFPM and DPWE resource professionals and GIS should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

Engine fill sites in FMU 16 are located at Potter Ranch, Herbie Well aka Rhodes C or Well 6, and at Rhodes Commo.



WHITE SANDS MISSILE RANGE

FMU 16 ~ Hardscrabble

40,526.3 Acres

7/9/2020

1 inch = 11,307 feet

0 0.5 1 Miles

File Location: Projects\FirePlan\FirePlan_2017\FirePlan_FMU_Mapbook_85x11.mxd

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- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland

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Location on WSMR

FMU 17 Space Harbor 195,986 Acres

Physical Characteristics

The eastern boundary of FMU 17 is the Holloman AFB boundary from Range Road 10 north to Range Road 9, then north on Range Road 9 to Range Road 6 at Minda Block. The north boundary of FMU 17 is Range Road 6 from Minda Block west to Range Road 7 at the Rhodes Canyon Range Complex. The west boundary of FMU 17 is Range Road 7 from Rhodes Canyon Range Complex south to Ethel Block. FMU 17 is bordered on the south by Range Road 10 from Range Road 7 at Ethel Block east to the Holloman AFB boundary.

There are large areas in FMU 17 where fuel is sparse to non-existent due to vast dune areas of gypsum and salt lake beds. The peripheral areas of the dunes contain mesquite, yucca, snakeweed, four-wing saltbush, tarbush and creosote intermixed with desert grasses of tobosa, bush muhly, dropseeds, black grama and alkali sacaton. Topography is mostly flat with gently rolling hills and dunes.

Infrastructure/Assets to be protected

FMU 17 contains the White Sands Space Harbor as well as numerous other launch sites and test facilities. Most of the facilities are located near the edges of FMU 17 close to the major Range Roads. There are no historic structures at risk of burning in a wildfire in FMU 17.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, but due to the surrounding gypsum, salt lake beds and dunes FMU 17 is not conducive to large wildfire spread.

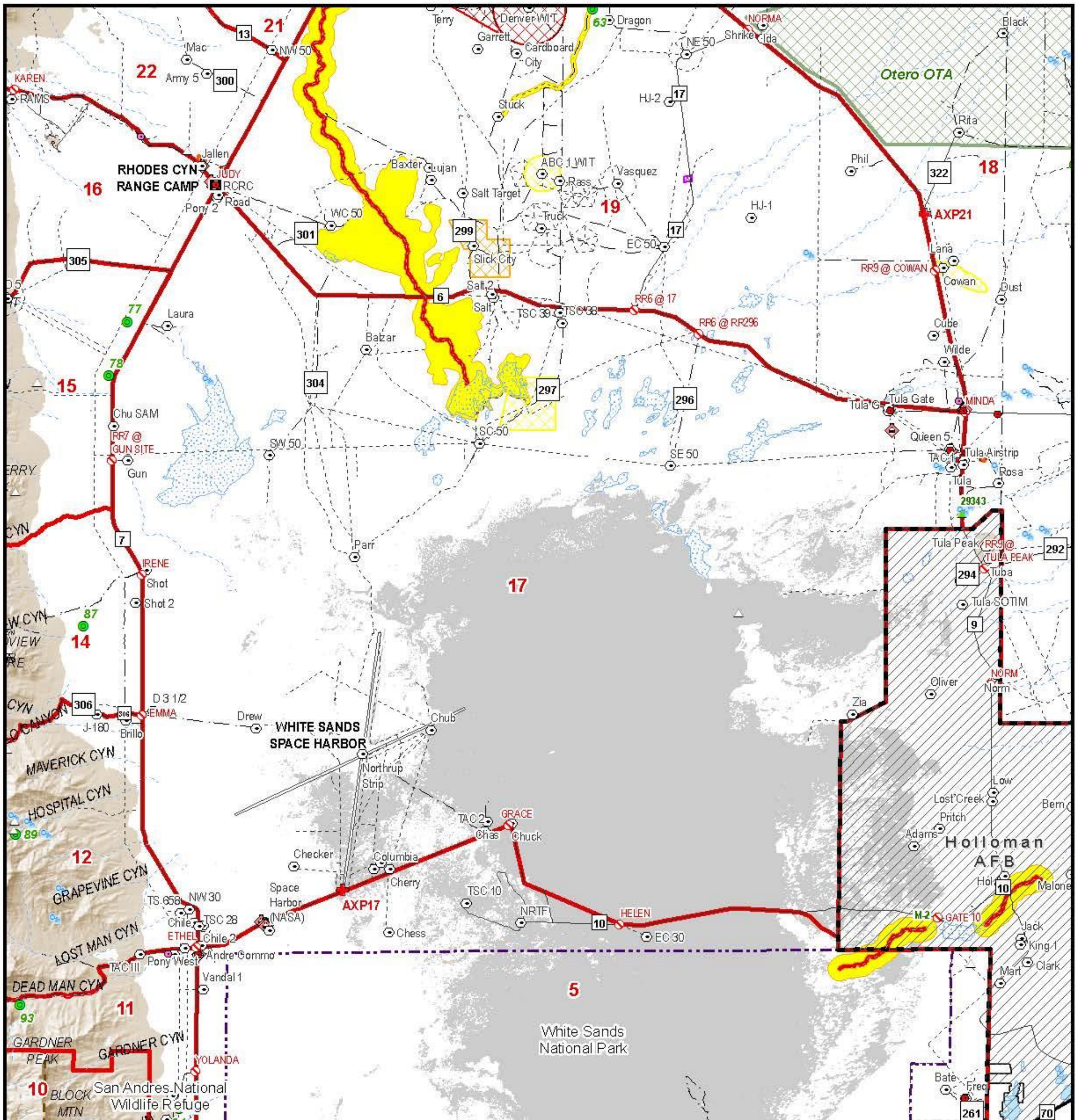
Pre Fire Season Fuels Management Actions

There are few concerns from wildfires for WSMR facilities located in FMU 17. It is possible for dried tumbleweeds to collect against structures and fences within FMU 17. These areas should be kept clean by crushing, burning or scattering built up fuels.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Provide point protection around facilities if wildfires are nearby. Firefighters should stay on roads throughout FMU 17 and suppress wildfires from these defensible positions.

Engine fill locations in FMU 17 are at Tula G and Tula Gate.



WHITE SANDS MISSILE RANGE

FMU 17 ~ Space Harbor

195,985.8 Acres

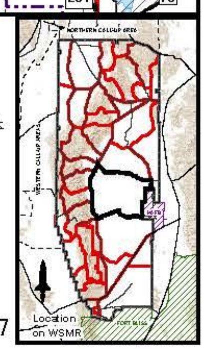
7/9/2020

1 inch = 18,259 feet

0 0.5 1

Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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FMU 18 Otero Maneuver Area 101,472 acres

Physical Characteristics
The eastern boundary of FMU 18 is the WSMR administrative boundary from Holloman AFB north, past gates E-9 through E-24 to E-25, to the Oscura Gate at Range Road 12. The northern boundary of FMU 18 is Range Road 12 from the Oscura Range gate west to Range Road 312. The west boundary of FMU 18 is Range Road 312 south from Range Road 12 to where it dead-ends, then southwest around the edge of the Malpais to Range Road 315. Then southwest on Range Road 315 to Range Road 9, then southeast on Range Road 9 to the Holloman AFB northern boundary, then east, northeast, then south following the administrative boundaries of Holloman AFB past Tularosa Peak, past Norm Block to the point where the Holloman AFB boundary turns east. FMU 18 is bordered on the south by the north Holloman AFB boundary.

FMU 18 is a long, narrow FMU that follows the WSMR east boundary south to north. Fuel is sparse in FMU 18 except for some low areas where Tularosa Creek and Three Rivers Wash cross the boundary. The majority of FMU 18 is alkali flats that contains vegetation of mesquite, yucca, snakeweed, four-wing saltbush, tarbush, pickle weed and creosote intermixed with desert grasses of tobosa, bush muhly, dropseeds and alkali/giant sacaton. Arroyo bottoms contain little leaf sumac, tamarisk and desert willow. Topography is mostly flat with gently rolling hills and dunes. The north end of FMU 18 contains the Phillips Hills which are rugged igneous hills with vegetation consisting of creosote, yucca, mesquite and desert grasses.

Infrastructure/Assets to be protected
FMU 18 contains a few, scattered launch sites and test facilities. These assets are mostly in areas devoid of fuel and are not at risk of burning in a wildfire.

There is one historic cultural site:

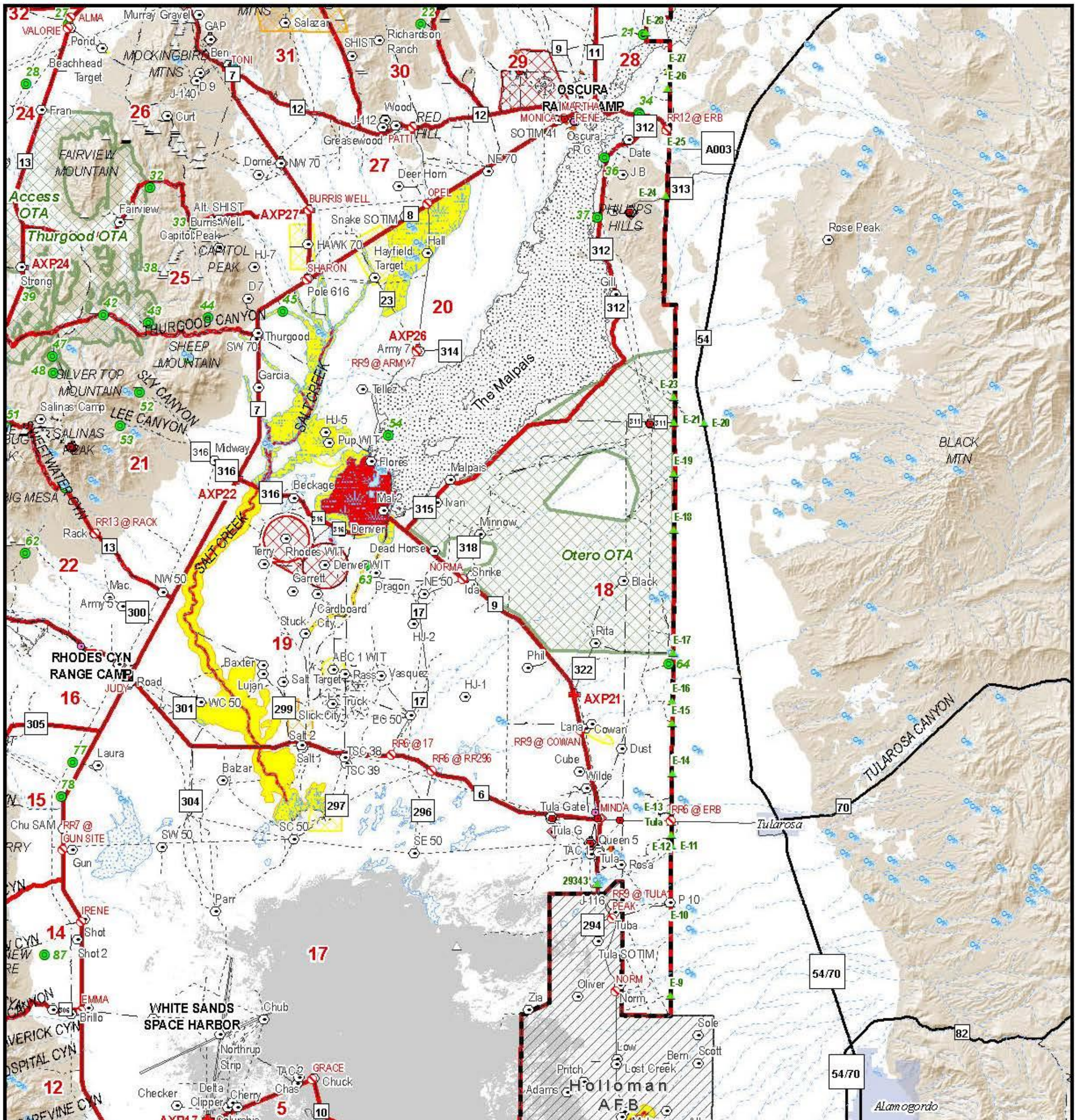
(#64 on map) Stover Ranch is dilapidated wooden structures at **low risk** of burning in a wildfire due to lack of continuous wildland fuels. Located at UTM coordinates 13S **397,334E** by **3,670,934N**.

Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, but due to the surrounding alkali flats there is not the fuel continuity to spread wildfires very far.

Pre Fire Season Fuels Management Actions
There are no concerns from wildfires for WSMR facilities located in FMU 18. It is possible for dried tumbleweeds to collect against structures and fences within FMU 18. These areas should be kept clean by crushing or scattering or burning built up fuels.

Wildfire Management
Allow wildfires off the road system to burn out and die on their own. Provide point protection around facilities if wildfires are nearby. Firefighters should stay on roads throughout FMU 18 and suppress wildfires from these defensible positions.

Engine fill sites in FMU 18 are located at Tularosa Gate, Minda, J-9, Russ Site and Phillips Hill.



WHITE SANDS MISSILE RANGE

FMU 18 ~ Otero Maneuver Area

101,471.5 Acres

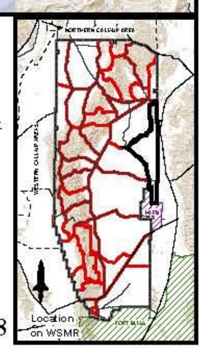
7/9/2020

1 inch = 29,008 feet

0 0.5 1

Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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FMU 19 Denver WIT 99,896 Acres

Physical Characteristics

FMU 19 is bordered on the east by Range Road 9 from its intersection with Range Road 6 north to its intersection with Range Road 316. The north boundary of FMU 19 is Range Road 316 from Range Road 9 intersection west to Range Road 7. The west boundary of FMU 19 is Range Road 7 from its intersection with Range Road 316 south to its intersection with Range Road 6 at Rhodes Canyon Range Complex (RCRC). The south boundary of FMU 19 is Range Road 6 from Range Road 7 east to its intersection with Range Road 9.

FMU 19 is typical Tularosa Basin alkali flat desert that contains vegetation of mesquite, yucca, snakeweed, four-wing saltbush, tarbush and creosote intermixed with desert grasses of tobosa, bush muhly, dropseeds and alkali/giant sacaton. Arroyo bottoms contain little leaf sumac, tamarisk (salt cedar) and desert willow. Topography is mostly flat with gently rolling hills and dunes. Salt Creek flows through the west side of FMU 19 from north to south.

Infrastructure/Assets to be protected

FMU 19 contains launch sites, impact areas (WITs) and test facilities as well as one historic cultural site:

(#63 on map) Lumley Lake Ranch consists of wooden corrals but is **not at risk** of burning in a wildfire due to lack of continuity of surrounding burnable fuels. Located at UTM coordinates 13S **377,020E** by **3,677,500N**.

All assets in FMU 19 are generally in areas devoid of fuels and are not at risk of burning in a wildfire. WIT sites are off limits to firefighters.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, but due to the surrounding alkali flats there is not the fuel continuity to spread wildfires very far. Tamarisk is a highly flammable fuel that lines areas of Salt Creek in FMU 19. Salt Creek is critical habitat for the endangered White Sands pupfish. Use Minimum Impact Suppression Tactics (MIST) when suppressing wildfires along Salt Creek.

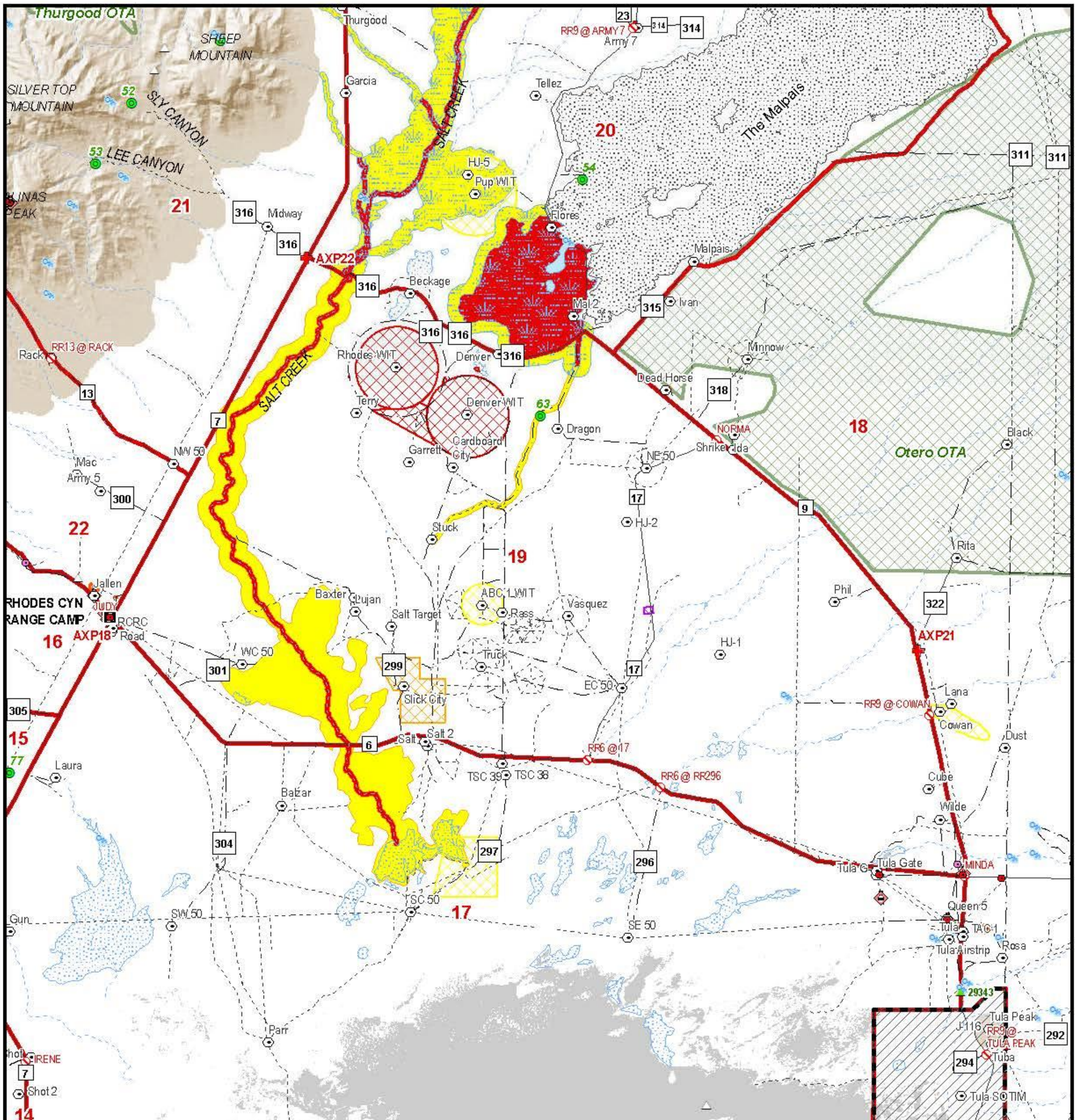
Pre Fire Season Fuels Management Actions

There are no concerns from wildfires for WSMR facilities located in FMU 19. It is possible for dried tumbleweeds to collect against structures and fences within FMU 19. These areas should be kept clean by crushing or scattering or burning built up fuels.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Provide point protection around facilities if wildfires are nearby. Firefighters should stay on roads throughout FMU 19 and suppress wildfires from these defensible positions. Do not use retardants or fire suppressants in vicinity of Salt Creek to ensure that the stream does not become polluted.

Engine fill water in FMU 19 is available at Rhodes Canyon Range Center, Tula Gate, J-9 and MINDA.



WHITE SANDS MISSILE RANGE

FMU 19 ~ Denver WIT

99,895.5 Acres

7/9/2020

1 inch = 16,010 feet

0 0.5 1

Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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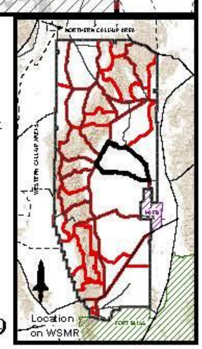


FMU 20 Malpais 109,479 Acres

Physical Characteristics

The eastern boundary of FMU 20 is Range Road 315 northeast from Range Road 9 to where the road dead ends at Malpais site. The edge of the Malpais becomes the eastern boundary at this point heading northeast to where the edge of the Malpais meets the southern end of Range Road 312, then north up Range Road 312 to its intersection with Range Road 12 near the Oscura gate. The northern boundary of FMU 20 is Range Road 12 from its intersection with Range Road 312 west to its intersection with Range Road 8. The western boundary of FMU 20 is Range Road 8 from Range Road 12 junction southwest to Sharon Block and the intersection of Range Road 7, then southwest and south on Range Road 7 to its intersection with Range Road 316. The south boundary of FMU 20 is Range Road 316 from Range Road 7 east to Range Road 9 intersection, then southeast along Range Road 9 to its intersection with Range Road 315.

FMU 20 is typical Chihuahuan Desert and contains vegetation of mesquite, yucca, snakeweed, four-wing saltbush, tarbush and creosote intermixed with perennial desert grasses of tobosa, bush muhly, dropseeds, three awns, gramas, and alkali/giant sacaton. Arroyo bottoms contain littleleaf sumac, tamarisk (salt cedar) and desert willow. Topography is mostly flat with gently rolling hills and dunes outside of the Malpais. Salt Creek flows through the west side of FMU 20 from north to south. Malpais Springs and Mound Springs are located east of Salt Creek in FMU 20 and also contain the endangered White Sands pupfish. The Carrizozo Lava Flow known also as the Malpais is found in FMU 20 and is characterized by black, jagged igneous rock overlaid on the desert floor as rolling, low hills. Vegetation is profuse in places within the Malpais, especially in low-lying pockets, but the rocky slopes and fissures serve to break up the fuel continuity and thus do not support large wildfire growth.

Infrastructure/Assets to be protected

FMU 20 contains launch sites, impact areas (WITs), cultural sites and other facilities, including the Oscura Range Center. These assets are mostly in cleared areas, mostly devoid of fuels and are not at risk of burning in a wildfire. WIT sites are off limits to firefighters. Maintain firebreak roads at least once yearly after the monsoon season. Historic sites include:

(#34 on map) Lowden 1 Ranch consists of standing wood structures and are at a **moderate risk** of burning in a wildfire due to the construction materials and the high fuel loads in proximity to the structures. Located at UTM coordinates 13S **395,370E** by **3,707,860N**.
(#36) Robinson Ranch consists of stone foundations and scattered wood and is at **low wildfire risk** due to low fuel loads in the area. Located at UTM coordinates 13S **393,058E** by **3,704,861N.**
(#37) Lathan Ranch consists of fallen brick and wooden structures and is rated at **moderate risk** of damage from a wildfire, Located at UTM coordinates 13S **392,600E** by **3,700,840N**.
(#45) Gilliland North Well consists of wooden corrals and is rated at **low risk** of damage from wildfires. Located at UTM coordinates 13S **371,470E** by **3,694,530N**.
(#54) Lower Well consists of a well and dilapidated structure and is at **low wildfire risk** due to low, discontinuous fuel loads in the area. It is located at UTM coordinates 13S **378,580E** by **3,686,260N.**

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, but due to the surrounding desert there is not the fuel continuity to spread wildfires very far. Tamarisk is a highly flammable fuel that lines areas of Salt Creek in FMU 20. Salt Creek is critical habitat for the endangered White Sands pupfish. Use Minimum Impact Suppression Tactics (MIST) when suppressing wildfires along Salt Creek. The Mound Springs are in areas where wildfires cannot spread. Malpais Springs is surrounded by fuel that, when dried or cured could carry a wildfire. There are several hundred acres of wetlands associated with Malpais Springs that are at risk from wildfire.

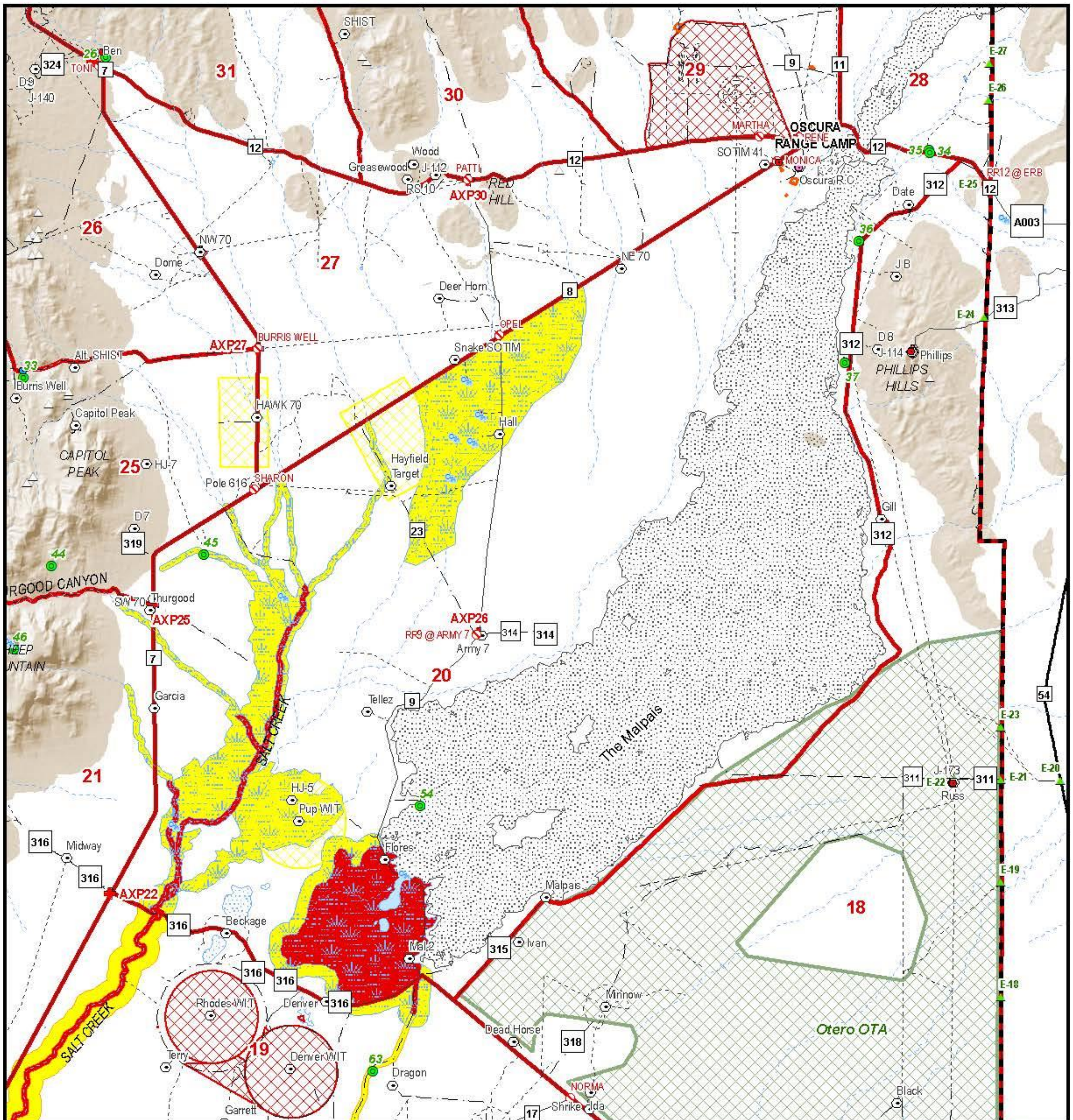
Pre Fire Season Fuels Management Actions

There are no concerns from wildfires for WSMR facilities located in FMU 20. It is possible for dried tumbleweeds to collect against structures and fences within FMU 20. These areas should be kept clean by crushing or scattering or burning built up fuels.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Provide point protection around facilities if wildfires are nearby. Firefighters should stay on roads throughout FMU 20 and suppress wildfires from these defensible positions. Avoid using fire suppressants or retardants around Salt Creek and within the wetland area of Malpais Springs to minimize pollution. Use MIST of firefighting on foot using handtools, chainsaws and plain water to suppress wildfires in these locations.

Engine fill water for FMU 20 is available at Oscura Range Center.



WHITE SANDS MISSILE RANGE

FMU 20 ~ Malpais

109,479.2 Acres

7/9/2020

1 inch = 14,201 feet

0 0.5 1

Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
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UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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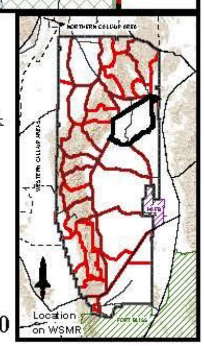


FMU 21 Salinas Peak 53,827 Acres

Physical Characteristics

FMU 21 is triangular in shape and is bordered on the east by Range Road 7 from Range Road 13 north to Thurgood Canyon. The north boundary of FMU 21 is an improved dirt road that goes west up Thurgood Canyon past Lava Gap, through a low saddle and past Jonce tank to Range Road 13. The south boundary of FMU 21 is Range Road 13 from its junction with the dirt road from Thurgood Canyon south and east through the head of Grapevine Canyon past the intersection with the road that climbs Salinas Peak, then southeast down Sweetwater Canyon to Range Road 7.

Fuels in FMU 21 range from typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, ocotillo, mesquite, tarbush, yucca, prickly pear, snakeweed and acacia to the montane woodlands of the San Andres Mountains. Montane vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, muhlys, bluestem, lovegrass, alkali, spike and giant sacaton, gramas and three-awns. At the upper reaches of Salinas Peak and Silvertop Mountain is ponderosa pine and Gambel oak. Topography ranges from gently sloping at Range Road 7 to the steep canyons, slopes and peaks of the northern San Andres Mountains. FMU 21 is remote and rugged. There are only a few roads inside of the FMU firebreak road boundaries.

Infrastructure/Assets to be protected

FMU 21 contains numerous historic and prehistoric cultural sites. Historic sites include:

(#46 on map) Greer Sheep Camp consists of a standing log cabin. It is at **moderate risk** of burning in a wildfire due to its remote location and the continuous flammable fuel loads in the area. It is located at UTM coordinates 13S **365,190E** by **3,691,420N**.
(#47) Thurgood Well consists of several standing wooden structures and is at **high risk** of burning in a wildfire due to fuel loads and construction materials. Located at UTM coordinates 13S **356,050E** by **3,691,550N**.
(#48) Greer Well consists of dilapidated structures and is at **moderate wildfire risk**. Located at UTM coordinates 13S **356,100E** by **3,690,400N**.
(#49) L.W. Well consists of a wooden house and is at **moderate risk** of burning in a wildfire due to fuel loads and construction materials. Located at UTM coordinates 13S **352,280E** by **3,689,400N**.
(#52) Silvertop Mine Camp consists of fallen debris and is **not at risk** of burning in a wildfire. Located at UTM coordinates 13S **361,900E** by **3,689,100N**.
(#53) Greer Ranch consists of two wooden structures and is at a **high risk** of burning in a wildfire due to its construction materials and high fuel loads in the area. Located at UYM coordinates 13S **360,560E** by **3,686,860N**.
(#55) Sweetwater Well Ranch consists of dilapidated structures and is at **low risk** of burning in a wildfire due to low fuel loads in the area. Located at UTM coordinates 13S **356,900E** by **3,682,700N**.

There are military facilities located near Range Road 7 on the bajadas below the mountains. These facilities are mostly protected from wildfires as they have been cleared around. There are military and civilian facilities atop Salinas Peak. The road to these facilities is precipitous but is maintained for safety. The structures atop Salinas Peak are fairly well protected from wildfire. Maintenance of the sites is necessary to keep brush from encroaching on the structures.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The eastern portions of FMU 21 near Range Road 7are mostly creosote bajadas and are not conducive to large wildfire spread. The western portion of FMU 21 is the interior of the San Andres Mountains and contains the highest peaks in the Range. The terrain is steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 21.

Pre Fire Season Fuels Management Actions

Inspection of historic sites needs to occur in the fall or early winter. Dried tumbleweeds can collect against structures and fences within FMU 21. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Fire break roads around the perimeter of FMU 21 in Thurgood, Grapevine and Sweetwater Canyons need to be maintained yearly, once in the fall after monsoon season.

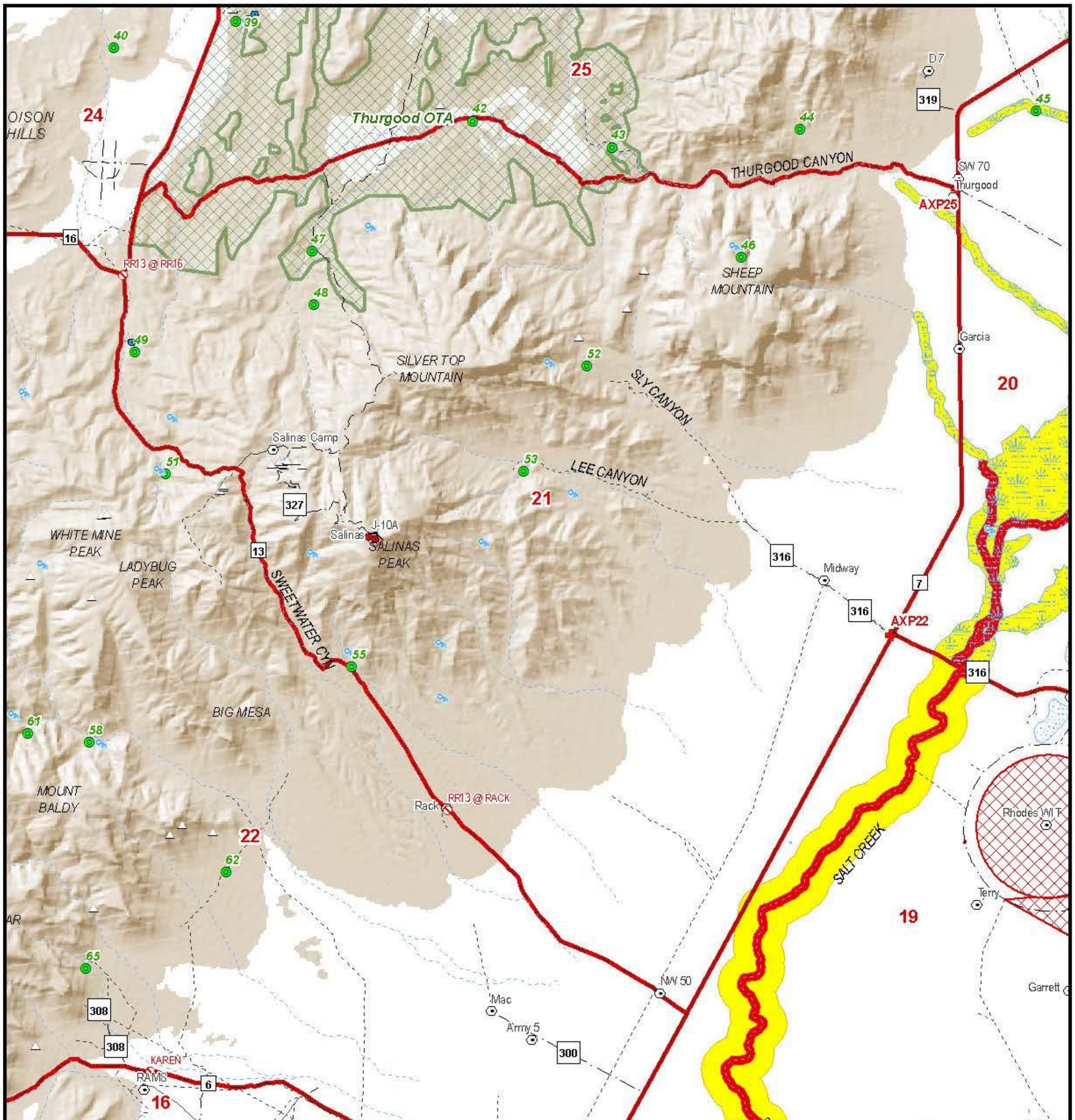
Wildfire Management

Wildfires should be suppressed immediately in FMU 21 as wildfires can spread rapidly in the San Andres Mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 21 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 21 to rough rocky roads that are often one way in and one way out. In these instances, the IC should consider using aerial assets if improvements are threatened. If improvements are not threatened and road access is poor or non-existent, then the IC, in coordination with FES leadership and PWE-CN, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal protection duties. The WSMR GC, WFPM and PWE resource professionals and GIS Specialist should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

Salinas Peak is one area that warrants aerial retardants and possibly aerially delivered firefighters if a wildfire was actively burning near the peak. Engines can provide point protection atop Salinas Peak, provided the road is clear, as there are adequate safety zones amongst the mostly metal structures. Do not risk engine entrapment on the road to Salinas Peak. Ensure the wildfire is well away from the road before starting a drive to the top of the peak.

Engine fill water in FMU 21 is available at Salinas Peak and at LW Well.



WHITE SANDS MISSILE RANGE

FMU 21 ~ Salinas Peak
53,827.3 Acres

7/9/2020

1 inch = 9,191 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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Location on WSMR

FMU 22 Ladybug Peak 69,966 Acres

Physical Characteristics

FMU 22 is bordered on the east by Range Road 7 from Rhodes Canyon Range Center north to Sweetwater Canyon and Range Road 13. The north boundary of FMU 22 is Range Road 13 in Sweetwater Canyon from Range Road 7 to past the Salinas Peak road turnoff, then down Grapevine Canyon to its intersection with Range Road 16, then west on Range Road 16 to its intersection with Range Road 5. The west boundary of FMU 22 is Range Road 5 south from its intersection with Range Road 16, past Wood Ranch, past Hardin Ranch to its intersection with Range Road 6 at Zelda Block. The south boundary of FMU 22 is Range Road 6 from its intersection with Range Road 5 southeast down Rhodes Canyon, past Bosque Canyon, past Bear Den Canyon to Range Road 7.

Fuels in FMU 22 range from typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, ocotillo, mesquite, tarbush, yucca, prickly pear, snakeweed and acacia to the montane woodlands of the San Andres Mountains. Montane vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, muhlys, alkali and giant sacaton, gramas and three-awns. Topography ranges from gently sloping at Range Road 7 to the steep canyons, slopes and peaks of the San Andres Mountains. FMU 22 is remote and rugged. There are only a few roads inside of the FMU firebreak road boundaries.

Infrastructure/Assets to be protected

FMU 22 contains numerous historic and prehistoric cultural sites. Historic cultural sites include:

(#50 on the map) John Wood Ranch consists of wood and rock structures and is at **high risk** of burning in a wildfire due to construction materials and high fuel loading of grasses in the area. Located at UTM coordinates 13S **344,879E** by **3,687,516N.**

(#51) Roy Tucker Ranch consists of a barely standing wood structure that is at a **high risk** of burning in a wildfire due to high fuel loads in the surrounding area. Located at UTM coordinates 13S **352,940E** by **3,686,800N**.

(#56) Goodfortune Canyon consists of a rock house and is at **moderate risk** of burning in a wildfire due to continuous fuel loading in the surrounding area. Located at UTM coordinates 13S **348,900E** by **3,684,900N.**

(#57) H.A. Wood Windmill consists of wooden corrals and a tack shed and is at **high risk** of burning in a wildfire due to construction materials and high fuels loads, Located at UTM coordinates 13S **344,000E** by **3,683,800N.**

(#58) Eagle Ranch consists of a standing stone and wood ranch house and is at a **moderate risk** of burning in a wildfire due to construction materials and heavy fuels surrounding the area. Located at UTM coordinates 13S **351,309E** by **3,671,748N.**

(#59) Joe Pete Wood Dugout consists of wooden materials but is at **low risk** of burning in a wildfire due to its construction and low fuel loads. Located at UTM coordinates 13S **343,650E** by **3,683,120N.**

(#60) J.P. Wood Headquarters, Pete Wood Ranch consists of stone and wood structures and is at **low risk** of burning in a wildfire due to low surrounding fuel loads. Located at UTM coordinates 13S **342723E** by **3,682,029N.**
(#61) Tipton Spring has **no wildfire risk** due to little structure remaining. Located at UTM coordinates 13S **350,000E** by **681,280N.**
(#62) Mine Shack is a collapsed wooden structure at **low risk** of burning in a wildfire. Located at UTM coordinates 13S **354,220E** by **3,678,320N.**
(#65) Henderson White Rock Well consists of a standing wooden structure but is at **low risk** of burning in a wildfire due to absence of continuous fuels. Located at UTM coordinates 13S **351,240E** by **3,676,270N.**
(#66) F. Henderson/Bear Den Canyon consists of a collapsed wooden structure that is at **moderate risk** of burning in a wildfire. Located at UTM coordinates 13S **344,880E** by **3,676,260N.**
(#69) Cholla Ridge Cabin is a stone structure and is **not at risk** of burning in a wildfire due to its construction and lack of surrounding burnable fuels. Located at UTM coordinates 13S **341,360E** by **3,675,310N.**
(#71) "Potsy" Potter Ranch; Potter Sheep Ranch consists of two wooden structures and is at **high risk** of burning in a wildfire due to construction materials and surrounding continuous fuels. Located at UTM coordinates 13S **343,970E** by **3,672,706N.**

There are a few military launch sites on the eastern side of FMU 22 on the bajadas below the mountains. These facilities are mostly protected from wildfires as they have been cleared around and the desert fuels here are not prone to wildfire spread. There is a small military facility atop Skillet Knob that is at moderate risk from wildfires.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The eastern portions of FMU 22 near Range Road 7 are mostly creosote bajadas and are not conducive to large wildfire spread. The western portion of FMU 22 is the San Andres Mountains and contains some large expanses of woodlands. The terrain is steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 22.

Pre Fire Season Fuels Management Actions

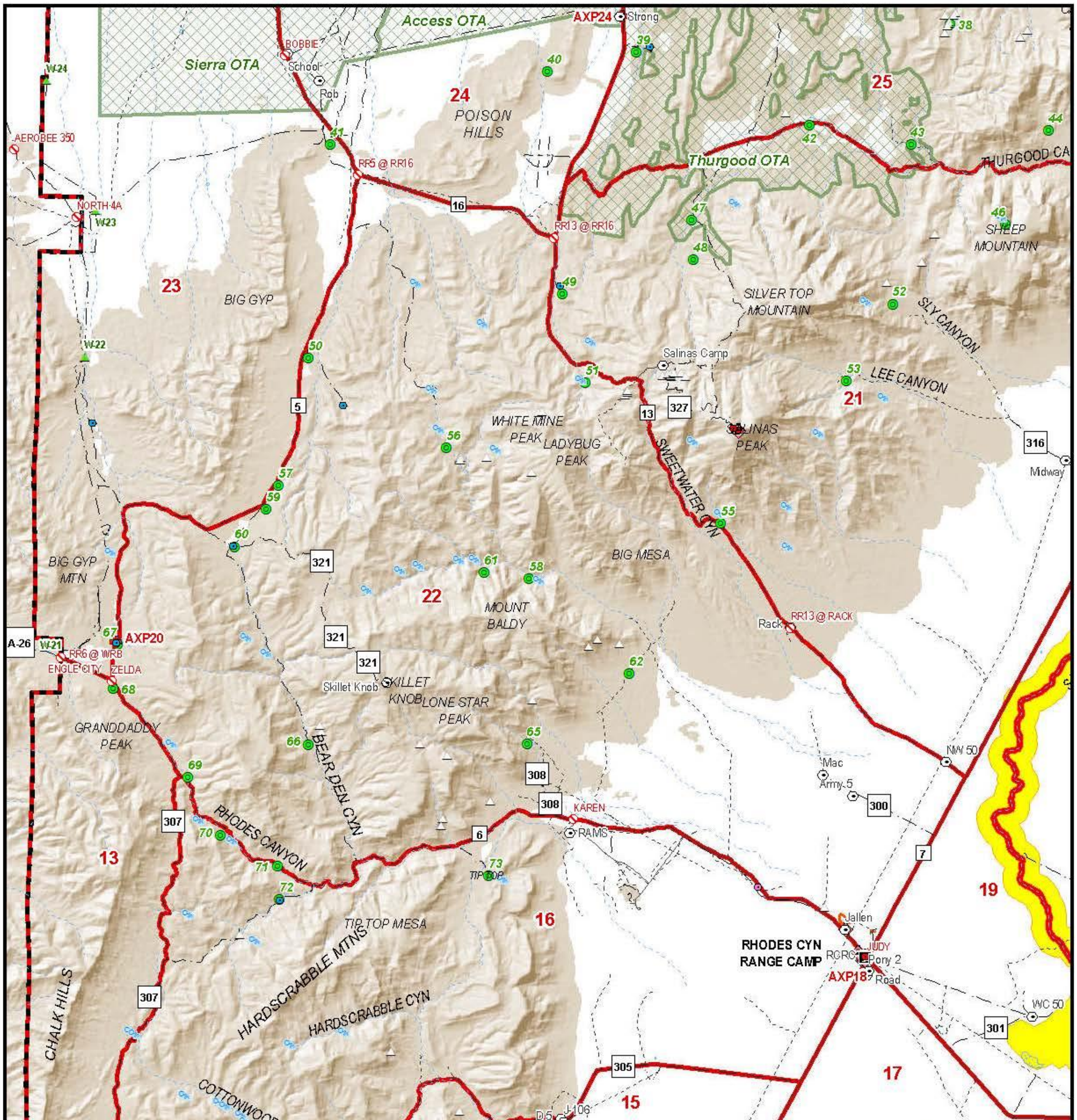
Inspection of historic sites needs to occur in the fall or early winter. Dried tumbleweeds can collect against structures and fences within FMU 22. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Fire break roads around the perimeter of FMU 22 in Sweetwater, Grapevine and Rhodes Canyons and the road to the top of Skillet Knob need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 22 as wildfires can spread rapidly in the San Andres Mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 22 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 22 to rough rocky roads that are often one way in and one way out. In these instances, the IC should consider using aerial assets if improvements are threatened. If improvements are not threatened and the wildfire is established and spreading and road access is poor, then the IC, in coordination with FES leadership and PWE-CN, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal protection duties. The WSMR GC, WFPM and PWE resource professionals and GIS Specialist should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

Engine water fill points for FMU 22 are located at Hardin Ranch, Pete Woods Well, John Woods Well, LW Well, Herbie Well (aka Rhodes C or Well 6) and Rhodes Commo at Rhodes Canyon Range Center.



WHITE SANDS MISSILE RANGE

FMU 22 ~ Ladybug Peak

69,965.9 Acres

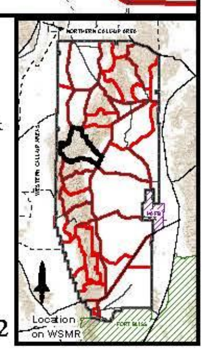
7/9/2020

1 inch = 12,610 feet

0 0.5 1

Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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Page 22

FMU 23 Cain 65,347 Acres

Physical Characteristics

FMU 23 is bordered on the east by Range Road 5 from its intersection with Range Road 6 at Zelda Block north to Range Road 5 intersection with Range Road 26. The north boundary of FMU 23 is Range Road 26 from its intersection with Range Road 5 west past Cain site to the western boundary of WSMR. The west boundary of FMU 23 is the administrative western boundary of WSMR from Range Road 26 south to the WSMR boundary intersection with Range Road 6 at Engle City Block. The south boundary of FMU 23 is a short section of Range Road 6 from Engle City Block to Zelda Block at the Range Road 5 intersection.

Fuels in FMU 23 range from desert plains grasslands with vegetation of grama, muhly, dropseed, galleta, three-awn, giant and alkali sacaton and bluestem grasses to typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, ocotillo, mesquite, tarbush, yucca, prickly pear, snakeweed and acacia to shrublands typical of foothills of the San Andres Mountains with grasses and shrubs intermixed. Foothills shrub vegetation includes oak spp., juniper spp., some piñon, mountain mahogany, ceanothus, sotol and sacahuista. Topography ranges from flat in the north along Range Road 26 to gently sloping along Range Road 5 heading south to steep slopes and ridges of the Gyp Hills. FMU 23 is long and comparatively narrow. There is a tongue of Malpais that enters into FMU 23 from the west and interrupts the fairly contiguous grasslands in the northern part of FMU 23. There are a few roads inside of the FMU firebreak road boundaries and road access within FMU 23 is good in the grasslands, less so in the mountainous portions of the Gyp Hills.

Infrastructure/Assets to be protected

FMU 23 contains a few historic cultural sites:

(#30 on map) J.A.C. Well consists of a concrete and cement house and wooden corrals and is at **moderate risk** of burning in a wildfire due to construction materials and nearby flammable wildland fuels. Located at UTM coordinates 13S **340,500E** by **3,704,800N**.

(#41) Dick Gilliland Ranch consists of a dilapidated wooden house and surrounding wooden corrals and is at **moderate risk** of burning in a wildfire due to construction materials and nearby wildland fuel loads. Located at UTM coordinates 13S **345,520E** by **3,693,760N**.

(#67) Hardin Ranch is a well-preserved ranch site with outbuildings and corrals and is at **low risk** of burning in a wildfire due to its being cleared around and the fuels are discontinuous in the surrounding area. Located at UTM coordinates 13S **339,300E** by **3,679,180N.**

There are occupied ranch houses very close to the WSMR boundaries in two locations, one at Engle City Block and one further north at North 4A Block. These ranches are mostly protected from wildfires as they have been cleared around but fuels nearby are prone to wildfire spread.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The northern portions of FMU 23 are mostly grass fuels and are conducive to large wildfire spread. The southern portion of FMU 23 is the Gyp Hills and contains high fuel loads of grass and shrubs. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 23.

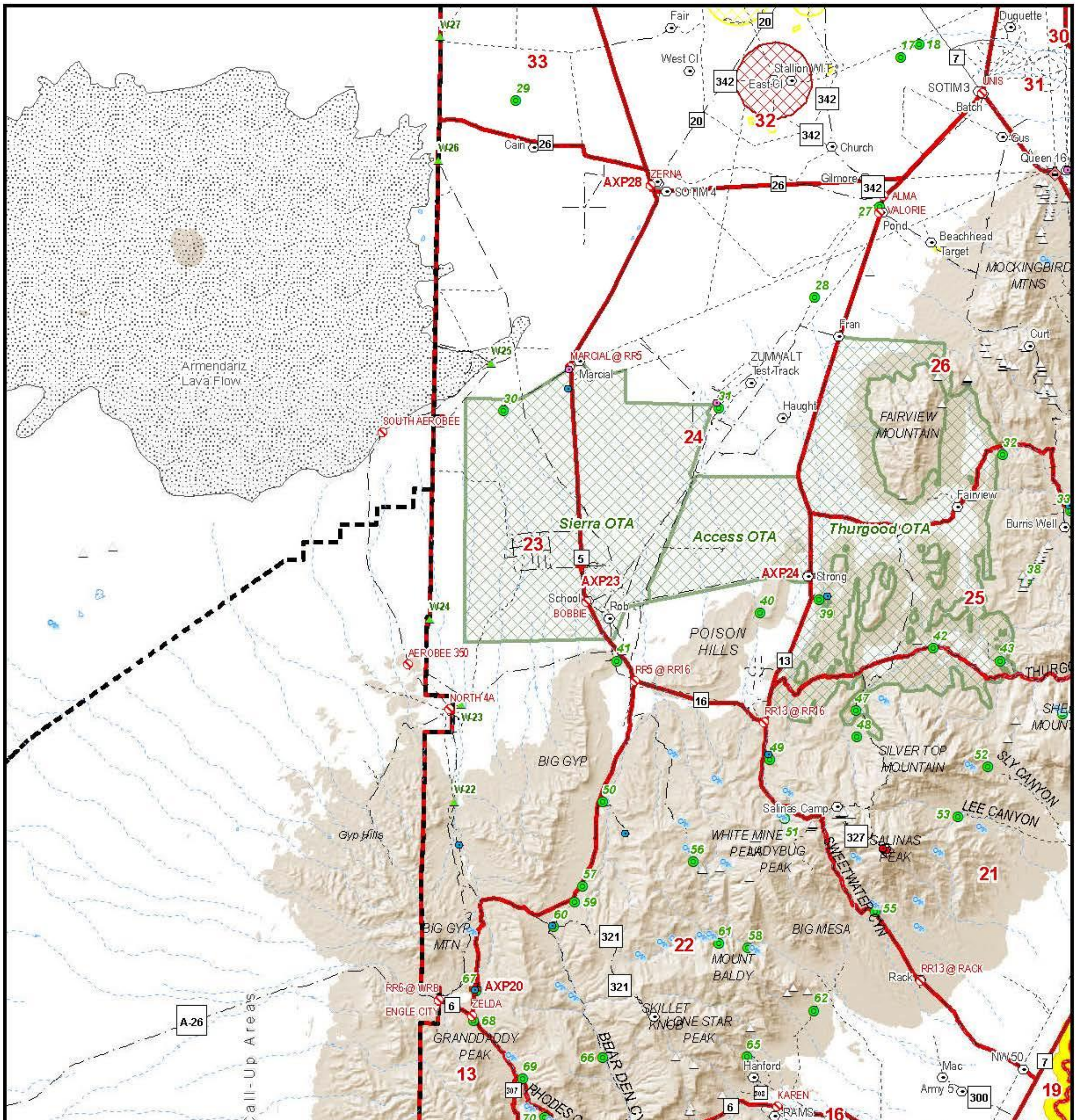
Pre Fire Season Fuels Management Actions

Inspection of historic sites needs to occur in the fall or early winter. Dried tumbleweeds can collect against structures and fences within FMU 23. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Firebreak roads around the perimeter of FMU 23 need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 23 as wildfires can spread rapidly in the grasslands and foothills if environmental conditions are right. All wildfires that start in FMU 23 near the western boundary of WSMR need to be kept on the Range if possible. There is a road along the boundary in the grasslands and is good access for blacklining in these areas. Wildfires within the road system of WSMR can be allowed to burn up to defensible barriers and suppressed or blacklined as conditions warrant. The Gyp Hills do not have a barrier to keep wildfires from crossing on to other agencies or privately owned lands. If wildfires are burning in this area, then activate mutual aid with BLM and other local fire resources to help in suppression operations.

Engine fill water is available in FMU 23 at Buckhorn Well, Hardin Ranch, Pete Woods Well, John Woods Well, Marcial aka Anderson Well, and at Range Road 5 Well.



WHITE SANDS MISSILE RANGE

FMU 23 ~ Cain
65,347.3 Acres

7/9/2020

1 inch = 19,088 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
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UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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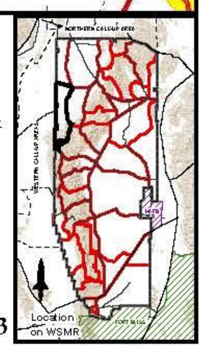

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FMU 24 Zumwalt 55,712 Acres

Physical Characteristics
The east boundary of FMU 24 is Range Road 13 from Range Road 16 north to Range Road 26. The north boundary of FMU 24 is Range Road 26 from its intersection with Range Road 13 west to its intersection with Range Road 5. FMU 24 is bordered on the west by Range Road 5 from its intersection with Range Road 26 south to Range Road 5 intersection with Range Road 16. The south boundary of FMU 24 is Range Road 16 from Range Road 5 intersection east to Range Road 13 intersection.

Fuels in FMU 24 range from desert plains grasslands with vegetation of grama, muhly, dropseed, galleta, three-awn, giant and alkali sacaton and bluestem grasses to typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as little leaf sumac, four-wing saltbush, creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia to shrublands typical of foothills of the San Andres Mountains with grasses and shrubs intermixed. Lowlands and draw bottoms contain significant littleleaf sumac concentrations that are valuable in terms of wildlife habitat and cover. Foothills shrub vegetation includes a few one-seed juniper and oak spp., but mostly mountain mahogany, sotol, ocotillo, skunkbush sumac and sacahuista.

Topography ranges from flat in the north along Range Road 26 to gently sloping along Range Road 5 heading south to steep slopes and ridges of the Poison Hills. There are a few roads inside of the FMU firebreak road boundaries and road access within FMU 24 is generally good in the grasslands, less so in the rugged portions of the Poison Hills.

Infrastructure/Assets to be protected
FMU 24 contains historic cultural sites:

(#27 on map) Dave McDonald Ranch consists of multiple standing adobe and wooden structures and is at **moderate risk** of burning in a wildfire due to surrounding heavy fuels. Located at UTM coordinates 13S **357,120E** by **3,713,800N**.
(#28) Mike Arrieta Ranch consists of a fallen wooden structure and standing wooden corrals and is at **low risk** of burning in a wildfire due to limited flammable fuels in proximity to structures. Located at UTM coordinates 13S **354,250E by 3,709,800N**.
(#31) Martin Ranch consists of several, both standing and fallen wooden structures that are at **moderate risk** of burning in a wildfire due to construction materials and proximity of continuous flammable fuels. Located at UTM coordinates 13S **350,000E** by **3,704,920N.**
(#40) Poison Hills Ruins consists of three rock structures and is **not at risk** of burning in a wildfire. Located at UTM coordinates 13S **351,840E** by **3,695,880N.**

There are military assets at Zumwalt Test Track in the form of structures, storage facilities, targets, antennae and infrastructure in the forms of power lines and roads. Most of these sites are at a low risk from wildfire damage as fuels are sparse in the areas of structures and there are clearings around most of the structures.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The northern portions of FMU 24 are mostly grass fuels and are conducive to wildfire spread. The southern portion of FMU 24 is the Poison Hills which contain moderate fuel loads of grass and shrubs. Wind-driven wildfires could spread in these hills. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 24.

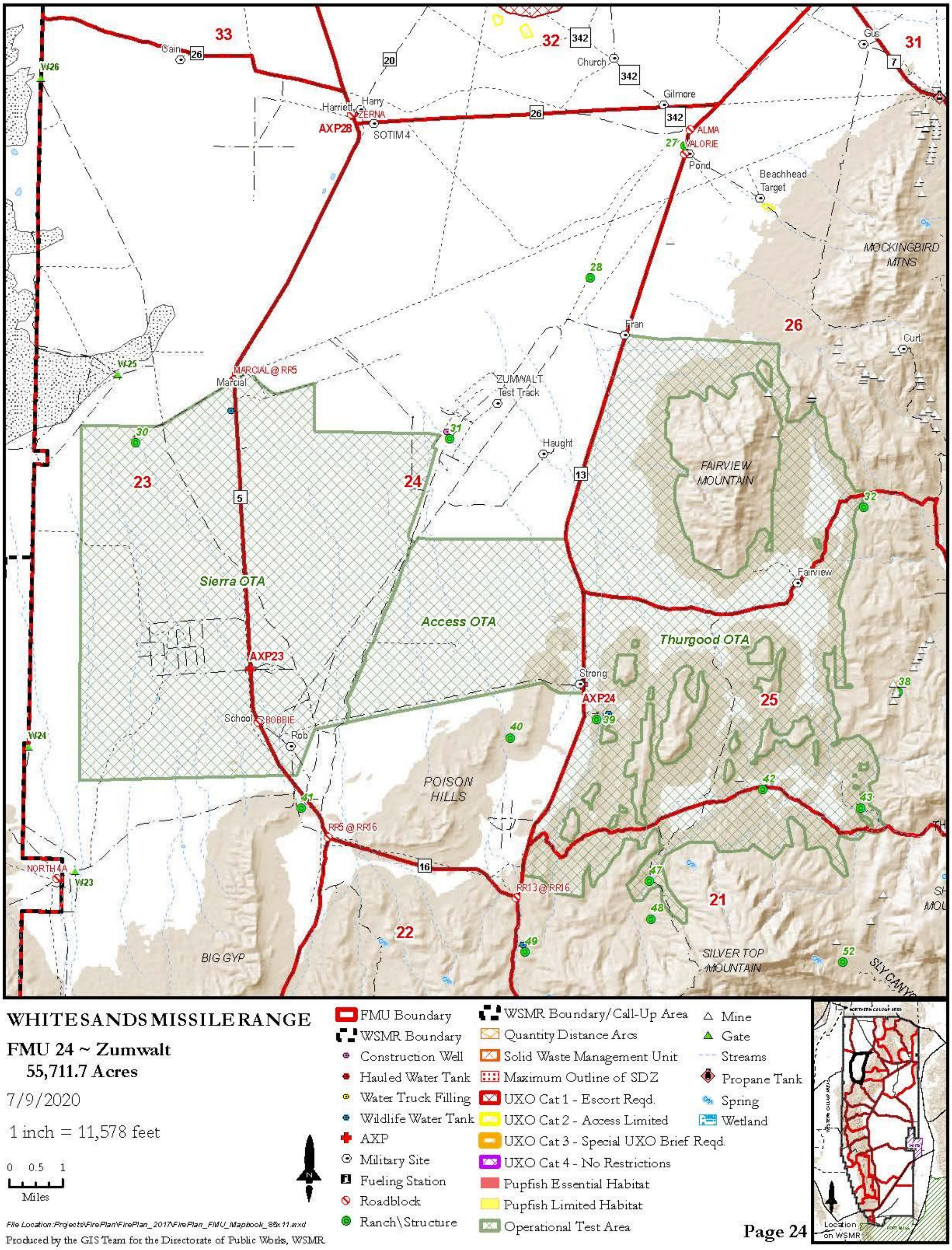
Pre Fire Season Fuels Management Actions

Inspection of historic and military sites needs to occur in the fall or early winter. Dried tumbleweeds may collect against structures and fences within FMU 24. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Firebreak roads around the perimeter of FMU 24 need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires that are readily accessible by engines and firefighters should be suppressed immediately in FMU 24 as wildfires can spread in the grasslands if environmental conditions are right. The firebreak roads surrounding FMU 24 are good for blacklining from. The Poison Hills do not have abundant fuels and contain many sparse, rocky areas that are not conducive to large wildfire growth. Allow wildfires in inaccessible areas to burn within the confines of firebreak roads. Most wildfires in FMU 24 will die out from lack of continuous fuels. Wildfires in FMU 24 can be allowed to burn up to defensible barriers and suppressed or blacklined as conditions warrant.

Engine fill water is available for FMU 24 at Marcial/Anderson Well, Range Road 5 Well, and Martin Ranch Construction Well and at Martin Well.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Cain
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Church
342
Gilmore
Gus
7
Harriett
Harry
ZERNA
AXP28
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26
342
ALMA
27
VALORIE
Pond
Beachhead
Target
W26
MOCKINGBIRD
MTNS
28
Fran
26
Curt
W25
MARCIAL @ RR5
Marcial
ZUMWALT
Test Track
30
31
Haught
23
24
5
13
FAIRVIEW
MOUNTAIN
32
Sierra OTA
Access OTA
Fairview
Thurgood OTA
AXP23
Strong
AXP24
25
38
School
BOBBIE
Rob
39
40
W24
POISON
HILLS
42
43
41
RR5 @ RR16
NORTH 4A
W23
16
47
RR13 @ RR16
21
48
22
49
BIG GYP
SILVER TOP
MOUNTAIN
52
SLY CANYO
WHITE SANDS MISSILE RANGE
FMU 24 ~ Zumwalt
55,711.7 Acres
7/9/2020
1 inch = 11,578 feet
0 0.5 1
Miles
FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
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UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland
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Location on WSMR

FMU 25 Capitol Peak 34,966 Acres

Physical Characteristics

FMU 25 is bordered on the east by Range Road 7 from the dirt road in Thurgood Canyon north to Burris Well Block. The north boundary of FMU 25 is a dirt road that goes west into the Burris Valley past Alt Schist site, past Burris Well, then north and west past Big Tank, then south past Fairview Gunnery Range, then west to Ladder Tank at Range Road 13. The west boundary of FMU 25 is Range Road 13 from its junction with the dirt road from Fairview Gunnery range south past the turnoff to Martin Well to an intersection with the road that accesses Thurgood Canyon. The south boundary of FMU 25 is the dirt road that accesses Thurgood Canyon from Range Road 13 east past Jonce Tank over a low saddle and into Thurgood Canyon, then east down Thurgood Canyon to Range Road 7.

Fuels in FMU 25 range from typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as four-wing saltbush, creosote, ocotillo, mesquite, tarbush, yucca, prickly pear, snakeweed and acacia to a few stands of woodlands on the north faces of Capitol Peak. Woodland vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs and include tobosa, dropseeds, muhlys, alkali, spike and giant sacaton, gramas, and three-awns. Topography ranges from gently sloping at Range Road 7 to the steep canyons, slopes and peaks of Capitol Peak. Much of FMU 25 is remote and roadless. There are only a few roads inside of the FMU firebreak road boundaries.

Infrastructure/Assets to be protected

FMU 25 contains numerous historic sites:

(#32 on map) Big Tank consists of a partially standing stone structure and wooden, standing corrals and is **not at risk** of burning in a wildfire due to lack of continuous fuels in the area. Located at UTM coordinates 13S **362,550E by 3,702,860N.**

(#33) Burris Ranch consists of a single standing structure that is at **low risk** of burning in a wildfire due to lack of burnable fuels in the surrounding area. Located at UTM coordinates 13S **365,520E** by **3,700,360N.**

(#38) Basso Four Mine consists of no burnable structures and is **not at risk** of damage from a wildfire. Located at UTM coordinates 13S **363,580E by 3,697,260N.**

(#39) Martin Line Camp consists of no structures and is **not at risk** from wildfires. Located at UTM coordinates 13S **354,440E by 3,696,440N**.

(#42) Brown Well and ruins consists of piles of collapsed rock and is **not at risk** of burning in a wildfire. Locate at UTM coordinates 13S **359,480E by 3,694,320N.**

(#43) Olden Place; Baldy Russell Ranch consists of adobe and wooden structure with wooden corrals and is at **low risk** of burning in a wildfire due to low fuel loading and discontinuous fuels in the area. Located at UTM coordinates 13S **362,440E by 3,693,760N.**

(#44) Lava Gap Mine consists of no burnable structures and is **not at risk** of burning in a wildfire. Located at UTM coordinates 13S **366,450E by 3,694,150N.**

There are military facilities located near Range Road 7 on the bajadas below Capitol Peak. These facilities are protected from wildfires as they have been cleared around and the desert fuels here are not prone to wildfire spread. There are military and civilian facilities at Alt Schist, Capitol Peak and Burris Well. The structures are fairly well protected from wildfire damage. Tumbleweed control is necessary to keep sites brush-free.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The eastern portions of FMU 25 near Range Road 7 are mostly creosote bajadas and are not conducive to large wildfire spread. The western portion of FMU 25 is the northern extent of the San Andres Mountains and contains Capitol Peak. The terrain is steep and rocky with flashy grass fuels being the main carrier of fire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 25.

Pre Fire Season Fuels Management Actions

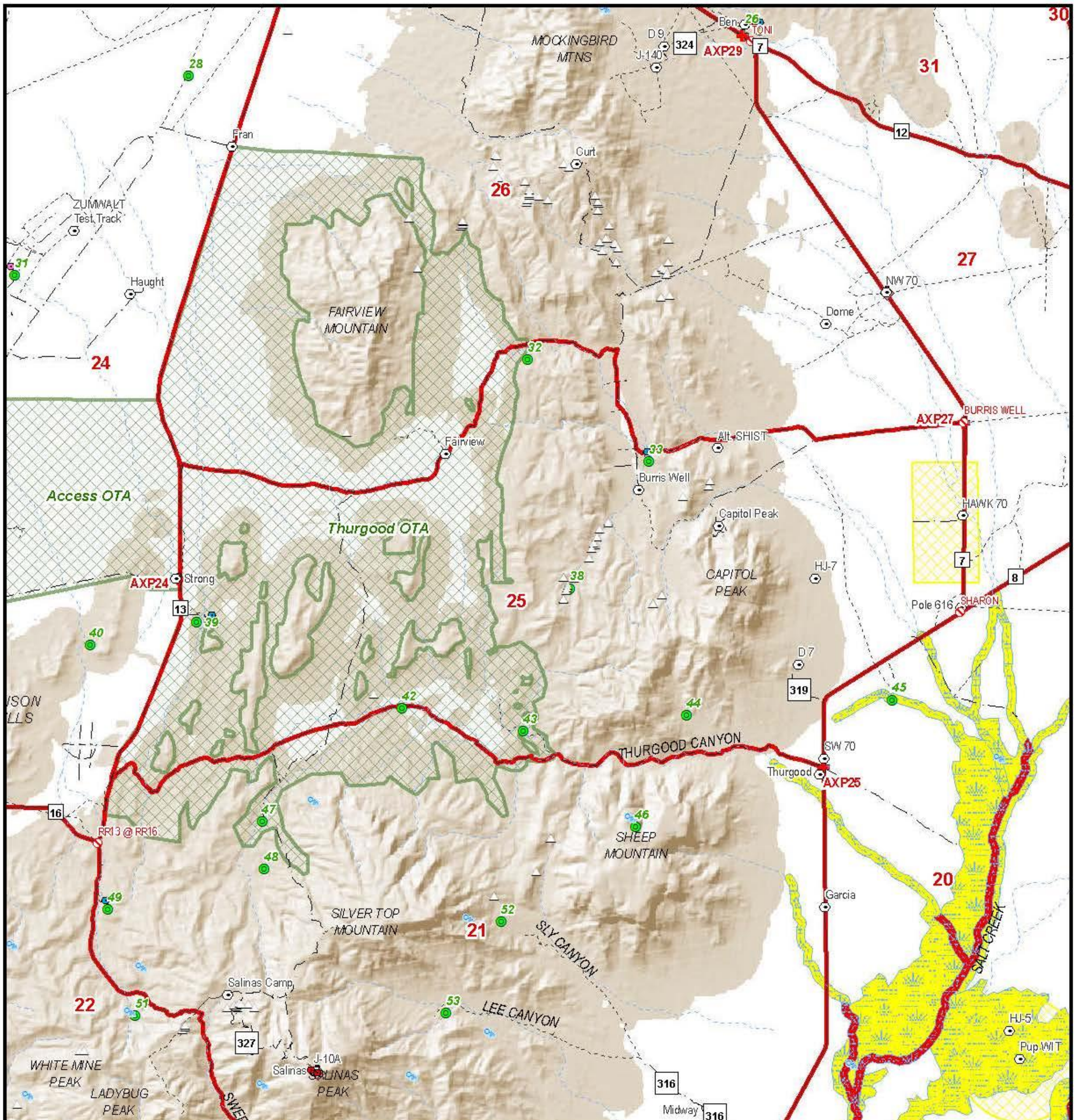
Inspection of historic sites needs to occur in the fall or early winter. Dried tumbleweeds can collect against structures and fences within FMU 25. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Fire break roads around the perimeter of FMU 25 in Thurgood Canyon and in Burris Valley need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires that are readily accessible by engines and firefighters should be suppressed immediately in FMU 25 as wildfires can spread in the grasslands and mountains if environmental conditions are right. The firebreak roads surrounding FMU 25 are good for blacklining from. Wildfires that start in the mountains of FMU 25 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 25 to a few rough, rocky roads that are often one way in and one way out. In these instances, the IC should consider using aerial assets if improvements are threatened. If improvements are not threatened and road access is poor or non-existent, then the IC, in coordination with FES leadership and DPWE, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal protection duties. The WSMR GC, WFPM and DPWE resource professionals and GIS Specialist should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

Engine fill water for FMU 25 is available at Burris Well and at Martin Well.



WHITE SANDS MISSILE RANGE

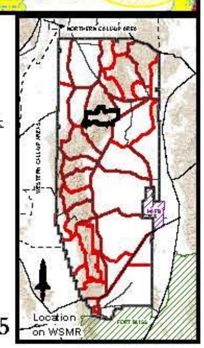
FMU 25 ~ Capitol Peak
34,966.2 Acres

7/9/2020

1 inch = 10,579 feet

0 0.5 1
Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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FMU 26 Mockingbird 50,473 Acres

Physical Characteristics

FMU 26 is bordered on the east by Range Road 7 from the dirt road in Burris Valley north to Range Road 26 intersection just west of Mockingbird Gap. The north boundary of FMU 26 is Range Road 26 from Range Road 7 west to Range Road 13 intersection. The west boundary of FMU 26 is Range Road 13 from its intersection with Range 26 south to its intersection with the dirt road that accesses the Fairview Gunnery Range. The south boundary of FMU 26 is the dirt road that accesses Fairview Gunnery Range from Range Road 13 east past the gunnery range and into Burris Valley, past Burris Well and Alt Schist site to Range Road 7.

Fuels in FMU 26 range from typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia to prolific black grama grasslands around the bases of the Mockingbird Mountains to woodlands on the north faces of the Mockingbird Mountains. Woodland vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs on the desert and include galleta, dropseed spp., muhly spp., sacaton spp. in draws and grama spp., three-awn spp. and bluestem spp. on mountain slopes. Topography ranges from gently sloping at Range Road 7 to the steep canyons, slopes and peaks of the Mockingbird Mountains. Much of FMU 26 is remote and roadless. There are few roads within the FMU firebreak road boundaries.

Infrastructure/Assets to be protected

FMU 26 contains prehistoric cultural sites. There are no identified historic cultural sites in FMU 26.

There are military facilities located near Range Road 7 on the bajadas below the Mockingbird Mountains. These facilities are protected from wildfires as they have been cleared around and the desert fuels here are not prone to wildfire spread. There are military and civilian facilities at Curt site atop the Mockingbird Mountains. This site is vulnerable to wildfire damage.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The southeastern portion of FMU 26 near Range Road 7 is a creosote bajada and not conducive to large wildfire spread. The Mockingbird Gap area is a relatively intact black grama dominated grassland and is conducive to wildfire spread. Fire history shows that these grasslands surrounding the bases of the Mockingbird Mountains are prone to wildfires and can spread into the mountains. The central portions of FMU 26 are the Mockingbird Mountains. The terrain here is steep and rocky with flashy grass fuels being the main carrier of wildfire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 26.

Pre Fire Season Fuels Management Actions

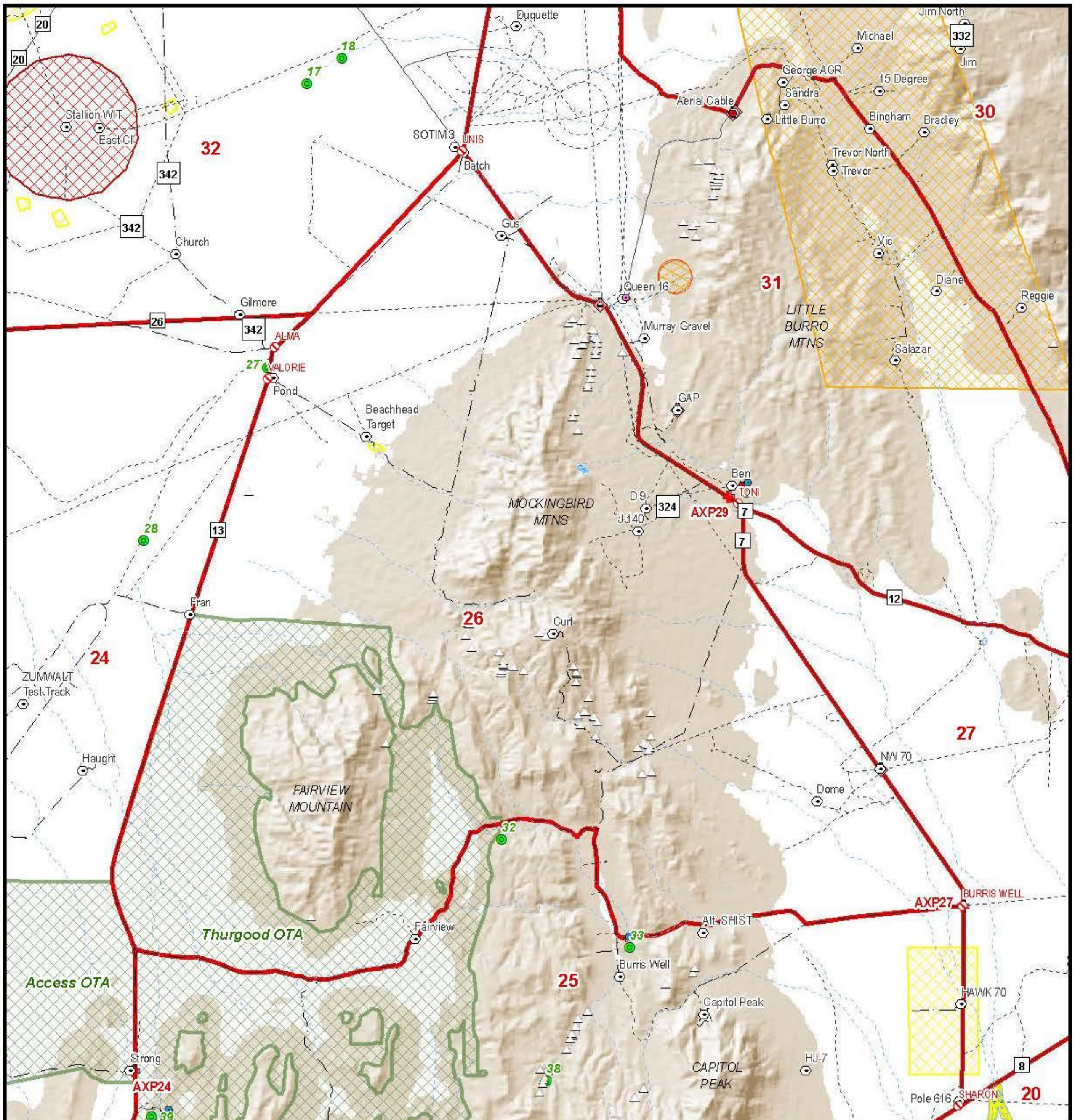
There are no cultural sites in FMU 26 that need treating. The military and civilian sites in FMU 26 are not at wildfire risk except for Curt Site atop the Mockingbird Mountains. Fuel accumulations near the structures at Curt Site should be inspected and removed as necessary. Fire break roads around the perimeter of FMU 26 need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires that are readily accessible by engines and firefighters should be suppressed immediately in FMU 26 as wildfires can spread in the grasslands and mountains if environmental conditions are right. The firebreak roads surrounding FMU 26 can be used for blacklining from. Wildfires that start in the mountains of FMU 26 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 26 to a few rough, rocky roads that are mostly one way in and one way out. If improvements are not threatened and road access is poor or non-existent, then the IC, in coordination with FES leadership and PWE-CN, will fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal protection duties. The WSMR GC, WFPM and PWE resource professionals should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

Engine fill water for FMU 26 is available at Ben Site, Ben Site Well, Murray Well and Burris Well.



WHITE SANDS MISSILE RANGE

FMU 26 ~ Mockingbird

50,473.4 Acres

7/9/2020

1 inch = 10,008 feet

0 0.5 1

Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland

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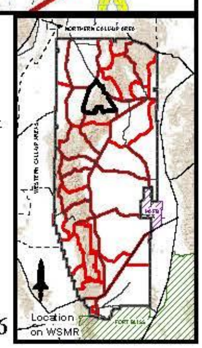


FMU 27 Red Hill 27,415 Acres

Physical Characteristics

FMU 27 is triangular shaped. The north boundary is Range Road 12 west from its intersection with Range Road 8 near the Oscura Range Center to its intersection with Range Road 7 near Gap site in Mockingbird Gap. The west boundary of FMU 27 is Range Road 7 south from its intersection with Range Road 12 to its intersection with Range Road 8 at Sharon Block. The south boundary is Range Road 8 from Sharon Block northeast to its intersection with Range Road 12 near the Oscura Range Center.

Vegetation in FMU 27 is typical of the Tularosa Basin and the Chihuahuan Desert consisting of creosote, four-wing saltbush, mesquite, yucca, broom snakeweed and desert grasses primarily alkali and giant sacaton, tobosa, black grama and sand dropseed. Terrain is gently rolling to hilly at Red Hill to flat in the southern portion of FMU 27.

Infrastructure/Assets to be protected

FMU 27 contains no historic cultural sites.

There are a few launch sites and impact areas. All are located in desert fuels and are not prone to damage by wildfire. Impact areas are off limits to firefighters.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are some low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, but due to the surrounding desert there is not the fuel continuity to spread wildfires very far.

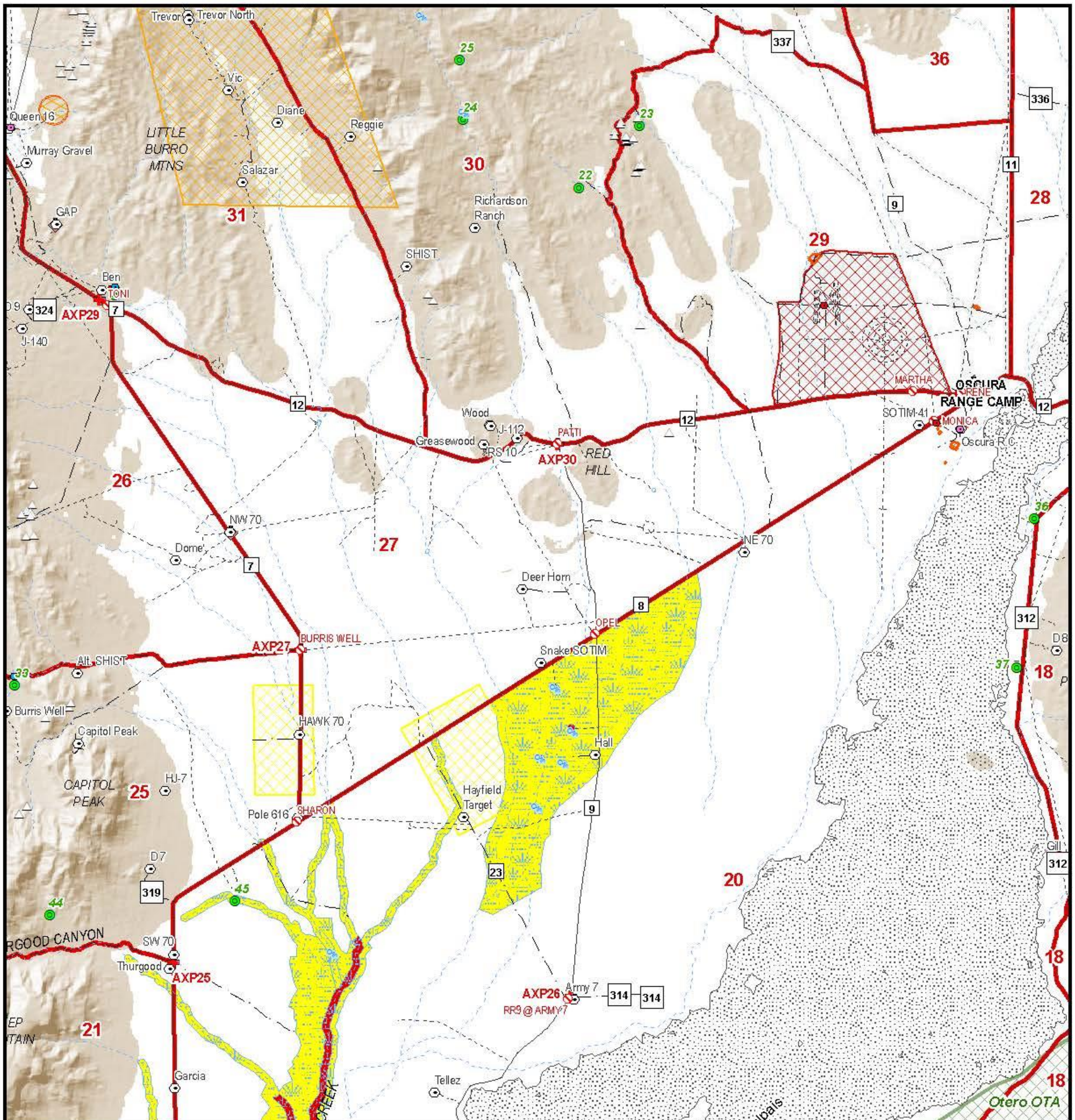
Pre Fire Season Fuels Management Actions

There are no concerns from wildfires for WSMR facilities located in FMU 27. It is possible for dried tumbleweeds to collect against structures and fences within FMU 127. These areas should be inspected annually and kept clean as needed by crushing or scattering or burning built up fuels.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Provide point protection around facilities if wildfires are nearby. Firefighters should stay on roads throughout FMU 27 and suppress wildfires from these defensible positions.

Engine water fill sites for FMU 27 include Ben Site and Oscura Range Center.



WHITE SANDS MISSILE RANGE

FMU 27 ~ Red Hill

27,414.6 Acres

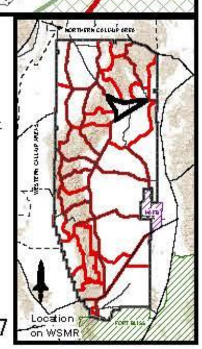
7/9/2020

1 inch = 11,668 feet

0 0.5 1

Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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FMU 28 Red Canyon 27,795 Acres

Physical Characteristics
FMU 28 eastern boundary is the WSMR eastern administrative boundary from Range Road 12 at the Oscura Gate north to the WSMR boundary northeast corner at Highway 380. The north boundary of FMU 28 is very short and runs west from the corner of WSMR to the Red Canyon gate at Silver Block and Range Road 11 intersection. The west boundary of FMU 28 is Range Road 11 from Highway 380 south to its intersection with Range Road 12. The south boundary is Range Road 12 east from Range Road 11 intersection to the Oscura Gate at the WSMR east boundary.

Vegetation in FMU 28 is typical Chihuahuan Desert consisting of creosote, four-wing saltbush, mesquite, yucca, broom snakeweed and desert grasses including black grama, galleta, muhly, sacaton and dropseed spp. Terrain is gently rolling to hilly. The Carrizozo Lava Flow passes through the southern portion of FMU 28 and is a barrier to wildfire spread. Low-lying areas near the lava flow contain abundant grasses and when cured can spread wildfire within the confines of the small basins but cannot spread into the bajadas or uplands due to lack of fuel continuity. The low hills in the northern portion of FMU 28 can have enough grass fuels, in years following good monsoon moisture, to spread wildfires.

Infrastructure/Assets to be protected
FMU 28 contains several cultural sites related to ranching and cold-war era military structures in the vicinity of the Red Canyon Range Camp. Ranch sites include:

(#21 on map) 7X7 Ranch consists of five standing structures and wooden corrals and is at **moderate risk** of burning in a wildfire due to construction materials and proximity to burnable fuels. Located at 13S **395,620E by 3,713,100N**.
(#35) Lowden Ranch II consists of standing wooden structures that are at **moderate risk** of burning in a wildfire. Located at 13S **395,390E by 3,707,770N**.

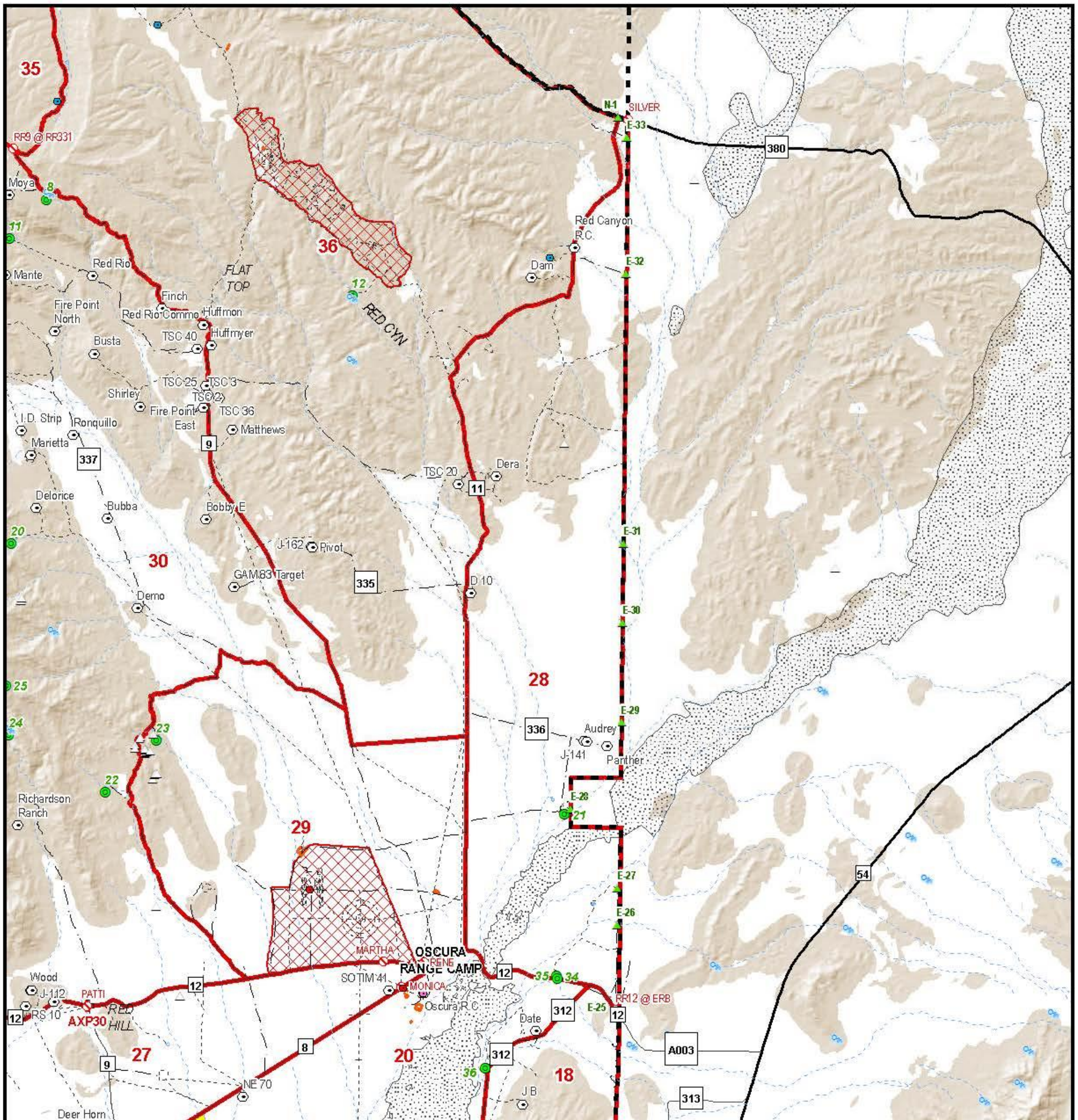
Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs and wildfires can spread here, as well as in the low-lying hills in the northern part of FMU 28.

Pre Fire Season Fuels Management Actions
It is possible for dried tumbleweeds to collect against structures and fences within FMU 28. These areas should be inspected annually and kept clean as needed by crushing or scattering or burning built up fuels. The road along the WSMR boundary fence and Range Road 11 are designated firebreak roads and should be maintained yearly once in the fall after the monsoon season ends.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Provide point protection around facilities if wildfires are nearby. Firefighters should stay on roads throughout FMU 28 and suppress wildfires from these defensible positions.

There is engine fill water available at Red Canyon well in a side canyon just west of the old Red Canyon Range Camp site in FMU 36.



WHITE SANDS MISSILE RANGE

FMU 28 ~ Red Canyon
27,795.5 Acres

7/9/2020

1 inch = 14,015 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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FMU 29 Oscura Range 20,890 Acres

Physical Characteristics

FMU 29 eastern boundary is Range Road 11 from its intersection with Range Road 12 north 7 Km. (4.33 mi.) to an intersection of a dirt road from the west (UTM Coordinate 13S 392452E 3715639N). The north boundary of FMU 29 is that dirt road west from Range Road 11 to Range Road 9 intersection. The west boundary of FMU 29 is Range Road 9 north from that dirt road intersection ¾ of a mile to Range Road 337 intersection, then west along Range Road 337 for two miles to an intersection with another dirt road that heads south (UTM coordinate 13S 384483E 3718419N), then south, then southwest on this dirt road past the turnoff to Estey City, through low hills covered with mining tailings, then south following a canyon bottom to Range Road 12. The south boundary of FMU 29 is Range Road 12 east from this dirt road (UTM coordinate 13S 385330E 3707777N) to its intersection with Range Road 11.

Vegetation in FMU 29 is typical Chihuahuan Desert consisting of creosote, four-wing saltbush, mesquite, littleleaf sumac, yucca, broom snakeweed and desert grasses including black grama, tobosa, muhly, sacaton and dropseed spp. Terrain is mostly flat with gently rolling to hilly in the west half of FMU 29. Low-lying areas and arroyo bottoms contain abundant grasses and when cured can spread wildfire within the confines of the small basins or arroyos but cannot spread into the bajadas or uplands due to lack of fuel continuity. The hills in the northwest portion of FMU 29 can have enough grass fuels, in years following good monsoon moisture, to spread wildfires.

Infrastructure/Assets to be protected

FMU 29 contains cultural sites related to early ranching and mining:

(#23 on map) Estey City consists of multiple stone structures, many dilapidated, and others partially standing. They are **not at risk** of burning in a wildfire due to their construction materials and lack of surrounding burnable fuels. Located at UTM coordinates 13S **382,400E by 3,715,500N.**

There are military assets in FMU 29 in the way of structures, targets, telemetry and infrastructure, particularly in the vicinity of Oscura Range Center. These sites are at low risk of damage from wildfires.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. There are low-lying pockets of cured annual and perennial grasses, shrubs and forbs which are areas where wildfires can spread but not grow large to lack of continuous fuels outside these areas. The low-lying hills in the northern and western part of FMU 29 may, during years following a strong monsoon season, have enough fuel to spread wildfires.

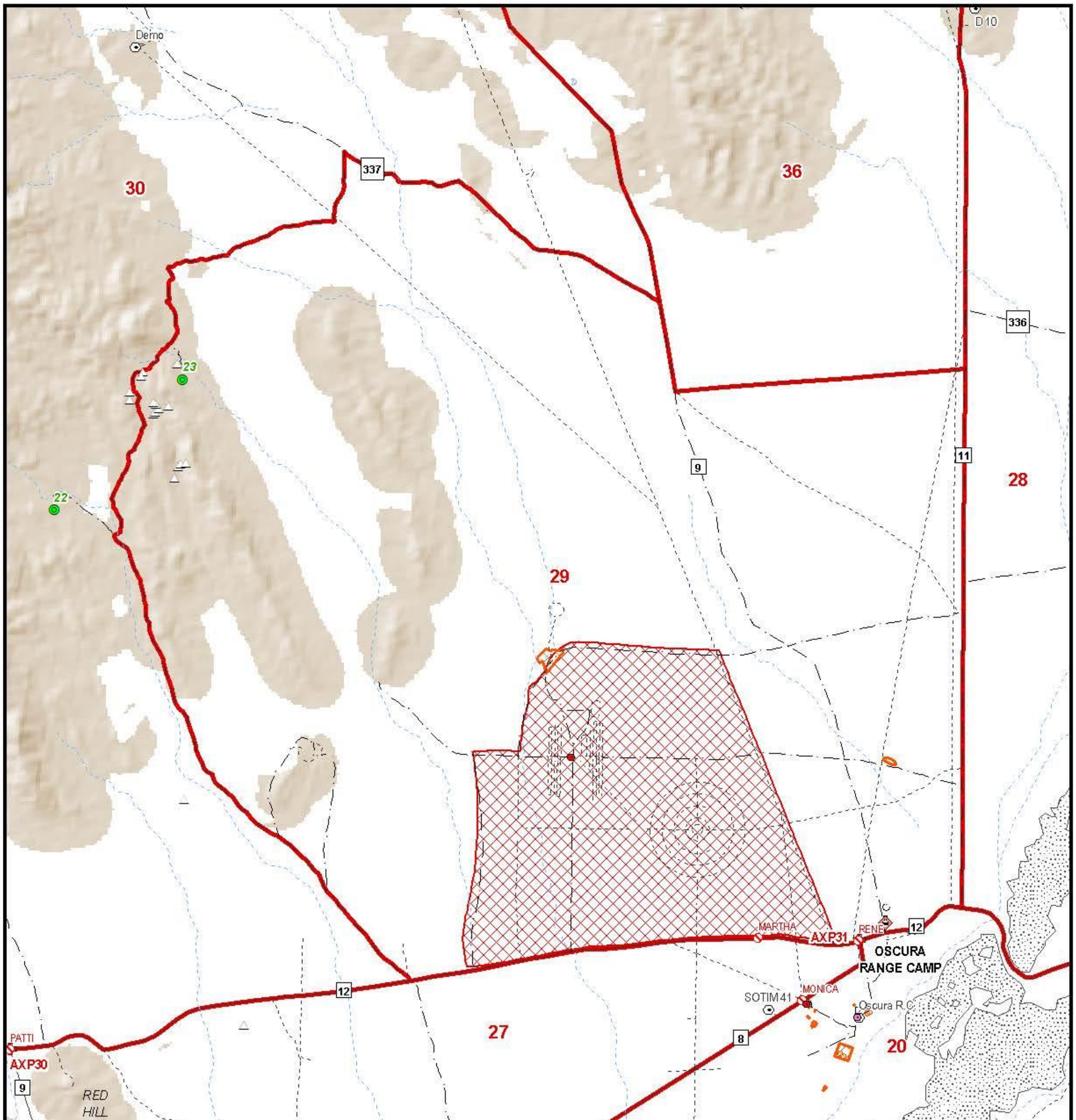
Pre Fire Season Fuels Management Actions

It is possible for dried tumbleweeds to collect against structures and fences within FMU 29. These areas should be inspected annually and kept clean as needed by crushing or scattering or burning built up fuels. Range Road 9, 11, 12, 337 and the road from 337 south to Range Road 12 are designated firebreak roads and should be maintained yearly, once in the fall after the monsoon season ends.

Wildfire Management

Allow wildfires off the road system to burn out and die on their own. Provide point protection around facilities if wildfires are nearby. Firefighters should stay on roads throughout FMU 29 and suppress wildfires from these defensible positions. The Oscura Bombing Range is off-limits to WSMR firefighters. Holloman AFB maintains a contract for providing fire protection at Oscura Bombing Range Center which includes firefighters, a Type 3 engine and a water tender. These assets are available to WSMR for wildfires in the vicinity of Oscura Range. Contact Gary Atwell (575 572-5074), Deputy Range Manager or Holloman ROC at 575 572-5716 for the availability of these assets.

There is engine fill water for FMU 29 available at Oscura Range Camp and at the Oscura Bombing Range Center.



WHITE SANDS MISSILE RANGE

FMU 29 ~ Oscura Range
20,890 Acres

7/9/2020

1 inch = 5,556 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
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UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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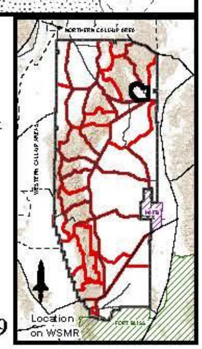


FMU 30 Oscura Mountains South 81,705 Acres

Physical Characteristics

FMU 30 is bordered on the east by Range Road 9 from its intersection with Range Road 337 north to its intersection with Range Road 331 near the Selso Martinez dirt tank. The north boundary of FMU 30 is Range Road 331 from Range Road 9 west to the edge of the Oscura Mountains escarpment just south of Bug Peak, then on an unmarked boundary for FMU 30 down Trail Canyon west to a point where the canyon bottom meets a two-track road, then west on that two-track road to its intersection with Range Road 3610. The west boundary of FMU 30 is Range Road 3610 from its intersection with the two-track road south to its intersection with Range Road 341, then west and then south on Range Road 341 to McDonald Ranch, then southeast from McDonald Ranch to a two-track dirt road that runs due south, then down this dirt road south to an intersection of dirt roads just north of Murry tank, then east on a two-track road past Murry tank to a powerline road, then east on the powerline road to Aerial Cable Site, then northeast on a maintained road to the Aerial Cable Road, then southeast on Aerial Cable Road to Range Road 12. The south boundary of FMU 30 is Range Road 12 east from Aerial Cable Range Road to the dirt road that accesses Estey City site, then northwest on that dirt road past Estey City turnoff to its intersection with Range Road 337, then east on Range Road 337 to its intersection with Range Road 9.

Fuels in FMU 30 range from typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia to prolific grama grasslands around the bases of the Oscura Mountains, to piñon-juniper woodlands on east-facing slope of the Oscura Mountains. Woodland vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol and sacahuista. Perennial grasses are intermixed with shrubs on the desert and include tobosa, dropseeds, muhly spp., sacaton in draws and gramas, three-awns, rice grass and bluestems on mountain slopes. Topography ranges from gently sloping at Range Road 12 to the steep canyons, slopes and escarpment of the Oscura Mountains. Much of FMU 30 is in the mountains and is remote and roadless.

Infrastructure/Assets to be protected

FMU 30 contains l historic cultural sites:

(#8 on map) Moya Cabin consists of a fallen stone house with intact wood flooring and is at a **moderate risk** of burning in a wildfire due to its construction materials and the proximity of surrounding burnable fuels. Located at UTM coordinates 13S **378,860E by 3,733,020N.**
(#9) Trail Canyon consists of a dilapidated rock structure that is **not at risk** of burning in a wildfire due to construction materials. Located at UTM coordinates 13S **371,500E by 3,732,500N.**
(#11) Probable Line Camp/Ranch at Yates Tank consists of wooden standing shack and fallen wooden structure and is at **high risk** of burning in a wildfire. Located at UTM coordinates 13S **377,645E by 3,731,743N**.
(#13) Helms Line Camp/Dripping Springs Shack consists of a standing wooden and stone single room cabin and is at **high risk** of burning in a wildfire. Located at UTM coordinates 13S **375,718E by 3,727,483N.**

(#14) Dillard Whitmore Well consists of a stone water tank, stone foundation and scattered wooden debris and is at **moderate risk** of burning in a wildfire due to surrounding grass and brush fuels and the fact the site is not accessible by road. Located at UTM coordinates 13S **376,260E** by **3,725,000N.**
(#15) Schmidt/McDonald Ranch consists of a restored wooden and stone ranch house and outbuildings and is at **low risk** of burning in a wildfire. Located at UTM coordinates 13S **364,585E by 3,724,385N.**
(#19) Chimney del Puerto consists of a standing rock chimney and is **not at risk** of burning in a wildfire. Located at UTM coordinates 13S **377,200E by 3,721,500N.**
(#20) Del Cuerto Spring consists of dilapidated structures and is at **low risk** of burning in a wildfire due to lack of burnable material at the site. Located at UTM coordinates 13S **377,700E by 3,721,860N.**
(#22) Scholle Well consists of a fallen wood structure and is at **low risk** of burning in a wildfire due to discontinuous fuels in the area. Located at UTM coordinates 13S **380,750E by 3,713,820N.**
(#24) Kidd and Duffy Spring consists of a fallen wooden structure and is at **low risk** of burning in a wildfire due to low and discontinuous fuels. Located at UTM coordinates 13S **377,640E by 3,715,660N.**
(#25) Wood's Tank consists of a fallen rock house with wooden windows and door frames and is at **low risk** of burning in a wildfire due to its construction materials and low fuel load. Located at UTM coordinates 13S **377,528E by 3,664,380N.**

There are military facilities located near Range Road 12, at the Aerial Cable Range at Jim Peak, and atop S. Oscuro Peak. These facilities are protected from most wildfires as they have been cleared around. A severe wildfire could harm the facilities atop S. Oscuro and Jim Peak.

Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The southern portion of FMU 30 near Range Road 12 is a creosote bajada and not conducive to large wildfire spread. The Aerial Cable Range area is good grasslands and is conducive to wildfire spread. Fire history shows that these grasslands are prone to wildfires and can spread into the mountains. The central portions of FMU 30 are the Oscura Mountains. Wildfires have become large in these mountains. The terrain here is steep and rocky with flashy grass fuels being the main carrier of wildfire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 30.

Pre Fire Season Fuels Management Actions
There are cultural sites in FMU 30 that need pre-season fuel reduction actions. Helm's Ranch needs clearing around and other sites in FMU 30 have accumulations of tumbleweeds and other brush against structures or fences. The military and civilian sites in FMU 30 are not at wildfire risk except for Jim Site atop the Oscura Mountains. Fuel accumulations near the structures at Jim Site should be inspected and removed as necessary, probably not more than once every 3 years. Fire break roads around the perimeter of FMU 30 need to be maintained yearly, once in the fall after monsoon season.

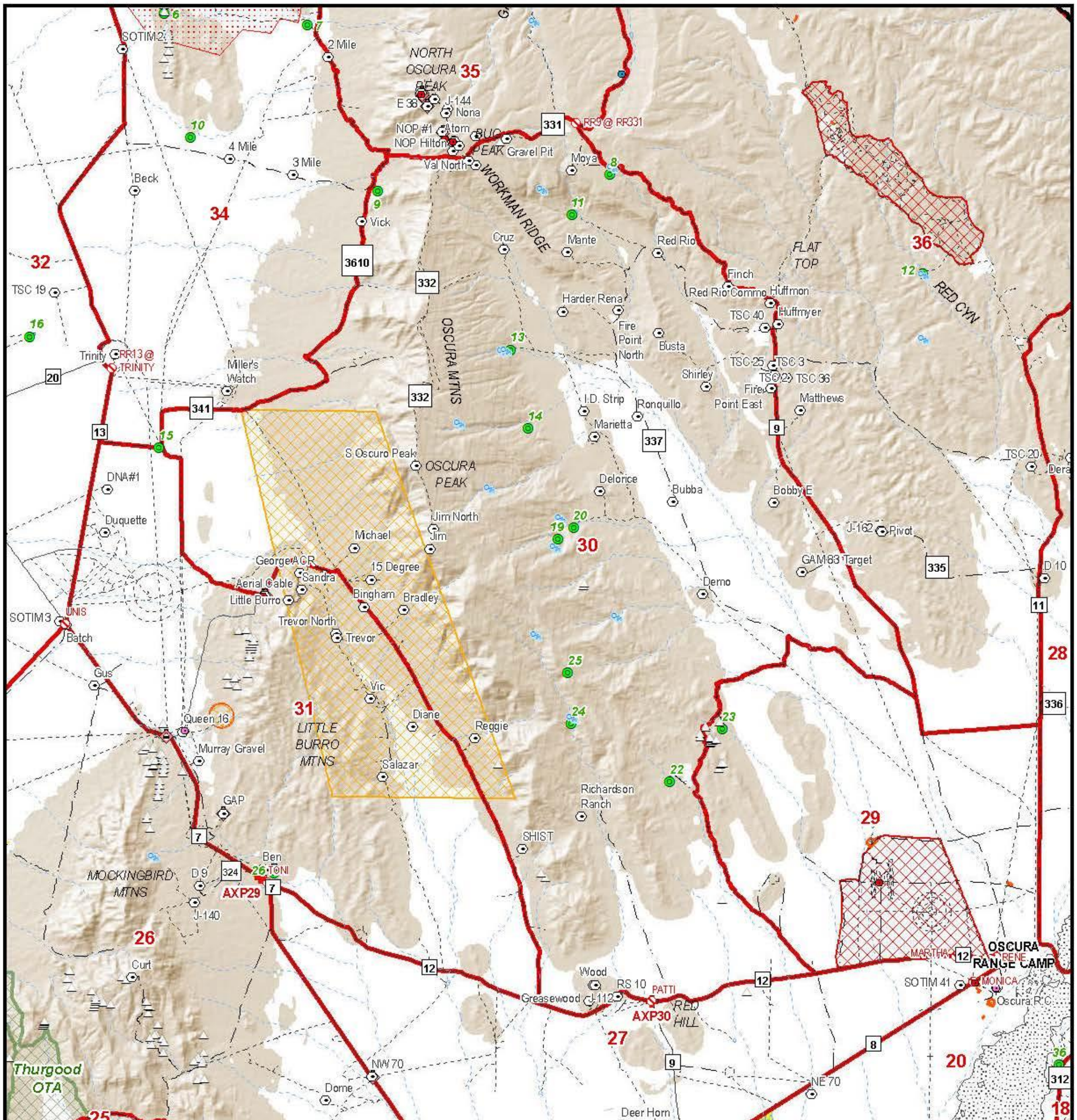
Wildfire Management
Wildfires that are readily accessible by engines and firefighters should be suppressed immediately in FMU 30 as wildfires can spread in the grasslands and mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 30 should not be attacked by ground troops unless the

access is good from nearby roads. Escape routes are limited in FMU 30 to a few rough, rocky roads that are mostly one way in and one way out. If improvements are not threatened and road access is poor or non-existent, then the IC, in coordination with FES leadership and DPWE, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal protection duties. The WSMR GC, WFPM and DPWE resource professionals should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

If the decision is made that the wildfire needs to be suppressed rather than allowed to burn, then a Type 3 Incident Management Team may need to be ordered through Alamogordo Dispatch Center (ADC). Options can be discussed with the ADC Center Manager. Aerial assets may need to be ordered which may include retardant aircraft, helicopters, smokejumpers or helitack which could also trigger the order for use of a fixed-wing air attack platform to help guide these aircraft and provide eyes in the sky for ground firefighters.

There are no reliable water fill sites for engines within FMU 30. There are dirt tanks that may hold water for engine fill during parts of the year.



WHITE SANDS MISSILE RANGE

FMU 30 ~ Oscura Mountains South
81,704.6 Acres

7/9/2020

1 inch = 13,679 feet

0 0.5 1
Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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FMU 31 Little Burro Mountains 29,699 Acres

Physical Characteristics

FMU 31 is bordered on the east by The Aerial Cable Range Road from Range Road 12 north to just past and north of the Aerial Cable crossing where the Aerial Cable Range Road bends sharply west. The north boundary of FMU 31 is Aerial Cable Range Road west through a low saddle between hills then south along the west side of the Little Burro Mountains to Aerial Cable site, then west at Aerial Cable site along a pole line road to Murry Tank, then northwest from Murry Tank on a dirt road to an intersection of dirt roads, then due north on a dirt road to McDonald Ranch at Range Road 341, then west on Range Road 341 to the Range Road 13 intersection. The west boundary of FMU 31 is Range Road 13 south from Range Road 341 intersection to Range Road 7 intersection at Unis Block. The south boundary of FMU 31 is Range Road 7 from Unis Block southeast to its intersection with Range Road 12 at Toni Block, then southeast on Range Road 12 to its intersection with the Aerial Cable Range Road.

Fuels in FMU 31 range from typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia to prolific grama grasslands in Mockingbird and Oscura Gaps and on Stallion Range to shrublands on the Little Burro Mountains. Shrubland vegetation includes mountain mahogany, ceanothus, sotol, sumac and sacahuista. Perennial grasses are intermixed with shrubs and include galleta, dropseed spp., muhly spp., sacaton spp. in draws and grama spp., three-awn spp. and bluestem spp. on mountain slopes. Topography ranges from gently sloping at Range Road 7 to moderately steep hills of the Little Burro Mountains. Much of FMU 31 is remote and roadless. There is one major road that parallels the Aerial Cable Range Road to the west and follows the bottom of the basin and accesses various military facilities along its route.

Infrastructure/Assets to be protected

FMU 31 contains one historic cultural site:

(#26 on map) Mockingbird Ranch; Tom McDonald Ranch; Ben Site consists of dilapidated wooden structures and is at **low risk** of burning in a wildfire due to discontinuous fuels in the area. Located at UTM coordinates 13S **368,220E by 3,710,920N.**

There are military facilities located near Range Road 7 in Mockingbird Gap and around the Aerial Cable Range. These facilities are protected from wildfires as they have been cleared around but adjacent fuels are prone to wildfire spread. There are military and civilian facilities on the Aerial Cable Range and atop Little Burro Mountain. These sites and their associated infrastructure (powerlines) are vulnerable to wildfire damage.

Risk to Firefighters

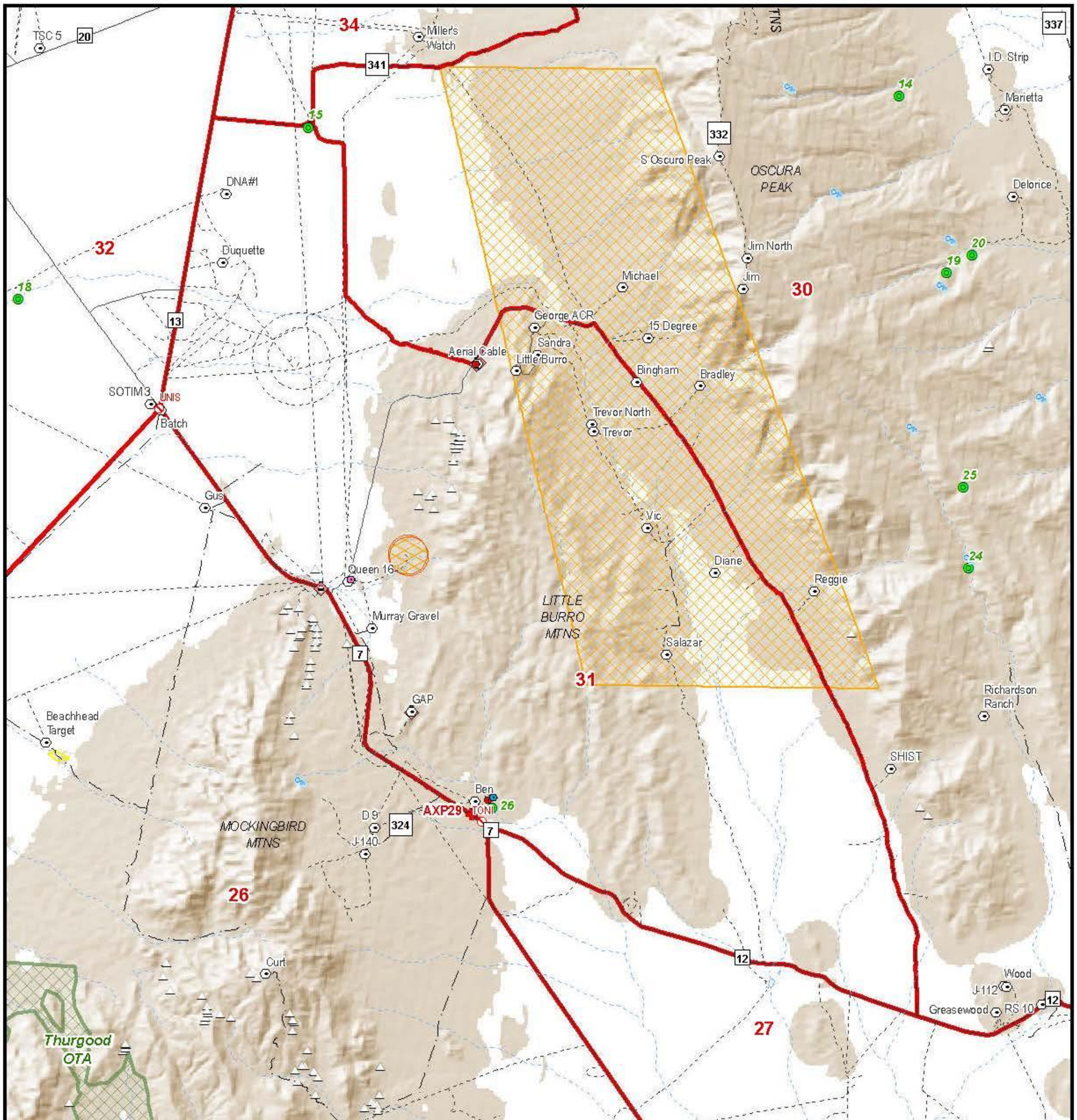
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. The southwestern portion of FMU 31 near Range Road 7 and Mockingbird Gap is a relatively intact black grama dominated grassland and is conducive to wildfire spread. Fire history shows that these grasslands surrounding the bases of the Little Burro Mountains are prone to wildfires that can spread. The terrain here is steep and rocky with flashy grass fuels being the main carrier of wildfire. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 31.

Pre Fire Season Fuels Management Actions
The McDonald Ranch house is a well-preserved cultural site in FMU 31 that needs pre-season inspecting for tumbleweed accumulations against structures and fences which could lead to fuel reduction actions of scattering, crushing or burning tumbleweeds. The military and civilian sites in FMU 31 are not at great wildfire risk but should be inspected annually for brush fuel accumulations. The fire break road from Aerial Cable site along the power line to Murry Tank and then north to McDonald Ranch needs to be maintained yearly, once in the fall after monsoon season.

Wildfire Management
Wildfires that are readily accessible by engines and firefighters should be suppressed immediately in FMU 31 as wildfires can spread in the grasslands and mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 31 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 31 to a few roads. Provide point protection around the facilities in FMU 31. If improvements are not threatened and road access is poor or non-existent, then the IC, in coordination with FES leadership and PWE-CN, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

At this point, monitoring of the wildfires progress can be made by other WSMR employees so FES firefighters are freed up to continue normal protection duties. The WSMR GC, WFPM and PWE resource professionals should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

In FMU 31, engine water fill locations are at Ben site, Murray Well and Aerial Cable site.



WHITE SANDS MISSILE RANGE

FMU 31 ~ Little Burro Mountains

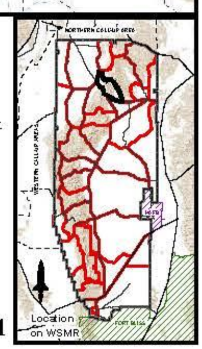
29,699.4 Acres

7/9/2020

1 inch = 8,554 feet

0 0.5 1
Miles

FMU Boundary	WSMR Boundary/Call-Up Area	Mine
WSMR Boundary	Quantity Distance Arcs	Gate
Construction Well	Solid Waste Management Unit	Streams
Hauled Water Tank	Maximum Outline of SDZ	Propane Tank
Water Truck Filling	UXO Cat 1 - Escort Reqd.	Spring
Wildlife Water Tank	UXO Cat 2 - Access Limited	Wetland
AXP	UXO Cat 3 - Special UXO Brief Reqd.	
Military Site	UXO Cat 4 - No Restrictions	
Fueling Station	Pupfish Essential Habitat	
Roadblock	Pupfish Limited Habitat	
Ranch\Structure	Operational Test Area	



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FMU 32 Stallion WIT 124,312 Acres

Physical Characteristics

FMU 32 is bordered on the east by Range Road 13 from its intersection with Range Road 26 north to Range Road 24 intersection at Frances Block, then north from Frances Block on Range Road 3621 to the north administrative boundary of WSMR. The north boundary of FMU 32 is the firebreak road along the administrative boundary of WSMR west from Range Road 3621 past Range Road 7 to Range Road 5 intersection. The west boundary of FMU 32 is Range Road 5 from the Stallion Range Center south to its intersection with Range Road 26 at Zerna Block. The south boundary of FMU 32 is Range Road 26 from Zerna Block east to its intersection with Range Road 13.

Fuels in FMU 32 range from desert plains grasslands with vegetation of grama, muhly, dropseed, galleta, three-awn, giant and alkali sacaton and bluestem grasses to typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as little leaf sumac, four-wing saltbush, creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia. Low-lying basins and draw bottoms contain significant littleleaf sumac concentrations that are valuable in terms of wildlife habitat and cover. Topography is generally flat across the entire FMU. There are many roads inside of FMU firebreak road boundaries and road access within FMU 32 is generally good.

Infrastructure/Assets to be protected

FMU 32 contains historic cultural sites:

(#5 on map) Hunter Long Well Ranch consists of fallen wooden structures and is at **moderate risk** of burning in a wildfire due to construction materials and continuous grass fuels in the area. Located at UTM coordinates 13S **353,160E by 3,736,960N.**

(#16) Story Ranch consists of standing wooden structures and is at **moderate risk** of burning in a wildfire due to its construction materials and surrounding fuel loads. Located at UTM coordinates 13S **360,500E by 3,727,900N.**

(#17) Foster Ranch consists of fallen wooden and adobe structures and is **not at risk** of burning in a wildfire due to low burnable fuel loads in the area. Located at UTM coordinates 13S **358,040E by 3,720,380N.**

(#18) Foster Well consists of a wooden windmill stand, wooden corrals and a grave and is at **moderate risk** of burning in a wildfire due to surrounding grass fuel continuity. Located at UTM coordinates 13S **358,840E by 3,720,980N**.

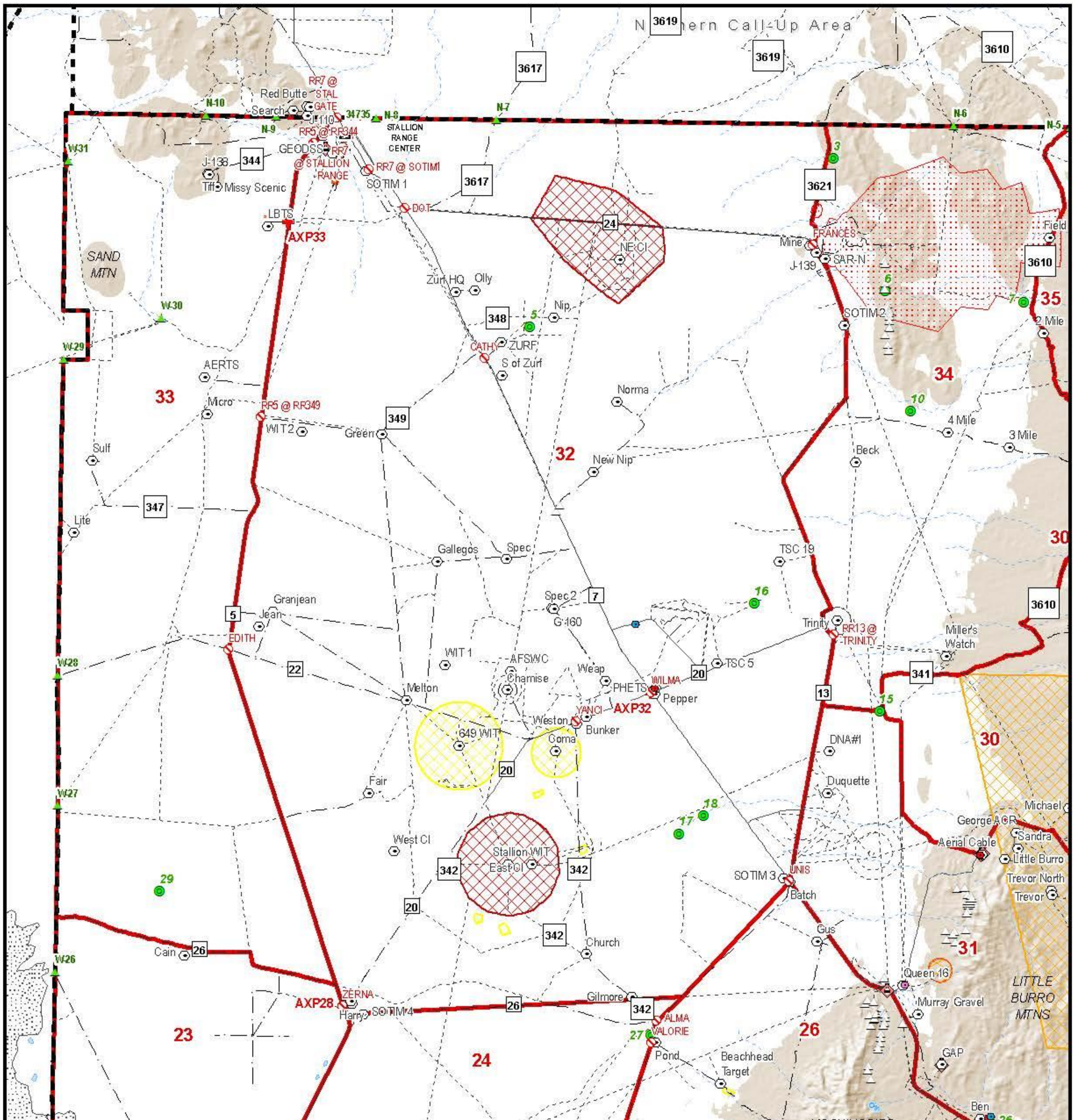
There are numerous military assets in the form of structures, storage facilities, targets, antennae and infrastructure including power lines and roads. The Stallion Range Center is located in the northwest corner of FMU 32 and contains numerous structures/infrastructure. Some of the outlying sites are at risk from wildfires as grass fuels are continuous in some areas. There are clearings to bare ground or asphalt around most structures.

Risk to Firefighters
Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. FMU 32 is mostly grass fuels and conducive to rapid wildfire spread. Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 32.

Pre Fire Season Fuels Management Actions
Inspection of historic and military sites needs to occur in the fall or early winter. Dried tumbleweeds may collect against structures and fences within FMU 32. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Firebreak roads around the perimeter of FMU 32 need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management
Wildfires should be suppressed immediately in FMU 32 as wildfires can spread in these grasslands if environmental conditions are right. There are numerous structures in FMU 32. All of the maintained roads in FMU 32 are good for blacklining from. Wildfires in FMU 32 can be allowed to burn up to defensible barriers and suppressed or blacklined as conditions warrant. Provide point protection at structures as needed.

Engine fill water for FMU 32 is available at Stallion Range Center, NECI well, Greens Baber well and at PHETS/DTRA site.



WHITE SANDS MISSILE RANGE

FMU 32 ~ Stallion WIT

124,311.9 Acres

7/9/2020

1 inch = 14,121 feet

0 0.5 1

Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland

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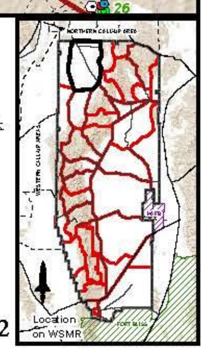


FMU 33 Grandjean 45,955 Acres

Physical Characteristics

FMU 33 is bordered on the east by Range Road 5 from its intersection with Range Road 26 north to the north administrative boundary of WSMR at Stallion Range Center. The north boundary of FMU 33 is the access road to Red Butte, then along the northern administrative boundary of WSMR west from that access road on a scraped bulldozer line through low hills where road access is intermittent. The north boundary is fenced but due to lack of roads is not a barrier to wildfire spread in many places. The north boundary ends at the northwest corner of WSMR. FMU 33 west boundary is the administrative western boundary of WSMR from the NW corner of WSMR south past Sand Mountain, past Range Road 22 to Range Road 26. The south boundary of FMU 33 is Range Road 26 east from the WSMR boundary to its intersection with Range Road 5.

Fuels in FMU 33 range from perennial grasses of grama, muhly, dropseeds, galleta, vine mesquite, three-awns, giant and alkali sacaton and bluestem grasses to Chihuahuan Desert shrubs such as little leaf sumac, four-wing saltbush, creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia. Low-lying basins and draw bottoms contain significant littleleaf sumac concentrations that are valuable in terms of wildlife habitat and cover. Topography is generally flat to gently rolling to a few steep hills on the north end. There are many roads inside of FMU boundaries and road access within FMU 33 is generally good except for the northwest corner.

Infrastructure/Assets to be protected

FMU 33 contains one historic cultural site:

(#29 on map) Cain Well consists of a collapsed wooden structure and is at **moderate risk** of burning in a wildfire due to continuous grass fuels in the area. Located at UTM coordinates 13S **341,050E by 3,718,490N.**

There are military assets in the form of structures, storage facilities, targets, antennae and infrastructure including power lines and roads. The Stallion Range Center is partially located in the northeast corner of FMU 33 and contains numerous structures/infrastructure. Some of the outlying sites are at slight risk from wildfires as grass fuels are continuous to structures in some areas. There are clearings of bare ground or asphalt around most structures.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. FMU 33 is mostly grass fuels and conducive to wildfire spread. Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 33.

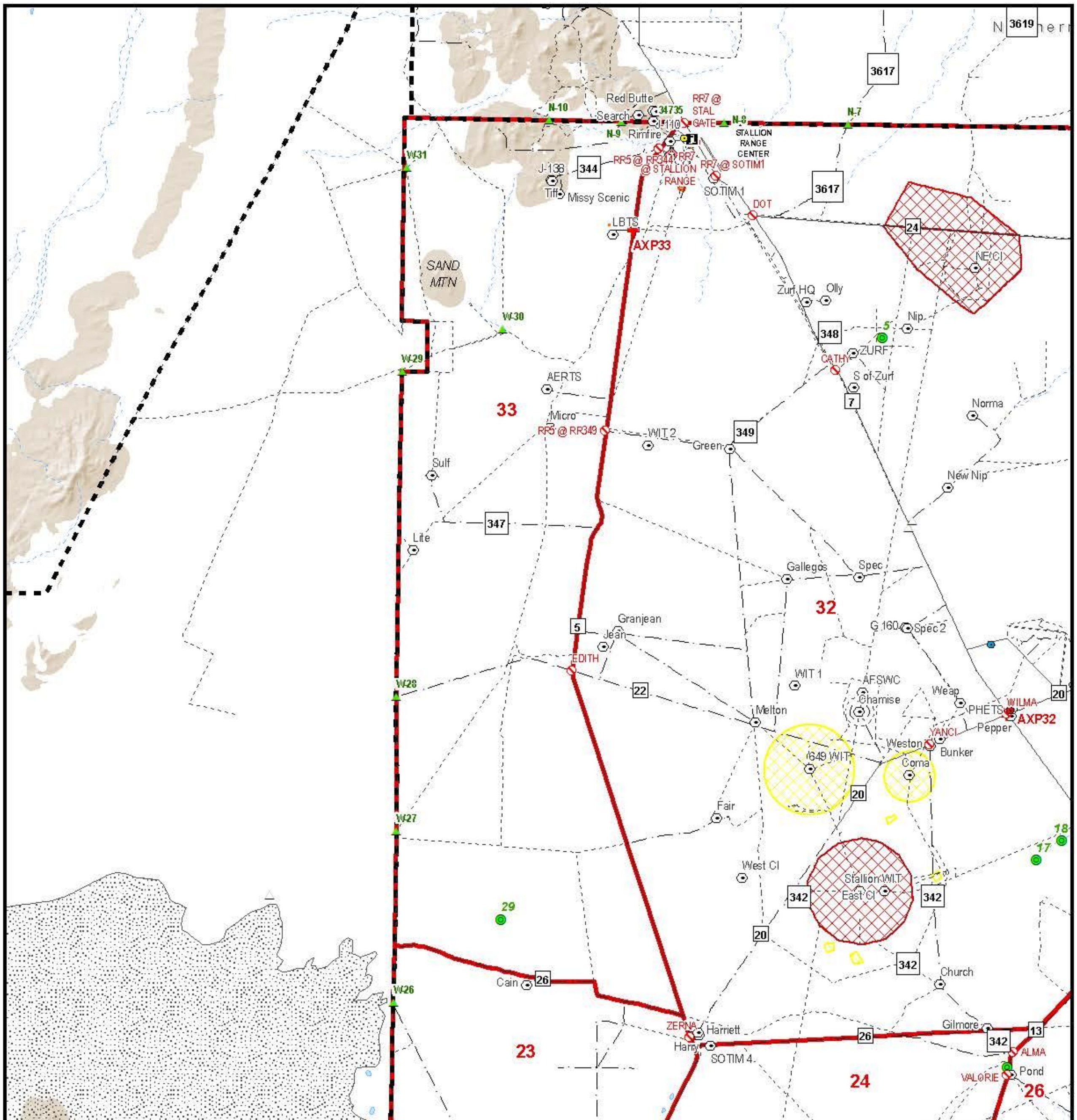
Pre Fire Season Fuels Management Actions

Inspection of historic and military sites needs to occur in the fall or early winter. Dried tumbleweeds may collect against structures and fences within FMU 33. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Firebreak roads around the perimeter of FMU 33 need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 33 as wildfires can spread in these grasslands if environmental conditions are right. There are important military structures in FMU 33. All of the maintained roads in FMU 33 are good for blacklining from. Most wildfires in FMU 33 will die out at barriers due to the nature of the light, flashy fuels found here. Wildfires in FMU 33 can be allowed to burn up to defensible barriers and suppressed or blacklined as conditions warrant. Provide point protection at structures as needed.

Engine fill water for FMU 33 is available at Stallion Range Center.



WHITESANDS MISSILE RANGE

FMU 33 ~ Grandjean

45,955 Acres

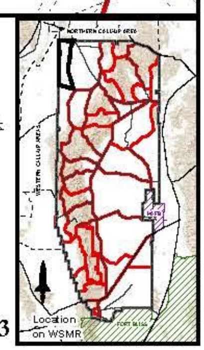
7/9/2020

1 inch = 13,736 feet

0 0.5 1

Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland



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FMU 34 Trinity 34,288 Acres

Physical Characteristics

FMU 34 is bordered on the east by Range Road 3610 from its intersection with Range Road 341 north to its intersection with Range Road 3501, then northeast on Range Road 3501 to the north administrative boundary of WSMR. The north boundary of FMU 34 is the northern administrative boundary of WSMR west from Range Road 3501 to Range Road 3621 intersection. There is a firebreak road that roughly follows the northern boundary from Range Road 3501 to Range Road 3621. The west boundary of FMU 34 is Range Road 3621 from its intersection with the northern boundary of WSMR south to its intersection with Range Road 13 at Frances Block, then south on Range Road 13, past Trinity site to its intersection with Range Road 341. The south boundary of FMU 34 is Range Road 341 from its intersection with Range Road 13 east and north to its intersection with Range Road 3610.

Fuels in FMU 34 range from desert plains grasslands with vegetation of gramas, muhlys, dropseeds, galleta, three-awns, sacaton and bluestem grasses to typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as little leaf sumac, four-wing saltbush, creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia. Topography is flat to gently rolling in the southern portions of FMU 34 to steep-sided hills in the northern portions of FMU 34. There are several maintained roads inside of FMU 34 firebreak road boundaries and road access is generally good.

Infrastructure/Assets to be protected

FMU 34 contains historic sites:

(#3 on map) Coronet Tank consists of a single rock structure and is **not at risk** of burning in a wildfire due to its construction materials. Located at UTM coordinates 13S **363,070E by 3,742,460N.**
(#6) Old Mine Site consists of a standing rock house and is at **low risk** of burning in a wildfire due to construction materials and low fuel load in proximity to structure. Located at UTM coordinates 13S **364,760E by 3,738,120N.**
(#7) Smith Tank consists of a standing cinder block house and is at **low risk** of burning in a wildfire due to its construction materials and low fuel loads in the area. Located at UTM coordinates 13S **369,300E by 3,737,760N.**
(#10) Red Hill House consists of fallen wooden and rock structure and is at **low risk** of burning in a wildfire due to surrounding discontinuous fuel loads. Located at UTM coordinates 13S **365,600E by 3,734,200N.**

There are a few military assets in the form of structures, storage facilities, targets, antennae and infrastructure including power lines and roads. Trinity Historical site is located in FMU 34 and is well-protected from wildfire effects. Some outlying sites are at risk from wildfires as grass fuels are continuous in some areas. There are clearings to bare ground or asphalt around most structures.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, blowing sand and low humidity are here and can contribute to hazardous conditions. FMU 34 is mostly grass fuels and conducive to wildfire spread.

Dehydration, snakes, insects, footing, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 34.

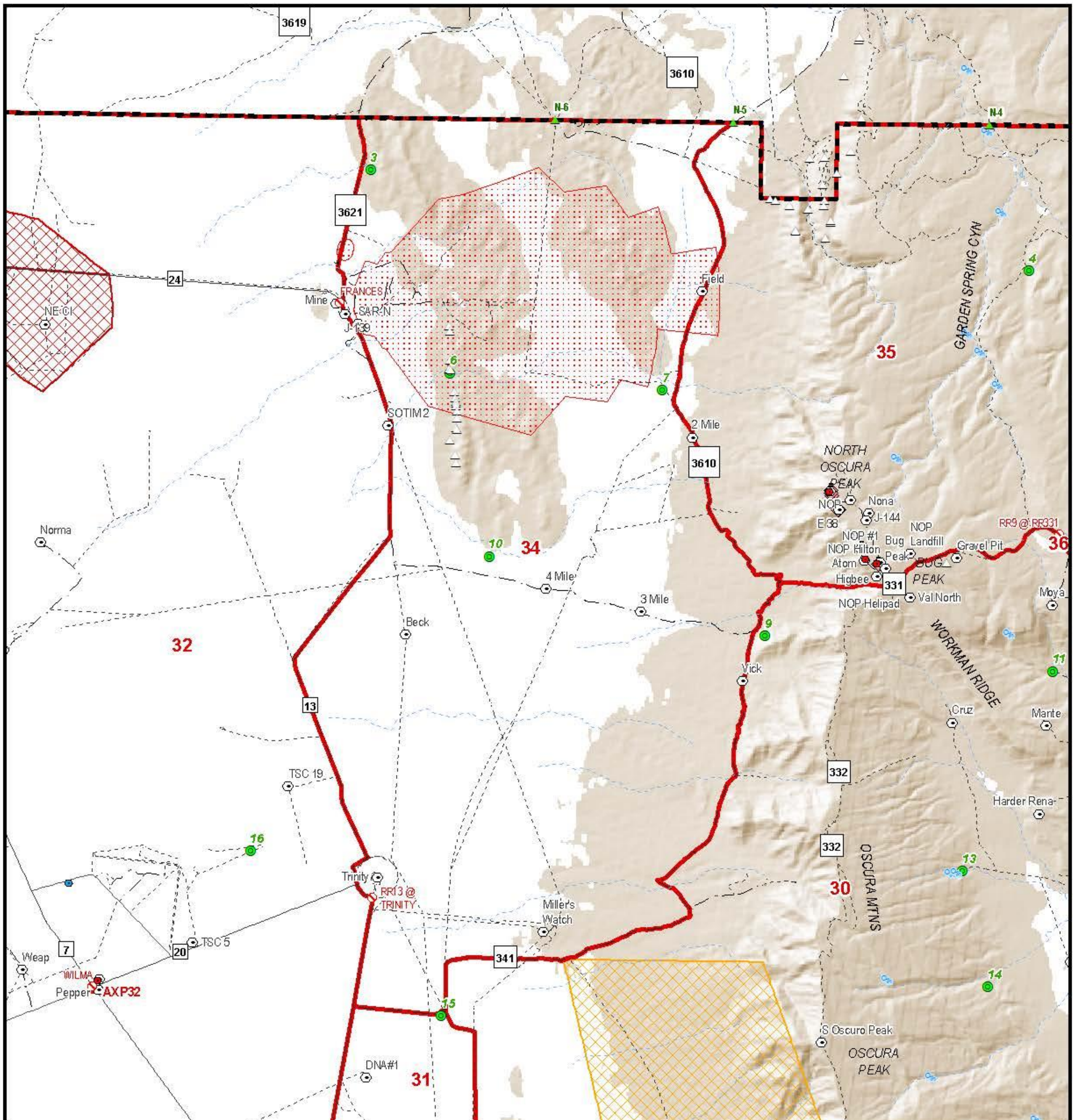
Pre Fire Season Fuels Management Actions

Inspection of historic and military sites needs to occur in the fall or early winter. Dried tumbleweeds may collect against structures and fences within FMU 34. These areas should be kept clean by crushing or scattering or burning accumulated fuels. Firebreak roads around the perimeter of FMU 34 need to be maintained yearly, once in the fall after monsoon season.

Wildfire Management

Wildfires should be suppressed immediately in FMU 34 as wildfires can spread in these grasslands if environmental conditions are right. There are some military structures in FMU 34. All of the maintained roads in FMU 34 are good for blacklining from. Most wildfires in FMU 34 will die out at barriers such as roads. Wildfires in FMU 34 can be allowed to burn up to defensible barriers and suppressed or blacklined as conditions warrant. Provide point protection at structures as needed.

There are no engine fill sites in FMU 34. Nearest engine fill water is NECI Well in FMU 32.



WHITE SANDS MISSILE RANGE

FMU 34 ~ Trinity

34,287.7 Acres

7/9/2020

1 inch = 9,229 feet

0 0.5 1

Miles

FMU Boundary
WSMR Boundary
Construction Well
Hauled Water Tank
Water Truck Filling
Wildlife Water Tank
AXP
Military Site
Fueling Station
Roadblock
Ranch\Structure
WSMR Boundary/Call-Up Area
Quantity Distance Arcs
Solid Waste Management Unit
Maximum Outline of SDZ
UXO Cat 1 - Escort Reqd.
UXO Cat 2 - Access Limited
UXO Cat 3 - Special UXO Brief Reqd.
UXO Cat 4 - No Restrictions
Pupfish Essential Habitat
Pupfish Limited Habitat
Operational Test Area
Mine
Gate
Streams
Propane Tank
Spring
Wetland

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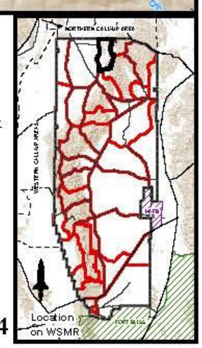


FMU 35 North Oscura Peak 22,240 Acres

Physical Characteristics

FMU 35 is bordered on the east by Range Road 9 from its intersection with Range Road 331 north to its intersection with US Highway 380 at Gate N-2 near Lonnie Moon Peak. The north boundary of FMU 35 is the north boundary line of WSMR from Range Road 9 west to Range Road 3501. Much of the north boundary is not accessible by road. The west boundary of FMU 35 is Range Road 3501 from the north boundary of WSMR southwest to Range Road 3610, then south on Range Road 3610 to Trail Canyon. The south boundary of FMU 35 is a dirt two-track road east up Trail Canyon to a wildlife water, then on an unmarked trail up Trail Canyon, up and over the Oscura escarpment to Bug Peak atop the escarpment, then east on Range Road 331 to its intersection with Range Road 9.

Fuels in FMU 35 range from typical Chihuahuan Desert bajada vegetation consisting mostly of shrubs such as creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia to prolific grama grasslands around the bases of the Oscura Mountains to piñon-juniper and oak woodlands on the east-facing slopes of the Oscura Mountains. Woodland vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol, cacti and sacahuista. Perennial grasses are intermixed with shrubs on the desert and include galleta, dropseeds, muhly spp., sacaton spp. in draws and gramas, three-awns, rice grass, fescue, muhlys and bluestems on mountain slopes. Topography ranges from gently sloping at Range Road 3610 to the steep canyons, slopes and escarpment of the Oscura Mountains. Much of FMU 35 is mountainous, remote and roadless.

Infrastructure/Assets to be protected

FMU 35 contains one historic site:

(#4 on map) Ozanne Stage Station; Mountain Stage Station consists of a fallen stone structure with scattered wood debris and is at **low risk** of damage from a wildfire due to its construction materials. Located at UTM coordinates 13S **377,150E by 3,740,300N.**

There are military facilities located atop North Oscura Peak that are vulnerable to wildfire damage. These facilities are protected from all but the most severe burning wildfires as they have been cleared around.

Risk to Firefighters

Normal environmental factors of heat, dust, wind, and low humidity are here and can contribute to hazardous conditions. The southern portion of FMU 35 near Range Road 331 is a piñon-dominated woodland with a closed canopy and is vulnerable to large wildfires spreading through the crowns of the trees. The northern portion of FMU 35 is piñon-juniper woodlands and savanna and is prone to large wildfire spread under dry conditions, but would burn as a ground fire and not through the canopies of trees. Wildfire history shows that wildfires have become large in these mountains. The terrain in the Oscura Mountains is steep and rocky with few roads or openings for safety zones and escape routes. Dehydration, snakes, insects, footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 35.

Pre Fire Season Fuels Management Actions

There are sites in FMU 35 that may need pre-season fuel reduction actions of clearing brush and tumbleweeds that may accumulate along fences and against structures. The military and civilian sites in FMU 35 atop North Oscura Peak are at wildfire risk from a crown fire. Light fuel treatments of selectively thinning, piling and burning juniper trees near the structures on North Oscura Peak would benefit the survivability of these structures. Firebreak roads around the perimeter of FMU 35 need to be maintained yearly, once in the fall after monsoon season.

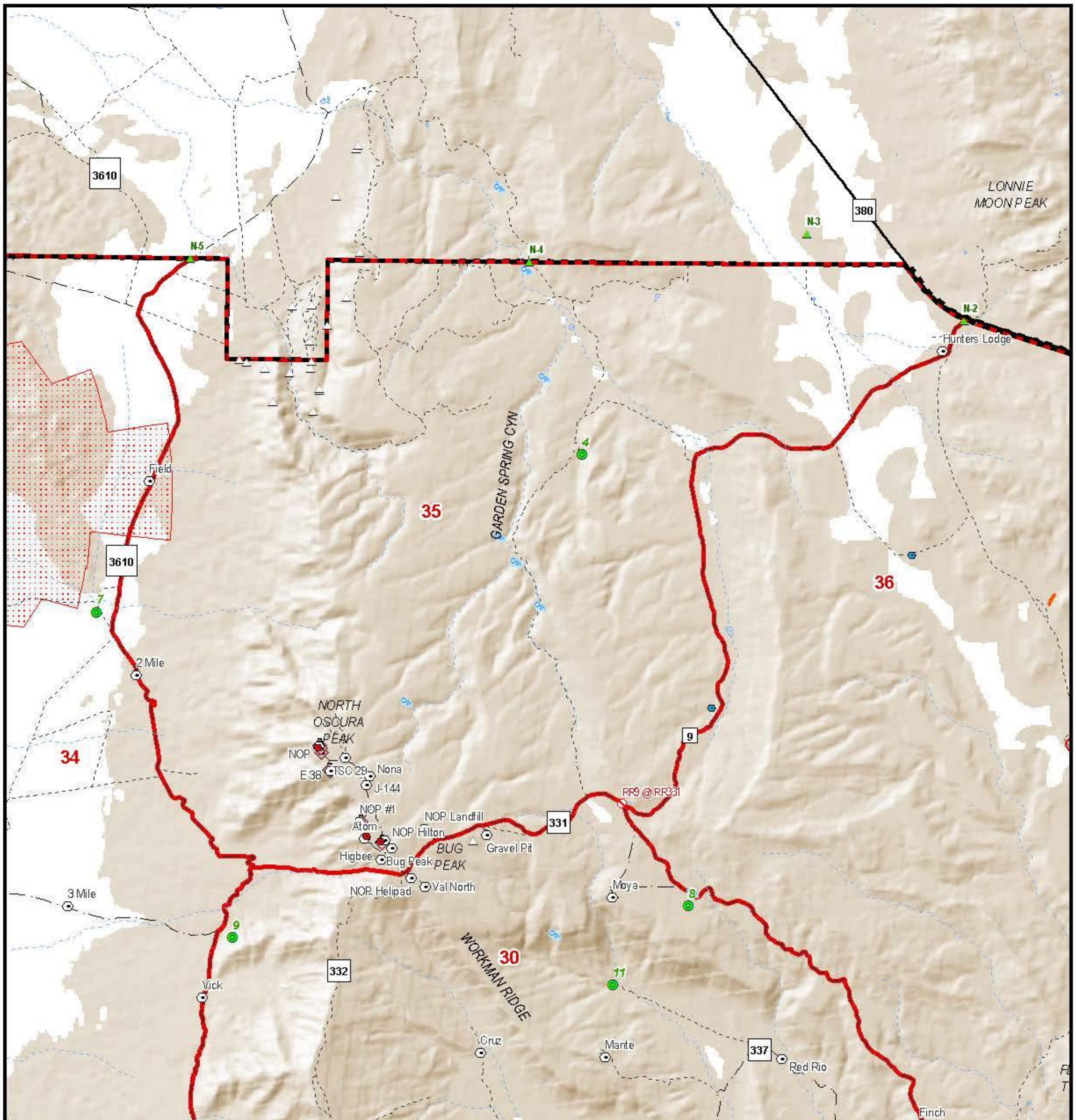
Wildfire Management

Wildfires that are readily accessible by engines and firefighters should be suppressed immediately in FMU 35 as wildfires can spread in the grasslands and mountains if environmental conditions are right. Wildfires that start in the mountains of FMU 35 should not be attacked by ground troops unless the access is good from nearby roads. Escape routes are limited in FMU 35 to a few rough, rocky roads that are mostly one way in and one way out. Do not put engines atop North Oscura Peak (NOP) if wildfire has the potential to burn and spread through the crowns of trees on the east side of the Oscura Mountains. A severe wildfire in the fuel conditions such as are found on the east slopes of the Oscura Mountains could become a plume dominated head and crown fire that will only die once it reaches the crest of the mountains. Crown fires in piñon-juniper do not spread well laterally and once the head fire dies down, firefighters could work the flanks of the fire after establishing a secure anchor point.

Lightning fires in FMU 35 that are off the road system and have received some monsoonal moisture are candidates to consider for allowing to burn for ecological benefits. If human-caused wildfires are burning under conditions such that containment of the wildfire cannot or is not likely to occur within 24 hours, then the IC, in coordination with FES leadership and PWE, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU. WSMR GC, WFPM and PWE resource professionals should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn within certain parameters. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire suppression actions will take place.

If the decision is made that the wildfire needs to be suppressed rather than allowed to burn, then additional resources, possibly including a Type 3 Incident Management Team, may be ordered through Alamogordo or Silver City Dispatch Centers (ADC/SDC). Aerial assets may need to be ordered which may include retardant aircraft, helicopters, smokejumpers or helitack which will also trigger the order for a fixed-wing air attack platform to help guide these aircraft and provide eyes in the sky for ground firefighters.

Engine water fill sites in FMU 35 are located at North Oscura Peak, NOP barracks, Atom Peak SST and Baca Well.



WHITE SANDS MISSILE RANGE

FMU 35 ~ North Oscura Peak

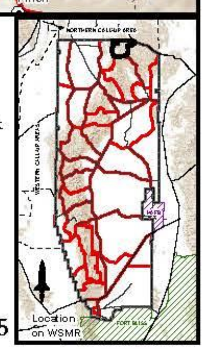
22,240.2 Acres

7/9/2020

1 inch = 6,979 feet

0 0.5 1
Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland



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FMU 36 Red Rio 67,457 Acres

Physical Characteristics
FMU 36 is bordered on the east by Range Road 11 from its intersection with an unnamed improved dirt road at UTM coordinate 13S 392,459E, 3,715,639N, north on Range Road 11 to its intersection with US Highway 380 at the Red Rio Gate (N-1). The north boundary of FMU 36 is the north administrative boundary of WSMR from Range Road 11 west along US 380 to Range Road 9 at Gate N-2. The west boundary of FMU 36 is Range Road 9 from the north boundary of WSMR southwest to Range Road 331, then southeast still on Range Road 9 to the unnamed improved dirt road at UTM coordinate 13S 388,729E, 3,715,350N. The south boundary of FMU 36 is an improved dirt road that runs east from Range Road 9 to Range Road 11.

Fuels in FMU 36 range from typical Chihuahuan Desert bajada vegetation in the south part of FMU 36 consisting mainly of shrubs such as creosote, ocotillo, mesquite, yucca, prickly pear, snakeweed and acacia to prolific grama grasslands in the central part of FMU 36 to piñon-juniper woodlands in the northern 2/3 of FMU 36. Woodland vegetation includes oak spp., juniper spp., piñon, mountain mahogany, ceanothus, sotol, cacti and sacahuista. Perennial grasses are intermixed with shrubs on the desert and include galleta, dropseeds, muhlys, sacaton spp. in draws; and gramas, three-awns, rice grass, muhlys and bluestems on mountain slopes. Topography ranges from gently sloping at the south end of FMU 36 to rolling grass-covered hills to steep-sided canyons and ridges of Chupadera Mesa. Much of FMU 36 is rugged, remote and roadless.

Fire history in FMU 36 shows that several wildfires have burned here. Most wildfires are mission-caused and are attributed to the Air Force mission of aerial gunnery and bombing targets on Red Rio Range.

Infrastructure/Assets to be protected
FMU 36 contains historic cultural sites:

(#12 on map) Red Canyon Stage Station consists of standing rock walls and is **not at risk** of burning in a wildfire due to low surrounding fuel loads. Located at UTM coordinates 13S **388,750E by 3,729,900N.**

The **Red Canyon Range Camp** is an historical site, but contains little in the way of burnable artifacts. There are US Air Force facilities and improvements located at the Red Rio Bombing Range. These facilities are protected from wildfires as they are within cleared areas.

Risk to Firefighters
Normal environmental factors of heat, dust, wind, and low humidity are here and can contribute to hazardous conditions. The southern portion of FMU 36 is desert and will not carry wildfires. The northern and central portions of FMU 36 are piñon-juniper woodlands and juniper savanna and are prone to large wildfire spread under dry conditions, but would burn as a ground fire and not through the canopies of trees. Wildfire history shows that wildfires have become large in FMU 36. The terrain in the northern portions of FMU 36 is steep and rocky with few roads. Dehydration, snakes, insects,

footing, loose rocks, shift in wind direction, flashy fuels, poor roads, poor visibility, and unexploded ordinance are all potential safety problems in FMU 36. The Red Rio Bombing Range is off limits to firefighters as UXO exists here. Contact Holloman Range Operations Center at 575 572-5716 if wildfires are in the vicinity of the Bombing Range.

Pre Fire Season Fuels Management Actions
The Red Rio Bombing range is a USAF controlled site and it is USAF responsibility to keep wildfires contained within the Range footprint which is within the firebreak roads that surround the Bombing Range. The AF has conducted prescribed fires on Red Rio Bombing Range in the past and plans to continue this practice. Firebreak roads around the perimeter of FMU 36 need to be maintained yearly, once in the fall after monsoon season.

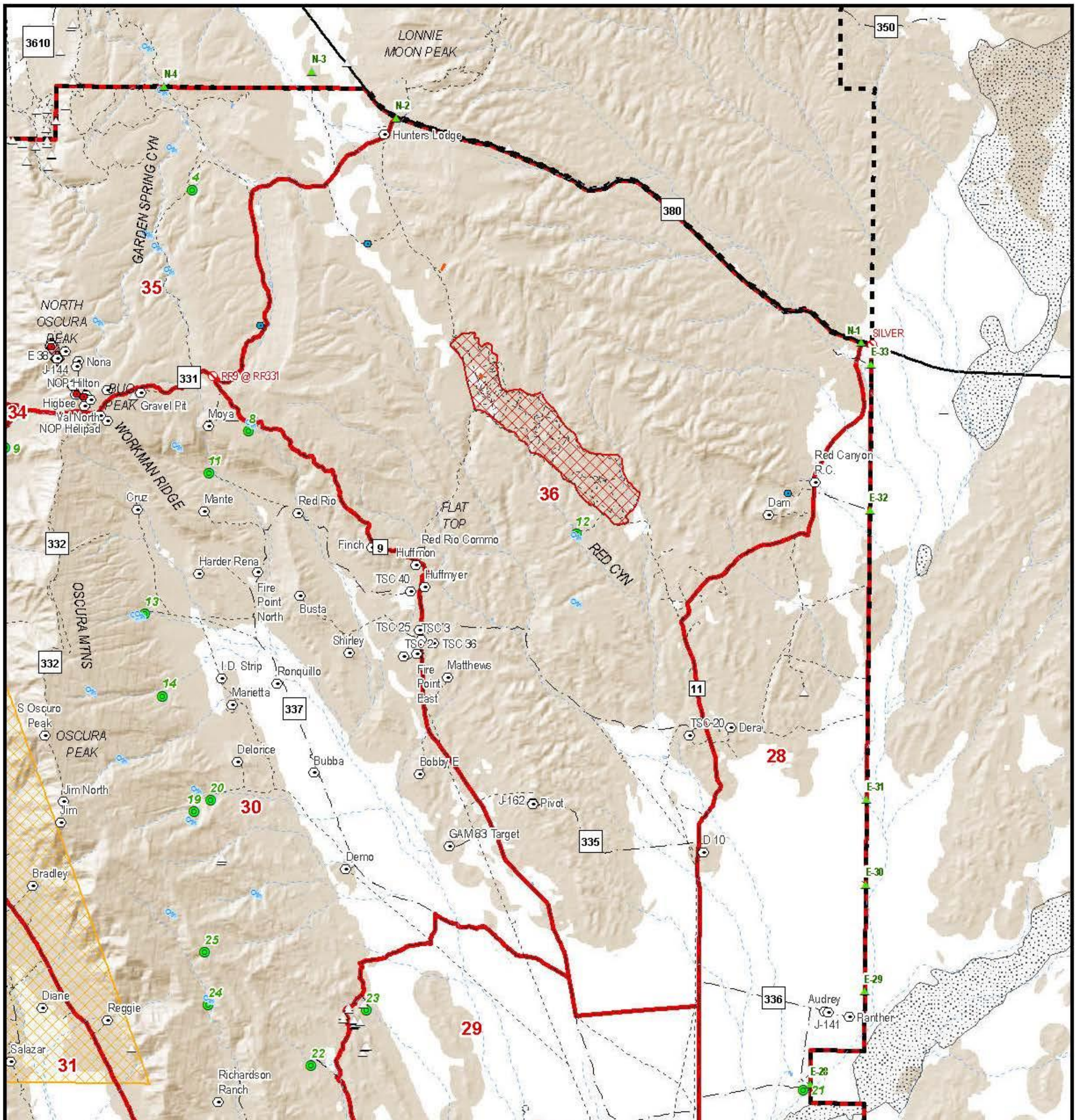
Wildfire Management
Wildfires are not fought inside the perimeter of Red Rio Bombing Range. Wildfires that are readily accessible by engines and firefighters should be suppressed immediately in FMU 36 as wildfires can spread in the grasslands and mountains if environmental conditions are right. Wildfires that start in the mountains and hills of FMU 36 should not be attacked by ground troops unless the access is good from nearby roads. Contact Holloman Range Operations Center at 575 572-5716 to get access to Red Rio.

If wildfires are burning within FMU 36 and are not likely to be contained within 24 hours, then the IC, in coordination with FES leadership and PWE, should fall back to defensible positions, usually at FMU boundaries and allow the wildfire to burn within the confines of the FMU.

WSMR GC, WFPM, FES chiefs and PWE resource professionals should convene, and in communication with Range Operations and in consideration of weather and operational constraints, document a decision to allow for the wildfire to burn within the FMU's boundaries. The document should contain a map that designates a maximum manageable area (MMA) and assigns trigger points that, if reached by the wildfire, fire management actions will take place.

If the decision is made that the wildfire needs to be suppressed rather than allowed to burn, then additional resources including a Type 3 Incident Management Team may be ordered through Alamogordo Dispatch Center (ADC). Aerial assets may need to be ordered which may include retardant aircraft, helicopters, smokejumpers or helitack which will also trigger the order for a fixed-wing air attack platform to help guide these aircraft and provide eyes in the sky for ground firefighters.

Engine fill water in FMU 36 is available at Baca Well, Red Rio Well, and Red Canyon Well and at the USAF administrative site on the Red Rio Bombing Range (not shown on map) located to the southeast of the Bombing Range on the southern Red Rio access road.



WHITE SANDS MISSILE RANGE

FMU 36 ~ Red Rio

67,456.8 Acres

7/9/2020

1 inch = 13,072 feet

0 0.5 1

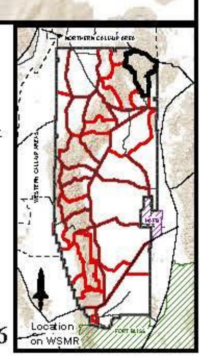
Miles

- FMU Boundary
- WSMR Boundary
- Construction Well
- Hauled Water Tank
- Water Truck Filling
- Wildlife Water Tank
- AXP
- Military Site
- Fueling Station
- Roadblock
- Ranch\Structure
- WSMR Boundary/Call-Up Area
- Quantity Distance Arcs
- Solid Waste Management Unit
- Maximum Outline of SDZ
- UXO Cat 1 - Escort Reqd.
- UXO Cat 2 - Access Limited
- UXO Cat 3 - Special UXO Brief Reqd.
- UXO Cat 4 - No Restrictions
- Pupfish Essential Habitat
- Pupfish Limited Habitat
- Operational Test Area
- Mine
- Gate
- Streams
- Propane Tank
- Spring
- Wetland

File Location:Projects\FirePlan\FirePlan_2017\FirePlan_FMU_Mapbook_85x11.mxd

Produced by the GIS Team for the Directorate of Public Works, WSMR.

Page 36



Appendix B Mutual Aid Agreements

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY WHITE SANDS MISSILE RANGE
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002

REPLY TO
ATTENTION OF
STEWS-NRES-F (5-8a)

MEMORANDUM OF AGREEMENT
BETWEEN
THE SECRETARY OF THE ARMY
BY
U.S. ARMY WHITE SANDS MISSILE RANGE
AND
N.A.S.A. WHITE SANDS TEST FACILITY

SUBJECT: Mutual Assistance Fighting Fires and Responding to Medical Emergencies

1. References:

a. 42 USC § 1856a, Authority to Enter into Reciprocal Agreement.

b. DODI 6055.6, DOD Fire Protection Program (15 Dec 94).

c. AR 420-90, Fire Protection (10 Sep 97).

2. Purpose: To agree upon terms of mutual assistance in fighting fires and responding to medical emergencies.

3. Definitions:

a. Requesting department is the department requesting aid.

b. Assisting department is the department providing aid.

4. Agreement: U.S. Army White Sands Missile Range (WSMR) and N.A.S.A. White Sands Test Facility (WSTF), collectively, The Parties, agree as follows:

a. The requesting department will request assistance through its fire chief or authorized subordinates designated in writing in advance to the assisting department.

b. When called the assisting department will assist to the maximum extent that other missions, personnel, and equipment permit.

c. The assisting department shall determine which personnel and equipment to send in response to a call for assistance.

d. The requesting department's fire chief or subordinate on the scene of the fire or emergency will be in charge of all personnel and equipment on the scene, regardless of which department they come from.

e. The assisting department's officers will command their own crews and equipment, subject to the overall direction of the requesting department's officer in charge on the scene.

f. Each department waives any claim against the other department for compensation for expenses, costs, or liability for damages, losses, injuries, or deaths resulting from performance under this agreement.

g. No department shall be liable to the other for failure to respond to a request for assistance.

h. The departments are encouraged to tour each other's facilities and to meet and plan for contingencies.

i. Either party may withdraw from this agreement after providing the other party written notice 30 days in advance.

j. This MOA shall be in force on the date the latest party executes it and shall remain in force until revoked or superseded.

k. Points of contact:

(1) White Sands Missile Range: The Fire Chief, STEWS-NRES-F, (505) 678-5105.

(2) NASA White Sands Test Facility: The Fire Chief, (505) 835-3969.

STEWS-NRES-F
SUBJECT: Mutual Assistance Fighting Fires and Responding to Medical Emergencies

WITNESS our hands this date:

FOR THE SECRETARY OF THE ARMY:

HARRY D. GATANAS
Brigadier General, USA
Commanding

Date: 30 SEP 1998

FOR THE NASA WHITE SANDS TEST FACILITY:

JOE FRIES
NASA Site Manager

Date: 11-10-98

DEPARTMENT OF THE ARMY
U.S. ARMY WHITE SANDS MISSILE RANGE
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

DEPARTMENT OF THE ARMY
MUTUAL AID AGREEMENT
BETWEEN
WHITE SANDS MISSILE RANGE
AND OTERO COUNTY

This agreement, entered into this ___ day of March, 2009, between the Secretary of the Army acting according to the authority of section 1856a, title 42, United States Code and the Otero County Office of Emergency Services is to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire, and firefighting to include emergency services, including basic medical support, basic and advanced life support, hazardous material containment and confinement, and special rescue events involving vehicular and water mishaps, and trench, building and confined space extrications.

It is agreed that

a. On request to a representative of the White Sands Missile Range by a representative of the County of Otero, firefighting equipment and personnel of the White Sands Missile Range Fire Department will be dispatched when available to any point within the area for which the County of Otero normally provides fire protection and Emergency Medical Services as designated by the representative of the Office of Emergency Services.
b. On request to a representative of the County of Otero by a representative of the White Sands Missile Range Fire Department, firefighting equipment, EMS Services and personnel of the County of Otero will be dispatched when available to any point within the firefighting jurisdiction of the White Sands Missile Range Fire Department.
c. The rendering of assistance under the terms of this agreement shall not be mandatory, but the party receiving the request for assistance should immediately inform the requesting department if, for any reason, assistance cannot be rendered.
d. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:
    (1) Any request for aid under this agreement will specify the location to which the equipment and personnel are to be dispatched; however, the amount and type of equipment and the number of personnel to be furnished will be determined by a representative of the responding organization.
    (2) The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of the official
    (3) A responding organization will be released by the requesting organization when the services of the responding organization are no longer required,

or when the responding organization is needed within the area for which it normally provides fire protection.

(4) If a crash of aircraft owned and operated by the United States or military aircraft of a foreign nation occurs within Otero County and normally provides fire protection, the Chief of White Sands Missile Range Fire Department or his or her representative may assume full command on arrival at the scene of the crash.

e. Each party hereby waives all claims against every other party for compensation for any loss, damage, injury or death occurring as consequence of the performance of this agreement except those claims authorized under 15 U. S. C. 2210.

f. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and, as feasible, to jointly prefire planning inspections and drills.

g. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operation necessary to effectively implement this agreement. Such plans and procedures of operations become effective upon ratification by the signatory parties.

h. All equipment used by Otero County in carrying out this agreement will be owned by the Otero County; and all personnel acting for Otero County under this agreement will be an employee or volunteer member of Otero County.

1. This agreement shall become effective upon the date hereof and remain in full force and effect until cancelled by mutual agreement of the parties hereto or by written notice by one party to the other party, giving thirty (30) days notice of said cancellation.

FOR OTERO COUNTY:	FOR THE SECRETARY OF THE ARMY WHITE SANDS MISSILE RANGE:
TIMOTHY C. SMITH Otero County County Manager	GARY GIEBEL Colonel, U.S. Army Garrison Commander
DATE: 3/3/09	DATE: 18 Mar 09

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

REPLY TO
ATTENTION OF

MUTUAL FIRE PROTECTION AND EMERGENCY RESPONSE AGREEMENT

THIS AGREEMENT, between the City of Las Cruces, a New Mexico municipal corporation and the United States Government, through its independent agency, White Sands Missile Range, provides for assistance in fire protection and emergency response between the jurisdictional areas of both parties contingent upon a request from the White Sands Missile Range Fire Chief or their designee, or any Las Cruces Chief ranking officer or their designee.

NOW, THEREFORE, the parties in consideration of the mutual promises herein contained and agree as follows:

1. The term of this Agreement shall be for an indefinite period of time.

2. Neither party shall be entitled to any reimbursement for all or any part of the costs or expenses incurred by such party in furnishing assistance outside of its jurisdiction.

3. Both parties waive all claims against each other from compensation for any property loss, damage, personal injury or death occurring in consequence of the performance of this Agreement.

4. Neither party shall be responsible for liability incurred as a result of the other party's acts or omissions with this Agreement. Any liability incurred by Las Cruces in connection with this Agreement is subject to the immunities and limitations of the New Mexico Tort Claims Act. Any liability incurred by White Sands Missile Range in connection with this Agreement is subject to the immunities and limitations of the Federal Tort Claims Act.

5. Each party shall be solely responsible for fiscal or other sanctions, penalties, or fines occasioned as a result of its own violation of requirements applicable to performance of this Agreement. Las Cruces shall be liable for its acts or failure to act in accordance with this Agreement, subject to the immunities and limitations of the New Mexico Tort Claims Act. White Sands Missile Range shall be liable for its acts or failure to act in accordance with this Agreement, subject to the immunities and limitations of the Federal Tort Claims Act.

6. Response to a request for assistance from the other party will be subject to availability of personnel, equipment and resources.

7. The respective authorized representatives will, upon receipt of an authorized call requesting assistance, determine the type and number of units which are needed for an adequate response and the availability of personnel, equipment and resources.

8. Both parties will have their fire departments respond to fires or other emergencies in the following manner:

a. Las Cruces will dispatch its emergency response equipment and personnel only upon official request for assistance from the White Sands Missile Range Fire Chief or their designee.

b. White Sands Missile Range will dispatch its emergency response equipment and personnel only upon official request for assistance from any Las Cruces Chief ranking officer or their designee.

c. All efforts will be made to release the assisting party as soon as practical.

d. A Rapid Intervention Team (RIT) is required when personnel from either entity operate in an environment that is classified as Immediately Dangerous to Life or Health (IDLH) in accordance with National Fire Protection Agency (NFPA) Standard 1500 and Occupational Safety & Health Administration (OSHA) CFR 1910.120 and 1910.134. If a RIT has not been established by either entity, Las Cruces' actions will be limited to those that are allowed through OSHA compliance.

e. Utilize Incident Command System/Unified Command to manage all emergency response incidents. The Unified Command structure is utilized for managing multi-jurisdictional responses. Conduct onsite safety briefings for firefighters prior to incident engagement (UXO, Target Hazard areas).

f. The Incident Commander for the incident will be from the jurisdiction where the incident is taking place.

g. The Incident Command System will be adhered to by both parties when responding to either jurisdiction. Responding units will report to the Incident Commander upon arrival and will be subject to the operational directives of that official.

h. The senior ranking officer from each department who responds to the request for assistance will become part of the incident command system command staff, and will remain with the Incident Commander throughout the incident mitigation period.

i. Both parties agree to assist each other with Emergency Medical Services calls, but will attempt to limit their request for assistance to those which are life threatening in nature.

j. Hazardous Materials response will be limited to a level commensurate to the severity of the incident. This response will be based on the information received from the requesting agency.

9. Both parties will keep accurate records of all calls requesting assistance from the respective jurisdiction requesting aid. Said records shall include data on equipment responding, personnel employed, time spent and materials expended.

10. Nothing under the terms of this Agreement shall require White Sands Missile Range or Las Cruces to purchase additional equipment or hire additional personnel in order to comply with the terms of this Agreement.

11. Both parties agree that furnishing of any Emergency Response under this Agreement will be subordinate to requests for, and rendering of, any services necessary within their respective jurisdictions.

12. This Agreement may be terminated by providing written notice to the other party of its intent to do so. Such notice will be deemed delivered when either the White Sands Missile Range Fire Chief or the Las Cruces City Manager are served with such documentation.

FOR WHITE SANDS MISSILE RANGE:

C. J. WICKER
COL, LG
Commanding

DATE: 26 May 2010

FOR CITY OF LAS CRUCES:

KEN MIYAGISHIMA
LAS CRUCES MAYOR

DATE: 5/11/2010

APPROVED AS TO FORM:

HARRY S. (PETE) CONNELLY
Las Cruces Interim City Attorney

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

REPLY TO
ATTENTION OF

MUTUAL AID AGREEMENT
BETWEEN
U.S. ARMY WHITE SANDS MISSILE RANGE, NEW MEXICO
AND
THE CITY OF SOCORRO FIRE DEPARTMENT, NEW MEXICO

This mutual aid agreement is entered into by and between White Sands Missile Range Fire Department and Socorro Fire Department.

IT IS MUTUALLY AGREED BETWEEN THE PARTIES:

PURPOSE AND SCOPE:

1. The purpose of the Agreement is for the parties to this Agreement to provide emergency assistance, outside their geographic area and responsibility, to a requesting party in emergency situations, which are beyond the total emergency response capability and capabilities of the primary responding agency.

2. Upon reasonable notice, the responding party will activate emergency support procedures for the type of support necessary and within its capabilities and available equipment. The responding party has the legal right to assist in such requests for assistance. The responding party shall provide its own liability insurance outside its own geographical area. For White Sands Missile Range Fire Department this geographical area is the boundaries of Socorro County.

3. Subject to availability of personnel and equipment, the responding party will render assistance in accordance with the capabilities of personnel and equipment available during the period of emergency. However, no party is obligated to respond to support another party and provide equipment if responding party has priorities within their area and shall not respond if it creates a situation wherein the geographic area of responsibility of the responding party is left without support, or is vulnerable to an emergency crisis of its own. This Agreement is not enforceable against any party refusing to provide or accept aid to or from the other party.

TERMS:

The period of the Agreement is from the date of the last signature on the Agreement and shall continue in effect until either party notifies the other party 60 days in advance of its intention to terminate the Agreement.

GOVERNING PROCEDURES:

This Agreement is governed by New Mexico Law. Both parties shall comply with the terms and conditions of the Agreement and also with the federal, state, and local laws applicable to emergency conditions of catastrophic proportions.

Each party shall maintain its own autonomy in regards to geographic jurisdictions. During those times that the responding party is contacted for support and provides emergency assistance, it is authorized to enter the jurisdictional territory of the party requiring assistance. The responding party shall report to the requesting party's Officer-in-Charge and is subject to the orders of that official during the emergency. They responding party reserves the right to withdraw its personnel and/or equipment, if the responding party Office-in-Charge determines that the situation is hazardous or an emergency situation has developed in his own area of responsibility.

TERMINATION:

The Agreement may be terminated by either with or without cause by providing notice to the other party in writing 60 days prior to the date of termination.

EQUIPMENT MANAGEMENT:

Each party to this Agreement shall keep strict accountability of its equipment. No equipment is to be acquired as a result of this Agreement, nor shall there be any disbursements or receipts of money between the parties as a result of the Agreement. Each party is responsible for maintenance and repair of its own equipment.

INSURANCE:

Each parties to this Agreement shall maintain liability insurance or qualify as a self-insured entity, as required by law.

SIGNATURE AUTHORITY:

Both parties represent that the persons signing this contract on behalf of White Sands Missile Range Fire Department and the Socorro Fire Department have the authority to do so.

FOR WHITE SANDS MISSILE RANGE:

C. J. WICKER
COL, LG
Commanding

DATE: 12 June 2010

FOR SOCORRO FIRE DEPARTMENT:

JOE GONZALES
CHIEF

DATE: 6-23-10

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

REPLY TO
ATTENTION OF

MUTUAL AID AGREEMENT
BETWEEN
U.S. ARMY WHITE SANDS MISSILE RANGE, NEW MEXICO
AND
THE SOCORRO COUNTY FIRE DEPARTMENT,

This agreement, entered into this 8 day of November 2011, between the Secretary of the Army, White Sands Missile Range, New Mexico, acting according to the authority of section 1856a, title 42, United States Code, and the Socorro County Fire Department, New Mexico, acting according to the authority of 16 United States Code 668dd. is to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire, and firefighting. This agreement is further intended to secure for each the benefits of mutual aid to support their missions, to decrease the risk and spread of catastrophic wildland fire, to use natural fire to achieve military and Socorro County natural resource management objectives, to use prescribed fire to achieve military and Socorro County Fire Department management objectives, and to use fuel reduction to lower the risk of wild fire. Prescription fire support request shall be coordinated through the White Sands Missile Range Environmental Office. It is agreed that:

a. On request to a representative of the White Sands Missile Range Fire Department by a representative of the Socorro County Fire Department, firefighting equipment and personnel of the White Sands Missile Range Fire Department will be dispatched when available to any point along or within the boundary of the White Sands Missile Range land for which the Socorro County Fire Department normally provides fire protection as designated by the Socorro County Fire Department Fire Marshal.

b. On request to the Socorro County Fire Marshal, or his or her designee, by a representative of the White Sands Missile Range Fire Department, firefighting equipment and personnel of the Socorro County Fire Department will be dispatched when available to any point within White Sands Missile Range, located within the boundaries of Socorro County, which the White Sands Missile Range Fire Department represents as having been cleared of unexploded ordnance issues, and for which the White Sands Missile Range Fire Department normally provides fire protection as designated by the representative of the White Sands Missile Range Fire Department.

c. A representative for either the Socorro County Fire Department or White Sands Missile Range Fire Department will be notified immediately of any fire found on or approaching the other's land.

d. The rendering of assistance under the terms of this agreement shall not be mandatory, but the party receiving the request for assistance should immediately inform the requesting party if, for any reason, assistance cannot be rendered.

e. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

(1) Any request for aid under this agreement will specify the location to which the equipment and personnel are to be dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

(2) The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

(3) A responding organization will be released by the requesting organization when the services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

(4) If a crash of aircraft, rockets, missiles, unmanned aerospace vehicles or similar systems owned or operated by the United States or any foreign nation occurs within the area for which the Socorro County Fire Department normally provides fire protection, the Chief of White Sands Missile Range Fire Department or his or her representative may assume full command on arrival at the scene of the crash.

f. Each party hereby waives all claims against every other party for compensation for any loss, damage, injury or death occurring as a consequence of the performance of this agreement except those claims authorized under 15 United States Code 2210.

g. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security issues and, as feasible, to jointly conduct wildland preseason fire program inspections, to jointly conduct wildfire risk evaluations, and to jointly plan and conduct both the use of prescribed fire and the use of natural fire.

(1) Both parties shall have access, if requested, to copy of the other party's Fire Management Plan to familiarize fire management personnel with accepted practices and limitations of acceptable resource management practices and appropriate management responses.

(2) All actions requested of the other party shall be approved in the respective Agency Land Use/Management Plan or Fire Management Plan including prescribed fire, natural fire use and wildfire suppression alternatives which are recommended or selected.

h. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to attend training and classroom exercise to meet Incident Qualifications and Certification System standards for fighting wildland fires and for conducting prescribed burns.

i. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to share fire weather information and any other information that pertains to planning and implementing wildland fire suppression, implementing and conducting prescribed fires, as well as, conducting natural fire use.

j. The technical staff of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operation to effectively implement this agreement. Such plans and procedures of operations shall become effective upon ratification by the signatory parties.

k. All equipment used by the Socorro County Fire Department in carrying out this agreement will be owned by the Socorro County Fire Department and all personnel acting for the Socorro County Fire Department under this agreement will be employees or volunteers of the Socorro County Fire Department.

l. This agreement shall become effective upon the date of the last signature hereon and shall remain in full force and effect until cancelled by mutual agreement of the parties or by written notice by one party to the other party, giving thirty days notice of said cancellation.

m. This agreement will be reviewed biennially (every two years) and updated by mutual aid agreement in writing as necessary.

n. This agreement may be amended by written agreement of the parties.

o. No direct funding is required or authorized by this agreement and no property, real or personal, shall be acquired, managed or disposed of hereto. Each party will maintain its own personnel's equipment and each will be responsible for all costs for emergency or routine assistance if it occurs as a result of an incident.

p. Implementation of this agreement by the parties is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this agreement will be construed by the parties to require the obligation, appropriation, or expenditure of any money from the United States Treasury. The parties acknowledge that they will not be required under this agreement to expend any federal appropriated funds unless and until an authorized official affirmatively acts to commit to such expenditures as evidenced in writing.

q. The provisions of the statues cited in this agreement contain legally binding requirements. The agreement itself does not alter, expand, or substitute for those provisions or regulations, nor is it a regulation itself. This agreement contains internal procedural guidance to the parties; respective staffs to assist them in carrying out existing legal requirements. This agreement does not create a right of action for third parties.

r. During the performance of this agreement, the parties agree to abide by the terms of Executive Order 11246 which addresses non-discrimination. The parties will not discriminate against any person because of race, color, religion, sex, or national origin.

FOR WHITE SANDS MISSILE RANGE:

Leo G. Pullar

LEO G. PULLAR
Colonel, US Army
Garrison Commander

DATE: 16 Nov 2011

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS MISSILE RANGE
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

17-139

MUTUAL AID AGREEMENT
BETWEEN
GARRISON COMMANDER, U.S. ARMY WHITE SANDS MISSILE RANGE, NEW MEXICO
AND
DONA ANA COUNTY

This agreement, entered into this 20 day of Jan 2017, between the Secretary of the Army, White Sands Missile Range, New Mexico, acting according to the authority of section 1856a, title 42, United States Code, and the Dona Ana County, New Mexico is to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire, and firefighting. This agreement is further intended to secure for each the benefits of mutual aid to support their missions, to decrease the risk and spread of catastrophic wildland fire, to use natural fire to achieve military and Dona Ana County natural resource management objectives, to use prescribed fire to achieve military and Dona Ana County management objectives, and to use fuel reduction to lower the risk of wild fire. Prescription fire support request shall be coordinated through the White Sands Missile Range Environmental Office. It is agreed that:

a. On request to a representative of the White Sands Missile Range Fire Department by a representative of the Dona Ana County, firefighting equipment and personnel of the White Sands Missile Range Fire Department will be dispatched when available to any point along or within the boundary of the White Sands Missile Range land for which the Dona Ana County normally provides fire protection as designated by the Dona Ana County Fire Chief.

b. On request to the Dona Ana County Fire Chief, or his or her designee, by a representative of the White Sands Missile Range Fire Department, firefighting equipment and personnel of the Dona Ana County will be dispatched when available to any point within White Sands Missile Range, located within the boundaries of Dona Ana County, which the White Sands Missile Range Fire Department represents as having been cleared of unexploded ordnance issues, and for which the White Sands Missile Range Fire Department normally provides fire protection as designated by the representative of the White Sands Missile Range Fire Department.

c. A representative for either the Dona Ana County or White Sands Missile Range Fire Department will be notified immediately of any fire found on or approaching the other's land.

d. The rendering of assistance under the terms of this agreement shall not be mandatory, but the party receiving the request for assistance should immediately inform the requesting party if, for any reason, assistance cannot be rendered.

e. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

(1) Any request for aid under this agreement will specify the location to which the equipment and personnel are to be dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

(2) The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

(3) A responding organization will be released by the requesting organization when the services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

(4) If a crash of aircraft, rockets, missiles, unmanned aerospace vehicles or similar systems owned or operated by the United States or any foreign nation occurs within the area for which the Dona Ana County normally provides fire protection, the Chief of White Sands Missile Range Fire Department or his or her representative may assume full command on arrival at the scene of the crash.

f. Each party hereby waives all claims against every other party for compensation for any loss, damage, injury or death occurring as a consequence of the performance of this agreement except those claims authorized under 15 United States Code 2210.

g. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security issues and, as feasible, to jointly conduct wildland preseason fire program inspections, to jointly conduct wildfire risk evaluations, and to jointly plan and conduct both the use of prescribed fire and the use of natural fire.

(1) Both parties shall have access, if requested, to copy of the other party's Fire Management Plan to familiarize fire management personnel with accepted practices and limitations of acceptable resource management practices and appropriate management responses.

(2) All actions requested of the other party shall be approved in the respective Agency Land Use/Management Plan or Fire Management Plan including prescribed fire, natural fire use and wildfire suppression alternatives which are recommended or selected.

h. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to attend training and classroom exercise to meet Incident Qualifications and Certification System standards for fighting wildland fires and for conducting prescribed burns.

i. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to share fire weather information and any other information that pertains to planning and implementing wildland fire suppression, implementing and conducting prescribed fires, as well as, conducting natural fire use.

j. The technical staff of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operation to effectively implement this agreement. Such plans and procedures of operations shall become effective upon ratification by the signatory parties.

k. All equipment used by the Dona Ana County in carrying out this agreement will be owned by the Dona Ana County and all personnel acting for the Dona Ana County under this agreement will be employees or volunteers of the Dona Ana County.

l. This agreement shall become effective upon the date of the last signature hereon and shall remain in full force and effect until cancelled by mutual agreement of the parties or by written notice by one party to the other party, giving thirty days notice of said cancellation.

m. This agreement will be reviewed biennially (every two years) and updated by mutual aid agreement in writing as necessary.

n. This agreement may be amended by written agreement of the parties.

o. No direct funding is required or authorized by this agreement and no property, real or personal, shall be acquired, managed or disposed of hereto. Each party will maintain its own personnel's equipment and each will be responsible for all costs for emergency or routine assistance if it occurs as a result of an incident.

p. Implementation of this agreement by the parties is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this agreement will be construed by the parties to require the obligation, appropriation, or expenditure of any money from the United States Treasury or the treasury of Dona Ana

County. The parties acknowledge that they will not be required under this agreement to expend any federal, state or county appropriated funds unless and until an authorized official affirmatively acts to commit to such expenditures as evidenced in writing.

q. The provisions of the statutes cited in this agreement contain legally binding requirements. The agreement itself does not alter, expand, or substitute for those provisions or regulations, nor is it a regulation itself. This agreement contains internal procedural guidance to the parties; respective staffs to assist them in carrying out existing legal requirements. This agreement does not create a right of action for third parties.

r. During the performance of this agreement, the parties agree to abide by the terms of Executive Order 11246 which addresses non-discrimination. The parties will not discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity or national origin.

FOR WHITE SANDS MISSILE RANGE:

RONALD D. BROWN
Colonel, US Army
Commanding

DATE: 12 JAN 17

DONA ANA COUNTY:

JULIA T. BROWN ESQ.
County Manager

DATE:

ERIC L. CRESPIN
Interim County Fire Chief

DATE: 20 JAN. 2017

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

REPLY TO
ATTENTION OF

MUTUAL AID AGREEMENT
BETWEEN
U.S. ARMY WHITE SANDS MISSILE RANGE, NEW MEXICO
AND
THE BUREAU OF LAND MANAGEMENT, NEW MEXICO

This agreement, entered into this 12th day of June 2010, between the Secretary of the Army, White Sands Missile Range, New Mexico, acting according to the authority of section 1856a, title 42, United States Code, and the Bureau of Land Management, New Mexico Fire District-San Andres National Wildlife Refuge, acting according to the authority of 16 United States Code 668dd. is to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire, and firefighting. This agreement is further intended to secure for each the benefits of mutual aid to support their missions, to decrease the risk and spread of catastrophic wildland fire, to use natural fire to achieve military and Bureau of Land Management natural resource management objectives, to use prescribed fire to achieve military and Bureau of Land Management management objectives, and to use fuel reduction to lower the risk of wild fire. Prescription fire support request shall be coordinated through the White Sands Missile Range Environmental Office. It is agreed that:

a. On request to a representative of the White Sands Missile Range Fire Department by a representative of the Bureau of Land Management, firefighting equipment and personnel of the White Sands Missile Range Fire Department will be dispatched when available to any point along or within the boundary between the Bureau of Land Management land and the White Sands Missile Range land and for which the Bureau of Land Management normally provides fire protection as designated by the Bureau of Land Management representative.

b. On request to a representative of the Bureau of Land Management by a representative of the White Sands Missile Range Fire Department, firefighting equipment and personnel of the Bureau of Land Management will be dispatched when available to any point within White Sands Missile Range, which the White Sands Missile Range Fire Department represents as having been cleared of unexploded ordnance issues, and for which the White Sands Missile Range Fire Department normally provides fire protection as designated by the representative of the White Sands Missile Range Fire Department.

c. A representative for either the Bureau of Land Management or White Sands Missile Range Fire Department will be notified immediately of any fire found on or approaching the other's land.

d. The rendering of assistance under the terms of this agreement shall not be mandatory, but the party receiving the request for assistance should immediately inform the requesting party if, for any reason, assistance cannot be rendered.

e. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

(1) Any request for aid under this agreement will specify the location to which the equipment and personnel are to be dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

(2) The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

(3) A responding organization will be released by the requesting organization when the services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

(4) If a crash of aircraft, rockets, missiles, unmanned aerospace vehicles or similar systems owned or operated by the United States or any foreign nation occurs within the area for which the Bureau of Land Management normally provides fire protection, the Chief of White Sands Missile Range Fire Department or his or her representative may assume full command on arrival at the scene of the crash.

f. Each party hereby waives all claims against every other party for compensation for any loss, damage, injury or death occurring as a consequence of the performance of this agreement except those claims authorized under 15 United States Code 2210.

g. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security issues and, as feasible, to jointly conduct wildland preseason fire program inspections, to jointly conduct wildfire risk evaluations, and to jointly plan and conduct both the use of prescribed fire and the use of natural fire.

(1) Both parties shall have access, if requested, to copy of the other party's Fire Management Plan to familiarize fire management personnel with accepted practices and limitations of acceptable resource management practices and appropriate management responses.

(2) All actions requested of the other party shall be approved in the respective Agency Land Use/Management Plan or Fire Management Plan including prescribed fire, natural fire use and wildfire suppression alternatives which are recommended or selected.

h. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to attend training and classroom exercise to meet Incident Qualifications and Certification System standards for fighting wildland fires and for conducting prescribed burns.

i. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to share fire weather information and any other information that pertains to planning and implementing wildland fire suppression, implementing and conducting prescribed fires, as well as, conducting natural fire use.

j. The technical staff of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operation to effectively implement this agreement. Such plans and procedures of operations shall become effective upon ratification by the signatory parties.

k. All equipment used by the Bureau of Land Management in carrying out this agreement will be owned by the Bureau of Land Management and all personnel acting for the Bureau of Land Management under this agreement will be employees of the Bureau of Land Management.

l. This agreement shall become effective upon the date of the last signature hereon and shall remain in full force and effect until cancelled by mutual agreement of the parties or by written notice by one party to the other party, giving thirty days notice of said cancellation.

m. This agreement will be reviewed biennially (every two years) and updated by mutual aid agreement in writing as necessary.

n. This agreement may be amended by written agreement of the parties.

o. No direct funding is required or authorized by this agreement and no property, real or personal, shall be acquired, managed or disposed of hereto. Each party will maintain its own personnel's equipment and each will be responsible for all costs for emergency or routine assistance if it occurs as a result of an incident.

p. Implementation of this agreement by the parties is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this agreement will be construed by the parties to require the obligation, appropriation, or expenditure of any money from the United States Treasury. The parties acknowledge that they will not be required under this agreement to expend any federal appropriated funds unless and until an authorized official affirmatively acts to commit to such expenditures as evidenced in writing.

q. The provisions of the statues cited in this agreement contain legally binding requirements. The agreement itself does not alter, expand, or substitute for those provisions or regulations, nor is it a regulation itself. This agreement contains internal procedural guidance to the parties; respective staffs to assist them in carrying out existing legal requirements. This agreement does not create a right of action for third parties.

r. During the performance of this agreement, the parties agree to abide by the terms of Executive Order 11246 which addresses non-discrimination. The parties will not discriminate against any person because of race, color, religion, sex, or national origin.

FOR WHITE SANDS MISSILE RANGE:	FOR THE BUREAU OF LAND MANAGEMENT:
C. J. WICKER COL, LG Commanding	Bill Childress BILL CHILDRESS District Manager
DATE: 12 June 2010	DATE: 24 June 2010

4

DEPARTMENT OF THE ARMY
U.S. ARMY WHITE SANDS MISSILE RANGE
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

08-MAR-2083

REPLY TO
ATTENTION OF

RECIPROCAL FIRE PROTECTION AGREEMENT
BETWEEN
GARRISON COMMANDER, U.S. ARMY, WHITE SANDS MISSILE RANGE,
NEW MEXICO
AND
MCKINLEY COUNTY, NEW MEXICO

This Reciprocal Fire and Emergency Services Protection Agreement is entered into this 18th day of March 2008, by and between the Secretary of the Army (hereinafter "the Army"), acting pursuant to the authority of 42 U.S.C. 1856(A), and the government of McKinley County, New Mexico. Hereinafter the Secretary of the Army, United States of America, who will be represented by the Garrison Commander of White Sands Missile Range (WSMR), will be referred to as the Government.

WITNESS THAT:

WHEREAS:

The Army owns the Fort Wingate Depot Activity, hereinafter referred to as Fort Wingate, a facility of the Department of the Army.

The McKinley County Government maintains a Fire Department, which includes volunteer personnel, fire trucks, and fire fighting equipment.

The Army does not maintain a Fire Department at Fort Wingate. The Fort Wingate caretakers are the designated facility Fire Wardens.

It is to the best interest of the parties here to cooperate in fire fighting and other emergencies that may occur within the Fort Wingate.

NOW THEREFORE, the parties hereto do hereby agree to render mutual assistance, one to the other, on the terms, conditions, and provisions hereinafter set forth:

(1) McKinley County will, at the request of the Garrison Commander WSMR or his properly authorized designee, in the time of emergency or necessity, furnish aid in the nature of apparatus, equipment, and personnel to combat fires or assist in time of disaster at Fort Wingate.

(2) The Army, acting through the caretaker or Garrison Commander WSMR will, at the request of the McKinley County Fire Chief or his properly authorized designee, in the time of

emergency or necessity, furnish aid to McKinley County in the nature of equipment, and personnel to combat fires or assist in time of disaster in the proximity of Fort Wingate.

(3) When the McKinley County or Gallup City Fire Department or parts thereof are engaged in fire fighting at Fort Wingate, they shall be subject to the authority and direction of the Caretaker of Fort Wingate and the Garrison Commander WSMR thereof. When the combined forces or parts thereof are engaged in fire fighting in McKinley County, they shall be under the authority and direction of the Fire Chief of McKinley County departments.

(4) Army personnel, acting pursuant to this agreement, shall be considered to be acting pursuant to lawful orders to the Garrison Commander WSMR and Caretaker of Fort Wingate, and therefore, acting within the scope of their employment and not as employees of McKinley County.

(5) It is understood and agreed that McKinley County will be under no obligation to furnish aid to Fort Wingate if, under the circumstances, furnishing of such aid will endanger or jeopardize the fire protection of the County. It is likewise understood and agreed that Fort Wingate shall be under no obligation to furnish aid to the County, if the furnishing of such aid, under the circumstances, will have an unacceptable impact on operations or fire protection at Fort Wingate. The County Commissioners or Fire Chief of the County departments or their properly authorized designee will be the sole judge as to when conditions permit assistance and the extent of such assistance to Fort Wingate. The Garrison Commander WSMR or Caretaker of Fort Wingate shall be the sole judge as to when conditions permit assistance and the extent of such assistance to the County by the Government.

(6) It is hereby agreed that cooperating fire departments will become familiar with the special fire fighting problems common to their territory.

(7) Under no circumstances will mutual aid fire fighters be expected to or permitted to enter the area or attach fires involving high explosives.

(8) In the event the combined departments or parts thereof are engaged in fighting a fire, a department lending assistance may, in order to attend any alarm at its regular station, withdraw on notice to the Fire Chief/personnel in charge.

(9) It is expressly hereby mutually agreed between the parties hereto that any claim against either party by the other party for compensation for any loss, damage, personal injury or death occurring in consequence of the performance of this agreement is hereby waived, except those claims authorized under 15 U.S.C. section 2210.

(10) This Agreement may be terminated at any time by either party, provided that such termination shall not be effective until 30 calendar days after the terminating party gives written notice of its intention to terminate and such notice is received by the other party. Until such termination is effected, the terms, provisions, and conditions of this agreement shall remain in full force and effect.

FOR MCKINLEY COUNTY, NEW MEXICO: FOR THE SECRETARY OF THE ARMY:

Tom Trujillo	
TOM TRUJILLO County Manager	GARY D. GIEBEL Colonel, U.S. Army Garrison Commander
DATE: 03-18-2008	DATE: 3 Apr 08

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

REPLY TO
ATTENTION OF

MUTUAL AID AGREEMENT
BETWEEN
U.S. ARMY WHITE SANDS MISSILE RANGE, NEW MEXICO
AND
UNITED STATES FISH AND WILDLIFE SERVICE, NEW MEXICO

This agreement, entered into this 13th day of June 2010, between the Secretary of the Army, White Sands Missile Range, New Mexico, acting according to the authority of section 1856a, title 42, United States Code, and the United States Fish and Wildlife Service, New Mexico Fire District-San Andres National Wildlife Refuge, acting according to the authority of 16 United States Code 668dd. is to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire, and firefighting. This agreement is further intended to secure for each the benefits of mutual aid to support their missions, to decrease the risk and spread of catastrophic wildland fire, to use natural fire to achieve military and United States Fish and Wildlife Service natural resource management objectives, to use prescribed fire to achieve military and United States Fish and Wildlife Service management objectives, and to use fuel reduction to lower the risk of wild fire. Prescription fire support request shall be coordinated through the White Sands Missile Range Environmental Office. It is agreed that:

a. On request to a representative of the White Sands Missile Range Fire Department by a representative of the United States Fish and Wildlife Service, firefighting equipment and personnel of the White Sands Missile Range Fire Department will be dispatched when available to any point along or within the boundary between the United States Fish and Wildlife Service land and the White Sands Missile Range land and for which the United States Fish and Wildlife Service normally provides fire protection as designated by the United States Fish and Wildlife Service representative.

b. On request to a representative of the United States Fish and Wildlife Service by a representative of the White Sands Missile Range Fire Department, firefighting equipment and personnel of the United Fish and Wildlife Service will be dispatched when available to any point within White Sands Missile Range, which the White Sands Missile Range Fire Department represents as having been cleared of unexploded ordnance issues, and for which the White Sands Missile Range Fire Department normally provides fire protection as designated by the representative of the White Sands Missile Range Fire Department.

c. A representative for either the United States Fish and Wildlife Service or White Sands Missile Range Fire Department will be notified immediately of any fire found on or approaching the other's land.

d. The rendering of assistance under the terms of this agreement shall not be mandatory, but the party receiving the request for assistance should immediately inform the requesting party if, for any reason, assistance cannot be rendered.

e. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

(1) Any request for aid under this agreement will specify the location to which the equipment and personnel are to be dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

(2) The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

(3) A responding organization will be released by the requesting organization when the services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

(4) If a crash of aircraft, rockets, missiles, unmanned aerospace vehicles or similar systems owned or operated by the United States or any foreign nation occurs within the area for which the United States Fish and Wildlife Service normally provides fire protection, the Chief of White Sands Missile Range Fire Department or his or her representative may assume full command on arrival at the scene of the crash.

f. Each party hereby waives all claims against every other party for compensation for any loss, damage, injury or death occurring as a consequence of the performance of this agreement except those claims authorized under 15 United States Code 2210.

g. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security issues and, as feasible, to jointly conduct wildland preseason fire program inspections, to jointly conduct wildfire risk evaluations, and to jointly plan and conduct both the use of prescribed fire and the use of natural fire.

(1) Both parties shall have access, if requested, to copy of the other party's Fire Management Plan to familiarize fire management personnel with accepted practices and limitations of acceptable resource management practices and appropriate management responses.

(2) All actions requested of the other party shall be approved in the respective Agency Land Use/Management Plan or Fire Management Plan including prescribed fire, natural fire use and wildfire suppression alternatives which are recommended or selected.

h. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to attend training and classroom exercise to meet Incident Qualifications and Certification System standards for fighting wildland fires and for conducting prescribed burns.

i. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to share fire weather information and any other information that pertains to planning and implementing wildland fire suppression, implementing and conducting prescribed fires, as well as, conducting natural fire use.

j. The technical staff of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operation to effectively implement this agreement. Such plans and procedures of operations shall become effective upon ratification by the signatory parties.

k. All equipment used by the United States Fish and Wildlife Service in carrying out this agreement will be owned by the United States Fish and Wildlife Service and all personnel acting for the United States Fish and Wildlife Service under this agreement will be employees of the United States Fish and Wildlife Service.

l. This agreement shall become effective upon the date of the last signature hereon and shall remain in full force and effect until cancelled by mutual agreement of the parties or by written notice by one party to the other party, giving thirty days notice of said cancellation.

m. This agreement will be reviewed biennially (every two years) and updated by mutual aid agreement in writing as necessary.

n. This agreement may be amended by written agreement of the parties.

o. No direct funding is required or authorized by this agreement and no property, real or personal, shall be acquired, managed or disposed of hereto. Each party will maintain its own personnel's equipment and each will be responsible for all costs for emergency or routine assistance if it occurs as a result of an incident.

p. Implementation of this agreement by the parties is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this agreement will be construed by the parties to require the obligation, appropriation, or expenditure of any money from the United States Treasury. The parties acknowledge that they will not be required under this agreement to expend any federal appropriated funds unless and until an authorized official affirmatively acts to commit to such expenditures as evidenced in writing.

q. The provisions of the statues cited in this agreement contain legally binding requirements. The agreement itself does not alter, expand, or substitute for those provisions or regulations, nor is it a regulation itself. This agreement contains internal procedural guidance to the parties; respective staffs to assist them in carrying out existing legal requirements. This agreement does not create a right of action for third parties.

r. During the performance of this agreement, the parties agree to abide by the terms of Executive Order 11246 which addresses non-discrimination. The parties will not discriminate against any person because of race, color, religion, sex, or national origin.

POINTS OF CONTACT:

United States Fish and Wildlife Service; telephone (575) 835-0040; fax number (575) 835-1101.

White Sands Missile Range; telephone (575) 678-0470; fax number (575) 678-7641.

FOR WHITE SANDS MISSILE RANGE:	FOR THE UNITED STATES FISH AND WILDLIFE SERVICE:
C. J. WICKER COL, LG Commanding	JULIAN AFFUSO Fire Management Officer United States Fish and Wildlife Service- New Mexico Fire District
DATE: 13 June 2010	DATE: 575-838-7479

Appendix C: Standard Fire Orders, 18 Watch Out Situations and LCES

The 10 Standard Fire Orders were developed in 1957 by a task force studying ways to prevent firefighter injuries and fatalities. Shortly after the Standard Fire Orders were incorporated into firefighter training, the 18 Situations That Shout Watch Out were developed. These 18 situations are more specific and cautionary than the Standard Fire Orders and described situations that expand the 10 points of the Fire Orders. If firefighters follow the 10 Standard Fire Orders and are alerted to the 18 Watch Out Situations, much of the risk of firefighting can be reduced. LCES is a short, easily memorized acronym that stands for Lookouts, Communications, Escape routes and Safety zones. These four actions must be established and made known to everyone before engaging in wildfire suppression.

The 10 Standard Fire Orders

The NWCG approved the revision of the Ten Standard Fire Orders in accordance with their original arrangement. The original arrangement of the Orders are logically organized to be implemented systematically and applied to all fire situations.

Fire Behavior

1. Keep informed on fire weather conditions and forecasts.
2. Know what your fire is doing at all times.
3. Base all actions on current and expected behavior of the fire.

Fireline Safety

4. Identify escape routes and safety zones and make them known.
5. Post lookouts when there is possible danger.
6. Be alert. Keep calm. Think clearly. Act decisively.

Organizational Control

7. Maintain prompt communications with your forces, your supervisor and adjoining forces.
8. Give clear instructions and insure they are understood.
9. Maintain control of your forces at all times.

If 1-9 are considered, then...

10. Fight fire aggressively, having provided for safety first.

The 10 Standard Fire Orders are firm. We don't break them; we don't bend them. All firefighters have the right to a safe assignment.

The 18 Watch Out Situations

1. Fire not scouted and sized up.
2. In country not seen in daylight.
3. Safety zones and escape routes not identified.
4. Unfamiliar with weather and local factors influencing fire behavior
5. Uninformed on strategy, tactics, and hazards.
6. Instructions and assignments not clear.
7. No communication link between crewmembers and supervisors.
8. Constructing line without safe anchor point.
9. Building line downhill with fire below.
10. Attempting frontal assault on fire.
11. Unburned fuel between you and the fire.
12. Cannot see main fire, not in contact with anyone who can.
13. On a hillside where rolling material can ignite fuel below.
14. Weather gets hotter and drier.
15. Wind increases and/or changes direction.

16. Getting frequent spot fires across line.
17. Terrain or fuels make escape to safety zones difficult.
18. Feel like taking a nap near fireline.

LCES

LCES must be established and known to ALL firefighters BEFORE it is needed.

Lookout(s)

- Experienced, competent, trusted
- Enough lookouts at good vantage points
- Knowledge of crew locations
- Knowledge of escape and safety locations
- Knowledge of trigger points
- Map, Weather Kit, Watch, IAP

Communication(s)

- Radio frequencies confirmed
- Backup procedures and check-in times established
- Provide updates on any situation change
- Sound alarm early, not late

Escape Route(s)

- More than one escape route
- Avoid steep uphill escape routes
- Scouted for loose soils, rocks, vegetation
- Timed considering slowest person, fatigue, and temperature factors
- Marked for day or night
- Evaluate escape time vs. rate of spread
- Vehicles parked for escape

Safety Zone(s)

- Survivable without a fire shelter
- Back into clean burn
- Natural features (rock areas, water, meadows)
- Constructed sites (clearcuts, roads, helispots)
- Scouted for size and hazards
- Upslope?
- Downwind?
- Heavy Fuels?

Escape time and safety zone size requirements will change as fire behavior changes.

APPENDIX D: WSMR FES Fire Department Standard Operating Procedures-Wildland Fire Responses

SOP 6.20

28 Sept 2015

1.0 PURPOSE

1.1. This SOP establishes procedures that will provide the fire ground Commander and personnel a safe and effective method of handling fires involving brush, grasslands, or forest. Employees engaged in fire management activities will follow all safety standards and guidelines in their agency specific health and safety guides and handbooks. All employees engaged in fire suppression activities will adhere to standards and mitigate risks defined in the Incident Response Pocket Guide (PMS#461, NFES #1077) and NWCG Fire line Handbook (NFES#0065).

2.0 SCOPE

2.1. This procedure shall be followed by all personnel responding to and operating at Wildland Fire incidents. This procedure complies with the Interagency Standards for Fire and Fire Aviation Operations and the Integrated Wildland Fire Management plan incorporated by WSMR.

3.0 INCIDENT COMMAND

3.1. The first arriving company officer who establishes Command must address Life safety, Fire Control, and Property Conservation Benchmarks. In a Wildland fire setting the Life safety benchmarks must include fire fighters as well as civilians. Command must have a plan that includes safety zones for fire fighters and equipment. These zones should be established early on to ensure all incoming resources are aware of them. Individual sectors can establish safety zones depending on the need or location. Safety zones should be easily accessible and large enough to support rehab sectors and equipment caches. The Incident Commander shall be responsible for establishing and managing the overall operational plan and directing the tactical operations of the incident. In the event that the incident is of such size or complexity that the Incident Commander designates an Operations Chief, this officer shall assume responsibility for all the tactical responsibilities defined herein.

3.2. The major responsibilities of the Incident Commander are as follows:

a. Verify that a command post is established in a location appropriate for the management of the incident.
b. Communicating the location of the command post to Rescue Control.
c. Coordinating and controlling all responders at the incident.
d. Designating/confirming that an incident classification is established.
e. Developing an effective organizational structure consistent with information gathered.
f. Notifying appropriate agencies
g. Developing and communicating the action plan to affected personnel.
h. Allocating sufficient resources as required by the action plan.
i. Verifying that department personnel work within their training levels.
j. Making adjustments in the Level of the incident as required.
k. Documenting all information relating to the incident including the command organizational chart.
l. Protect and rehab fire fighters.

4.0. KEY FACTORS

a. Set firefighting goals commensurate with available resources. Safety takes precedence, and firefighters should be withdrawn when hazardous factors are likely to interfere with safety considerations, i.e. topography, UXO, weather conditions.

b. Firefighters must be confident that sufficient risk management controls are in place (effective escape routes, safety zones, and control applications) before implementing “light on the land” suppression tactics.

c. The following factors have a critical effect on the burning characteristics of a Wildland fire. Command must maintain an awareness of these conditions and be prepared to act quickly, pessimistically and well ahead of the fire. The factors are: WEATHER, FUEL, and TOPOGRAPHY.
d. WEATHER
e. Command must be aware of constantly changing weather conditions. During a normal day, local winds can change 180 degrees near midday and usually become gusty during the afternoon. Morning and afternoon winds are normally out of the Southwest and blowing towards the Northeast. Fire spread will usually slow in the evening as the humidity increases (25%), and the temperature decreases. Fire spread will increase during the midmorning hours as the humidity decreases (15%), and the temperatures increase.
f. Command should always be aware of the fire conditions, weather conditions and the time of day. Remember that a large Wildland fire can create dangerous convection currents that cause erratic fire behavior and spot fires far in advance of the fire head. Strong winds also produce similar results.
g. Hot and dry conditions produce extremely rapid fire spread. A slight decrease in relative humidity will cause a significant increase in fire intensity. During extreme days surface wetted fuel will dry in a few minutes.
4.1. FUEL
4.1.1. Fuel loading refers to the amount of available burnable fuel in a designated zone. Fuel types are grasses, woody debris, trees, organic litter, etc. The accumulation of these fuels indicates an increase in the potential for ignition, spread of fire, and fire intensity.
4.2. TOPOGRAPHY
4.2.1. Fires burn uphill much more rapidly than downhill. On an uphill slope, the fire will tend to crown over the top and start spot fires a considerable distance down the receding slope. A large free burning fire will tend to create its own convection currents and spot fires may be started. Access is often the most serious problem with topography.
4.2.2. Companies with considerable brush fire potential should size-up areas with regard to fuel, topography and extent of exposure to structures. Particular attention should be paid to access roads and accessible areas where apparatus may travel. Natural fire breaks and potential exposure problems should be noted on the area maps provided for this purpose.

5.0. RESPONDING TO BRUSH/WILDLAND FIRES
5.1. ON SCENE INITIAL REPORT OF A WILDLAND FIRE

- a. Location of fire
- b. Size of fire
- c. Rate of Spread / Fuel Type / Topography
- d. Fire Potential (how large will/may fire get)
- e. Anticipated Control Problems
- f. Estimated Control Time
- g. Values Threatened
- h. Weather Conditions
- i. Additional Resources Needs
- j. Cause of Fire

5.2. INITIAL ATTACK OPERATIONS
5.2.1. The objective of initial attack fire suppression is to safely and efficiently suppress fires in conformance with existing policy and procedures consistent with WSMR Fire
5.2.2. Management Plan.
5.2.2.1. Organization and qualifications
5.2.2.2. Resources taking initial attack action on a fire must be qualified and have a designated qualified Initial Attack Incident Commander.

5.2.2.3. At the earliest opportunity after arrival on an incident, the initial attack incident commander will Size up the fire and relay the information to Rescue Control, and continue to keep the dispatcher informed of any significant changes and progress on the fire.

6.0 FIRE CAUSE DETERMINATION

6.1. The Incident Commander is responsible for assisting in the determination of the cause of the fire. A checklist for Fire Cause and Determination can be found in the NWCG Incident Response Pocket Guide (IRPG).

7.0 OPERATIONAL BRIEFINGS

7.1. All personnel arriving at the incident must receive a briefing from the Incident Commander, or delegate, prior to initiating any actions on the incident. Incoming IC's must place a priority on providing briefings to resources already on the scene. The principles of LCES must be implemented prior to the initiation of any actions.

7.2. The Operational Briefing Checklist found in the IRPG, contains the minimum items required to brief all incoming crews, personnel, or resources. Units are encouraged to expand the minimum briefing, as appropriate, to ensure that safety and efficiency are addressed.

8.0 SPOT WEATHER FORECAST

8.1. Spot Weather Forecasts must be requested for fires that exhibit extreme fire behavior, exceed initial attack, or are located in areas where Fire Weather Watch and Red Flag Warnings have been issued. Spot Weather Forecasts may be requested at any time through Rescue Control.

9.0 STRATEGY AND TACTICS

9.1. Determining Strategy and Tactics:

8.1.1. Determining appropriate initial attack strategies and tactics must be based on appropriate management response while providing for firefighter and public safety. Other factors to consider are: Suppression Objectives, Values at Risk, Current and Predicted Fire Behavior, Weather Conditions and available Resources.

9.2. Application of Risk Management

9.2.1. Identification and Mitigation of Risk must be considered in all strategic and tactical planning. Use of the Risk Management Process is mandatory. Tactical assignments for all resources will not be initiated or continued without strict adherence to the Risk Management Process, incorporating the 10 Standard Fire Orders, 18 Watch Out Situations, and principles of LCES. These items can be found in the IRPG.

10.0 DIRECT ATTACK

10.1 This strategy is conducted directly on the flaming edge of the fire. Direct attack must start with an anchor point. On large open grass fires, command must take advantage of natural fire barriers that will assist in control measures, such as: dry sandy washes, roads, trails, rock outcroppings, patch fuels etc. When water is in short supply, it is usually most effective when applied to burning material instead of wetting fuels in advance of the fire. The advantages and disadvantages of Direct and Indirect attack are listed in the IRPG. Command must quickly develop a fire fighting plan. The following is a list of size-up considerations that greatly affect tactics and strategy.

- Location of fire head or heads, the fast moving part of the fire.
- Pertinent burning conditions—Weather, Fuel, Topography, Time of Day, etc.
- Types of fuel—Light or heavy fuel
- Exposures—improvements, buildings, crops, etc.
- Size of fire and rate of spread.
- Special Hazards—hot spots, spot fires, developing heads and UXO considerations
- Manpower needs.
- Fuel continuity.
- Accessibility into fire area.

- Water resources—Tenders, hydrants, etc.
- Line of retreat—Escape routes.

11.0 INDIRECT ATTACK

11.1 This strategy is used when a direct attack is not possible or practical. The use of natural barriers, roads, fuel type changes, etc. helps to establish control lines as part of burnout or backfiring operations. Effective strategy when fire behavior is intense and/or firefighting resources are scarce. Indirect attack must start with an anchor point.

12.0 DOWNHILL FIRELINE CONSTRUCTION

12.1. Downhill Fire line Construction is hazardous in steep terrain, fast-burning fuels, or rapidly changing weather. Downhill fire line construction should not be attempted unless there is no tactical alternative. When building downhill fire line, reference the checklist in the IRPG.

13.0 HOTSPOTTING

13.1. Hot spotting as a tactic is used to hold the active areas on a fires edge long enough to allow line construction operations to encompass the area. Emphasis must be placed on the use of viable anchor points, escape routes and safety zones to maintain LCES.

14.0 COLDTRAILING

14.1. Cold trailing as a tactic means the firefighters are working along a partially cold line. They are inspecting the black line for heat, constructing line where needed, and mopping up hotspots. Cold trailing is used to reduce unnecessary disturbance to the environment.

15.0 MOP UP

15.1. Mop up as a tactic is to extinguish burning material that may cause a fire to spread.
15.1.1. Determine the distance inside the control line to be overhauled (for small fire; this may be the entire burn area).
15.1.2. During rehab of mop up crews, ensure at least two firefighters remain in the area to monitor for re-ignition or spread of fire.
15.2.3. Schedule for follow-up checks by crews to ensure the fire is out in perimeter.

16.0 SAFETY

16.1. PERSONNEL SAFETY
16.1.1. All personnel assigned on wildfires and prescribed fires are required to use Personal Protective Equipment (PPE) appropriate for their duties. Employees must be trained to use safety equipment effectively. Wildland firefighting is a physically demanding operation and members should be fit and prepared mentally for a very hot, fast moving, and dangerous environment. Remember that heat is a major safety problem and all personnel should be kept well hydrated.
16.2. SCENE SAFETY
16.2.1. Wildland fires are extremely dangerous and require that all personnel have been trained in accordance with all NWCG standards and follow the 10 standard firefighting orders, 18 watchout situations and LCES.
16.3. CREW SAFETY
16.3.1. Wildland fires demand that Incident Commanders maintain a high level of awareness regarding crew accountability. Crew members can easily become spread out and not visible in rugged and rocky terrain. IC’s must maintain communication with and control over crew members to ensure a safe operation. Wildland fire will still employ the buddy system, watch out for each other.
16.4. UNEXPLODED ORDNANCE-UXO

16.4.1. Recognizing Unexploded Ordnance (UXO) is the first and most important step in reducing the risk posed by UXO. UXO may be found intact or in fragments which presents a potential hazard and should be treated as such. Deteriorated UXO presents a particular hazard because it may contain chemical agents that could become exposed. UXO poses risks of injury or death to anyone in the vicinity.
16.4.2. If you see UXO, stop. Do not move any closer, do not Key radios, mark the area and stay a minimum of 500' away from UXO which is on fire. Fire units will not engage any fire that is in an Impact Zone or in an area where UXO is discovered, all firefighting actions will occur on the boundary of the area. Consider Back burn or Burn out operations from the boundary. Report discovery of UXO to your immediate supervisor.
16.4.3. IF YOU DIDN'T DROP IT- DON'T PICK IT UP

//Original Signed//
CARLOS SOTO JR.
Chief, Fire and Emergency Services

APPENDIX E: Sample Delegation of Authority

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS MISSILE RANGE
100 HEADQUARTERS AVENUE
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

Date

IMWS-ZA

MEMORANDUM FOR RECORD

SUBJECT: Delegation of Authority

1. As of ____ hours, Date, I have delegated authority to manage the ______ Fire to Incident Commander ______________, Agency, and his Incident Management Team.

2. The fire, which originated on ________________, occurring on Date is burning on lands managed by US Army Garrison-White Sands.

3. My priorities and considerations for the management of this fire are:

a. Provide for firefighter and public safety.

b. Manage the fire with as little environmental damage as possible.

c. Key cultural features requiring priority protection are:

1)

d. Key natural resources requiring protection are:

e. Restrictions for suppression actions include:

1) On-going or planned military test missions have priority over firefighting and fire resources may need to evacuate the fire area during test missions.

2) Use light on the land suppression techniques which minimize the damage to natural and cultural resources.

f. My agency Resource Advisor will be:

1) Patrick Morrow, (575) 678-7095.

2) Brian Knight, (575) 678-1618.

g. The fire borders are the physical boundaries of White Sands Missile Range.

h. Manage the fire cost-effectively for the values at risk.

i. Provide training opportunities for WSMR personnel to help strengthen our organizational capabilities.

j. Minimize disruption of military training activities without compromising firefighter or military personnel safety.

k. Ensure that Garrison Commander is kept informed of major actions and decisions made during the containment of this fire.

NAME
COL,
LG
Commanding

Appendix F: 3 Rs of Explosives Safety for Firefighting Safety

Recognize, Retreat, Report

The safety information below is taken from the US Army DENIX publication: **3Rs of Explosives Safety. http://www.denix.osd.mil**

Firefighting Safety

It is essential that firefighting operations within or near areas that are known or suspected to contain military munitions (e.g., unexploded ordnance (UXO)) be planned with consideration of explosives safety. This is equally true where military munitions operating facilities (e.g., current of former production facilities, demilitarization facilities) exist. The local explosives safety specialists, bomb squad, or nearest military explosives ordnance disposal (EOD) unit should be contacted and used as a resource.

Millions of acres of property in the United States are known or suspected to contain UXO and discarded military munitions (DMM). The entire 2.2 million acres of WSMR has potential for UXO. The presence of UXO and DMM is for the most part a direct result of weapons system testing and troop training activities that the Department of Defense (DOD) conducted to ensure the readiness or our Nation's military forces. This property includes, but may not be limited to operational ranges on active military installations, formerly used defense sites (FUDS), installations closed or closing under the Base Realignment and Closure (BRAC) Act (BRAC sites). The potential risks posed by UXO and/or DMM could be great depending on the types and amount present.

Knowing the history of an area is paramount! Fire departments that are responsible for fighting fires that could involve areas that are part of an active military installation or that were once used by the military (e.g., a FUDS, BRAC property), should coordinate, as appropriate, with the below to become familiar with areas known or suspected to contain UXO or DMM, or other explosive hazards. This information can be obtained:

- For active installations - from the commander, fire department, director of safety or facilities engineer. (This coordination should also be done when a department has a mutual support agreement with the installation's fire department.)
- For FUDS – from the US Army Corps of Engineers' District Commander
- For BRAC installations – from the installation commander, BRAC Environmental Coordinator, or local reuse authority, if established.

Recognizing and taking action to mitigate the potential hazards (explosive and/or chemical agent) associated with military munitions that may be present is paramount to reducing the risk of serious injury or loss of firefighting resources when fighting fires that may potentially involve military munitions.

The ability to recognize military munitions is the first and most important step in reducing the potential risks associated with UXO. Many weapons systems are developed at WSMR. They may or may not look the same once they are mass produced for the soldier. These difference can produce unfamiliar UXO on WSMR. UXO does not always land within a WIT or impact area. Because some are aerially dispersed, wind can cause the article to drift outside of the intended impact area. The below military munitions are likely to be encountered as UXO or DMM on operational ranges or property (e.g., FUDS) formerly used by the DoD for live-fire training or testing or military maneuvers. The potential explosives hazards from munitions vary based on a number of factors. Although the explosives hazards associated with small arms ammunition - defined as ammunition, without projectiles that contain explosives (other than tracers), that is .50 caliber or smaller, or for shotguns - are considered minimal, they should not be ignored. Any munitions encountered should be considered UXO and extremely dangerous.

UXO can be found in many different ways (e.g., on the surface, partially buried in soil or partially submerged under water, or buried or fully submerged) and in many different conditions (e.g., rusty and crusted, like new, in parts). The location and condition of the munitions found on a site depends in part on the type of munitions used, the weapon systems employed, how the munitions were used (e.g., training or the geology and environmental conditions of the area, and activities that may have taken place on the property since DoD last used the site. Dynamite from mining decades ago might still be around and still be potentially explosive.

UXO may be found fully intact or in parts or fragments. All UXO, whether intact or in parts, presents a potential explosion hazard and should be treated as such. Even UXO that have deteriorated present a significant explosives hazard. In addition, these munitions can also present an environmental hazard because munitions constituents, like their fillers (e.g., RDX, HMX, TNT), could become exposed.

EXPLOSIVES SAFETY MEASURES: Whether present in an area by design or by accident, UXO poses potential risks of injury or death. Remember the following:

- If you did not drop it, do not pick it up or disturb it!
- Do not enter an area known or suspected to contain munitions. All munitions, whether intact or in fragments, present a potential explosive hazard.
- If you encounter or suspect you may have encountered a munition, stop, and scan the area for additional munitions. Do not move closer.
- Never touch, move, or disturb a munition or suspect munition.
- If time permits, clearly mark the area where munitions were encountered. Do not mark the munition.
- Do not attempt to fight fires in areas known or suspected to contain munitions.
- Report the discovery of munitions to your immediate supervisor or the incident commander as soon as possible!
- Do not use radios or cell phones within 100 feet of areas known to contain munitions, unless specifically authorized or in an emergency.

Wildland Firefighting Safety Guide: **RECOGNIZE** — *when you may have encountered a munition.* **RETREAT** — *do not touch, move or disturb it, but carefully leave the area.* **REPORT** — *call Range Operations at 575 678-2222, the Installation Safety Office at 575 678-2305 or WSMR DES/FES Rescue Control at 575 678-1234 or 911.*

Appendix G: Fire Effects Information for the Threatened, Endangered and Sensitive Plant and Animal Species Found on WSMR

E-Endangered species
C-Candidate species
SC-Species of concern
S-Sensitive Species
T-Threatened species
SGCN-Species of Greatest Conservation Need

Species	Status		Habitat Descriptions	Wildfire Effects
	Federal	New Mexico		
PLANTS				
Crested coral-root *(Hexalectris spicata)*	—	E	Found in Organ Mountains in leaf litter in oak, pine, or juniper woodlands over limestone. [1]	Wildfires pose potentially adverse effects to populations of this species due to high quantities of flammable fuel loads within its habitat.
Desert night blooming cereus *(Peniocereus greggii var. greggii)*	—	E	Dry alluvial soils at elevations between 370 and 1,500m; in highly broken terrain in desert grassland or Chihuahuan desert scrub, typically in sandy to silty gravelly soils on upper to mid bajadas among creosote bush, mesquite, Palo Verde, knife-leaf condalia. [1]	Wildfires pose little adverse effects to this species because of its habitat requirements of open desert with low fuel loads
Nodding Cliff Daisy (*Perityle cernua*)	—	SC	Endemic to the Organ Mountains. [1] Grows in cracks of igneous cliffs of rhyolite or andesite.	Wildland fires pose low potential adverse effects to this species due to its habitat requirements of rocky cliffs.
Organ Mountain Paintbrush (*Castilleja organorum*)	--	SC	Endemic to higher elevations of the Organ Mountains. [1] Open to partly shady montane slopes and rocky canyons in piñon-juniper woodland or lower montane coniferous forest; 2000-2400 m.	Wildland fires pose moderate potential adverse effects to this species due to habitat requirements of open, grassy areas in woodlands.

Organ Mountain Evening Primrose (*Oenothera organensis*)	--	SC	Forest, woodlands and shrublands of the Organ Mountains. Restricted to canyon floor streambeds and adjacent hillside seeps where water is present for at least part of the growing season. [5]	High intensity wildfires pose a potential adverse effect due to heavy scouring and massive sediment depositions that can occur with subsequent rains within this species limited habitat.[1]
Organ Mountain Figwort (*Scrophularia laevis*)	--	SC	Moist canyons of the Organ Mountains on quartz monzonite substrate in piñon-juniper woodlands and Rocky Mountain montane, coniferous forests. [1]	Wildland fires pose low potential adverse effects due to its habitat requirements of moist soils.
Organ Mountain Pincushion Cactus (*Escobaria organensis*)	--	E	Found in the Organ Mountains on andesite, quartz-monzonite, and to a lesser extent rhyolite and limestone in broken mountainous terrain. Associated with Chihuahuan desert scrub and open oak and piñon-juniper woodland. [1]	Fires pose low potential adverse effects due to its preferred habitat of open, rocky soils.
Sand Prickly Pear (*Opuntia arenaria*)	--	E	Sandy areas, particularly semi-stabilized sand dunes among open Chihuahuan desert scrub, often with honey mesquite and a sparse cover of grasses. [1]	Wildland fires could pose moderate adverse effects to this species due to its habitat where there can be abundant annual and perennial grasses and forbs.
Sandhill Goosefoot (*Chenopodium cycloides*)	--	SGCN	Sandy soils, frequently around the vegetated edges of blowouts on semi-stable sand dunes. Typically found in open, disturbed sites along with perennial plant species. [6, 7]	Wildland fires pose a low potential adverse effect to this species due to its habitat requirements of open, disturbed areas.
Standley Whitlowgrass (*Draba standleyi*)	--	SC	Found in the Organ and San Andres Mountains on igneous rock faces, bases of overhanging cliffs, and clefts of porphyritic and andesitic rocks in shaded areas. [1]	Wildland fires pose low potential adverse effects to this species because preferred habitat is on high rocky cliffs where there are low fuel loads.
Todsen's pennyroyal *(Hedeoma todsenii)*	E	E	Occurs in the San Andres and Sacramento Mountains on steep, north-facing slopes within piñon-juniper habitat in gypseous, sandy loam soils, often with loose limestone gravel.[7A]	Wildland fires could pose adverse potential effects to this species because there can be heavy fuel loads in the area. However, moderate or light burning may be beneficial to this species by opening up canopy and reducing competition for sunlight, water and nutrients.

Mollusks				
Organ Mountain Woodland Snail *(Ashmunella organensis*)	—	SGCN	Found in the Organ and San Andres Mountains in areas of Gambel oak, wortleleaf snowberry, one seed juniper, mixed grasses, piñon pine with oak and alligator juniper, Ponderosa pine, Douglas fir, Box elder. [8]	Wildland fires pose low potential adverse effects to this species because of habitat requirements of moist layers of decomposed organic material within talus slopes.
Oscura Mountains Woodland Snail *(Ashmunella oscuraensis)*	—	SGCN	Spaces among rock talus in the Oscura Mountains, among Gambel's oak, wortleleaf snowberry, oneseed juniper, mixed grasses, piñon pine. [8]	Wildland fires pose low potential adverse effects to this species because of habitat requirements of moist layers of decomposed organic material within talus slopes.

Reptiles				
Mountain short horned lizard (*Phrynosoma hernandesi hernandesi*)	—	—	Species occurs on WSMR. Inhabits semi-arid plains to high mountains; usually in open, shrubby, or openly wooded areas with sparse vegetation at ground level; soil may vary from rocky to sandy. [14]	Wildland fires pose low potential adverse effects to this species because its habitat is mainly rocky areas and it seeks refuge in rock crevices.
Texas horned lizard (*Phrynosoma cornutum*)	—	—	Widespread across WSMR, this species Inhabits open areas with sparse vegetation (deserts, prairies, playa edges, bajadas, dunes, foothills) with grass, cactus or scattered brush or scrubby trees. Soils may vary in texture from sandy to rocky. 15	Wildland fires pose low potential adverse effects to this species because habitat is sparsely vegetated and it seeks refuge below ground or in rocky crevices.

Texas lyre snake (*Trimorphodon vilkinsoni*)	—	—	Documented on WSMR. Found in arid to semi-arid, dry, rocky terrain of mountains, canyons, hills, rocky outcrops, fissured bluffs, and arroyos, with ocotillo, catclaw mimosa, white thorn, yucca, lechuguilla, prickly pear, cholla, and desert grasses or riparian vegetation (e.g., ash, hackberry, juniper, oak), sometimes on desert flats dominated by creosote bush or in shallow canyons with mesquite. [16]	Wildland fires pose low potential adverse effects to this species because its habitat is mainly rocky areas and it seeks refuge in rock crevices.
Birds				
Baird's sparrow (*Ammodramus bairdii*)	—	T	Migrates through and winters on WSMR. Stable native or tame grasslands, lightly to moderately grazed pastures, occasionally inhabits plant covered, dry wetland basins, wet meadows, and dense stands of grass, moderately deep litter, vegetation height of >20cm but <100 cm. Moderately high, but patchy, forbs coverage; patchy grass and litter cover; and little woody vegetation. 17	Wildland fires pose moderate potential adverse effects to this species because of habitat requirements of dense, flammable grasses. Prescribed fires can potentially improve habitat by reducing litter and woody shrub encroachment. This species will not inhabit prairie lands where woody vegetation has invaded grasslands. [18,19]
Bald eagle (*Haliaeetus leucocephalus*)	T	T	Forages on WSMR. Typically found in areas near large water bodies such as inland lakes and rivers. Habitat selection depends greatly on prey availability and availability of tall trees. Nests in the canopy of tall, coniferous trees, surrounded by smaller trees. 20	Wildfires pose a moderate potential adverse effect because high-intensity wildfires can destroy old-growth forests which can reduce populations. Low intensity prescribed fires can be beneficial by reducing litter build up, controlling disease, removing less vigorous species, and allowing more vigorous trees to reach maturity. [20]

Bell's vireo (*Vireo bellii*)	—	T	Found occasionally on WSMR in dense low shrubby vegetation, generally early succession stages in riparian areas, young second-growth forest or woodland, scrub oak, and mesquite brush lands, often near water in arid regions.[21]	Wildland fires could pose moderate potential adverse effects due to the high fuel loads found within its habitat.
Costa's hummingbird (*Calypte costae*)	--	T	Uncommon migrant on WSMR. Inhabits desert, semiarid desert, arid brushy foothills and chaparral, in migration and in winter also found in adjacent mountains and in open meadows and gardens.[22]	Wildland fires pose low potential adverse effects to this species. Wildfires in arroyo-riparian habitats could indirectly effect local populations because of damage to food sources and nesting trees. [23, 24]

Ferruginous hawk (*Buteo regalis*)	—	SGCN	Occupies a variety of habitat types including open grasslands, shrub-steppe, croplands, desert, and the periphery of piñon, juniper woodlands. Similar habitat is sought for breeding, smaller scale features are important for successful reproduction 25	Wildfires pose moderate adverse effects to this species. Fire effect studies show that fires destroy potential breeding habitat by destroying nest trees. Severe wildfires or fire suppression efforts during nesting season may cause hawks to abandon nests. Prescribed fires can be beneficial to hawk populations by providing an increased prey base. [25]
Gray vireo (*Vireo vicinior*)	--	T	Nests in the San Andres and Oscura Mountains. Inhabits desert shrub land, chaparral, coniferous, hardwood woodlands, including hot, semi-arid, shrubby habitats, especially mesquite and brushy piñon-juniper woodlands; oak-juniper woodlands. Nests where dense understory vegetation is present. [26]	Wildland fires pose moderate adverse effects to this species due to the high fuel loads found within preferred habitats.
Loggerhead shrike (*Lanius ludovicianus*)	—	S	Winter and breeding bird from Stallion Range and Tularosa Basin. Inhabits deserts, sagebrush, grasslands, and pastures, native and non-native grasslands with scattering of bushes, trees and bare ground. [28]	Wildland fires pose an adverse effect if nesting or large areas of winter grassland habitat are burned. Fires studies show a decline in breeding populations after wildfires due to decreases in habitat. [29]

Mountain plover (*Charadrius montanus*)	—	—	Found on WSMR. Inhabits disturbed-prairie or semi-desert. Nests in disturbed grassland habitats including areas formerly occupied by bison and prairie dogs. Nests in disturbed areas, native short and mixed grass prairie, and semi-desert habitats generally dominated by saltbush or sagebrush, prefers heavily grazed areas.**33,34**	Wildland fires pose potential adverse effects to this species due to fuel loads in grasslands. Low to moderate intensity wildfires or prescribed fires can be beneficial to species based on its preference for disturbed and open habitats and because they increase prey availability. [37]
Aplomado falcon (*Falco femoralis*)	E	E	A few sightings of transient birds on WSMR. Inhabits open terrain with scattered trees or shrubs, riparian woodlands in open grasslands, and desert grasslands with scattered mesquite and yucca. [35]	Wildland fires pose low potential for adverse effects to this species due to its mobile and transitory nature. Wildland fires could benefit this species by increasing prey availability.

Northern goshawk (*Accipiter gentilis*)	--	S	An uncommon migrant on WSMR. Inhabits a variety of forest types; coniferous and deciduous forests, nests in mature forests consisting of mature trees with intermediate canopy coverage and small open areas within forests for foraging. 36, 37	Wildland fires pose low potential for adverse effects to this species due to its mobile and transitory nature. Wildland fires could benefit this species by increasing prey availability. Fire effects on raptor populations suggests that direct mortality from fire is rare, it is suspected that higher death rates might occur during breeding seasons because nestlings are unable to flee fires. [37,38]

Peregrine falcon (*Falco peregrinus anatum*)	--	T	Migrant that nests occasionally in the mountains of WSMR. Shows no preference for specific ecological communities but prefers hunting grounds to be open or partially wooded ranging from coastal areas, plains, grasslands, shrublands, heaths, steppes, forests, and deserts. Utilizes riparian areas within desert habitats but not exclusively. Does not typically nest in areas receiving <10 in of annual rainfall. Eyries are made typically on open cliff ledges or in shallow caves. [39, 40]	Wildland fires pose low potential for adverse effects to this species due to their constant mobility. Fire-related mortality of adult raptors is likely low. Nestling mortality is potentially higher but risk of fire reaching eyries on cliff faces and rock outcrops is low. Indirectly, wildfire can affect prey base by destroying trees. Prescribed fire activities can help deter catastrophic fires but fire studies have shown that any human activities near an eyrie should be done after nestlings have fledged.[41]

Sprague's Pipit (*Anthus spragueii*)	C	—	Migrant and winter resident on WSMR. Inhabits native prairie grasslands of intermediate height and sparse to intermediate vegetation density. Will use exotic grasslands but are more abundant in native prairie grasslands.[43]	Wildland fires pose potential adverse effects to this species because habitat preference is grasslands with intermediate litter depth. Prescribed burning in late spring after birds have migrated north and prior to monsoon onset has shown to be beneficial to some populations. [43]
Western burrowing owl (*Athene cunicularia hypugaea*)	—	SGCN	Occurs throughout WSMR in all desert shrub land and grassland vegetative communities and other open areas such as agricultural areas, old fields, extensive forest clearings, airports, golf courses, and residential zones. [44, 45]	Wildland fires pose a low potential for adverse effects to this species but high intensity wildfires can alter vegetation which may affect prey base. Frequent low intensity prescribed fires can potentially improve habitats by reducing plant height and cover.[46]
White-faced ibis (*Plegadis chihi*)	—	SGCN	Regular migrant at sewage lagoons, playas and earthen tanks on WSMR. Inhabits freshwater wetlands, especially cattail, bulrush marshes, feeds in flooded hay meadows, agricultural fields, and estuarine wetlands. Seasonal habitats include wet mudflats, wet meadows, and shallow emergent marshes. [47]	Wildland fires pose low potential for adverse effects to this species due to habitat preferences of wetlands and marshes.

Yellow-billed cuckoo (*Coccyzus americanus*)	—	SGCN	An uncommon migrant on WSMR. In the desert Southwest, nesting habitat is invariably riparian woodlands, particularly those with intact understory, occasionally nesting in orchards and other riparian-associated woodlands. Nests typically placed in dense patches of broad-leaved deciduous trees usually with relatively thick understory. In western portions of its range, its nests are often situated close to water, likely because of lack of dense vegetation away from water. 48, 49	Wildland fires pose potentially adverse effects to this species due to high fuel loads in its preferred habitats of dense, riparian vegetation. On Fort Bliss, there is very little potential to adversely affect this species due to the lack of suitable habitat.
Zone-tailed hawk (*Buteo albonotatus*)	—	—	An uncommon migrant on WSMR. Habitat ranges from open to forested areas, preferring areas with water and rugged topography with some forest component. It nests in large trees or on cliffs situated in riparian woodlands or forested canyons. Breeding habitats include montane forest within or near steep-walled canyons and with extensive cliffs, groves of mature riparian trees, usually cottonwoods.[50, 51]	Wildland fires pose a potential adverse effect because its preferred habitat is wooded areas, where wildfires can potentially destroy nests. [50]
Mammals				
Organ Mountains Colorado chipmunk (*Tamias quadrivittatus australis*)	—	T	Occurs in the Organ Mountains. Habitats include steep, rocky areas with vegetation of ponderosa pine, deciduous oaks, juniper, apache plume and sumac, mountain mahogany, gray oak, wavy leaf oak. [54]	Prescribed fires can benefit habitat, catastrophic wildfires potentially destroy habitat. During monitoring surveys, chipmunks were associated with burned habitats. Prescribed burn during the cool season months only using a prescription for fuel moistures and relative humidity that allow for burning underbrush and litter while leaving tree canopies and large, down logs intact.

Oscura Mountains Colorado chipmunk *(Tamias quadrivittatus oscuraensis)*	---	T	Occurs in the Oscura Mountains. Habitat includes steep, rocky areas with vegetation of piñon pine, one-seed juniper, mountain mahogany, gray oak, Gambel oak and wavy-leaf oak.[54]	Prescribed fires can benefit habitat, catastrophic wildfires potentially destroy habitat. During monitoring surveys, chipmunks were associated with burned habitats. Prescribed burn during the cool season months only using a prescription for fuel moistures and relative humidity that allow for burning underbrush and litter while leaving tree canopies and large, down logs intact.
Spotted Bat *(Euderma maculatum)*	—	T	Found on WSMR. Habitat ranges from desert shrub to coniferous forest. Riparian habitats consisting of creosote bush, mesquite, tamarisk, desert willow, baccaris, and arrow weed. Douglas fir, subalpine meadows, ponderosa pine, white-fir, and aspen. Roosts in limestone cliffs and ridges. 55, 56	Wildland fires pose potential adverse effects to this species because they are sensitive to disturbance. Prescribed fires can be potentially beneficial if avoiding 2.5 km radius of known roosts. Low intensity prescribed burns can help to conserve foraging habitats. [57]

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Appendix H Minimum Impact Suppression Tactics (MIST) Guidelines

IMPLEMENTATION

Keep this question in mind: What creates the greater impact, the fire suppression effort or the Fire?

SAFETY

Apply principles of LCES to all planned actions.
Constantly review and apply the 18 Watch out Situations and 10 Standard Firefighting Orders.
Be particularly cautious with:

- Burning snags allowed to burn.
- Burning or partially burned live and dead trees.
- Unburned fuel between you and the fire.

Escape Routes and Safety Zones

In any situation, the best escape routes and safety zones are those that already exist. Identifying natural openings, existing roads and trails and taking advantage of safe black will always be a preferred tactic compatible with MIST. If safety zones must be created, follow guidelines similar to those for helispot construction.
Constructed escape routes and safety zones in heavier fuels will have a greater impact, be more time consuming, labor intensive, and ultimately less safe.

GENERAL CONSIDERATIONS

Consider the potential for introduction of noxious weeds and mitigate by removing weed seed from vehicles, personal gear, cargo nets, etc. Equipment should be washed down before leaving the incident in order to prevent the spread of noxious weeds.
Consider impacts to riparian areas when setting up water handling operations.

- Use longer draft hoses to place pumps out of sensitive riparian areas.
- Plan travel routes for filling bladder bags to avoid sensitive riparian areas. Ensure adequate spill containment at fuel transfer sites and pump locations. Stage spill containment kits at the incident.

LINE CONSTRUCTION PHASE

Select tactics, tools, and equipment that least impact the environment.
Give serious consideration to use of water or foam as a fire lining tactic.
Use alternative mechanized equipment such as motor patrols, disks, rubber-tired skidders, etc., when available and appropriate rather than dozers when constructing mechanical line.
When constructed fireline is necessary, use only the width and depth to prevent the fires spread.
Allow fire to burn to natural barriers and existing roads and trails.
Monitor and patrol firelines to ensure continued effectiveness.

Ground Fuels

Use cold-trail, wet line, or combination when appropriate. If constructed fireline is necessary, use minimum width and depth to stop fire spread.
Consider the use of fireline explosives (FLE) for line construction and snag falling to create more natural appearing firelines and stumps.

Burn out and use low impact tools like swatters and gunny sacks.

Minimize bucking to establish fireline: preferably move or roll downed material out of the intended constructed fireline area. If moving or rolling out is not possible, or the downed log/bole is already on fire, build line around it and let the material be consumed.

Aerial Fuels–brush, trees, and snags

Adjacent to fireline: limb only enough to prevent additional fire spread.

Inside fireline: remove or limb only those fuels which would have potential to spread fire outside the fireline.

Cut brush or small trees necessary for fireline construction flush to the ground.

Trees, burned trees, and snags:

- Minimize cutting of trees, burned trees, and snags.
- Do not cut live trees unless it is determined they will cause fire spread across the fireline or seriously endanger workers. Cut stumps flush with the ground.
- Scrape around tree bases near fireline if hot and likely to cause fire spread.
- Identify hazard trees with flagging, glow sticks, or a lookout.

When using indirect attack:

- Do not fall snags on the intended unburned side of the constructed fireline unless they are an obvious safety hazard to crews.
- Fall only those snags on the intended burn-out side of the line that would reach the fireline should they burn and fall over.

MOPUP PHASE

- Consider using “hot-spot” detection devices along perimeter (aerial or handheld).
- Use extensive cold-trailing to detect hot areas.
- Cold-trail charred logs near fireline: do minimal scraping or tool scarring. Restrict spading to hot areas near fireline.
- Minimize bucking of logs to check for hot spots or extinguish fire: preferably roll the logs and extinguish the fire.
- When ground is cool return logs to original position after checking.
- Refrain from piling: burned/partially burned fuels that were moved should be arranged in natural positions as much as possible.
- Consider allowing larger logs near the fireline to burn out instead of bucking into manageable lengths. Use a lever, etc., to move large logs.
- Use gravity socks in stream sources and/or combination of water blivets and fold-a-tanks to minimize impacts to streams.
- Personnel should avoid using rehabilitated firelines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehabilitation work.
- Avoid use of non-native materials for sediment traps in streams.
- Aerial fuels (brush, small trees, and limbs): remove or limb only those fuels which if ignited have potential to spread fire outside the fireline.

Burning trees and snags:

- Be particularly cautious when working near snags. *(*Ensure adequate safety measures are communicated.)

- The first consideration is to allow a burning tree/snag to burn itself out or down.
- Identify hazard trees with flagging, glow sticks or a lookout.
- If there is a serious threat of spreading firebrands, extinguish with water or dirt.
- Consider felling by blasting, if available.

AVIATION MANAGEMENT

Minimize the impacts of air operations by incorporating MIST in conjunction with standard aviation risk assessment processes.

Possible aviation-related impacts include:

- Damage to soils and vegetation resulting from heavy vehicle traffic, noxious weed transport, and/or extensive modification of landing sites.
- Impacts to soil, fish and wildlife habitat, and water quality from hazardous material spills.
- Chemical contamination from use of retardant and foam agents.
- Biological contamination to water sources; e.g., whirling disease.
- Safety and noise issues associated with operations in proximity to populated areas, livestock interests, wildland-urban interface, and incident camps and staging areas.

Helispot Planning

- When planning for helispots, determine the primary function of each helispot;

e.g., crew transport or logistical support.

- Consider using long-line remote hook in lieu of constructing a helispot.
- Consult Resource Advisors in the selection and construction of helispots during incident planning.
- Estimate the amount and type of use a helispot will receive and adapt features as needed.

Balance aircraft size and efficiency against the impacts of helispot construction. Use natural openings as much as possible. If tree felling is necessary, avoid high visitor-use locations unless the modifications can be rehabilitated. Fall, buck, and limb only what is necessary to achieve a safe and practical operating space.

Retardant, Foam, and Water Bucket Use

Assess risks to sensitive watersheds from chemical retardants and foam. Communicate specific drop zones to air attack and pilots, including areas to be avoided. Fire managers should weigh use of retardant with the probability of success by unsupported ground force. Retardant may be considered for sensitive areas when benefits will exceed the overall impact. This decision must take into account values at risk and consequences of expanded fire response and impact on the land.

Consider biological and/or chemical contamination impacts when transporting water.

Limited water sources expended during aerial suppression efforts should be replaced. Consult Resource Advisors prior to extended water use beyond initial attack.

LOGISTICS, CAMP SITES, AND PERSONAL CONDUCT

Consider impacts on present and future visitors.

Provide portable toilets at areas where crews are staged.

Good campsites are found, not made. If existing campsites are not available, select campsites not likely to be observed by visitors.

Select impact-resistant sites such as rocky or sandy soil, or openings within heavy timber.

Avoid camping in meadows and along streams or shores.

When there is a small group, try to disperse use. In the case of larger camps, concentrate, mitigate, and rehabilitate.

Coordinate the layout of the camp components carefully from the start. Help to define cooking, sleeping, latrine, and water supplies areas.

Prepare bedding and campfire sites with minimal disturbance to vegetation and ground.

Personal Sanitation:

- Designate a common area for personnel to wash up. Provide fresh water and biodegradable soap.
- Do not introduce soap, shampoo, or other chemicals into waterways.
- Dispose of wastewater at least 200 feet from water sources.
- Toilet sites should be located a minimum of 200 feet from water sources. WSMR provides porta-potties at all campsites.
- If more than one crew is camped at a site, strongly consider portable toilets and remove waste.

Store food so that it is not accessible to wildlife, away from camp and in animal resistant containers.

Do not let garbage and food scraps accumulate in camp.

Monitor travel routes for damage and mitigate by:

- Dispersing on alternate routes or
- Concentrating travel on one route and rehabilitate at end of use.

If a campfire is built, leave no trace of it and avoid using rock rings. Use dead and down wood for the fire and scatter any unused firewood. Do not burn plastics or metal.

- Consider using a fire pan or "mound fire" in sensitive areas.

Use "scrim" (porous ground cloth) to protect high traffic areas from trampling.

RESTORATION AND REHABILITATION

Firelines:

- After fire spread has stopped and lines are secured, fill in deep and wide firelines and cup trenches and obliterate any berms. The berm material should be spread back into the fireline or re-contoured to the fireline.
- Be careful not to reignite or spread hot material hidden in berms across the fireline.
- Restore drainages by removing fill or dams, reestablish crossings and return to natural configuration.
- Use waterbars only when necessary to prevent erosion or use woody material to act as sediment dams. Waterbars should only be used on steep slopes and only when necessary. General guidelines for waterbar spacing are listed in the table below. However, it is important to note that improper construction and inappropriate placement of waterbars can create excessive erosion.

Maximum Waterbar Spacing General Guidelines

Percent Grade	Maximum Spacing (Feet)
< 9	400
10 – 15	200
15 – 25	100
25 +	50

- Ensure stumps are cut flush with ground.
- Camouflage cut stumps by flush-cutting, chopping, covering, or using FLE to create more natural appearing stumps.
- Any trees or large size brush cut during fireline construction should be scattered to appear natural.
- Discourage the use of newly created firelines and trails by blocking with brush, limbs, poles, and logs in a naturally appearing arrangement.

Camps:

- Restore campsite to natural conditions.
- Scatter fireplace rocks and charcoal from fire, cover fire ring with soil, and blend area with natural cover.

Pack out all garbage and dispose of in an approved facility.

General:

- Remove all signs of human activity.
- Remove all flagging.
- Restore helicopter landing sites.
- Fill in and cover latrine sites.

Walk through adjacent undisturbed areas and take a look at your rehabilitation efforts to determine your success at returning the area to as natural a state as possible.

Appendix I Wildland/Urban Interface/Intermix (WUI) Wildfire Safety Considerations and Operations

Excerpted from Firescope California, Wildland Urban Interface (WUI) Structure Defense, October 21, 2013

INTRODUCTION

Wildland firefighting by itself is very challenging and adding structures and other improvements into the equation greatly increases the complexity. Over the last several decades an expansion of communities, homes and other improvements into wildland areas has created a significant challenge for the fire service agencies responsible for providing fire protection in those areas.

WUI fires often overtax the local fire agency resulting in the activation of mutual aid and automatic aid agreements to augment jurisdictional resources. Nearly every WUI fire includes responses from a variety of wildland and municipal fire agencies resulting in the need for clear text and common terminology among emergency responders. This appendix on WUI operations and structure defense is designed to provide common terminology and operating principles for responders. It also includes guidelines and checklists to complement and enhance first responders differing levels of training and experience.

This document describes tactical actions that emphasize firefighter safety during structure defense assignments. Successful WUI firefighting operations are accomplished by selecting sound strategies supported by effective tactical actions that keep firefighters safe, protect the public and minimize property loss.

Firefighters can prepare themselves for structure defense activities by developing a sound understanding of the wildland structure environment, fire behavior and forecasting, the Risk Management process, tactical terms and associated tactical actions. An understanding of all these components will allow firefighters to safely mitigate the fire's impact upon the values they are charged with protecting.

Over the past several decades there has been a growing trend of building homes and improvements in the Wildland Urban Interface (WUI) area. Wildland Urban Interface can be defined as a location where people and their development meet or are intermixed with wildland fuels. There are two different wildland urban conditions. They are:

- **Interface**– a condition where structures abut wildlands. There is a clear line of demarcation between the structures and the wildland fuels along roads or back fences. There is a greater risk for house to house ignition in the interface.
- **Intermix**– a condition where structures are scattered throughout a wildland area. There is no clear line of demarcation; the wildland fuels are continuous outside of and within the developed area.
- Each structure must be assessed independently
- Usually more complex to triage than an interface condition
- Usually more complex to defend than an interface condition
- Usually requires a higher ratio of engines to structures than an interface condition

DEFINITIONS

Safety Zone–A preplanned area of sufficient size and suitable location that is expected to protect fire personnel from known hazards without using fire shelters.

Temporary Refuge Area (TRA) – an identified area that firefighters can immediately take refuge for temporary shelter and short-term relief without using a fire shelter in the event that emergency egress to an established

Safety Zone is compromised. Examples: lee side of structure, inside of structure, large lawn or parking area, cab of apparatus.

FIRE BEHAVIOR FORECASTING

Firefighter and public safety is the first priority in every fire management activity. Using the Standard Firefighting Orders, firefighters are guided to make a fire behavior prediction that considers the fire potential at the time of contact with the structure. If at any time risk to firefighters is determined to be too great, an alternative action should be selected.

It is important to remember that fire conditions can change very quickly, so constant observation and reassessment is necessary; the tactic selected may need to change. Tactical maneuver or agility is essential to ensure firefighter safety. Safety Zones should always be identified in the WUI environment in conjunction with a viable escape route; however, they may not always be immediately available. Often a Temporary Refuge Area (TRA) is more accessible in the WUI environment. A TRA will provide temporary shelter and short-term relief from approaching fire without the use of a fire shelter and allow the responders to develop an alternate plan to safely survive the increase in fire behavior..

FIRE BEHAVIOR/STRUCTURE DEFENSE SIZE-UP

Use standardized references to validate your fire behavior prediction:

- Incident Response Pocket Guide
- Lock up, Look Down, Look Around indicators
- Extreme Fire Behavior indicators (spotting, crowning, rate of spread)
- Know what the fire is doing at all times in order to maintain an accurate fire behavior prediction.
- Evaluate surrounding fuels for type, height, continuity, and conditions. Observe current burning activity in order to predict flame length and intensity.
- Consider local factors and fire history.
- Know current weather conditions and forecasts. Consider wind speed, direction, relative humidity, temperatures.
- Evaluate for wind shifts, micro-climates, weather indicators and hazards.
- Evaluate location of the structure and surrounding area. Is wind and slope in alignment with topography leading to the structure?
- Location of the structure on the slope; canyon bottom, mid-slope, or ridge top.
- Is the structure in or near a chute, chimney, saddle, or other topographic hazard?

STRUCTURE TRIAGE CATEGORIES

Not Threatened - Safety Zone and TRA's are present and construction features or defensible space make it unlikely that the structure will ignite during initial fire front contact.

Threatened Defensible - Safety Zone and TRA is present and construction features, lack of defensible space, or other challenges requires firefighters to implement structure protection tactics during fire front contact. Threatened Non-Defensible - No Safety Zone and TRA are present. Structure has challenges that do not allow firefighters to commit to stay and protect the structure.

STRUCTURE TRIAGE GUIDELINES

Factors to consider during structure triage:

- Safety Zones should be established and made available based upon predicted fire behavior.

- Temporary Refuge Areas (TRA) should be identified in the event that emergency egress to an established Safety Zone is compromised.
- Adequate space to park your apparatus safely based upon predicted fire behavior
- Adequate lookout and communication capability
- Proximity of the fuels and predicted flame length to structure, no defensible space
- Position on slope relative to fire spread, avoid narrow canyon bottoms, mid-slopes with fire below, or narrow ridges near chimneys and saddles
- Fire behavior and intensity (the greater the intensity, the wider the defensible space needed)
- Narrow roads, unknown bridge limits, and septic tank locations
- Ornamental plants and combustible debris next to the structure
- Open vents, eaves, decks, and other ember traps
- Power lines
- Limited water supply flow rates and gpm output
- Property owners that remain on site
- Flammability of roof and siding (wood roof and siding, vinyl siding, along with inadequate defensible space may make structure impossible to protect)
- Timing and available resources (not having time to position resources or lack of resources to protect structure)

STRUCTURE DEFENSE GUIDELINES

Personal Protective Equipment (PPE):

•Structure defense tactics can be undertaken utilizing standard wildland PPE.

•If the structure becomes involved in fire, and a decision is made to extinguish the fire, utilize the appropriate Structure Fire PPE including SCBA's as required.

•**DO NOT** enter a structure unless you are trained, equipped, and authorized. If safe, a structure can be used as a temporary refuge.

- Supervisors must keep in close communication with those they supervise and adjoining forces in the area.

Equipment Placement:

- Identify escape routes and Safety Zones and TRA's and make them known to all crew members
- STAY MOBILE and wear all of your PPE
- Back equipment in for quick escape
- Park in a cleared area (watch for overhead hazards)
- Protect your equipment (park behind structure, placing structure between equipment and fire front; be aware of spot fires occurring behind you)
- Watch for hazards (drop-offs, pot holes, above-ground fuel storage, chemicals, and septic tanks) • Keep egress route clear
- Have an engine/crew protection line charged and readily available
- Avoid long hose lays
- Try to keep sight contact with all crew members **Water Use Guidelines:**
- Keep at least 100 gallons of water reserve in your tank
- Top off tank at every opportunity, use garden hose(s)
- Draft from swimming pool, hot tub, lake, stream and fishpond

- Stay mobile. Be aware that hydrants may not always work if system is electric powered and power is lost in the area
- Conserve water, avoid wetting down an area well before the fire front arrival
- Apply water only if it controls fire spread or significantly reduces heating of structure being protected
- Keep fire out of the heavier fuels
- Extinguish fire at its lowest intensity, not when it is flaring up
- Knock down fire in the lighter fuels
- Have enough water to last duration of main heat wave and to protect crew

Class A Foam/Gel Use Guidelines:
- Direct Attack with Class A Foam – apply to base of flame
- Indirect Attack with Class A Foam – lay out wet line and burn out
- Apply Class A Foam to structure (roof and siding) 10-15 minutes before fire arrives, (reapply as necessary)
- Foam or gel the structure and the vegetation immediately surrounding the structure

Preparing Structure:
- Determine if residents are home. If residents remain on scene, advise them to use structure as refuge if it is safe to do.
- For roof access, place owner's ladder at a corner of structure on side with least fire threat and away from power line drop zone.
- Clear area around above-ground fuel tank and shut off tank
- Place combustible outside furniture inside the structure
- Close windows and doors, including garage, leaving them unlocked
- Remove combustibles immediately next to the structure and scatter fire wood
- Construct fire line around out-buildings, power poles and fuel tanks
- Remove vegetation from the immediate area of the structure
- Have garden hose(s) charged and place strategically around structure for immediate use
- AS A LAST RESORT, YOU MAY NEED TO USE THE STRUCTURE AS A TEMPORARY REFUGE

STRUCTURE DEFENSE STRATEGIES

The Incident Commander (IC) or Operations Section Chief (when assigned) is responsible for establishing the strategy. The strategy should reflect a "general" plan that is broad in scope and provides direction for accomplishing the incident objectives. For example, the strategy for protecting structures on the right flank of a wildland urban interface (WUI) fire is to keep the fire away from the homes using a coordinated direct attack with aircraft, dozers and crews. At the same time, the strategy for controlling the left flank on the same fire is to develop an indirect attack, utilizing resources to burn out along a series of small dirt roads and create a line that will stop the fire from spreading. The strategy must reflect a realistic approach for meeting the objectives for all portions of the fire.

The strategy must take into consideration the numbers and types of resources necessary to accomplish the incident objectives and the reflex time it will take to have them in position. A strategy that requires a large number of resources to execute the plan will fail if the needed resources cannot arrive in a timely fashion.

The strategy is also subject to change due to changes in weather, fire behavior, resource availability and any change to the objectives. For example, firefighters planning to burn out from a road system a mile from the fire front may be forced to change to a direct suppression strategy if a forecast calling for cool weather with accompanying moisture is predicted to arrive before the burnout can be executed.

STRUCTURE PROTECTION TACTICS

Where the strategy gives firefighters a general plan, tactics are the specific actions firefighters will take to accomplish the incident objectives. The choice of which tactic to use can come in the form of direction from the IC or the Operations Section Chief or it may be a decision made by the Division/Group Supervisor.

The chosen tactical action must be capable of stopping the advance of the fire or prevent the fire from damaging property and do so without incurring injuries to firefighting personnel. This means that when choosing a tactical action or making a tactical plan it is very important to know what the fire behavior will be at the time firefighters engage the fire.

Making accurate fire behavior predictions in advance of the fire's arrival is the wildland firefighter's greatest challenge. Accurate predictions are difficult to make with absolute certainty and at the same time is the crux for determining if a tactical measure will be effective and safe.

Recognizing that there is always the potential for error in our fire behavior prediction means that we must compensate for the uncertainties by having alternative actions built into the plan. The key point here is to never get locked into a single plan of action.

TACTICAL MANEUVER

Tactical maneuver implies movement or purposeful reaction to change. Tactical maneuver builds *agility* into a tactical plan by allowing resources to work and move around in a hazardous environment without injury, while remaining effective. Tactical maneuver is most effective when potential changes to the primary plan have been identified and fire fighter's reactions to those changes are planned out.

Firefighters must be prepared to utilize tactical maneuver when changing from structure defense mode (defensive) to suppression mode (offensive) when fire behavior allows. It is imperative to take advantage of situations that allow for firefighters to take perimeter control actions and suppress the fire.

Tactical planning must be developed in conjunction with anticipated changes in the fire environment, or fire behavior. Tactical maneuver (*agility*) is essential to ensure fire fighter safety since legitimate Safety Zones are not always immediately present in the WUI.

Firefighters should focus on *agile tactical solutions* to unanticipated changes as opposed to a rigid and inflexible siege approach. It is imperative that contingency planning be part of every tactical plan. The tactic selected may need to change to compensate for a change in the fire's behavior. Always have a way out!

Tactical maneuver can be an offensive or defensive action. Be prepared to move decisively during lulls in fire activity or take shelter in Temporary Refuge Areas or Safety Zones when the fire is active. Examples of tactical maneuver would be an engine crew going from one structure to another, moving with the fire, or staying behind a house when the fire is hitting hard and moving into full suppression mode when the fire subsides. This requires a continuous assessment of the fire and it's potential. Crews must continually identify Temporary Refuge Areas and Escape Routes to Safety Zones.

STRUCTURE DEFENSE TACTICAL ACTIONS

After making a fire behavior forecast and triaging the assigned structures, responders must now implement the necessary tactics to defend the structure from the advancing fire front. Supervisors must keep in close communication with those they supervise and adjoining forces in the area. The following are the seven tactical actions available to structure defense resources:

CHECK AND GO- a rapid evaluation to check for occupants requiring removal or rescue:

- Structure Triage Category – Threatened Non-Defensible
- This tactic is most appropriate when there is no Safety Zone or TRA present and the forecasted fire spread, intensity, and the projected impact time of the fire front prohibit resources from taking preparation action to protect the structure.
- Complete a rapid evaluation to check for occupants at a structure, evaluate life threat and to assist in evacuation
- Used when fire spread, intensity, lack of time or inadequate defensible space prohibit firefighting resources from safely taking action to protect the home when the fire front arrives
- Evaluate the structure for follow up action when additional resources become available, the fire front passes or fire behavior intensity is reduced

PREP AND GO - implies that some preparation of the structure may be safely completed prior to resources leaving the area:

- Structure Triage Category – Threatened Non-Defensible
- A tactic used when a Safety Zone and TRA are not present and/or when fire spread and intensity are too dangerous to stay in the area when the fire front arrives, but there is adequate time to prepare a structure for defense ahead of the fire front.
- Utilized for structures where potential fire intensity makes it too dangerous for fire resources to stay when the fire front arrives
- There is some time to prepare a structure ahead of the fire; resources should engage in rapid, prioritized fire protection preparations and foam the structure prior to leaving
- Resources should leave with adequate time to avoid the loss of Escape Routes
- Advise residents to leave and notify supervisors of any residents who choose to stay so that you can follow-up on their welfare after the fire front passes
- As with Check and Go, Prep and Go is well suited for engine strike teams and task forces.

PREP AND DEFEND - a tactic used when a Safety Zone and TRA are present and adequate time exists to safely prepare a structure for defense prior to the arrival of the fire front:

- Structure Triage Category – Threatened Defensible
- An ideal multiple resource tactic especially in common neighborhoods where efforts may be coordinated over a wide area. A tactic used when it is possible for fire resources to stay when the fire front arrives. Fire behavior MUST be such that it is safe for firefighters to remain and engage the fire
- Adequate Escape Routes to a Safety Zone must be identified. A Safety Zone or TRA must exist on site
- Firefighters must be vigilant to sudden changes in fire intensity and be prepared to move to the TRA or withdraw along the Escape Route to the Safety Zone
- Adequate time must exist to safely prepare the structure for defense prior to the arrival of the fire front.

FIRE FRONT FOLLOWING - a follow up tactic employed when Check and Go, Prep and Go, or Bump and Run tactics are initially used:

- A tactic used to come in behind the fire front.

- This action is taken when there is insufficient time to safely set up ahead of the fire or the intensity of the fire would likely cause injury to personnel located in front of the fire
- The goal of “Fire Front Following” is to search for victims, effect perimeter control, extinguish spot fires around structures, control hot spots and reduce ember production.

BUMP AND RUN - a tactic where resources typically move ahead of the fire front in the spotting zone to extinguish spot fires and hot spots, and to defend as many structures as possible:

- Bump and Run may be effective in the early stages of an incident when the resource commitment is light and structure defense is the priority.
- Bump and Run may also be used on fast moving incidents when there are adequate resources available, but where an effort must be made to control or steer the head and shoulders of the fire to a desired end point.
- Perimeter control and structure defense preparation are secondary considerations with the Bump and Run tactic.
- Resources must remain mobile during Bump and Run and must constantly identify Escape Routes to Safety Zones and Temporary Refuge Areas as they move with the fire front.
- Bump and Run is a defensive tactic when fire front impact in the WUI is imminent and there are not enough resources to effectively take perimeter control action. It is an offensive tactic when resources are steering the head of the fire to a desirable end point.
- The tactic is useful when terrain and fuels are suitable for mobile attack.
- Fire line supervisors and Strike Team/Task Force Leaders must realize that Bump and Run places resources in front of the advancing fire front and that extreme caution should be exercised.
- Control lines in front of the fire should be identified and prepared with dozers and fire crews enabling the Bump and Run resources to direct the fire to logical end point. This is a frontal attack strategy and a watch out situation. Control lines in front of the main fire must be reinforced with retardant drops, coordinated firing operations and engine support.

ANCHOR AND HOLD - a tactic utilizing control lines and large water streams from fixed water supplies in an attempt to stop fire spread. The goal is to extinguish structure fires, protect exposures, and reduce ember production.

- Anchor and Hold can be referred to as taking a stand to stop the progression of the fire.
- Anchor and Hold tactics are more effective in urban neighborhoods where the fire is spreading from house to house.
- Establishing an Anchor and Hold line requires considerable planning and effort and utilizes both fixed and mobile resources:
    - ✓ Fixed engines should be spotted in safe areas where they can safely withstand any fire situation.
    - ✓ Mobile engines or task forces can engage in individual structure defense actions or perimeter control and re-supply from fixed water source.
    - ✓ Mobile engines should be prepared to re-deploy to other areas should the fire escape the Anchor and Hold line.
- Ground resources, such as engine crews and fire crews should staff hose lines and be prepared to extinguish hot spots, fire perimeter, and structures. Hand crew strike teams should be deployed to construct fire control lines wherever needed and conduct firing operations.

TACTICAL PATROL - a tactic where the key element is mobility and continuous monitoring of an assigned area: Tactical Patrol can either be initiated:

- After the main fire front has passed and flames have subsided but when the threat to structures still remains:
- Patrol areas where the fire has passed but the risk to structures remains from fire brands smoldering in void spaces, on roofs, in rain gutters and stored material near buildings.

In neighborhoods away from the interface where there is predicted to be significant ember wash and accumulated ornamental vegetation:

- The goal is to patrol areas downwind of potential ember showers
- This tactic should be used to extinguish hot spots or secondary structure ignitions, and address safety issues such as power lines, weakened trees, and other hazards.
- Vigilance, situational awareness and active suppression actions are a must

WILDLAND FIRE MANAGEMENT GUIDING PRINCIPLES

1. The first priority for all-risk decisions is human survival, both firefighters and the public.
2. Incident containment strategies specifically address and integrate protection of defendable improved property and wildland values.
3. Direct protection of improved property is undertaken when it is safe to do so, where there are sufficient time and appropriate resources available, and when the action directly contributes to achieving the overall incident objectives.
4. The firefighter's decision to accept direction to engage in structure defense actions is based on the determination that the property is defendable and the risk to firefighters can be safely mitigated under the current or potential fire conditions.
5. A decision to delay or withdraw from structure defense operations is the appropriate course of action when made in consideration of firefighter safety, current or potential fire behavior, or lack of defensibility of the structure or groups of structures.
6. Firefighters at all levels are responsible for making risk decisions appropriate to their individual knowledge, experience, training, and situational awareness.
7. Every firefighter is responsible for awareness of the factors that affect their judgment and the decision-making process, including: a realistic perception of their own knowledge, skills, and abilities, the presence of life threat or structures, fire behavior, availability of resources, social/political pressures, mission focus, and personal distractions such as home, work, health, and fatigue.
8. An individual's ability to assimilate all available factors affecting situational awareness is limited in a dynamic wildland and urban interface environment. Every firefighter is responsible to understand and recognize these limitations, and to decide, and act in preparation for the "worst case."
9. It is the responsibility of *every* firefighter to participate in the flow of information with supervisors, subordinates and peers. Clear and concise communication is essential to overcome limitations in situational awareness.

RISK MANAGEMENT PROCESS

Step 1 Situation Awareness

Gather Information

Objective(s) Previous Fire Behavior

Step 5 Evaluate

Personnel: Low experience level with local factors?

Distracted from primary tasks?

Communication
Weather Forecast
Who's in Charge?
Local Factors
Scout the Fire
Fatigue or stress reaction?
Hazardous attitude?
The Situation: What is changing?
Are strategy and tactics working?

Step 2 Hazard Assessment
Estimate Potential Fire Behavior Hazards
Look Up/Down/Around Indicators
Identify Tactical Hazards
Watch Outs
What other safety hazards exist?
Consider severity vs. probability?

Step 3 Hazard Control
Firefighting Orders
LCES Checklist – MANDATORY
Anchor Point
Downhill Checklist (if applicable) What other controls are necessary?

Step 4 Decision Point
Are controls in place for identified hazards?
NO – Reassess situation
YES – Next question
Are selected tactics based on expected fire behavior?
NO – Reassess situation
YES – Next question
Have instructions been given and understood?
NO – Reassess situation
YES – Initiate action

TACTICAL ENGAGEMENT PROCESS - PACE

Structure defense firefighting in the Wildland Urban Interface (WUI) is inherently dangerous because it is primarily associated with *in-direct* firefighting. An approaching fire is a dynamic event and subject to sudden changes that can be very difficult to anticipate. Structure defense should start with a determination of the exit strategy. *In-direct* firefighting safety mitigations depend on fire behavior forecasts made in advance of the fires arrival. Accurate fire behavior forecasts are difficult to make with absolute certainty and at the same time these forecasts are the crux for determining effective safety mitigations. (Tactical Refuge Areas, Escape Routes and Safety Zones) With firefighter safety hanging in the balance of accurate fire behavior estimates that cannot be assured, it is imperative that a multi-step safety plan be established to compensate for the uncertainties.
Firefighters must anticipate the unexpected and build agility (Tactical Maneuver) into their plan with *contingency planning.* The lexicon for contingency planning is PACE:

P - Primary Plan [Offense]
Is focused on firefighter safety
Is focused on mission objectives
Yields the most desirable results

(Manning hose lines to suppress the fire around a structure)

A - Alternate Plan [Offense]
A fallback plan that closely supports the Primary Plan
The results may be less desirable but still supports the Primary Plan
(Retreating into or behind the structure until fire intensity diminishes)

C - Contingency Plan [Defense]
A plan totally focused on the firefighter's safety
Move to a tactical refuge area (an area that provides short-term relief) or;
Withdraw along the Escape Route
Move into a Safety Zone

E - Emergency Plan [Defense]
A plan totally focused on individual firefighter survival
When threatened by fire, firefighters should get into their fire shelter: **ALWAYS HAVE A DEPLOYMENT SITE IDENTIFIED!**

Implement PACE prior to engaging in any structure defense action. P–Primary A–Alternate C– Contingency E–Emergency

LEVELS OF ENGAGEMENT - DRAW-D
As with military operations, there are FIVE Levels of Engagement in firefighting – DRAW-D. These actions apply to all aspects of wildland firefighting from the incident strategy to the individual line assignments and structure defense. They identify a thoughtful and mindful approach to choosing the appropriate tactical action. Use of DRAW-D as Levels of Engagement incorporates a "can do" attitude in every level of engagement and every level of engagement is equal in value to the overall effort as the other.

D - Defend – Holding actions, protecting priority areas
Protect the structures
Hold and improve the line

R - Reinforce –
Bring more resources to bear
Add resources necessary to *advance* or *defend*

A - Advance – Anchor and Flank
Direct or indirect attack
Active burnout operations

W - Withdraw – Cease current activities until conditions modify
Abandon an established position or constructed line in response to an increase in fire intensity
Not a stigma, but a decision to move away from a threat

D - Delay – Wait until the situation has modified sufficiently to allow a different level of engagement
Waiting for conditions to meet pre-identified triggers necessary to *advance* or *defend*
Not a lack of effort, but a conscious decision to maximize long-term effectiveness

STRUCTURE ASSESSMENT CHECKLIST

Address/Property Name

- Numerical Street address, ranch name, etc.
- Number of residents on site

Road Access

- Road surface (paved, gravel, unimproved, dirt)
- Adequate width, vegetation clearance and Safety Zones along road
- Undercarriage problems (4x4 access only)
- Turnouts and turnarounds
- Bridges (load limits)
- Stream crossings (approach angle, crossing depth and surface)
- Terrain (road slope, location on slope-near chimneys, saddles, canyon bottom)
- Grade (greater than 15%)

Structure/Building

- Single residence or multi-complex, out building (barn, storage)
- Does building have unknown or hazardous materials?
- Exterior walls (stucco or other noncombustible, wood frame, vinyl, wood shake)
- Large unprotected windows facing heat source
- Proximity of any aboveground fuel tanks (LPG, propane, etc.)
- Roof material (wood shake, asphalt, noncombustible)
- Eaves (covered with little overhang, exposed with large overhang)
- Other features (wood deck, wood patio cover and furniture, wood fencing)

Clearances/Exposures/Defensible Space

- Structure location (narrow ridge, canyon, mid-slope, or chimney)
- Adequate clearance around structure-minimum of 100 feet (steeper the slope, the more clearance required)
- Surrounding fuels (larger, denser the fuels, the more clearance required)
- Flammable fuels (trees, ladder fuel, shrubs) adjacent to structure (is there time for removing these fuels?)
- Other combustibles near structure (wood piles, furniture, fuel tanks)
- Is there adequate clearance around fuel tank?
- Power lines or transformers (DO NOT park under lines)

Hazardous Materials

- Chemicals (Look for DOT/NFPA/UN symbols)
- Pesticides and herbicides
- Petroleum products

- Paint product

Water Sources

- Hydrant/standpipe (When connecting with hydrant, be aware of flow rate and gpm output, size and venting capability of engine or water tender may not be able to handle hydrants with high flow and gpm rates.)
- Storage tank
- Swimming pool
- Hot tub
- Fish pond
- Irrigation ditch

Evacuation

- Is safe evacuation possible? (Identify safe refuge for those who cannot be evacuated.)
- Coordinate with on-scene law enforcement and emergency services personnel.

Estimated Resources for Protection

- Number(s) and type(s) of engines, water tenders, crews, dozers (General Guidelines: one engine per structure, one additional engine for every four structures to be used as "backup" and for patrol. For structures that are close together (50 feet or less), one engine may be adequate to protect two structures.)
- Type and number of aircraft available

POWERLINE SAFETY

- Downed conductor on vehicle: stay in vehicle until the power company arrives.
- If the vehicle is on fire or fire is near, jump clear, keep feet together and don't hang on.
- Smoke, water, and retardant are all good conductors and can cause power line-to-ground arc.
- Don't operate heavy equipment under power lines
- Don't use right-of-way as a jump or cargo drop spot
- Don't drive with long antennas under power lines
- Don't fuel vehicles under power lines
- Don't stand near power lines during retardant drops
- Don't park under power lines
- Don't apply straight stream to power lines
- Spot fires or low ground fires can be fought with hose lines if heavy smoke or flame is not within 100 feet of the power lines
- If safe, extinguish wood poles burning at the base to prevent downed wire hazards later

Appendix J: Bare Bones Guide to Fire Effects on Cultural Resources For Cultural Resource Specialists

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I. Introduction

This document briefly synthesizes some of the technical information available on the effects of fire on cultural resources. This synthesis should assist cultural resource specialists with their contributions to fire management planning, compliance for prescribed fire projects, and participation in wildland fire use or wildfire events.

Research on fire effects is on-going. A publication on this topic will soon be released under the USFS Rocky Mountain Research Station ―Rainbow‖ series, and much of the data here is from drafts of articles for that publication. While there is a lot we do not know, there is also a considerable amount of work accomplished on this topic. This brief guide summarizes the results of some of these technical studies.

Fire effects to cultural resources, and the appropriate ways to manage for these effects, are context dependent. Fire itself is dependent on a suite of variables which change across the landscape; fire in grassland is likely to produce different effects to cultural materials than fire through a forest with heavy duff. Different types of archaeological materials, such as varieties of toolstone or types of ceramics may react differently in similar fire related circumstances. This guide offers technical information which cultural resource specialists can use to craft locally and regionally appropriate strategies for protecting cultural resources within the context of fire.

References: References are cited at the end of the document. Where possible, links are provided to resources that are already available on the web. The Western Archaeological Conservation Center, National Park Service, is currently digitizing many reports concerning fire effects on cultural resources. Those reports will also be available on the web in the next few months, and will be linked to this document.

II. Fire Basics

Fire effects to cultural resources vary depending on **temperature** and **duration** of exposure to heat. Generally, higher temperatures and/or longer duration of exposure to heat increase the potential for damage to cultural resources. Variables that affect temperature and duration include (Wiltz n.d., Hanes 2001):

- Type of fuel
- Fuel load/ distribution
- Moisture content of fuels
- Soil type, soil moisture
- Weather, terrain

As a general rule, fire does not affect buried cultural materials. Studies show that even a few centimeters of soil cover (10 cm) are sufficient to protect cultural materials (Oster, n.d.). However, there are times when conditions do carry heat below the surface, with the potential to affect buried materials. These conditions include:

- Stumps that smolder and burn have the potential of affecting buried materials that are in the vicinity.

- Heavy duff, surface logs, and roots that smolder and burn also have the potential to expose subsurface materials to heat over a period of time, and hence have the potential to affect cultural materials.

Fires that burn hot and fast through a site may have less of an effect on certain types of cultural materials than fires that smolder in the duff, or than logs that burn for a period of time.

III. Cultural Resource Basics

When assessing the potential effects of fire on cultural resources there are some fundamental considerations (Hanes 2001, Duke et al. 2003):

- Even if fire affects certain cultural materials, that effect may not be important. That is, the effect may not actually diminish characteristics that make a site eligible to the National Register. For example, high heat may destroy obsidian hydration bands on surface artifacts, but the surface component of the site may not be of particular value in the site's overall assessment. Fire may burn the solder out of a hole-in-cap can, but this effect does not diminish the can's ability to provide chronological information for a site.
- Wildland fire is generally more destructive to cultural resources than prescribed fire, since it includes both uncontrolled fire effects and the effects of fire suppression. Management decisions may need to balance the potential effects of a prescribed burn with the risk of damage from an uncontrolled wildfire.
- Fire history may be important. When assessing the potential effects of fire to cultural resources, cultural resource specialists should consider the nature of past fires compared to the potential for fire at the current time. For example, have fires routinely burned through an area? Have conditions (e.g. fuels and fuel loads) changed significantly over time? Will the effects of fire today be significantly different—and pose a greater threat to cultural materials than in the past?
- Prescribed fire can be controlled. Cultural resource specialists can work with fire managers to determine the predicted temperature and duration of a fire through an area, and possibly to modify burn plans to minimize effects to cultural resources.
- Protecting cultural resources during fire begins with fire management planning. This is the place to define vulnerable cultural resources, appropriate protection measures for them, and appropriate management responses with regard to cultural resources in the event of wildland fire or a wildland fire use event.
- As always, consultation with SHPO, Tribes, and other appropriate entities should be part of the project planning process, especially when designing fire-specific protocols for identification and protection of potentially affected cultural resources.

IV. Fire Effects on Lithics (Deal n.d., Buenger 2003)

Fire can affect chipped and groundstone tools, primarily through changes in morphology rather than in chemistry. Residues on artifacts are not necessarily destroyed by fire. As a general rule-of-thumb, hotter temperatures and longer exposure to fire may affect lithic materials. When these materials are important, it may be necessary to take protective measures.

Obsidian

Fire can modify or destroy obsidian hydration rinds, but does not affect obsidian source analysis (Shackley and Dillon 2002). High temperatures, such as those experienced in a catastrophic wildfire, may be sufficient to cause obsidian to bubble and crack, losing shape as well as hydration capacity.

The exact temperature at which obsidian is affected varies, probably due to components of the field environment and/or differences in source materials. Duration of exposure increases the effect of heat on obsidian. High temperatures and smoldering fires can both affect hydration bands.

Obsidian: Approximate Temperature Guide (Deal n.d., Buenger 2003, Loyd et al. 2002)

Temperature	Effect
300 C (572 F)	Hydration band begins to become diffuse
400 C (752 F)	Hydration band not visible
450 C – 800 C (842-1472 F)	Enhanced fracture lines
760 C (1292 F)	Obsidian may melt

Chert

Fire can also affect chert (including various silicates), through fracturing, pot-lidding, crazing, shattering, changes in color and internal luster, and other such effects which might reduce an artifact's ability to render information about the past. Temperatures which affect chert vary, possibly dependent upon source or other variables such as prior heat-treatment for tool manufacture. Generally, longer and/or hotter fires produce more intense effects upon chert artifacts (Deal n.d., Waechter n.d.).

Chert: Approximate Temperature Guide (Deal n.d., Buenger 2003)

Temperature	Effect
350 C (662 F)	May become distorted, brittle or explosive
350 - 550 C (662 – 1022 F)	Cracking, Fracture

Basalt

Fire can produce changes in basalt including spalling, potlidding, crazing, and fracturing; these effects possibly result from rapid cooling. There is little experimental data for fire effects on basalt. One study indicates that spalling or flaking may occur at temperatures around 350 – 400 C (662 - 752 F) (Deal n.d.).

Groundstone

Rock types vary in their response to fire. Sandstone reportedly cracks or fractures at a lower temperature than basalt. Granites and quartzite withstand higher temperatures. Severe wildfire may cause portable groundstone to crack or fracture. Thermal shock—such as rapid heating or cooling--can cause fracturing and exfoliating of groundstone artifacts, including bedrock mortars. Burning or smoldering fuels on groundstone artifacts or features (e.g. a fallen tree on a bedrock mortar) may contribute to increased damage during a fire. As is true for other tool types, longer exposures to heat and/or hotter fires increases the potential for artifact damage (Deal n.d., Buenger 2003).

V. Fire Effects on Ceramics (Rude n.d., Buenger 2003, Haecker n.d.)

Different types of clays, inclusions, and manufacturing techniques lead to different effects among distinct pottery types. Since all pottery—historic and prehistoric—has been fired to some degree, heat damage is not as significant a consideration for this artifact type as it is for others. Generally, structural damage does not occur until temperatures exceed the original firing temperature. The main type of damage noted is to the surface decoration or glaze.

Prehistoric Ceramics

Temperatures do not exceed the original firing temperature for most prehistoric ceramics until about 600 C (1112 F) (Andrews 2004). Fire can, however, affect the appearance of pottery shards, possibly leading to misidentification. Effects from fire include surface spalling, alteration of painted decoration, blackening and sooting, and loss of appliqué designs which may break off. In one experiment painted designs faded and turned color at temperatures greater than 800 C (1472 F). However, sooting or blackening may be removed by cleaning in a lab, and discoloration does not necessarily prevent identification of pottery type (Rude n.d.).

Fire may affect the potential for thermoluminescence (TL) dating. However, surface potsherds are generally not used for this technique, and buried potsherds are not likely to be affected by fire. Another study also showed that TL dating was not affected at temperatures below 400 C (752 F), indicating that moderate intensity wildland and prescribed fire may not have an impact on TL dating (Rude n.d.).

Historic Ceramics

Historic ceramics consist of earthenwares, stonewares, and porcelain. These types of pottery are differentiated in part by the heat of firing. All of these pottery types may be glazed, and the glaze or other decoration is likely to be the most vulnerable characteristic. Some early glazes (e.g. majolica glaze) and glazes on whiteware (refined earthenware common at nineteenth and twentieth century sites) may crackle or spall even in a low temperature fire.

Ceramics: Approximate Temperature Guide
(Rude, n.d., Haecker n.d., Duke et al. 2003)

Ceramic	Firing Temperature	Temperature Effects
Prehistoric	> 350 C (662 F)	Minor effects (sooting, fading, discoloration)
Prehistoric	> 600 C (1112 F)	Structural change possible
Prehistoric	> 400 C (752 F)	TL dating potential compromised
Historic: Unrefined Earthenware	500–900 C (932–1652 F)	Glazes may crackle and spall at low fire temperatures
Refined Earthenware or	1100–1500 C (2012-2732	Glaze may crackle at low
whiteware	F)	fire temperatures

Stoneware	900–1100 C (1652-2012 F)	Temperatures above firing point may oxidize glaze or crack shards
Porcelain	1250-1450 C (2282-2642 F)	Temperatures above firing may oxidize glaze or crack shards

VI. Fire Effects on Organic Materials

Organic Materials

Organics will usually burn or alter at lower temperatures than inorganic items. Artifacts (e.g. basketry, digging sticks, clothing, textiles) and features (e.g. structures, bow-stave trees, wikiups, dendroglyphs) made of or containing organics such as wood, leather and hide, or cordage will need protection or treatment before any fire burns through a site containing such items.

Bone and Shell

Bone and shell can sustain some degree of burning without complete destruction (Buenger 2003):

Bone and Shell: Approximate Temperature Guide (Buenger 2003)

Material	Temperature	Effect
Bone	200 C – 400C (392-752 F)	Bone chars, becomes darkened
Bone	600 C – 800 C (1112-1472 F)	Bone becomes calcined
Shell	>300 C – 400 C (572-752 F)	May delaminate, burn

Organic Residues

Plant and animal residues may survive exposure to fire. Pollen may be destroyed at temperatures greater than 300 C (572 F), but animal proteins survive to 800 C (1472 F) (Jones n.d.)

VII. Fire Effects on Historic Materials

The following chart provides melting points for materials commonly found at historic sites. Fire may produce complex interactions which affect these baseline temperatures, however. Metal alloys may react differently, and metal artifacts/ materials which do not melt may warp.

Melting Points of Materials Commonly Found on Historic Sites (Haecker n.d.)

Temperatures are Approximate

MATERIAL	TEMP (F)	TEMP (C)
Plastics	167-509	75-265
Solder (tin-alloy)	275-350	135-177
Tin	449	232

Pot Metal (copper lead alloy)	572-752	300-400
White pot metal	572-752	300-400
Lead	621	327
Zinc	707	375
Glass	1100-2600	593-1427
Unrefined Earthenware	1112 – 1832	600-1000
Aluminum	1220	660
Brass (yellow)	1710	932
Silver	1760	960
Stoneware	1832-2192	1000-1200
Gold	1945	1063
Copper	1981	1082
Refined Earthenware	2192-2912	1200-1600
Cast Iron	1920-2550	1350-1400
Steel (stainless)	2600	1427
Nickel	2651	1455
Steel (carbon)	2760	1516
Iron	2795	1535
Porcelain	2822	1550

Cans

Cans from late nineteenth and twentieth century sites are made from rolled, tinned steel. Fire may damage labels, melt solder on the older ―hole-in-cap‖ cans, and burn off the tinned surface. However, can morphology (size, shape) which is usually the key to identification is unlikely to be affected by fire (Haecker n.d.).

VIII. Fire Effects on Inorganic Architectural Materials (Buenger 2003, Haecker n.d.)

Sandstone (Architectural)

Fire will damage architectural stone. Above about 300 C (572 F) sandstone will begin to oxidize and at higher temperatures (pervasive at 700 C, 1292 F) it will spall and fracture. These effects can significantly alter features constructed of this material and may constitute a significant effect to sites with these features (Buenger 2003).

Adobe

Adobe bricks and mortar and rammed earth walls are created from non-flammable sand, silt, and clay. These materials may be mixed with straw, however, and construction of adobe structures will often include wooden poles and posts, which may burn. Walls may be smoothed with adobe plaster. When intact, an adobe structure will resist fire. Plaster that is made with gypsum will spall when exposed to sufficient heat, which may expose more flammable parts of a structure. If the straw used in the adobe burns, the structure may also be weakened (Haecker n.d.).

Cement-mortared Fieldstone, Firebrick, Cinder Block, Cement Aggregate

These materials are generally resistant to fire. Low-fired, non-commercial, locally made brick may weaken and crumble in a hot fire. Hot fires will also calcinate lime-based mortar, causing it to crumble and the wall to eventually collapse. Masonry and cinder block may spall, resulting in damage to the surface of the structure (Haecker n.d.)

IX. Fire Effects on Rock Art

Fire has a high potential for damage to rock art. Though there are no specific temperature guidelines for rock art, fire effects include soot smudging and discoloration from smoke, which obscure the rock art images; degradation of the rock surface from spalling, exfoliation, and increased weathering; changes in organic paints due to heat; and damage to rock varnish which may destroy its potential to date the art (Tratebas 2004, Kelly and McCarthy 2001).

Fire retardants, slurry, foam, and water should never be dumped/ sprayed on rock art during a fire.

X. Effects of Fire Suppression on Cultural Resources

Ground Disturbance

Fire suppression activities have considerable potential to damage archaeological and historic sites and materials from many activities, including fireline construction (hand line and bulldozer line), establishment of helicopter bases, fire camps, and related activities.

Fire Retardant/ Chemical Products

Application of fire retardant and other chemical products has the potential to affect cultural resources, although use of fire retardants on historic structures may protect them from destruction during a fire. Cultural resource specialists may need to consider the effects of fire itself versus the effects of retardant use or the possibility of other protection options during a fire. See these references for further information: Saleen 2004, Corbeil 2002, and the USDA Wildland Fire Chemical Systems website. This website (see references at end of this document) has brief descriptions of the types of chemicals used and their potential effects on structures.

There are various types of products:

- Long-term retardants, which contain salts (fertilizers) with additives that may color covered items red or which may turn metals bluish;
- Foam fire suppressants, which are detergents and surfactants (wetting agents);
- Water enhancers which increase the effectiveness of water.

There are various potential effects from use of retardants, foams, and water:

- Rapid cooling: dumps of any of these materials on hot surfaces may cause effects to archaeological materials (e.g. artifact fracture) from rapid temperature change;
- Materials dumped onto fragile archaeological features may break/ displace them;
- Long-term retardants contain salts which can be desiccants, which damage old, fragile wood and may cause spalling in sandstone; chemicals may cause corrosion in metals; iron oxide additives may leave a permanent red stain and corrosion inhibitors in the retardant may turn surfaces, especially metals, blue or black;

- Foams may hasten rusting on metal surfaces by removing protective coatings and may cause wood to flake due to swelling and contracting;
- Water enhancers are desiccants and may damage wood surfaces, strip surfaces of finishes, and damage sandstone; they are also difficult to remove from wood surfaces, especially for old or fragile wood.
- Retardant should be washed off important structures as soon as possible. Pre-soaking, then handbrushing with water and a mild detergent may work for sandstone or painted wood. Metals and glass may be wiped with water and a mild detergent. Power washing, sand-blasting, and acid based washes may damage historic materials.

XI. Effects of Fire on Archaeological Sites

There are a number of potential fire effects to cultural resources which do not depend upon effects to specific materials, including:

- Increased visibility from vegetation burn-off and consequently greater vulnerability to vandalism
- Physical damage to sites from snags/ trees falling
- Soil erosion and loss of archaeological data
- Increased damage from rain, new drainage patterns, flood
- Increased rodent and insect activity within site soil matrix

XII. Protection Protocols

Management Measures

There are a number of actions which cultural resource specialists can take or promote to help preserve cultural resources from the effects of fire, including fire suppression:

- Serve as a technical specialist during fire events; the best protection for cultural resources during a wildfire is to have knowledgeable professionals ready and able to participate in the suppression effort.
- Prepare plans for protecting high value cultural resources before a fire occurs, and make sure that appropriate authorities know about and have access to these plans. Define ahead of time those high value cultural resources which are really worth saving. ―Fire proof‖ vulnerable sites ahead of time when possible.
- Work with prescribed fire project planners to accommodate cultural resource concerns in the burn prescriptions.
- Ensure that cultural resource concerns are included in fire management plans, especially with regard to appropriate management responses to fire whenever it might occur in specific areas. For example, where there are areas of high value cultural resources and these are also areas where fires will be suppressed, ensure that plans include the necessity for ―ordering up‖ a cultural resource specialist when a fire occurs.
- Track fire effects on cultural materials in local contexts, and share that information regionally. When possible, do ―before/after‖ experiments of prescribed burns, to assess the effects of fire in specific, local contexts on those archaeological materials which are typical in your area.

Protection measures

There are many actions which will help protect cultural resources from the effects of fire. Cultural resource specialists should work with fire specialists to implement these measures.

In some cases there may be adverse effects associated with implementing the protection measures, such as using retardant on historic structures during a fire, or clearing vegetation which screens sites from vandals. In these cases, of course, the effects of the protection measures must be weighed against the potential for loss of the resource due to fire. In all cases, prescribed fire offers the chance of greater control over fire effects than does wildfire.

Some of these protection measures are pertinent to prescribed fire, some to wildfire, and some to both.

- Identify and avoid vulnerable cultural resources. Note that avoidance may contribute to greater likelihood of wildfire in the future when sites have high fuel loads, or that avoidance may create —vegetation islands‖ that identify sites to vandals. If necessary, work with fire planners to minimize these effects.
- Record and collect information that would be lost during a fire. For important rock art, thorough recordation and collection of samples of the surface varnish for dating may be the best protection possible.
- Manually reduce fuels on and/or around vulnerable sites; pile debris offsite.
- Create fire breaks near/ around sites. This may be an effective way to protect rock art panels, for example.
- Use retardant or foam to protect structures.
- Wrap structures in fire proof materials to protect from fire.
- Remove logs/ heavy fuels from vulnerable sites/ features (e.g. clear snags off bedrock mortars), or cover with foam or retardant prior to burn.
- Flush cut and cover stumps with dirt, foam, or retardant, where burnout could affect subsurface cultural resources.
- Modify burn plans to minimize effects to cultural resources, such as burning when duff has high moisture.
- Identify and reduce hazard trees next to structures.
- Use low intensity backing fire in areas near historic features.
- Saturate ground/grass adjacent to vulnerable structures with water, foam, or gel before burning.
- Preburn site at lower intensity than planned for surrounding areas.
- Limit fire intensity and duration over vulnerable sites.
- Use a fast-moving, higher intensity fire over lithic scatters, where rock materials are vulnerable to longer-duration heating.
- Wrap carved trees, dengroglyphs, and other such features in fire retardant fabric.
- Limb carved trees to reduce ladder fuels, if possible to do so.
- Cover rock art in fire retardant fabric.
- Minimize fuels and smoke near rock art.
- Cover fuels near rock art with foam, water, or retardant, avoiding the rock art.

For a good discussion of protection measures for historic structures, see Matz (2002)

XIII. Summary

Fire effects are context-dependent. The effects of fire on cultural resources depend upon factors which vary from place to place, including physical factors such as fuels, terrain, site type, and cultural materials present. Managing for fire effects also depends upon the value of the cultural materials at risk. In areas where surface materials have little integrity, for example, due to collecting, erosion, past fires, or other factors, surface effects from fire may be of minimal consideration.

The brief synthesis of fire effects information in this guide should assist cultural resource specialists to address the conditions that apply to their local/ regional circumstances. There are few hard and fast answers; local circumstances and conditions require appropriate strategies based on good technical information.

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