Table of Contents

Purpose ........................................................................................................................................3
General Information ......................................................................................................................3
Trigger Points ..................................................................................................................................3
Function of Resource Advisor .......................................................................................................3
Resource Advisor Kit ......................................................................................................................4
Availability ......................................................................................................................................4
Dispatch .........................................................................................................................................5
Fire Management Plan Direction .....................................................................................................6
General Direction ............................................................................................................................6
  1. Interface FMU .......................................................................................................................... 11
  2. Desert FMU ............................................................................................................................. 14
  3. Shivwits FMU .......................................................................................................................... 19
Mitigation .........................................................................................................................................25
Biological Opinion ..........................................................................................................................40
Management - All FMUs ..................................................................................................................40
Conservation Measures - All FMUs ...............................................................................................40
Conservation Measures - Mojave desert tortoise .........................................................................42
Conservation Measures - Mexican spotted owl .............................................................................43
Conservation Measures - Interface FMU (FMU1) .........................................................................44
Conservation Measures - Desert FMU/Desert Zone (FMU2A) ....................................................44
Conservation Measures - Desert FMU/Tamarisk Zone (FMU2B) ................................................44
Conservation Measures - Shivwits FMU (FMU3) .........................................................................45
Reasonable and Prudent Measures with Terms and Conditions ..................................................45
Invasive Species Guidance ...........................................................................................................48
SOP: Invasive Species Prevention in Fire Operations .................................................................48
Operational Guidelines for Aquatic Invasive Species Prevention and Equipment Cleaning ... 53
Mojave Desert Initiative ................................................................................................................56
Wilderness Protection .....................................................................................................................57
Mitigation .........................................................................................................................................59
Minimum Impact Suppression Tactics (M.I.S.T.) ........................................................................60
Key Contacts .................................................................................................................................71

Preparers

This Resource Advisor guide is a working document and meant to be updated frequently. This draft updates the 2009 version and was prepared by:
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2
Purpose

This document describes some of the natural and cultural resources at Lake Mead NRA that may be impacted during wildland fire incidents. It lists resource protection and/or mitigation measures sufficient to minimize the negative impacts resulting from certain fire management actions. It also includes requirements identified in the Fire Management Plan, Environmental Assessment, FONSI, and Biological Opinion.

General Information

Trigger Points

Based on the park’s approved Fire Mgmt Plan and discussions with fire and resource staff, the following have been identified as trigger points for fire incidents that need a resource advisor:

- All fires in critical tortoise habitat (due to USFWS requirements)
- All fires in springs or riparian habitats (due to endangered species and cultural issues)
- All fires in the Newberry Mountains (due to cultural resource issues)
- All fires in wilderness, proposed wilderness, potential wilderness or suitable wilderness
- All fires in/near the historic St. Thomas townsite
- All fires at Tassi Ranch
- Fires over 5 acres in size
- Fires that go into extended attack

Function of Resource Advisor

The primary role of the Resource Advisor (RA) is to provide technical advice to the Incident Commander (IC) regarding resource issues. Specifically, the RA

- Makes timely recommendations to the IC based on resource concerns associated with fire management tactics and incident management activities
- Advises the IC on the need for and techniques used in suppression rehab
- Considers the need for burned area emergency response (BAER) and recommends actions to both the Incident Commander and the Chief of Resource Management
- Maintains a Unit log of their activities and writes a report that summarizes the resource concerns associated with the incident, actions taken or not taken based upon those concerns, and recommendations for follow-up action, if any.

At any point in the incident, the RA may determine the need for consultation with other park staff and/or agencies, specifically the US Fish and Wildlife Service (for endangered species), the State Historic Preservation Office (for cultural resources) and the Tribal Historic Preservation Office (for ethnographic resources). Such consultations should be coordinated through the appropriate Resource Management Branch Chief or their designee.
**Resource Advisor Kit**

All RAs should respond wearing Nomex shirt and pants, fire boots, and bring all other standard personal protective equipment including line pack with fireshelter, water, and a hand tool. If available, the following items should also be taken by the RA when responding to an incident:

- 4x4 vehicle
- Sleeping bag
- Laptop computer with READ external hard drive and GIS software
- Programmable handheld radio
- Cell phone
- USB mini-hub
- Digital Camera
- Garmin GPS unit
- Portable printer
- Power converter
- “weed” flagging
- Extra ‘AA’ batteries
- Topo maps of response area

**Availability**

All RAs will be listed in IQCS. A lead RA will be responsible to meet annually with the Fire Program prior to fire season to establish a RA availability schedule and resolve issues and concerns. Generally, with input from the RAs, the lead RA will prepare a weekly schedule that shows an “on-call” RA assigned for each week of the fire season and updated monthly as needed throughout the fire season. The schedule weeks will start on Monday morning with the passing of the READ phone from the previous READ to the on-call read for that week. Before someone is listed as available, they need to clear their dates with their immediate supervisor to make sure that their work schedule has the flexibility to allow their response in the event of an incident.

When the IC determines the need for a RA, they will place an order with dispatch who will then contact the person who is on-call for the week using the READ phone. If they are unable to reach that person, they will contact the Lead RA who will serve as the coordinator for resource advising functions at Lake Mead. The Lead RA will then try to find someone else who is available as a RA and, if cell coverage or satellite phone availability at the incident allows, will begin advising remotely via telephone.

In addition, a RA consultation list will be prepared and updated annually that lists who in Resource Management will need to be contacted during a fire emergency and include their after hours contact information. For example, this consultation list will include personnel that are responsible for conducting Emergency Sec 7 consultation under the Endangered Species Act and the person responsible for conducting emergency SHPO/THPO consultation for cultural resources.
**Dispatch**

READ on-call cell phone number 702-249-2873
Lead READ Dingman cell phone number 702-423-2372 (use if on-call READ doesn’t answer)

ROSS may or may not be used to dispatch and status RAs within their home unit depending on FMO and IC needs. All RAs will be dispatched to the incident upon order from the incident commander, either through ROSS or direct communication. No one will self-dispatch. When an RA is called to an incident, they should immediately accept or decline the assignment. If they accept, they should notify their immediate supervisor in person or by leaving a message on their work phone. All non-federal employees should be signed up in advance as an “AD” employee with the Lake Mead Fire Mgmt office. On-scene resource advisors should generally be arduous-duty qualified firefighters, and if not, must inform the IC upon arrival at the incident.

The first READ assigned to an incident will determine the need for additional READs based upon incident complexity and resource values at risk. Generally, an extended attack incident that is running both a day shift and a night shift will need at least two READs, one to cover each shift. For Type I or II incidents, an “overhead” READ will be designated to work in ICP directly with the Incident Management Team to make sure that resource issues are considered in all planning meetings and briefings, other READs will be ordered and assigned as needed in the field. Orders for additional READs will go through the IC and Dispatch for initial attack incidents, or through the Ordering Unit for larger incidents.
Fire Management Plan Direction

The following text is excerpted from the approved Fire Management Plan (updated 2011 version), Environmental Assessment, and Finding of No Significant Impact, signed in September 2004. Figure and table numbers correspond to their source document.

General Direction

Initial attack suppression actions would be taken on all human-caused wildland fires. Suppression actions would also be taken on all escaped prescribed fires, and lightning-caused fires that are within or threaten the suppression units. Initial attack suppression actions would provide for public and firefighter safety, protect public and private resources, and utilize techniques that are least damaging to the natural, cultural, and historic resources. Dozers and other heavy equipment would be used only with superintendent approval, unless life or property is threatened. Standard tactics that would be utilized include deployment of fire engines and ground personnel with hand tools.

The park is divided into three Fire Management Units (FMUs):
1. Interface (FMU1);
2. Desert below 6,000 feet (FMU2a and FMU2b); and,
Figure 1. FMUs Lake Mohave
Figure 2. FMUs Hoover Dam Area
Figure 3. FMUs Overton Arm Area
Figure 4. FMUs Temple Bar Area
1. Interface FMU

Interface FMU physical description

This FMU has 23 separate interface areas that encompass residential areas, recreational trailer villages, commercial buildings, administrative sites and developed campgrounds, that are within or directly adjacent to the Lake Mead NRA boundary (Figures 6, 7, 8, and 9). These areas are described in the affected environment section. The Interface FMU suppression strategy would match that of the shared boundary administrator, be it federal, state, county or local. The suppression response will be identified in Annual Operating Plans that are in accordance with an approved agreement (Master, MOU, Mutual Aid, other).

Interface FMU Strategic Management Objectives

Within this FMU all wildland fires will be suppressed using a response to wildland fire with the intent of minimizing loss of structures and property. Management of the Interface FMU is designed to meet the following FMP objectives.

1) All fire management activities will have as the highest priority firefighter and public safety.

2) Response to wildland fires for all wildland fires (regardless of ignition source) will be rapid containment and suppression to protect the public, check fire spread onto private property and protect the National Park Service’s natural, cultural and historic resources.

3) Emphasis will be placed on facilitating reciprocal fire agreements and the maintenance of these agreements with pertinent fire management entities.

4) Hazard fuel reduction will be given a high priority. Consideration needs to given to a range of issues prior to implementation, such as unwanted vegetation that may result from such a treatment. Hazard fuel reduction will mainly be in and around developed areas.

5) Prescribed fires in the Interface FMU will be accomplished under a prescription that minimizes risk to private property and invasion of unwanted vegetative species.

6) If fuel loadings pose a high risk and make control of the burn difficult, then consider other alternatives, such as mechanical treatment to facilitate protection of values at risk.

7) Strong interagency fire participation will be encouraged for all fire operations, including fire planning, fire suppression, fire for resource benefit, fire prevention and hazard fuel reduction.

Interface FMU Management Constraints and Mitigation

Management of the Interface FMU will include the following constraints:
Smoke management reporting procedures for burning in Nevada/Arizona will be followed for all prescribed fire operations.

Employ minimum impact tactics where possible.

No bulldozer or grader use unless approved by the Superintendent.

Prior to 2010 update, no off road vehicles were allowed unless approved by the Superintendent. In consideration of the objectives of the Mojave Desert Initiative and protection of desert tortoise habitat from fire, this direction is updated in 2010 to allow for mobile attack if the following conditions are met:

a. IC is local and has attended a pre-season values at risk training
b. A large acreage can be prevented from burning with a minimal amount of off-road travel and the fire has a reasonable potential for spread given fuel and weather conditions
c. It is safe to travel off-road and a spotter walks in front of the vehicle to look for both safety hazards and resources of concern (e.g. tortoises)
d. There is a reasonable chance of catching fire with the water available in engines or other equipment on scene
e. The distance traveled is generally less than ¼ mile off-road
f. Mobile attack is used during the first hour of the IC being on scene
g. There is no off-road travel for mop-up
h. Avoid tracks in the black

Retardant use is allowed for direct attack (e.g. not for installing contingency lines) in this FMU if the following criteria can be met:

a. IC is local and has attended a pre-season values at risk training
b. READ recommends or concurs with the decision
c. No known springs, seeps, or other surface water resources will be affected by the delivery (distance away varies by delivery mechanism, terrain, etc)
d. READ or IC records the volume, formulation, and location of retardant use for follow-up on resource impacts, to greatest extent possible.
e. Any other use of retardant is subject to Superintendent authorization as per existing plan

Protection mitigation measures for known historic and cultural resource sites in or near the project area must be assured before a prescribed burn project is initiated.

All fire management activities will consider safety of personnel and the public as the highest priority.

Recreation Area neighbors, park visitors and the local residents will be notified of all planned and unplanned fire management activities that have the potential to impact them.

All park closures are at the discretion of the Superintendent.
No fire management operations will be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions (LCES), current fire season conditions and current and predicted fire weather and behavior.

Fire management operations will be carried out by qualified individuals who promote the safe and skillful application of fire management strategies and techniques.

**Interface FMU Values to be Protected and Special Concerns**

Interface sites adjacent to and within the Recreation Area.

Administrative sites, campgrounds, concessioner facilities, utility infrastructure, and housing are areas to be protected.

Any known T&E species sites will be acknowledged and mitigated for during prescribed burn operations. Desert tortoise habitat is included in this FMU.

A special concern for this FMU is the reduction of hazardous fuels in areas dominated by saltcedar.
2. Desert FMU

Figure 5. Desert FMU (Low Desert Region not included in interface areas)
This FMU was mainly established to encompass the desert tortoise habitat (Figure 10). Desert tortoises prefer desert shrub areas such as creosote bush scrub on flats and on slopes up to 5000 feet. Also occurring in this FMU are areas with stands of tamarisk. Tamarisk is a non-native invasive plant that is displacing the native riparian plants. This FMU would be divided into two zones. A desert habitat zone and a tamarisk zone. Tamarisk control would be the same as described under Alternative A.

Desert FMU Strategic Management Objectives

1) Desert Habitat

- Personnel and public safety are the highest priority for all fire management activities.
- All wildfires will be suppressed.
- The desert tortoise and its habitat will be protected during all fire suppression and fuel management operations.
- The effects of fire on the ecosystem will be monitored.
- Fire management operations will be carried out by qualified individuals who promote the safe and skillful application of fire management strategies and techniques.

2) Riparian Zone

- Personnel and public safety are the highest priority for all fire management activities.
- Fuels management projects will be conducted in the saltcedar habitat to achieve resource management objectives.
- An herbicide treatment will follow the prescribed burns where appropriate.
- Native riparian species may be planted after prescribed burns.
- The effects of fire on the ecosystem will be monitored.
- Fire management operations will be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.

Desert FMU Management Constraints and Mitigation

A. Desert Habitat Zone

1) Desert Habitat Area

No fire management operations will be initiated until all personnel involved receive a safety
briefing describing known hazards and mitigating actions (LCES), current fire season conditions and current and predicted fire weather and behavior.

All fire management activities will consider safety of personnel and public as the highest priority.

Fire management operations will be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.

Fire management activities will employ minimum impact tactics.

Firefighters will be briefed on the desert tortoise.

Prior to 2010 update, no off road vehicles were allowed unless approved by the Superintendent. In consideration of the objectives of the Mojave Desert Initiative and protection of desert tortoise habitat from fire, this direction is updated in 2010 to allow for mobile attack if the following conditions are met:

a. IC is local and has attended a pre-season values at risk training  
b. large acreage can be prevented from burning with a minimal amount of off-road travel and the fire has a reasonable potential for spread given fuel and weather conditions  
c. It is safe to travel off-road and a spotter walks in front of the vehicle to look for both safety hazards and resources of concern (e.g. tortoises)  
d. There is a reasonable chance of catching fire with the water available in engines or other equipment on scene  
e. The distance traveled is generally less than ¼ mile off-road  
f. Mobile attack is used during the first hour of the IC being on scene  
g. There is no off-road travel for mop-up  
h. Avoid tracks in the black

Retardant use is allowed for direct attack (e.g. not for installing contingency lines) in this FMU if the following criteria can be met:

a. IC is local and has attended a pre-season values at risk training  
b. READ recommends or concurs with the decision  
c. No known springs, seeps, or other surface water resources will be affected by the delivery (distance away varies by delivery mechanism, terrain, etc)  
d. READ or IC records the volume, formulation, and location of retardant use for follow-up on resource impacts, to greatest extent possible.  
e. Any other use of retardant is subject to Superintendent authorization as per existing plan

No dozers or graders will be used unless approved by the Superintendent.

No fire management operations will be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions (LCES), current fire season conditions and current and predicted fire weather and behavior.
All fire management activities will consider safety of personnel and public as the highest priority.

Fire management operations will be carried out by qualified individuals who promote the safe and skillful application of fire management strategies and techniques.

Smoke management reporting procedures for burning in Nevada/Arizona will be followed for all prescribed fire operations.

Protection mitigation measures for known historic and cultural resource sites in or near the project area must be assured before a prescribed burn project is initiated.

Clearance from a Lake Mead NRA wildlife biologist will be received before burning in the riparian habitats.

B. Tamarisk Zone

No fire management operations would be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions, current fire season conditions and current and predicted fire weather and behavior.

All fire management activities would consider safety of personnel and public as the highest priority.

Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.

Smoke management reporting procedures for burning in Nevada/Arizona would be followed for all prescribed fire operations.

Fire management activities would employ minimum impact tactics.

Off-road vehicle use would be prohibited unless approved by the superintendent.

Dozer or grader use would be prohibited unless approved by the superintendent.

Protection mitigation measures for known historic and cultural resource sites in or near the project area would be assured before a prescribed burn project is initiated (with special concern for the St. Thomas area in the Upper Overton Arm).

Desert FMU Values to be Protected and Special Concerns

Sensitive, threatened, and endangered plants, animals and habitat communities are of special
concern. Of particular concern is desert tortoise and its critical habitat, which are common within this zone.

Any known T&E species sites will be acknowledged and mitigated for during prescribed burn operations as well as fire suppression actions.

All known archeological and cultural sites will be mitigated for in all fire management activities.
3. Shivwits FMU

Figure 6. FMUs Shivwits Plateau

Shivwits FMU Physical Description

This FMU is an extremely remote area within the Arizona Strip located on the northwest rim of the Grand Canyon (Figure 11). The nearest community is St. George, Utah, which lies 90 miles to the north. Most of the area is without roads; access to the area is via unpaved dirt roads with varying road conditions. Most of the northern boundary is adjacent to BLM administered lands and the southern and eastern boundaries are adjacent to Grand Canyon NP. The area is part of Grand Canyon-Parashant NM, but is still managed under the direction of the NPS at Lake Mead NRA.
There are three main habitat types on the Shivwits Plateau: including pinyon-juniper, ponderosa pine, and sagebrush. There are several administrative sites, historical sites, and two special plant populations that would receive full suppression. This is also an area with numerous historic and cultural resources. Any prescribed fire or fire for resource benefit would receive an evaluation from a resource advisor.

**Shivwits FMU Strategic Management Objectives**

Personnel and public safety are the highest priority for all fire management activities.

All human caused wildfires will be suppressed.

Fire for resource benefit is an option as well as prescribed burning and a combination of prescribed burning and mechanical (except for chaining, which is specifically prohibited in the Park’s General Management Plan) and herbicide treatments to meet resource objectives.

The effects of fire on the ecosystem will be monitored.

Fire management operations will be carried out by qualified individuals who promote the safe and skillful application of fire management strategies and techniques.

Air quality will be maintained at acceptable levels.

**Shivwits FMU Management Constraints and Mitigation**

No fire management operations will be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions (LCES), current fire season conditions and current and predicted fire weather and behavior.

All fire management activities will consider safety of personnel and public as the highest priority.

Fire management operations will be carried out by qualified individuals who promote the safe and skillful application of fire management strategies and techniques.

Fire management activities will employ minimum impact tactics.

No off road vehicles will be used unless approved by the Superintendent.

No dozers or graders will be used unless approved by the Superintendent.

Retardant use is allowed for direct attack (e.g. not for installing contingency lines) in this FMU if the following criteria can be met:

a. IC is local and has attended a pre-season values at risk training

b. READ recommends or concurs with the decision
c. No known springs, seeps, or other surface water resources will be affected by the delivery (distance away varies by delivery mechanism, terrain, etc.)
d. READ or IC records the volume, formulation, and location of retardant use for follow-up on resource impacts, to greatest extent possible.
e. Any other use of retardant is subject to Superintendent authorization as per existing plan

Smoke management reporting procedures for burning in Arizona will be followed for all prescribed and fire use operations.

Protection mitigation measures for known historic and cultural resource sites in or near the project area must be assured before a prescribed burn project is initiated or a fire for resource benefit is allowed to burn.

Protection/mitigation measures for known T, E, & S species in or near the project area will be initiated before a prescribed burn takes place or before a fire for resource is allowed to burn.

Shivwits FMU Values to be Protected and Special Concerns

Sensitive, threatened, and endangered plants, animals and habitat communities are of special concern. Additional guidance is provided in the Resource Advisor Guide.

Any known T&E species sites will be acknowledged and mitigated for during prescribed burn operations as well as fire suppression actions.

Prior to any prescribed burn in the ponderosa pine habitat a Mexican spotted owl and northern goshawk surveys will be completed.

All known archeological and cultural sites will be mitigated for in all fire management activities.

Dellenbaugh Administrative Site and the historic Waring Ranch will be proactively protected from unplanned ignitions.

Additional Guidance for managing unplanned ignitions for resource benefit in FMU 3

Fire Management Area 1:
- Community Description: Pinyon-juniper woodland type
- Dominant Vegetation: Juniper (Juniperus osteosperma) and Pinyon (Pinus monophylla)
  Associated Vegetation: Gambel Oak (Quercus gambelii), Scrub Oak (Quercus turbinella), Mountain Mohagany (Cercocarpus spp.), Squaw Bush (Rhus trilobata), Manzanita (Arctostaphylos spp.)
- Ground Cover: Sparse to non-existent, mix of native and exotic grasses and forbs, mostly bare ground lacking continuous fuels
- Desired Plant Community: A mosaic of native grasses, forbs, shrubs, with scattered juniper and pinyon trees

Resource Management Objectives: Reduce soil erosion,
vegetation type conversion to above desired plant community, promote the improvement of wildlife habitat by increasing forage and habitat diversity.

- **Expected Fire Behavior:** Small fires less than one acre, many single trees burning with high intensity. Minimum chance for fire spread due to lack of continuous ground fuels. Extreme fire conditions (high winds, low live fuel moisture, drought conditions) will be required to produce fire spread.

- **Maximum allowable fire prescription/behavior parameters:**
  - Wind Direction and Speed: all conditions acceptable
  - Temperature: all conditions acceptable
  - Relative Humidity: all conditions acceptable
  - Fuel Moisture (all sizes included): all conditions acceptable
  - Live Fuel Moisture: all conditions acceptable
  - Fire Danger Rating: Extreme, all ratings acceptable
  - Drought (Palmer Index): -3.99 (severe drought) or wetter
  - Burn Index: >36, all acceptable
  - Preparedness Level: 5, all acceptable
  - Smoke: all acceptable upon Arizona Department of Environmental Quality (ADEQ) approval, smoke volume and dispersal may limit allowable acres per day to be determined by ADEQ. Refer to smoke management section for further details.

**Fire Management Area 2:**

- **Community Description:** Big Sagebrush
- **Dominant Vegetation:** Big Sagebrush (*Artemisia tridentata*)
- **Associated Vegetation:** Low sagebrush (*Artemisia arbuscula*), Snakeweed (*Gutierrezia sarthrae*), Rabbit Brush (*Chrysothamnus spp.*), Black brush (*Coleogyne ramosissima*), Winterfat (*Eurotia lanata*)
- **Ground Cover:** Mostly sparse, some areas have continuous exotic grasses mixed with native plant diversity
- **Resource Management Objectives:** Reduce soil erosion, increase plant diversity, wildlife habitat enhancement.
- **Expected Fire Behavior:** Fire size and spread will be determined mainly by wind speed and direction. Without wind, fires will only spread when continuous fine fuels are present. Wind driven fires, intensity will vary according to fuel load.

- **Maximum allowable fire prescription/behavior parameters:**
  - Wind Direction and Speed: all acceptable
  - Temperature: all acceptable
  - Relative Humidity: all acceptable
  - Fuel Moisture (all size classes): all acceptable
  - Live Fuel Moisture: all acceptable
  - Flame Lengths: all acceptable
  - Fire Spread Type: crown, all acceptable
  - Fire Danger Rating: extreme, all ratings acceptable
  - Drought (Palmer Index): -3.99 (severe drought) or wetter
  - Burning Index: >36, all acceptable
Fire Management Area 3:

- Community Description: Ponderosa pine woodland type
- Dominant Vegetation: Ponderosa pine (Pinus ponderosa)
- Associated Vegetation: Gambel oak (Quercus gamblii), Big sagebrush (Artemisia tridentata), Juniper (Juniperus osteosperma)
- Ground Cover: litter and duff, exposed rocky areas, lack of herbaceous cover, minimum grasses and forbs
- Desired Plant Community: Open park like stands of large ponderosa pine with an understory of native grasses and forbs. Increase herbaceous cover and plant diversity. Reduction of “dog-hair” thickets of ponderosa pine poles and juniper trees encroaching underneath the overstory forest canopy.
- Resource Management Objectives: Protection and maintenance of remaining old growth ponderosa pines. Reduce “dog hair” thickets of ponderosa pine poles and juniper trees encroaching underneath the overstory canopy. Reduce soil erosion and provide for wildlife habitat. Increase snags per acre for wildlife habitat. Reduce forest fire ladder fuels, which threaten torching of old growth trees and lead to crown fires.
- Expected Fire Behavior: Fire spread and intensity will vary and depend upon a variety of weather and fuel conditions. Stand density, structure and fuel accumulations are adequate for producing repeated torching and crown fire if weather conditions are extreme. Fire behavior can range from low intensity ground fire to high intensity crown fire.
- Maximum allowable fire prescription/behavior parameters:
  - Wind Direction and Speed: up to 18 mph, any direction acceptable
  - Temperature: <95 degrees F
  - Relative Humidity: >10%
  - Fuel Moisture (1 hour): >2 (10 hour) >4
  - Live Fuel Moisture: >100%
  - Flame Lengths: < 8 feet
  - Fire Spread Type: ground fire dominated with intermittent torching of overstory (non-old growth) trees
  - Fire Danger Rating: very high
  - Drought (Palmer Index): -2.99 (moderate drought) or wetter
  - Burn Index: 0-35 maximum range
  - Preparedness Level: 5, if no structures at risk
  - Smoke: Regulated by ADEQ, refer to smoke management section for further details

- Observed Fire Behavior Conditions: Whatever combination of fuel and weather conditions that will allow for low to moderate fire behavior that will achieve resource objectives. Collect current fuel and weather conditions, along with forecasted weather predictions and input into fire behavior prediction models (BEHAVE).
- Unacceptable Fire Behavior Observations: Torching of old growth trees (>200 years) usually described by orange colored, deeply furrowed bark and trees that do not have

- Smoke: subject to ADEQ approval, smoke volume and dispersal may limit allowable acres per day to be determined by ADEQ. Refer to smoke management section for further details.
apical dominance. Excessive torching of younger to moderately aged trees (70-100 year old). Scorch heights should average less than 25 feet on ponderosa pine, refer to BEHAVE fire prediction program to determine prescription variables that are acceptable. Smoke output and dispersal may limit fire size (refer to smoke management section).

- **Recommended Fire Management Actions:** Area 3 fires will be more labor intensive to manage than other areas. A fire for resource benefit in area 3 may prompt the following management actions:
  - require more on site fire monitoring
  - may require fuels manipulation and preparation of old growth ponderosa pines and large snags by prescribed fire crews including pulling fuel away from canopy drip line and constructing fire control lines around tree bases
  - fire spread predictions will be critical to prepare for necessary management

**Fire Management Area 4:**

- **Description:** Administrative Boundary
- **Coordination:** This area includes all lands within 0.5 mile inside the Park boundary including BLM and Grand Canyon National Park. A fire within this zone will have a “4-#,” followed by the zone number that represents the community it’s burning in. Fires will be allowed to burn according to the prescriptions and conditions that are represented in zones 1-3. However, notification and coordination with the adjacent land management agency (BLM and Grand Canyon National Park) will be a necessity. Fire spread direction and rates of spread will be closely monitored by actual observations and model predictions will be conducted for each burn period.

- **Limiting Factors/Restrictions:** If the fire is likely to cross management boundaries within the next two burn periods then suppression actions will be taken in this zone if the following conditions exist:
  - No coordination with adjacent land manager has been established.
  - Fire behavior conditions are unacceptable to adjacent land manager.
  - The adjacent land manager does not want to accept the fire for any reason.

**Fire Management Area 5:**

These areas are designated fire suppression areas and relate to the protection of life and property, residential and historic cabins, fences, cultural sites, recreational sites, sensitive habitats, designated threatened, endangered or rare plant and animal species. Suppression actions will be determined by the value at risk. Area 5 does not mean that all fires within this area should be declared wildfires, but appropriate suppression actions must be taken. It may not be desirable or necessary to convert a fire for resource benefit into a wildfire when entering area 5 if all active fire perimeters within the suppression area can be controlled with fire for resource benefit available resources. The park’s cultural resource specialist should be notified immediately if a fire threatens a cultural resource and suppression actions should be approved by this specialist if time allows possible. A fire that starts within the area and spreads outside into another area may be allowed to burn under acceptable prescriptions, however, any active fire perimeter within area 5 should be fully suppressed. Suppression actions may be implemented prior to the fire entering area 5 if a fire is burning in an adjacent area. Area 5 will be designated as a high priority for
Mitigation

Mitigation measures have been incorporated into the selected alternative to reduce impacts. General mitigation measures are included for soils, vegetation, wildlife, special status species, riparian areas, wilderness areas, grazing, air quality, scenic quality, cultural resources, visitor use, safety, and recreation and national monument operations. Where appropriate, further mitigation is described under mitigation for suppression activities, mitigation for wildland fire use, or mitigation for treatment activities, including prescribed fire and hazard fuel reduction activities.

To mitigate potential impacts to wilderness, the park will employ its standard minimum tool decision process on a project-by-project basis to determine the appropriate suppression techniques. The appropriate tools may depend on the acreage of the area, the location of the unit, the resource goal for the unit, and the timing of the treatment. This process ensures that tools used are the minimum necessary to achieve the desired goal and that their impacts will be temporary and minor and outweighed by the long-term benefits of achieving the desired objectives.

Through consultation with the U.S. Fish and Wildlife Service for compliance with section 7 of the Endangered Species Act of 1973, as amended, specific mitigation measures will be implemented for protection of the desert tortoise, Mexican spotted owl, California condor, bald eagle, Southwestern willow flycatcher, and Yuma clapper rail. In addition, the Service provided technical assistance in developing conservation measures to benefit the Northern goshawk, relict leopard frog, and American peregrine falcon.

Table 1 describes mitigation measures that will be implemented, including those for the protection of the threatened, endangered, and sensitive species mentioned above.
<table>
<thead>
<tr>
<th>Impact Topic</th>
<th>Mitigation Measure</th>
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<td>Soils</td>
<td>No off-road vehicle use will be permitted unless specifically authorized by the Superintendent. Suppression activities will utilize minimum impact suppression tactics where possible. To protect the soils in the recreation area, fire lines and other soil scars will be restored after the completion of suppression activities. Mitigation for treatment activities: A soil monitoring program may be initiated in cooperation with USGS to determine the effects of the treatment activities, or lack of activities, on soil erosion. Treatment methods would be re-evaluated based on the findings of the monitoring program.</td>
<td>NPS Fire Specialist and Resource Advisor</td>
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<tr>
<td>Vegetation</td>
<td>All areas with rare plants will be mapped and designated as non-treatment units. Full suppression tactics will be used to protect these areas. Areas identified as problem areas for non-native plants will be mapped and designated as full suppression zones, except tamarisk areas. To protect the region from the spread of non-native plants, no personnel or equipment will be permitted in the designated non-native plants problem areas, except in emergency situations. Fire crews will be dispatched to construct control lines around snags, old growth trees, and large down logs. Restoration and seeding activities may occur in wildland fire areas (FMU 3), or areas in the low desert where fire burns prior to suppression (FMU 2). In these circumstances, the NPS restoration specialist and/or burned area rehabilitation team will be consulted to determine the best native seeding for the burned area. Vegetation treatment and seeding activities will be monitored and evaluated on an annual basis. Seeding activities could also occur in the wildland fire use zones. Seeding guidelines are outlined in Appendix F in the EA. Vegetation plots, photo monitoring, and observations will be compiled for analysis to determine treatment effectiveness. Adaptive management principles will be applied throughout all phases of restoration treatments.</td>
<td>NPS Botanist, NPS Fire Specialist, and Resource Advisor</td>
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<tr>
<td>Vegetation</td>
<td>Mitigation for treatment activities: Treatment units will be surveyed prior to any activities to look for rare plants and non-native species. Areas identified as problem areas for non-native plants will be mapped and designated as suppression zones. To protect the region from the spread of non-native plant problem areas, except where authorized by resource project monitors. Thinning will occur in portions of the ponderosa pine treatment areas and pinyon-juniper areas, and only post-settlement trees will be designated for thinning. Cut trees could be removed or burned in place from ponderosa pine treatment areas to reduce the potential for hazard fuel accumulation.</td>
<td>NPS Botanist, NPS Fire Specialist, and Resource Advisor</td>
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<tr>
<td>Wildlife</td>
<td>Surveys will be conducted on potential nesting cavities and all areas where nesting sites are found will be protected by designating the areas as suppression and non-treatment zones. Maps of existing sites and habitat will also be consulted when making decisions and designating suppression or non-treatment zones. A resource management specialist will be present for suppression, wildlife fire use, and treatment activities. Appropriate suppression activities will take place if biologists determine that a fire would adversely impact wildlife habitat.</td>
<td>NPS Wildlife Biologist and Resource Advisor</td>
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<tr>
<td>Threatened, Endangered, and Sensitive Species</td>
<td>Maps of existing and potential habitat will be consulted when planning and implementing the fire management activities. Suppression and non-treatment zones will be designated around potential and known habitat for threatened, endangered, and sensitive species. Surveys will continue in the region as directed by the NPS wildlife biologists. If more potential habitat is designated, these areas will also be designated as non-treatment zones.</td>
<td>NPS Wildlife Biologist</td>
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<tr>
<td>Desert Tortoise</td>
<td>Mitigation for suppression activities is detailed in <em>Fighting Wildfire In Desert Tortoise Habitat: Considerations for Land Manager</em> (Duck et al.) and refined in Appendix A of that document, <em>A Hierarchy for Fire Suppression Activities in Desert Tortoise Habitats</em>. This has been adopted by managers throughout desert tortoise habitat and will be adopted in the fire management plan.</td>
<td>NPS Wildlife Biologist and NPS Fire Managers</td>
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<tr>
<td>Mexican spotted owls</td>
<td>Surveys will be conducted on the Shivwits Plateau. Preliminary surveys by NPS wildlife biologists found no Mexican spotted owls. Follow-up two-year surveys began in 2002 in accordance with U.S. Fish and Wildlife Service protocol. The survey areas will continue to focus on ponderosa pine stands, slot canyons, and riparian zones. If Mexican spotted owls are found, all vegetation treatment operations in that area will be halted and further consultations with the U.S. Fish and Wildlife Service will be initiated.</td>
<td>NPS Wildlife Biologist and NPS Fire Managers</td>
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<tr>
<td>Northern goshawks</td>
<td>Surveys will be conducted on the Shivwits Plateau. Surveys will be conducted in all areas in which fire activities are planned, and no activities will occur in areas where goshawks are nesting. Goshawks have a lengthy nesting period, and the sensitive period for breeding goshawks extends from early March through September. Any burning scheduled for this period will be preceded by a goshawk survey. Goshawk surveys will be coordinated through the Resource Management Division, Lake Mead NRA. If goshawks are discovered in an area proposed for burning, fire managers will consult with the park’s wildlife biologists to determine an acceptable course of action, which may include delaying the burn schedule or altering the location of the proposed burn.</td>
<td>NPS Wildlife Biologist and NPS Fire Managers</td>
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<td><strong>California condor</strong></td>
<td>If condors are found inhabiting portions of the Shivwits region, those areas will be designated as non-treatment zones. In addition, the following mitigation measures will be adopted specifically for the protection of the California condor. If condors occur in the action area during mechanical treatment operations, activities within 300 feet of the bird will cease until it leaves on its own or until techniques are employed by permitted personnel which result in the individual leaving the area.</td>
<td>NPS Wildlife Biologist, NPS Fire Specialist, Resource Advisor</td>
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<td>If condors are located near the project area, weather conditions will be evaluated by Prescribed Fire Specialists and Resource Advisors to determine the potential for impacts from smoke on the condors. Prescribed fire will be cancelled if weather conditions increase the impacts of smoke on condors.</td>
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<tr>
<td>Threatened, Endangered, and Sensitive Species</td>
<td>Habitat for the Southwestern willow flycatcher, Yuma clapper rail, and relict leopard frog could exist in the spring riparian areas.</td>
<td>NPS Wildlife Biologist</td>
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<tr>
<td>Southwestern willow flycatcher and Yuma clapper rail</td>
<td>The tamarisk treatments occur in small isolated patches (1 to 5 acres) associated with springs that form narrow thicketts usually only one tree width along linear stream courses. Most if not all of the tamarisk prescribed burn treatment sites occur within areas that no potential breeding habitat for Southwestern willow flycatchers. However, this determination is still evaluated on a case by case basis of each treatment site prior to implementing a prescribed burn tamarisk control project. The Southwestern willow flycatcher and Yuma clapper rail will be protected from treatment activities. Surveys in accordance with U.S. Fish and Wildlife Service protocol will occur for Southwestern willow flycatchers prior to any treatment activities. Surveys will also occur for the Yuma clapper rail in suitable habitat. If nests or these species are found, these areas will be designated as non-treatment sites. Treatment will include planting native riparian vegetation to restore the springs. Spring restoration will improve habitat for Southwestern willow flycatchers and other riparian bird species.</td>
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<td>Relict leopard frog</td>
<td>The relict leopard frog exists in several springs around Lake Mead NRA. Extensive surveys have occurred for the past several years, and are continuing for the foreseeable future. All spring and riparian areas will be surveyed prior to any treatment activities. The portions of the springs inhabited by the relict leopard frog will not be treated by prescribed burning. Instead, under the direction of the wildlife biologist, non-native vegetation will be cut and removed from these areas. No slurry or fire retardant chemicals will be utilized in spring and riparian areas or within 300-feet of these areas.</td>
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<td>Riparian Areas</td>
<td>Suppression actions will be undertaken in riparian areas, except those designated as tamarisk control areas, to prevent riparian areas from burning in order to preserve streamside vegetation and upslope cover and prevent further erosion. No slurry or fire retardant chemicals will be utilized in spring and riparian areas or within 300-feet of these areas.</td>
<td>NPS Fire Specialist</td>
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<td>All herbicides utilized in riparian areas will be applied according to label instructions and not applied directly to water. Backpack sprayers will be utilized which pinpoint the herbicide treatment to the cut stumps and/or the small tamarisk resprouts.</td>
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<td>Wilderness Areas</td>
<td>Suppression and burn methods will be those that minimize the impact of the action and the fire itself to ensure that the wilderness character is preserved. The minimum tool decision tree will be utilized for each project to determine the appropriate suppression and monitoring technique.</td>
<td>NPS Fire Specialist and NPS Wilderness Coordinator</td>
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<td>The “Light Hand” and “Minimum Impact Suppression Techniques” (MIST) will be employed for all fire activities where determined appropriate after a minimum tool evaluation. Light hand suppression involves the use of minimum impact strategies and tactics. Each burn will be evaluated on a case-by-case basis to determine the appropriate tools. The appropriate tool will depend on the acreage of the area, the location of the unit, the resource goal for that unit, the timing of the treatment, and the staff available for the treatment and/or suppression.</td>
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<td>Prescribed burn units are located and designed to make use of natural and unnatural fuel breaks. Lake Mead NRA burn unit boundaries utilized roads, natural fuel breaks, and natural features such as canyon rims, rocks, and drainages. This reduces the use of constructed fire-lines; and most burns do not require any perimeter fireline construction. Light hand tactics in prescribed burns also exclude the use of bulldozers. Handlines are the only constructed fireline used at Shivwits. Indirect fire suppression strategy using natural barriers and backfiring and burnout creates less impact and line construction than direct attack.</td>
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<tr>
<td>Wilderness Areas</td>
<td>Other light hand suppression actions include the use of air tankers to create retardant lines as well as helicopters to build wetline along the fire perimeter. Engine crews can be used to put in hoselays to minimize disturbance.</td>
<td>NPS Managers and NPS Fire Specialist</td>
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<tr>
<td>Grazing</td>
<td>Fire lines and other soil scars will be restored after completion of management activities. Park mangers will apply the minimum requirement concept to determine the appropriate management practice and the minimum tool analysis to determine the appropriate equipment used in proposed and potential wilderness areas in order to preserve the wilderness character of the area.</td>
<td>Grand Canyon-Parashant NM Range Management Specialist</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Grazing may be temporarily restricted in some treatment areas. However, after a period of 1 to 2 years, grazing could be reinstated in certain treatment areas if park biologists and BLM Range Conservationists determine that these areas are suitable for grazing.</td>
<td>NPS Fire Specialist</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Smoke management is critical within this region when managing any form of fire. Arizona Department of Environmental Quality (ADEQ) and Clark County Department of Air Quality smoke management procedures, requirements, and recommendations will be followed during all phases of a prescribed fire, during any suppression activity, or during burning of treated vegetation debris.</td>
<td>NPS Fire Specialist</td>
</tr>
<tr>
<td>Scenic Quality</td>
<td>Smoke management is critical within this region when managing any form of fire. Arizona Department of Environmental Quality (ADEQ) and Clark County Department of Air Quality smoke management procedures, requirements, and recommendations will be followed during all phases of a prescribed fire, during any suppression activity, or during burning of treated vegetation debris.</td>
<td>NPS Fire Specialist</td>
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<tr>
<td>Scenic Quality</td>
<td>A burn plan will be submitted to the appropriate agency for approval upon designation of a prescribed fire, followed by a daily burn request and accomplishment report (Arizona only). Monitoring of smoke will be a high priority that will include approximate volume, dispersal, mixing heights, atmospheric conditions, and any other smoke concerns.</td>
<td>NPS Fire Specialist</td>
</tr>
<tr>
<td>Scenic Quality</td>
<td>Management objectives will include requirements that the existing character of the natural landscape be retained. Any changes caused by the treatment of vegetation will repeat the basic elements (line, form, color, and texture) found in the predominant natural features of the landscape.</td>
<td>NPS Managers and NPS Resource Management Specialist</td>
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<td>Cultural Resources</td>
<td>Specific mitigation and monitoring measures employed for cultural resources at Lake Mead NRA are discussed in the EA.</td>
<td>NPS Cultural Resource Specialist, NPS Fire Management Staff, and Resource Advisor</td>
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<td>Impacts to cultural resources resulting from fire management actions can be direct, operational, or indirect. Direct, operational, and indirect effects are discussed in the EA.</td>
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<td>Direct Effects Mitigating and monitoring the direct impacts of fire on cultural resources will be accomplished through a variety of methods.</td>
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<td>✦ A pre-burn cultural resources survey of the appropriate extent and intensity will be conducted in every prescribed burn unit. This survey will encompass not only the unit itself, but also take into account surrounding areas that do, or have the potential to, contain cultural resources of interest. In areas where pre-burn ground visibility precludes adequate survey, such areas will be noted and inspected in a post-burn phase for any undocumented resources.</td>
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<td>✦ Pre-burn survey may be conducted in FMU-3 during Wildland Fires for Resource Benefit (WFRBs) if cultural resources of interest are known or expected to occur in the maximum management area (MMA). If the fire intensity of a WFRB is expected to exceed the damage threshold of cultural resources of interest, a Cultural Resource Specialist will work with Fire Management staff to configure the MMA so that resource damage resulting from direct effects will be minimized. In cases where damage levels will be unacceptable, a proposed WFRB will be declared wildfire and suppressed using the appropriate measures.</td>
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<td>✦ All documented cultural resources of interest will be assessed with respect to vulnerability from direct fire effects, including material composition and condition and predicted fire intensity.</td>
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<td>✦ In cases where a cultural resource of interest is likely to sustain adverse impacts from direct fire impacts, appropriate mitigation measures will be employed. These include, but are not limited to,</td>
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<td>reducing excess fuel loads, constructing fuel breaks, use of fire retardants and shelters, permanent or temporary resource collection and field documentation. Particularly significant and/or vulnerable cultural resources of interest outside of prescribed burn areas will be mitigated and maintained on an appropriate cyclical basis. + A monitoring program will be initiated in order to assess the effectiveness of particular mitigation measures. This will include observations on treated resources of interest during fires, as well as post-burn assessments of treated resources. Objective measurement criteria will be utilized and the results employed to refine mitigation measures.</td>
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<td>Operational Effects</td>
<td>Mitigating and monitoring operational effects on cultural resources will be accomplished through a variety of methods. + All areas of proposed ground disturbance and fire management activity will be inspected for cultural resources of interest prior to all prescribed burns and mechanical thinning projects. + To the extent possible, all potentially ground disturbing activities associated with prescribed burns and mechanical thinning projects will be conducted outside the boundaries of cultural resources of interest. In cases where this is not possible and/or desirable, those operational activities resulting in the least impact will be employed. Cultural resources of interest will also be considered when implementing firing operations during prescribed burns. + A fireline-qualified Cultural Resource Specialist will be present during and after all prescribed burn and mechanical thinning projects in order to conduct additional survey as needed, as well as monitor activity around cultural resources of interest. + In the event of a wildfire in or adjacent to Lake mead NRA, pertinent cultural resources data will be made available to appropriate Fire Management personnel for planning purposes. A Cultural Resource Specialist will be available on all incidents to provide input on cultural resource</td>
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<td>To prevent unwanted distribution, access to cultural resources data will be closely controlled.</td>
<td>To the appropriate Fire Management personnel.</td>
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<td>In the event of a wildfire in or adjacent to Lake Mead NRA, a Resource Advisor with knowledge of cultural resources will accompany fire crews into the field. Ideally, a Resource Advisor will be assigned to each hand crew or piece of heavy equipment, with a minimum adequate staffing level of one Resource Advisor per division. Resource Advisors will survey areas of proposed ground disturbance, not cultural resources already impacted by direct or operational effects, and identify potential areas for indirect effects.</td>
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<td>Prior to each fire season, a Cultural Resource Specialist will give a presentation on cultural resources during Annual Fireline Safety Refresher Training courses held at Lake Mead NRA. A brief information guide on cultural resources and Minimum Impact Suppression Tactics (MIST) will be prepared and made available to pertinent fire management entities that have suppression responsibilities within and adjacent to Lake Mead NRA. Following winters with precipitation in excess of eight inches at the Lake Mead NRA headquarters in Boulder City, a Cultural Resources Specialist will visit fire stations of cooperator fire management entities and provide information on cultural resources and MIST.</td>
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### Indirect Effects

Mitigating and monitoring indirect effects on cultural resources will be accomplished through a variety of methods:

- A Cultural Resource Specialist will inspect all recorded cultural resources of interest following a given fire management action. Information on potential indirect effects will be collected for each, and, if necessary, appropriate mitigation tactics implemented such as site stabilization measures in the case of erosion threats, felling of fire-killed snags on or near cultural resources, and stepped up law enforcement patrols to deter looting.
A Cultural Resource Specialist will perform select cultural resource inventory of areas subjected to fire management actions. The amount and location of inventory will be dictated by a combination of cultural resource and fire-related factors. For example, previously unsurveyed areas with high cultural resource sensitivity that burned at a high intensity would be preferentially surveyed over a high sensitivity area that burned at a low intensity. Areas with poor ground visibility, such as the ponderosa pine stands in FMU-3, will be targeted for post-burn survey following prescribed burns, WFRBs and wildfires. All previously undocumented cultural resources will be recorded to current professional standards, and data will be collected on resource condition and potential indirect effects. If necessary, appropriate protective measures will be implemented on resources of interest.

**Standard Procedures**
In addition to the procedures identified to mitigate and monitor direct, operational, and indirect fire effects, the following measures will be taken in association with each Fire Management action at Lake Mead NRA and Parashant NM.

- Native American consultation includes the following:

  Consult with tribes in initial phases of planning of burns and treatment activities. Consultation has been ongoing and will continue as new areas are considered for burning and new issues develop.

  Work with tribes to identify sensitive areas in terms that are agreeable to tribal members (e.g., document location, but not cultural function). Develop acceptable protocol for making that information available to fire personnel for both prescribed burns and wildfires.

  Following wildfires, notify tribes with a narrative, report, letter of explanation with map, and/or news release relating to the fire.
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<td>Wildfires in Traditional Cultural Properties:</td>
<td>Contact affiliated tribes immediately. Keep tribes informed through the fire event. Provide summary letter of fire and suppression activities. Use water drops over retardant where appropriate. If retardant is crucial to suppression of fire, clear retardant is requested. Colored retardant will be avoided in sacred areas. Use fire trained archeologists to work with crews to avoid destroying archeologically dense areas. Utilize “light on the land” suppression techniques. Restore area utilizing native grasses and other native vegetation.</td>
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<td>Lake Mead NRA Fire Management staff will provide pertinent project information to Cultural Resource Specialists prior to each proposed undertaking, such as project schedule and description, maps (project boundary, areas of proposed disturbances, fire history, fuels, etc.) and burn prescriptions. Ideally, such information will be available at least one year prior to project implementation.</td>
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<td>All Cultural Resource Specialists performing duties for fire management activities with Lake Mead NRA will meet minimum qualifications put forth in the Secretary of Interior’s Guidelines for Historic Preservation Projects, Professional Qualifications Standards (1983).</td>
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<td>All cultural resources will be documented using respective record forms of the states of Nevada or Arizona.</td>
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<td>Reporting standards will follow those outlined in the cultural resource component of the Fire Management Plan.</td>
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<td>Opportunities for fire-related research will be identified and funding sought from the appropriate sources. Potential research topics at Lake Mead NRA and Parashant NM include direct and indirect</td>
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<td>Visitor Use</td>
<td>Visitors will be directed to alternate recreation sites and informed that fire suppression activities, prescribed fire activities, or vegetation treatments are taking place.</td>
<td>NPS Public Information Officer and Fire Specialist</td>
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| Safety       | Fire crews will wear required personal protective equipment (PPE) at all times during any prescribed fire, fire suppression, or debris burning activities. Mandatory PPE includes:  
  ✗ 8-inch high, laced, leather boots with lug soles  
  ✗ Fire shelter  
  ✗ Hard hat with chin strap  
  ✗ Goggles/safety glasses  
  ✗ Ear plugs  
  ✗ Nomex shirts  
  ✗ Nomex trousers  
  ✗ Leather gloves  
  No PPE will be purchased that is not National Fire Protection Association compliant or that does not meet standards.                                                                 | NPS Fire Management Officer                                                   |
|              | Each burn plan will contain holding and wildland fire transition plans describing appropriate actions in the event the prescription is exceeded. All burn plans will address the need for alerting park neighbors and appropriate public officials to the objectives and timing of the planned burn and designate a specific individual as responsible for making these notifications. No fires will be ignited unless the responsible personnel determine immediately prior to the fire that optimum conditions exist to prevent the fire from exceeding prescription.  
  Fire suppression zones will be designated around administrative structures, residential areas, and recreational sites. In these areas, appropriate suppression activities will occur to protect these resources.  
  Hazard fuel reduction will occur around residential, historic, and administrative structures to prevent wildland or structural fires in these areas. | NPS Fire Management Officer                                                   |
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<td>Recreation Area and National Monument Operations</td>
<td>Fire management units will be established. Prescriptions will be set within these units to determine the appropriate management action. The purpose of these prescriptions and the decision process is to prevent fires from developing into high-intensity wildfires and to allow managers to meet resource objectives.</td>
<td>NPS Fire Management Officer</td>
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<td>The policies for handling an escaped prescribed fire are contained within RM-18 and existing interagency agreements, and will be followed under this plan.</td>
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<td>Fire effects monitoring will be completed in selected plots after each burn to evaluate the degree to which objectives are accomplished. Long-term monitoring of the overall project will be required to document that overall programmatic objectives are being met and undesired effects are not occurring.</td>
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**Biological Opinion**

The following text is excerpted from the approved Biological Opinion issued by the US Fish and Wildlife Service for the Fire Management Plan, signed on September 22, 2004.

**Management - All FMUs**

Smoke management reporting procedures for burning in Arizona and Nevada would be followed for all prescribed fire and wildland fire use operations. Maps of suitable habitat would be consulted when planning and implementing fire management activities. Suppression and non-treatment zones would be designated around suitable habitat for listed and sensitive species. Surveys would continue in LMNRA as directed by staff biologists. If more suitable habitat is located, these areas would also be designated as non-treatment zones.

A soil monitoring program would be initiated in cooperation with the U.S. Geological Survey to determine the effects of treatment activities, or lack of activities, on soil erosion. Treatment methods would be re-evaluated based on the findings of the monitoring program.

Seeding of native species may be used to assist in the recovery of treatment areas, prevent soil erosion and runoff, and reduce the potential for non-native plant invasions. Only certified “weed-free” seed will be used as per the LMNRA Seeding Guidelines. If necessary, non-native plant control would occur as a follow-up action.

Vegetation treatment and seeding activities would be monitored and evaluated on an annual basis. Vegetation plots, photo monitoring, and observations would be compiled for analysis to determine treatment effectiveness. Adaptive management principles would be applied throughout all phases of restoration treatments.

The effects of fire on the ecosystem would be monitored at tamarisk prescribed burn areas within FMU1, and throughout FMU2 and FMU3. All NPS units using prescribed fire must implement a standardized vegetation monitoring program to track fire effects and to ensure that fire management resource objectives are met. The LMNRA fire monitoring program has been implemented for the past 11 years and is described in the NPS Fire Monitoring Handbook (NPS 2003b). The information provided in this document is included herein by reference.

**Conservation Measures - All FMUs**

LMNRA has proposed the following conservation measures to minimize effects to listed and sensitive species from the proposed action throughout the action area:
1. LMNRA wildlife biologists would be consulted when making decisions regarding wildland fire use and suppression in listed or sensitive species habitat.
2. A resource monitor would be on-site as determined necessary by pre-project surveys.
3. Minimum impact tactics would be employed for all fire management activities where possible.
4. Fire lines and other soil scars would be restored after the completion of fire management activities.

5. All personnel involved in fire management operations would be briefed on listed and sensitive species mitigation actions prior to initiation of fire management operations.

6. For wildfire suppression in riparian areas, natural barriers or openings in riparian vegetation would be used where possible as the easiest, safest method to manage a riparian wildfire. Where possible and practical, wet firebreaks in sandy overflow channels would be used rather than constructing fire lines by hand or with heavy equipment.

7. In undeveloped areas of LMNRA, fire engines and other fire-related vehicles would not be driven off paved or unpaved roadways.

8. Use of bulldozers, graders, and off-road vehicle travel would be prohibited unless approved by the LMNRA Superintendent.

9. Permanent road construction would not occur during wildfire suppression activities in habitat occupied by listed or sensitive species. Construction of temporary roads would occur only if necessary for safety or the protection of property or resources, including listed or sensitive species habitat. Temporary road construction would be coordinated with the FWS, through the Resource Advisor.

10. Treatment units would be surveyed for rare and exotic plants prior to any fire management activities. With the exception of tamarisk, areas containing rare plants or those identified as problem areas for exotic plants will be mapped and designated as full suppression zones. To protect LMNRA from the spread of exotic plants, no personnel or equipment would be permitted in designated exotic plant problem areas, except in emergency situations. If crews are required to travel into a problem area for emergencies or otherwise, appropriate mitigation, including washing vehicles and equipment, would be implemented.

11. During wildfire suppression activities, Resource Advisors would be designated to coordinate natural resource concerns, including listed and sensitive species. They would also serve as a field contact representative (FCR) responsible for coordination with the FWS. Duties would include identifying protective measures endorsed by the Superintendent and delivering these measures to the Incident Commander; surveying prospective campsites and aircraft landing and fueling sites; and performing other duties necessary to ensure adverse effects to listed and sensitive species and their habitats are minimized. On-the-ground monitors would be designated and used when wildfire suppression activities occur within identified occupied or suitable habitat for listed and sensitive species.

12. By February 1 of each year, LMNRA will submit a report to the FWS detailing the previous calendar year’s actions involving prescribed fires and slash burns, tamarisk control treatments, wildland fire use fires, wildfire suppression, and mechanical hazardous fuels reduction treatments. The report will describe the fires, treatments, and associated actions; impacts on listed and sensitive species; implementation and effectiveness of any conservation measures and terms and conditions in this BO and Appendix A; quantification of any incidental take as defined in this BO; rehabilitation completed for this and previous year’s fire, suppression actions, and treatments under this consultation; and planned activities for the current year. All deaths, injuries, and illnesses of listed species, whether associated with project activities or not, will be summarized in the report. LMNRA will work with the FWS in determining the specific information necessary and the format.
Conservation Measures – Mojave desert tortoise

LMNRA has proposed the following conservation measures to minimize effects to the Mojave desert tortoise (tortoise) from the proposed action:

1. All personnel on the fire shall be informed and educated about desert tortoises and the importance of protecting habitat and minimizing take. Fire crews shall be briefed on the desert tortoise.
2. Fire-related vehicles shall drive slow enough to ensure that tortoises on the roads can be identified and avoided.
3. Resource Advisors shall be designated to coordinate desert tortoise and other resource concerns and serve as a liaison between the Area Manager and the Incident Commander. Monitors shall be designated to monitor wildfire suppression activities; to ensure protective measures endorsed by the Incident Commander are implemented; to survey prospective campsites and aircraft landing and fueling sites; and to perform other duties necessary to ensure adverse effects to desert tortoises and their habitat are minimized. Resource Advisors and monitors shall be on call 24 hours during the fire season.
4. Off-road vehicle activity shall be kept to a minimum. Vehicles will be parked as close to roads as possible, and vehicles shall use wide spots in roads to turn around. If off-road travel is necessary, a biologist or crew person shall walk in front of the vehicle to direct the driver around tortoises and tortoise burrows. Whenever possible, local fire-fighting units should go off-road first because of their prior knowledge of the area.
5. Prior to moving a vehicle, personnel shall inspect under the vehicle for tortoises.
6. Campsites should be located outside of desert tortoise habitat or in locations that are previously disturbed. If camps are located in desert tortoise habitat, surveys of the site should be conducted.
7. All aircraft landing and fueling areas within desert tortoise habitat must be surveyed and monitored for presence of desert tortoise prior to use to reduce chances of tortoises being killed.
8. A litter-control program will be implemented to reduce the attractiveness of the area to opportunistic predators such as desert kit fox, coyotes, and common ravens. Trash and food items will be disposed of properly in predator-proof containers with re-sealing lids. Trash containers will be emptied when needed, and removed from the project area during clean-up operations following wildfire suppression activities, and disposed of in an approved landfill.
9. Use of tracked vehicles in desert tortoise habitat shall be restricted to improving roads or constructing lines where a short distance of line might save a large area from wildfire. Monitors shall walk in front of tracked vehicles to ensure minimal impacts to tortoises and their burrows. Equipment staging areas shall be surveyed for desert tortoises prior to use.
10. Fingers or patches of unburned vegetation within burned areas shall not be burned out as a wildfire suppression measure.
11. Fire crews shall, to the extent possible, obliterate vehicle tracks made during the wildfire, especially those of tracked vehicles.
12. Rehabilitation of the burned areas shall be considered, including seeding and planting of perennial species.
13. Recovery of vegetation shall be monitored, including establishment and monitoring of paired plots, inside and outside of the burned area.
14. The effectiveness of suppression activities and desert tortoise conservation measures shall be evaluated after a wildfire. Procedures shall be revised as needed.

**Conservation Measures – Mexican spotted owl**

LMNRA has proposed the following conservation measures to minimize effects to the Mexican spotted owl (MSO) from the proposed action:

2. Maps of protected MSO habitat would be consulted when planning and implementing fire management activities.
3. Protected MSO habitat would receive full suppression and would not be considered for wildland fire use.
4. Surveys would be conducted in accordance with the FWS recommended protocol.
5. Wildland fire use fires would be managed to ensure unsurveyed MSO habitat is more than ½ mile from downwind smoke effects.
6. Crew camps, staging areas, fire lines, and any other areas of disturbance created for wildfire suppression or wildland fire use activities would be located outside of MSO protected habitat, and preferably in locations that are disturbed whenever possible. If camps and staging areas must be located in MSO protected habitat, the Resource Advisor would be consulted to ensure habitat damage and other effects to MSO are minimized and documented. The Resource Advisor should also consider the potential for indirect effects to MSO or their habitat from the siting of camps and staging areas.
7. Restricted habitat for MSO would be surveyed prior to implementing wildland fire use fires on LMNRA-administered lands to determine MSO presence and breeding status. Wildland fire use fires would only be allowed to burn within restricted habitat if birds are not present. If a spotted owl is discovered during these surveys, LMNRA would notify the FWS to determine the need to reinitiate consultation and would determine any additional Conservation Measures necessary to minimize or eliminate impacts to the MSO.
8. If a MSO is discovered during wildfire suppression or wildland fire use activities, the Resource Advisor or a qualified wildlife biologist would document the find, assess potential harm to the owl, and advise the Incident Commander or project crew boss of methods to prevent harm. The information for each owl would include for each owl the location, date, and time of observation and the general condition of the owl. The Resource Advisor or biologist would contact the FWS as soon as possible, and LMNRA would reinitiate consultation for the wildfire suppression or wildland fire use activities following control of the incident.
9. To minimize negative effects on restricted MSO habitat, wildland fire use fires would be managed primarily as low-intensity fires, with only scattered high-intensity patches.
10. If fire line construction is necessary during wildfire suppression in protected habitat, LMNRA would minimize the cutting of trees and snags larger than 18 inches dbh, and no trees or snags larger than 24 inches dbh would be cut unless absolutely necessary for safety reasons.
11. Protected habitat disturbed during wildfire suppression activities such as fire lines, crew camps, and staging areas, would be rehabilitated to prevent their use by vehicles or hikers.
Fire line rehabilitation would include pulling soil, duff, litter, woody debris, and rocks back onto the line to bring it up to grade and to make it blend in with the surrounding area. Such rehabilitation would be inspected one year after the event to ensure effectiveness.

12. The effects of wildfire suppression on MSO and their habitat, and the effectiveness of these Conservation Measures, would be assessed after each fire event by the Resource Advisor or local biologist to allow evaluation of these guidelines and to allow the FWS to track the species environmental baseline.

**Conservation Measures – Interface FMU (FMU1)**
LMNRA has proposed the following conservation measures to minimize effects to listed and sensitive species from the proposed action within FMU1:
1. Low-level aircraft and retardant/surfactant use would be prohibited unless approved by the LMNRA Superintendent, and may not be allowed if listed or sensitive species are near the site.
2. Buffers would be established around known locations of listed or sensitive species.

**Conservation Measures – Desert FMU/Desert Zone (FMU2A)**
LMNRA has proposed the following conservation measures to minimize effects to listed and sensitive species from the proposed action within FMU2A:
1. Low-level aircraft and retardant/surfactant use are authorized in this zone, but may not be allowed if listed or sensitive species are near the site.
2. Buffers would be established around known locations of listed or sensitive species.

**Conservation Measures – Desert FMU/Tamarisk Zone (FMU2B)**
LMNRA has proposed the following conservation measures to minimize effects to listed and sensitive species from the proposed action within FMU2B:
1. A 500-foot buffer zone would be established around spring and riparian areas and retardants/surfactants would not be used within this zone.
2. Access would be by existing road. Off-road vehicle use would be prohibited unless approved by the Superintendent.
3. All treatment areas would be surveyed for listed and sensitive species and migratory birds prior to treatment activities.
4. No excavation or earthmoving would occur.
5. On large-scale tamarisk thickets (>10 acres), treatment blocks would be identified and prioritized.
6. Slash piles, if used, would be located outside the riparian zones.
7. No native vegetation would be cut or treated with herbicide.
8. All chemicals, containers, and equipment would be handled in accordance with the label instructions.
9. Mixing of herbicide would occur off-site, in accordance with label instructions and in a contained area for spill mitigation.
10. Prior to applying herbicide to selected sites, the weather, wind speed, air temperature, and surface water flows would be considered. Herbicide applications would not occur within 24-hours of forecasted precipitation or when ground level wind speeds are in excess of 10 mph.

11. Herbicide would not be applied directly into water. Selective application using backpack sprayers to spot apply to specific plants and cut stumps can normally avoid application into water sources.

12. If, even with the above methods, application into water cannot be avoided, an aquatic approved herbicide (Rodeo, Aqua-Master) would be used.

13. Use of Garlon would not occur if temperatures exceed 90° F.

14. Monitoring would be conducted to detect initial presence or post-treatment recruitment of invasive or noxious weed species and control efforts would be applied as necessary.

15. Restoration, including planting of native vegetation and seeding, would occur on selected sites based on the recommendations of the LMNRA restoration specialist.

**Conservation Measures – Shivwits FMU (FMU3)**

LMNRA has proposed the following conservation measures to minimize effects to listed and sensitive species from the proposed action within FMU3:

1. Springs would be designated as suppression zones, and a 500-foot buffer would be established around spring and riparian areas where retardants and surfactants would not be used.
2. Low-level aircraft and retardant/surfactant use are authorized in this zone, and may not be allowed if listed or sensitive species are near the site.
3. Any potential wildland fire use fire would receive an evaluation from a resource advisor.
4. The effects of fire on the ecosystem would be monitored.

**Reasonable and Prudent Measures with Terms and Conditions**

The FWS believes that the following reasonable and prudent measures (RPMs), which are implemented by their accompanying terms and conditions (T&Cs), are necessary and appropriate to minimize take of Mojave desert tortoise. In order to be exempt from the prohibitions of section 9 of the ESA, you must comply with the RPMs and their accompanying T&Cs. These T&Cs are non-discretionary. [Note these RPMs and T&Cs apply to Mojave desert tortoise due to the likelihood of take, since no take is anticipated of Mexican spotted owl there are no RPMs or T&Cs for that species in this Biological Opinion.] [note these were re-affirmed in the 2011 BO]

1. LMNRA shall implement desert tortoise education and monitoring programs.

A. Before the beginning of each fire season, a desert tortoise education program will be presented to all personnel anticipated to be onsite during wildfire suppression activities. This program will contain information concerning the biology and distribution of the desert tortoise, its legal status and occurrence in the proposed project area, the definition of take and associated penalties, measures designed to minimize the effects of construction activities, the means by which employees can facilitate this process, and reporting requirements to be
implemented when tortoises are encountered. Following training of project staff, each trained individual will sign a completion sheet to be placed on file at LMNRA.

B. Resource Advisors designated to coordinate desert tortoise and other resource concerns during wildfire suppression activities shall be trained as monitors. Both Resource Advisors and monitors shall be designated to oversee wildfire suppression activities; to ensure protective measures endorsed by the Incident Commander are implemented; to survey prospective campsites, aircraft landing and fueling sites; and to perform other duties necessary to ensure adverse effects to desert tortoises and their habitat are minimized.

C. LMNRA shall conduct post-wildfire suppression surveys to identify desert tortoise mortalities along the vehicle travel routes. The Resource Advisor will record each observation of desert tortoise handled. Information will include the following: Location, date and time of observation, whether tortoise was handled, general health and whether it voided its bladder, location tortoise was moved from and location moved to, and unique physical characteristics of each tortoise.

2. LMNRA shall move tortoises out of harm’s way as needed to avoid injury or mortality to tortoises.

A. If a desert tortoise is found in harm’s way, it shall be moved by an authorized biologist and released in the closest suitable habitat that removes the tortoise from potential harm, but within 2 miles from the point of collection. The tortoise shall be handled in accordance with FWS-approved protocol (Desert Tortoise Council 1994, revised 1999). If the tortoise cannot be released safely, the Resource Advisor shall contact the FWS’s Arizona Ecological Services Flagstaff Suboffice if in Arizona at (928) 226-0614 or if in Nevada, the FWS’s Southern Nevada Field Office at (702) 515-5230, for instructions.

B. Any tortoise found within one hour before nightfall or under circumstances that would not allow the tortoise to be safely moved and released, will be placed in a separate clean cardboard box and held in a cool, predator-free location. The box will be covered and kept upright at all times to minimize stress to the tortoise. Each box will be used once and then disposed of properly. The tortoise will be released the next day in a safe location nearest to the point of capture as possible. Each tortoise will be handled with new disposable latex gloves. After use, the gloves will be properly discarded and a fresh set used for each subsequent tortoise handling. All desert tortoises will be handled in accordance with FWS-approved protocol, which was prepared by the Desert Tortoise Council (1994, revised 1999).

3. To the degree possible, LMNRA shall locate activities away from desert tortoises and their burrows.

A. To the maximum extent practicable, campsites, aircraft landing and fueling areas, and staging areas shall be located outside of desert tortoise habitat, or in locations that are previously disturbed, in consultation with the designated Resource Advisor. If areas of such activity must be located in desert tortoise habitat, 100-percent coverage surveys of the site shall be
conducted by an authorized biologist or qualified Resource Advisor. Any tortoise found shall be handled and moved in accordance with T&C 2.B. above.

B. If a desert tortoise burrow is found in a potential impact area, efforts shall be taken to avoid the burrow. If disturbance to the burrow is unavoidable, it shall be excavated. If a desert tortoise or nest is found, it shall be relocated by an authorized biologist in accordance with FWS approved protocol (Desert Tortoise Council 1994, as revised).

C. If off-road vehicle travel in tortoise habitat is necessary, potential impacts to the desert tortoise shall be avoided to the maximum extent possible by directing vehicles around tortoise burrows. If impacts cannot be avoided, any desert tortoise in the path of the vehicle shall be moved from harm’s way in accordance with T&C 2.B.

D. Fire-related vehicles shall drive slow enough to ensure that tortoises on the roads or in the path of the vehicle can be identified and avoided.

4. LMNRA shall reduce desert tortoise habitat destruction and/or modification.

A. The Resource Advisor may authorize the limited use of tracked vehicles or similar equipment in desert tortoise habitat if he/she believes that the wildfire is serious enough that direct mortality of desert tortoise and habitat loss would result from the wildfire, and other means of control will not effectively prevent spread of wildfire.

B. LMNRA shall ensure that, to the extent possible, vehicle tracks made during wildfire suppression activities, especially those of tracked vehicles, are obliterated and appropriate measures are taken to minimize the potential access and use of these tracks by the public, which may include placement of large material at potential entry points.

C. Revegetation conducted during any burned area rehabilitation shall occur using native species from genetic stocks originating in LMNRA, which would replace plants lost as a result of the wildfire or are representative of plant species adjacent to the burned area. Revegetation shall attempt to reconstruct the natural spacing, abundance, and diversity of native plant species. No imported topsoil or hay bales shall be used during revegetation, in an effort to avoid introduction of non-native plant species or inappropriate genetic stock of native plant species.

D. All firefighting vehicles and equipment shall be pressure washed and/or steam cleaned to ensure that they are free of alien plant materials before entering LMNRA, except where doing so would slow the response to a wildfire.
Invasive Species Guidance

SOP: Invasive Species Prevention in Fire Operations

Justification for Proposed Park Procedures

National Park Service (NPS 2006) policy states that the Service will... prevent the introduction of exotic species into units of the national park system, and remove, when possible, or otherwise contain individuals or populations of these species that have already become established in parks.

The Lake Mead Fire Management Plan (NPS 2004) states that “Areas identified as problem areas for non-native plants would be mapped and designated as full suppression zones, except for tamarisk areas. To protect the region from the spread of non-native plants, no personnel or equipment would be permitted in the designated non-native plant problem areas, except in emergency situations.” This standard serves to minimize the potential for exotic plant spread from fires within the park and additional measures are needed to prevent the accidental importation of seed from outside the park on incoming fire equipment. Additional guidance is also needed on post-fire rehabilitation guidelines as it relates to plant materials.

General Provisions for LAME Equipment Returning from an Off-Park Assignment

All LAME fire vehicles returning from off-park fire assignments will be cleaned before re-entry into the park. Cleaning shall include removal of all dirt, vegetation, and other foreign material from both the exterior and interior of the vehicle. Concentrate inspection and cleaning on the tire treads, wheel wells, undercarriage (including axles, frame, cross-members, motor mounts, and the area underneath steps, running boards, and front bumper/brush guard assemblies) and interior floor mats as these are the locations most likely to harbor foreign seed and propagules.

To prevent the spread of aquatic nuisance species (including aquatic exotic plants), all firefighting equipment in contact with natural water sources will be drained and dried before re-use in the park. Such equipment includes floatable pumps, hoses, fittings, water tanks, and portable tanks (e.g. pumpkins). Where appropriate and in compliance with manufacturers specifications, certain equipment may be decontaminated using as outlined on the tables at the end of this SOP. Draining of equipment should be done before re-entry into the park, but drying may take place in the fire cache area or other appropriate location.

All firefighting handtools will be cleaned at the assignment location to remove all dirt and foreign material before being loaded into the fire vehicles. Firefighter boots will be cleaned of all dirt and foreign material before re-entry into the park.

Responsibility: The engine captain is responsible for assuring the above procedures are accomplished before re-entry into the park and shall inspect the vehicles, equipment, handtools and boots, to assure the adequacy of the cleaning effort.
General Provisions for Incoming Fire Response Equipment during a LAME Incident

Protection of life and property are the highest priority during fire response. To the extent that this priority is not compromised, all incoming fire vehicles and equipment will be inspected at Equipment Check-in and determined to be clean of dirt and foreign material or directed off park to the nearest commercial facility for cleaning prior to deployment in the park.

At demobilization, all non-local vehicles and equipment that operated off-pavement (including unpaved road shoulders and dirt parking lots) will be washed and inspected to assure that local exotic plants are not inadvertently transported to other wildland areas. Ideally, a hot water pressure sprayer should be used for the cleaning and one is available from Resource Management at Boulder City (Hilltop facilities) as well as at Katherine Landing (Maintenance yard). If water is not available for washing, compressed air will be used instead. The wash location must be in a location where wash water will not enter any drainages channels (natural or human-made) or bodies of water. The wash location must be mapped as part of the incident documentation and a copy provided to the park’s Weed Manager to allow for follow-up inspections of the site to assure that no new exotic plants have become established.

Upon arrival or during demobilization, all non-local equipment operators will be notified that the park contains known invasive plant and animal species that may be transported off-site if precautions are not taken. Of specific concern is the potential for equipment damage caused by quagga mussels as well the potential for firefighting equipment leaving LAME to spread this organism to other water bodies. The entirety of Lakes Mead and Mohave are infested with quagga mussels. Decontamination of water tanks and hoses should be included in all demob procedures for incidents that use raw lake water for any aspect of the fire operations. Other aquatic invasives are also known to occur in other areas of the Lower Colorado River System and/or western waters. Refer to the tables on the following 2 pages for species specific decontamination procedures as recommended for the Intermountain Region (which includes the Great Basin, where most of the fire equipment deployed at LAME originates).

Responsibility: The Agency Rep and/or Resource Advisor is responsible for assuring that the Incident Commander (IC) and his/her Command and General Staff are made aware of these requirements. Ideally, these requirements should be identified in the delegation of authority from the Park Superintendent to the IC. In most cases, the implementation of these requirements will fall on the Planning Section Chief and more specifically the Resources Unit Leader (for incoming equipment) and the Demobilization Unit Leader (for outgoing equipment). The Incident Resource Advisor has the responsibility to map and report the wash location and Park’s Weed Manager has the responsibility to inspect the location for the establishment of new exotic plants.

General Provisions for Post-fire Rehabilitation Practices

Experience in recent fires at Mojave National Preserve, Joshua Tree National Park, Bureau of Land Management Field Offices in Las Vegas and Ely, as well as research conducted by the US Geological Survey in the eastern Mojave Desert have found that post-fire seeding is a tricky proposition. Generally, seeding for the purpose of soil stabilization is very unlikely to succeed
due to the precipitation patterns common in the Mojave Desert. Basically, for soil stabilization to work, the seed needs to be applied immediately after fire, germinate and develop a root system before the first heavy rain event. As most natural fires in the Mojave are the result of dry lightning that occurs just prior to the strong monsoonal flows that bring sporadic, but heavy rain to the desert, such seeding efforts are usually in vain. Seeding for the purpose of “re-establishing” the native desert flora is also prone to failure due to the complex seed germination requirements and species biology of most desert species coupled with the extreme environmental conditions of the desert.

For these reasons it is the general policy of LAME that post-fire seeding or planting will be limited in scale and scope to meet a specific management need, such as providing forage to desert tortoise or re-establishing shrublands/woodlands in high use areas for visitor benefit, or to prevent exotic plant invasion in areas prone to such invasion. In these specific cases, the park’s Vegetation Program Manager or their designee will work with fire rehabilitation specialists to determine the appropriateness of seeding/planting and the species and maturity most likely to succeed. Strong preference will be given for native plant materials of local genotypes available in the park’s native plant nursery. Secondary preference, particularly for larger quantities of plant materials, will be given to native plant species from designated sources. Only under extreme circumstances will the use of non-native plant materials be considered for post-fire rehabilitation at LAME.

Responsibility

The Fire Management Officer and the Chief of Resource Management jointly have the responsibility to determine the need for post-fire rehabilitation planning. During the planning process, park staff as well as outside experts will make treatment recommendations. It is the responsibility of the Park’s Vegetation Program Manager to assure that this SOP is communicated to the rehab planning team and that it’s intent is reflected in the final treatment recommendations. Local approval of the rehabilitation plan is made by the Park Superintendent. Final approval of the rehab plan lies with either the Regional Director or the National Fire Director, depending on the dollar amounts involved. Upon approval of a rehabilitation treatment plan, it is the responsibility of the Vegetation Program Manager to monitor implementation of those treatments that relate to plant materials to assure that the intent of this SOP is followed and the treatment is installed as designed.
### AQUATIC INVASIVE SPECIES OF CONCERN IN INTERMOUNTAIN REGION AND METHODS OF CONTROL

<table>
<thead>
<tr>
<th>Sources</th>
<th>Whirling Disease</th>
<th>New Zealand Mudsnails</th>
<th>Chytrid Fungus</th>
<th>Zebra/Quagga Mussels</th>
<th>Didymo</th>
<th>Eurasian Watermilfoil</th>
</tr>
</thead>
</table>

| Wash and remove organics (e.g. mud) | Yes | Yes | Yes | Yes, pressure wash flushes veligers | Yes | Yes |
| Temperature | 90°C (195°F), 10 min | 46°C (120°F), 5 min | -3°C (27°F), 1 hr | 60°C (140°F), 5 min | ≥140°F water | 60°C (140°F), 1 min | NA |
| Drying | Be dry for 24 h, in sunlight best | Be dry for 48 h, in sunlight best | Be dry for 3 h, in sunlight best | 3-5 days, in sunlight best | Be dry for 48 h, in sunlight best | NA |

| Bleach (6% hypochlorite) | For 10 min: 1% bleach solution (500 ppm active ingred.) = 8.3 ml/L = 1.3 oz bleach/gal = 2.6 Tbs bleach/gal | Not effective | For 30 sec: 20% bleach solution (>1% active ingred.) = 25 oz/gal OR For 10 min: 7% bleach solution (0.4% active ingred.) = 9 oz/gal | Gear rinsed with 0.5% bleach solution (250 ppm active ingred.) = 4.2 ml/L = 0.6 oz bleach/gal = 1.5 Tbs bleach/gal | For 1 min: 2% bleach solution = 16.6 ml/L = 2.6 oz bleach/gal = ⅓ cup bleach/gal | NA |

| Quaternary ammonium compounds (e.g. alkyl dimethyl benzylammonium chloride; dialkyl dimethyl ammonium chloride) | For 10-15 minutes: (1500 ppm active ingred) 2% Quat 128 (7.7% active ingred) = 19.6 ml/L = 2.5 oz/gal OR 1.2% Sparquat 256 (12.5% active ingred) = 12.0 ml/L = 1.5 oz/gal | For 10 min: 5% Quat 128 = 50 ml/L = 6.4 oz/gal OR 3.1% Sparquat 256 (12.5% active ingred) = 31.3 ml/L = 4 oz/gal | For 30 sec: .001% Quat 128 solution = 1.0 ml/L = 0.13 oz/gal = ¼ tsp/gal | No data, but likely effective | No data, but likely effective | NA |

Taken from Preventing Spread Of Aquatic Invasive Organisms Common To The Intermountain Region Interim Guidance For 2007 Fire Operations distributed by the Intermountain Region, USDA Forest Service, May 2007
### RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Whirling disease</th>
<th>NZ Mudsnails</th>
<th>Chytrid Fungus</th>
<th>Zebra/Quagga Mussels</th>
<th>Didymo</th>
<th>Eurasian Watermilfoil</th>
</tr>
</thead>
<tbody>
<tr>
<td>The principle vector for spread of whirling disease is contaminated fish parts and not typically through fire activities. Avoiding and removal of organics (the spores reside in mud), power washing, and flushing will greatly reduce or eliminate spores on external gear surfaces. However, wet internal tanks and hoses should be decontaminated with a quaternary ammonium compound, such as <em>Quat128</em>. While only 2.5 oz per gal is required for whirling disease, a higher concentration (6.4oz/gal) would also knock out NZ mudsnails.</td>
<td>NZ mudsnails are resistant to treatment, and may insert themselves in small crevices and resist flushing. However, unless vehicles are driving through streams, or buckets scrape bottom sediments, they are unlikely to get snails on external surfaces. Avoiding organics, power washing, flushing, and drying gear in the sun for 48 hours (if possible) will reduce risk. Wet internal tanks and hoses should be decontaminated with a quaternary ammonium compound, such as <em>Quat128</em>. While only 2.5 tsp per gal is required for chytrid, a higher concentration (6.4oz/gal) would also knock out whirling disease spores and chytrid fungus.</td>
<td>Avoiding organics, power washing, flushing, and letting equipment dry in the sun for 3 hours (if possible) will reduce risk of transfer on external surfaces. However, wet internal tanks and hoses should be decontaminated with a quaternary ammonium compound, such as <em>Quat128</em>. While only 2.5 tsp per gal is required for chytrid, a higher concentration (6.4oz/gal) would also knock out chytrid fungus.</td>
<td>Fire activities are unlikely to come into contact with adult mussels. However, it is possible that water used for activities or surfaces of gear may be contaminated with the microscopic veliger stage. Pressure washing and strong flushing of tanks and hoses should be sufficient to injure and remove these organisms.</td>
<td>Didymo is a native diatom that erupts into high densities in special habitats, such as tailwaters below dams. Avoiding contaminated water sources and organics, power washing, and flushing would likely reduce risk of transfer on fire equipment to acceptable levels. For waders, routine protocols for chytrid or whirling disease may apply for this species.</td>
<td>Watermilfoil propagates from broken stems. Avoiding organics, power washing, and flushing to ensure the removal of all plant parts will prevent transport on external and internal gear.</td>
</tr>
</tbody>
</table>

Taken from *Preventing Spread Of Aquatic Invasive Organisms Common To The Intermountain Region Interim Guidance For 2007 Fire Operations* distributed by the Intermountain Region, USDA Forest Service, May 2007
Operational Guidelines for Aquatic Invasive Species Prevention and Equipment Cleaning

Why? Firefighter and public safety is still the first priority, but aquatic invasive plants and animals pose a risk to both the environment and to firefighting equipment (some species can clog valves, pumps, etc. if equipment is not completely drained or treated). Prevention and sanitation can prevent the spread of these organisms to other environments and help to assure that firefighting equipment remains operational.

Prevention, where possible
- Avoid dumping water directly from one stream or lake into another.
- Avoid obtaining water from multiple sources during a single operational period unless drafting/dipping equipment is sanitized between sources.
- Use screens and avoid sucking organic and bottom material when drafting from streams or ponds.
- Minimize driving equipment through waterbodies.

Sanitation
- Any equipment that comes into contact with raw water should be sanitized. Drying alone may be effective in some situations depending upon equipment, temperature, and relative humidity. Consult the Resource Advisor (READ).
- In coordination with the READ, establish sanitation areas where there is no potential for runoff into stormdrains, waterways, or sensitive habitats.
- Remove all visible plant parts, soil and other materials from external surfaces of gear and equipment. If possible, powerwash all accessible surfaces with clean, hot water (≥140°F ideally).
- Set up a portable disinfection tank using a cleaning solution of quaternary ammonium compound, a common cleaning agent used in homes, swimming pools, and hospitals, and safe for gear and equipment when used at the recommended concentration. Two brands are readily available from GSA or local suppliers: Quat128® (by Waxie) or Sparquat 256® (by Spartan). Costs and effectiveness are comparable; both are labeled for use as fungicides/virucides. Follow individual agency integrated pest management requirements, including pesticide use proposals.

Recipe for cleaning solution using either 5% Quat128® or 3% Sparquat 256®

<table>
<thead>
<tr>
<th>Volume of tap water</th>
<th>Volume of Quat128®</th>
<th>Volume of Sparquat 256®</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mL water</td>
<td>4.63 mL</td>
<td>3.00 mL</td>
</tr>
<tr>
<td>1 gallon water</td>
<td>6.35 liquid oz.</td>
<td>4.12 liquid oz.</td>
</tr>
<tr>
<td>1 gallon water</td>
<td>12.7 tbsp</td>
<td>8.2 tbsp</td>
</tr>
<tr>
<td>1 gallon water</td>
<td>0.79 cups</td>
<td>0.51 cups</td>
</tr>
<tr>
<td>100 gallons water</td>
<td>4.96 gallons</td>
<td>3.22 gallons</td>
</tr>
<tr>
<td>1000 gallons water</td>
<td>49.6 gallons</td>
<td>32.2 gallons</td>
</tr>
</tbody>
</table>

- For engines and tenders, empty the tank then circulate the cleaning solution for 10 minutes. Float portable pumps in the disinfection tank and pump cleaning solution through for 10 minutes. Pump cleaning solution through hose then rinse with water. Discharge cleaning solution back into the disinfection tank for re-use. Wait one hour to use the equipment.
- Where feasible dip gear or equipment (e.g. helicopter buckets) into the cleaning solution. Alternatively, put the cleaning solution in backpack spray pumps to clean portable tanks, helicopter buckets, and other equipment. The solution must be in contact with the surface being sanitized for at least 10 minutes and then rinsed with water. Wait one hour to use the equipment.
• Under the direction of the READ, test cleaning solution daily according to the directions below. The cleaning solution can be used repeatedly for up to a week unless heavily muddied or diluted. If the concentration is too weak, dispose of the used solution properly and make a new solution.

Safety
• Use protective, unlined rubber gloves and splash goggles or face shield when handling the cleaning solution and take extra precautions when handling undiluted chemicals. Have eye wash and clean water available on-site to treat accidental exposure.
• Consult the product label and Material Safety Data Sheet for additional information.

Testing Solution
• To determine if the solution is below the 3% or 5% strength use “Quat Chek 1000” Test Papers (purchase these from the supplier of the cleaning compound). The used cleaning solution needs to be diluted to about 600 ppm of ammonium compounds before it can be tested with these papers.
  o Take one cup of used Sparquat 256® cleaning solution, pour into a bucket. Add 5 cups of water. Mix. OR
  o Take one cup of used Quat128® cleaning solution, pour into a bucket. Add 4 cups of water. Mix.
• Test the diluted solution with “Quat Chek” Test Paper. Match up the color of the paper with the ppm’s on the color chart. For optimal disinfection, the diluted solution should have a concentration between 600 and 800 ppm. If it is too dilute, dispose of properly and make a new cleaning solution.

Disposal
• Use caution when disposing the used cleaning solution and follow all federal, state, and local regulations.
• Do not dump cleaning solution into any stream or lake, or on areas where it can migrate into any stormdrain, waterbody, or sensitive habitat. Small quantities may be disposed of down sanitary drains into a municipal sewer system. Larger quantities may need to be transported to a municipal wastewater treatment facility. Consult the facility operator/manager prior to disposal.
• Used cleaning solution may or may not be suitable for disposal in on-site septic systems. Consult the local agency’s utilities supervisor or facilities manager prior to disposal.
• It may be possible to dispose of used cleaning solution over open land or on roadways where there is no potential for runoff into stormdrains, waterways, or sensitive habitats. Consult the READ for appropriate locations before using this method and check with the appropriate state or county authority as state or local permits may be required.

Storage
Sparquat 256® and Quat128® can be stored up to two years in an unopened container without losing its effectiveness. Both should be stored in a cool, dry place, out of direct sunlight. Temperatures can range from 32º to 110º F.

Purchase
Both products are available from GSA (https://www.gsaadvantage.gov) and are commonly available through local janitorial and swimming pool chemical suppliers.
• Quat 128® by Waxie’s Enterprises Inc.; GSA (NSN No. 170304) =$36/case (4 gal); EPA registration #1839-166-14994. Additional info can be found at http://www.waxie.com

1 For discharges in Arizona, notify Arizona Department of Environmental Quality as soon as possible following the disposal, using the template letter, attached.
• Sparquat 256® by Spartan Chemical Company; GSA (NSN No. 1025-04) = $54/case (4 gal); EPA registration #5741-9. Additional info can be found at http://www.spartanchemical.com
• Remember to buy “Quat Chek 1000” test papers when you purchase the chemicals.

Example discharge report letter:

Agency/Fire #
Date, Year

Ms. Carrolette Winstead
Arizona Department of Environmental Quality
1110 West Washington Street, Mailcode 5415B-3
Phoenix, Arizona 85007

Dear Ms. Winstead:

We are requesting that Arizona Department of Environmental Quality’s Water Quality Division grant a Temporary Emergency Waiver for the purpose of discharging water used in decontaminating fire-fighting equipment to prevent cross-contamination of water bodies within the State of Arizona. Decontamination is accomplished using a 5% solution of quaternary ammonium compound (Quat128® or Sparquat 256®) and water in engines, pumps, or other equipment that has been wetted by any raw (non-domestic or treated) water during fire operations. The solution is re-used until testing indicates it is muddied or diluted. Used cleaning solution is disposed of over open land where there is no potential for runoff into stormdrains, waterways, or sensitive habitats.

(Fill in information in italics, below)

• The discharge occurred during management of the (Name) Fire during the period (date or dates of discharge), located in an area (describe general area using roadways, communities, or landmarks). The approximate location of the discharge is (UTM coordinates or legal description).
• The discharge consisted of approximately (volume) gallons of water from (water body or other source) containing approximately 5% (identify either Quat128® or Sparquat 256®).
• The discharge did not occur in or near a water of the U.S., or in an area where runoff could occur into stormdrains or waterways. (This is essential. If runoff into a water body is unavoidable, do not dispose of solution in the area and truck to a municipal treatment plant.)
• The Material Safety Data Sheet for the compound discharged is enclosed.

If you have any questions, please contact (Name) at (Phone). Thank you for your assistance.
Sincerely,
(Agency Administrator)
Enclosure (MSDS)
cc: Assistant Field Supervisor, Fish and Wildlife Service, Flagstaff, AZ (email: brenda_smith@fws.gov)
(Your agency FMO)
(Others?)
Mojave Desert Initiative

This is an interagency effort, led by the US Fish and Wildlife Service, and agreed upon by the agency administrators in the Mojave Desert, including the Lake Mead Superintendent. This is to supplement other information and emphasize the reduction in acres burned of desert tortoise habitat, but it does not supercede the Biological Opinion.

MANAGING WILDFIRES IN THE MOJAVE DESERT
PREFERENCES AND GUIDANCE FOR INCIDENT COMMANDERS
SPRING 2011

During periods of high fuel loads and hot, dry, windy weather conditions, wildfires in the Mojave Desert have the potential to exhibit extreme fire behavior and grow large quickly. The Mojave Desert is not a fire-adapted ecosystem, but exotic vegetation can fuel fires that can drastically alter the landscape. Firefighters are encouraged to safely and aggressively suppress wildfires to reduce total acres burned, while minimizing impacts from their suppression actions. Agency administrators must provide guidance to incident commanders on resource values, goals, and constraints through preseason planning.

MOJAVE DESERT PRIORITIES
1. ENSURE SAFETY OF FIREFIGHTERS AND THE PUBLIC
2. MINIMIZE ACRES BURNED (HABITAT LOSS) THROUGH RAPID FIRE SUPPRESSION
3. MINIMIZE SUPPRESSION DAMAGE TO RESOURCES

DECISION MAKING

Protecting life and property is paramount in every decision and action. Consider the current and predicted weather, fire behavior, fuel loading, available suppression tools, and resources that are threatened by the fire, and implement appropriate firefighting methods that will minimize resource damage. Rapid and aggressive response may be warranted and can minimize acres burned. Resource damage occurs from both fire and some suppression actions, but burned desert is damaged desert. Use Best Management Practices to minimize resource damage.

Incident commanders should not wait for Resource Advisors before implementing all safe and aggressive suppression tactics necessary during Initial Attack:

- **Consider immediately the use of air attack resources to limit fire spread.** Avoid spreading non-native organisms by following the Operational Guidelines for Aquatic Invasive Species Prevention and Equipment Cleaning.
- **Using backfires/burnouts, off-road driving or heavy equipment to construct fireline may have substantial impacts, but may be justified in order to minimize acres burned. Use tactics appropriate for the area designation and administering agency.** **For NPS lands the Resource Advisor must be consulted before use of heavy equipment or off-road driving. In designated wilderness, all motorized equipment usage must be approved by the appropriate agency administrator.**
- **Stop all habitat damaging tactics when they are no longer required** to prevent a larger or more severe fire. Constantly assess the fire situation and Mojave Desert priorities as they relate to your operations. Document actions to facilitate post-fire rehabilitation of suppression actions.
- **Avoid spreading non-native organisms** by following guidance such as Operational Guidelines for Aquatic Invasive Species Prevention and Equipment Cleaning.
- **Upon communication with the Resource Advisor,** incorporate his/her knowledge and advice into the Incident Operations in a safe and efficient manner.

STAY CALM, BE ALERT, THINK CLEARLY, ACT DECISIVELY
Cultural Resource Considerations

When to call an ARCH:

1) A cultural resource specialist (Archeologist) will be contacted if a fire breaks within or threatens any of the cultural “Trigger” zones (e.g., Spirit Mountain, Christmas Tree Pass boundary, St. Thomas and Lost City, etc.) identified on the Resource Advising plan maps;

2) The Park’s Tribal Consultation coordinator (Steve Daron) will be contacted in the event a fire breaks in or threatens Spirit Mountain, the Christmas Tree Pass boundary or the Black Canyon Corridor/Sugarloaf area (see Maps in Advising drive);

3) A cultural resource specialist will be contacted if a fire exceeds 10 acres, if suppression tactics threaten to disturb known cultural resources, if suppression tactics anticipate substantial ground disturbance, or if cultural resources are identified by suppression personnel within the suppression zone;

4) If possible, a cultural resource specialist will be contacted prior to suppression impact rehabilitation.

St. Thomas: Pre-Burn Treatments: With Archaeological Monitoring

- Remove/flush cut 15-20 feet of vegetation away from historic structural features and remnants
- Remove/flush cut 6-10 feet of vegetation away from historic tree stumps & posts
- Cut and piled vegetation must be piled at least 20 feet from existing historic features and not more than 4 feet in height

MIST tactics for Cultural Resources:

- Avoid mechanical thinning (dozers, blades, etc.) within site boundaries (especially sites with features)
- Avoid dropping fire directly on sites (All Ignition Types)
- Avoid application of retardants, foams, and gels directly on historic features (St. Thomas foundations, Pine Valley log ranch house, Waring Ranch, Tassi Ranch structures) as chemicals stain and desiccate these materials, aiding in decay.
- Avoid use of chemical retardants, gels, and foams in areas identified as containing petroglyphs or pictographs (Grapevine Canyon-on READ maps).
- Create fire breaks and remove surface vegetation from around threatened structures (backing fires, hand lines)
- If chemical retardant is necessary in wilderness locations, request clear retardant, gels, and/or foams be used, but avoid application if possible.

Comment [GAO1]: Trigger Points list 5 acres for READ...Should this be the same?
Minimize ground disturbance in regions known or likely to contain cultural resources (Lost City, St. Thomas, on READ maps, near water/springs sources, etc.)

For threatened Historic Properties (structures), established structure protection protocols will be enacted (cabin wrap procedures, building misters for under the wrap...)

<table>
<thead>
<tr>
<th>Historic Property</th>
<th>Protection Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dame Sawmill</td>
<td>Full</td>
</tr>
<tr>
<td>2. Dinner Pocket Cabin</td>
<td>Critical</td>
</tr>
<tr>
<td>3. Green Spring Sawmill</td>
<td>Full</td>
</tr>
<tr>
<td>4. Horse Valley Ranch-Waring</td>
<td>Critical</td>
</tr>
<tr>
<td>5. Nutter Cross Fence</td>
<td>Not Designated</td>
</tr>
<tr>
<td>6. Penn’s Pocket-Ambush Pocket</td>
<td>Not Designated</td>
</tr>
<tr>
<td>7. Pine Valley Ranch</td>
<td>Critical</td>
</tr>
<tr>
<td>8. Shanley Ranch</td>
<td>Critical</td>
</tr>
<tr>
<td>9. Spencer Tank</td>
<td>Full</td>
</tr>
<tr>
<td>10. Tassi Ranch</td>
<td>Critical</td>
</tr>
<tr>
<td>11. Undocumented Structures</td>
<td>Not Designated</td>
</tr>
</tbody>
</table>

Sensitive Cultural Areas:
These areas require compliance and monitoring for prescribed burns and require immediate contact for all wildland fire. MIST tactics preferred in these areas with Arch Monitor on the ground. Contact with Park/Tribal Representative (Steve Daron) for areas of critical concern related to traditional cultural properties.

- Goldstrike Canyon/Sugarloaf Mountain (TCP)

Newberrys:
- Bridge Canyon (Petroglyphs Site)
- Grapevine Canyon (Petroglyphs Site)
- Spirit Mountain (TCP)

Overton:
- Lost City (Prehistoric Site)
- St. Thomas (Historic Town Site)

Parashant:
- Pine Valley Ranch (Historic Ranch)
- Shanley Ranch (Historic Ranch)
- Tassi Ranch (Historic Ranch)
- Waring Ranch (Historic Ranch)
**Wilderness Protection**

Lake Mead NRA contains several designated wilderness areas, including: Jimbilnan, Muddy Mountains, Pinto Valley, Black Canyon, Eldorado, Iretaba Peaks, Nellis Wash, Spirit Mountain, and Bridge Canyon. In addition, much of the land on the Arizona side of the park is proposed wilderness and most of the Shivwits Plateau is also proposed wilderness. As per NPS policy, all categories of wilderness are essentially treated as designated wilderness.

**Mitigation**

The following mitigation measures specific to wilderness were included in the Finding of No Significant Impact for the adoption of Alternative C of the Fire Management Plan in 2004.

<table>
<thead>
<tr>
<th>Mitigation Measure</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suppression and burn methods will be those that minimize the impact of the action and the fire itself to ensure that the wilderness character is preserved. The minimum tool decision tree will be utilized for each project to determine the appropriate suppression and monitoring technique.</td>
<td>NPS Wildland Fire Specialist and NPS Wilderness Coordinator</td>
</tr>
<tr>
<td>The “Light Hand” and “Minimum Impact Suppression Techniques” (MIST) (Appendix E in the EA) will be employed for all fire activities where determined appropriate after a minimum tool evaluation. Light hand suppression involves the use of minimum impact strategies and tactics. Each burn will be evaluated on a case-by-case basis to determine the appropriate tools. The appropriate tool will depend on the acreage of the area, the location of the unit, the resource goal for that unit, the timing of the treatment, and the staff available for the treatment and/or suppression.</td>
<td>NPS Fire Specialist and NPS Wilderness Coordinator</td>
</tr>
<tr>
<td>Prescribed burn units are located and designed to make use of natural and unnatural fuel breaks. Lake Mead NRA burn unit boundaries utilized roads, natural fuel breaks, and natural features such as canyon rims, rocks, and drainages. This reduces the use of constructed fire-lines; and most burns do not require any perimeter fireline construction. Light hand tactics in prescribed burns also exclude the use of bulldozers. Handlines are the only constructed fireline used at Shivwits. Indirect fire suppression strategy using natural barriers and backfiring and burnout creates less impact and line construction than direct attack.</td>
<td>NPS Managers and NPS Fire Specialist</td>
</tr>
<tr>
<td>Other light hand suppression actions include the use of air tankers to create retardant lines as well as helicopters to build wetline along the fire perimeter. Engine crews can be used to put in hoselays to minimize disturbance.</td>
<td>NPS Managers and NPS Fire Specialist</td>
</tr>
<tr>
<td>Fire lines and other soil scars will be restored after completion of management activities. Park managers will apply the minimum requirement concept to determine the appropriate management practice and the minimum tool analysis to determine the appropriate equipment used in proposed and potential wilderness areas in order to preserve the wilderness character of the area.</td>
<td>NPS Managers and NPS Fire Specialist</td>
</tr>
</tbody>
</table>
Minimum Impact Suppression Tactics (M.I.S.T.)

Concept

Minimum Impact Suppression Tactics (MIST) is not intended to represent a separate or distinct classification of firefighting tactics but rather a mind-set of how to suppress a wildfire while minimizing the long-term effects of the suppression action. When the term MIST is used in this document, it reflects the above principle.

The concept of MIST is to use the minimum amount of forces necessary to effectively achieve the fire management protection objectives consistent with ecosystem management objectives. It implies a greater sensitivity to the impacts of suppression tactics and their long-term effects when determining how to implement an appropriate suppression response. In some cases, MIST may indicate cold trailing or wet line may be more appropriate than constructed hand line.

Goal

The goal of MIST is to halt or delay fire spread in order to maintain the fire within predetermined parameters while producing the least possible impact on the resource being protected.

Appropriate Suppression Response

When selecting an appropriate suppression response, firefighter safety remains the highest priority. In addition, fire managers must be assured the planned actions will be effective and will remain effective over the expected duration of the fire.

Actions will be anchored to the standard fire orders and watch out situations.

The key challenge to the line officer, fire manager and firefighter is to be able to select the wildfire suppression tactics that are appropriate given the fire's probable or potential behavior. The guiding principle is always least cost plus loss while meeting ecosystem management objectives. It is the second part of this statement that must be recognized more than it has in the past. It is important to consider probable rehabilitation needs as a part of selecting the appropriate suppression response. Tactics that reduce the need for rehab are preferred whenever feasible.

These actions, or MIST, may result in an increase in the amount of time spent watching, rather than disturbing, a dying fire to insure it does not rise again.

Suppression Responsibility

As stated previously, safety is the highest priority. All action will be anchored to the standard line orders and watch out situations. Safety will remain the responsibility of each person.
involved with the incident. MIST guidelines are not intended to replace firefighter judgment. Determination of suppression needs well in advance of the fire is a major asset in effectively applying MIST.

Initial/Extended Attack

Incident Commander

To understand and carry out an appropriate suppression response which will best meet the land management objectives of the area at the least cost plus loss.

- Insure all forces used on the fire understand the plan for suppressing the fire in conjunction with MIST.
- Maintain communication with responsible fire manager or line officer to insure understanding and support of tactics being used on the fire.
- Evaluate and provide feedback as to the tactical effectiveness during and after fire incident.
- If the fire incident is in wilderness, assure authorization has been given if motorized or mechanical equipment is determined to be necessary.

Project Fire

Type I/II Incident Commander:

- Insure all forces used on the fire understand the plan for suppressing the fire in conjunction with MIST.
- Insure instructions given by the responsible line officer verbally are carried through into the EFSA.
- Establish and nurture a close dialogue with the resource advisor assigned to the fire team.
- Review actions on site and evaluate for compliance with line officer direction and effectiveness at meeting fire management protection objectives.
Responsible Line Officer

- To understand and carry out an appropriate suppression response which will best meet the objectives utilizing MIST,

- To transmit the land management objectives of the fire area to the fire team and to define specific fire management objectives.

- Periodically review for compliance, Resource Advisor Participate at fire team planning sessions, review incident action plans and attend daily briefings to emphasize resource concerns and management's expectations.

- To insure the interpretation and implementation of EFSA and other oral or written line officer direction is adequately carried out.

- Provide specific direction, guidelines, and monitoring actions to insure successful MIST activities as needed.

- Provide assistance in updating EFSA when necessary.

- Participate in incident management team debriefing and assist in evaluation of team performance related to MIST.

- If wilderness, assure compliance with wilderness management objectives.

List of Considerations

Fire Line Construction

Use cold-trail wet line or combination when appropriate.
If constructed fire line is necessary, use only width and depth necessary to check fire spread.

Consider use of fire line explosives for line construction and felling when possible to meet the need for more natural appearing stumps.

Minimize bucking and cutting of trees to establish fire line; build line around logs and standing trees whenever possible.

Where appropriate for low intensity fire, trails can be utilized as fire line in lieu of constructing new line.

Constantly re-check cold trailed fire line.

Limb vegetation adjacent to fire line only as needed to prevent additional fire spread.
During fire line construction, cut shrubs or small trees only when necessary. Make all cuts flush with the ground.

Minimize felling of trees and snags unless they threaten the fire line or endanger workers.

Line around tree bases near fire line, if it is likely they will ignite.

Fire line location is the key element in helping maximize application of MIST.

**Burn Out**

Allow fire to burn to natural barriers.

Burn out and use a low impact tool like a swatter.

Areas that can be called black line should be used as such, and patrolled often.

During burn out and firing operations, use low intensity backfires and short duration strip fires. Avoid high intensity head fires or other heavy handed firing operations.

**Mop Up**

Do minimal spading; restrict spading to hot areas near fire line.

Cold-trail charred logs near fire line, do minimal tool scarring.

Minimize bucking of logs to extinguish fire or to check for hot spots; roll the logs instead if possible.

Refrain from making bone yards.

Consider allowing large logs to burnout. Use a lever rather than bucking to manage large logs that must be extinguished.

Use gravity socks in stream sources and/or a combination of water buckets and fold-a-tanks to minimize impacts to streams.

Consider using infrared detection devices along perimeter to reduce risk.

Personnel should avoid using rehabilitated fire lines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehab work, i.e. water bars.

Remove or limb only those fuels that if ignited have potential to spread fire outside the fire line.
If burning trees/snags pose a serious threat of spreading fire brands, extinguish fire with water or dirt whenever possible. Consider felling by blasting when feasible.

Consider felling single snag fires by crosscut or explosives.

Align saw cuts to minimize visual impacts from more heavily traveled corridors. Slope cut away from line of sight when possible.

Discourage use of newly established trails created during the suppression effort.

Use caution when operating pumps or engines with foaming agents to avoid contamination of water sources.

**Logistics**

**Campsite Considerations/Personal/Camp Conduct/Personnel Movement**

Locate facilities (fire camp, helispots) outside of wilderness whenever possible.

Minimize the overall degradation of the wilderness resource.

Facilities shall be temporary.

Utilize natural openings for camps, helispots, or staging areas whenever possible.

Minimize the number of locations used for spike camps, helispots, etc.

Coordinate with the Resource Advisor in choosing a site with the most reasonable qualities of resource protection and safety concerns.

Evaluate short-term low impact camps such as coyote or spike versus use of longer-term, higher impact camps.

Use existing campsites.

New site locations should be on impact resistant and naturally draining areas such as rocky or sandy soils, or openings with heavy timber.

Avoid camps in meadows along streams or on the lakeshore. Locate at least 200 feet from lakes, streams, trails, or other sensitive areas.

Consider impacts on both present and future users. An agency commitment to wilderness values will promote those values to the public.

Lay out the camp components carefully from the start. Define cooking, sleeping, latrine, and water supply.
Minimize the number of trails and ensure adequate marking.

Consider fabric ground cloth for protection in high use areas such as around cooking facilities.

Use commercial portable toilet facilities where available. If these cannot be used, a latrine hole should be utilized.

Where there are no facilities, dig a cat-hole 6 to 8 Inches deep and at least 200 feet from sensitive areas. Completely bury waste and paper.

Select latrine sites a minimum of 200 feet from water sources with natural screening.

Do not use nmls

Constantly evaluate the impacts that will occur, both short and long term.

Use "leave no trace" camping techniques.

Pack out all garbage, including left over food.

Minimize disturbance to land when preparing bedding site. Do not clear vegetation or trench to create bedding sites.

Use stoves for cooking, when possible. If a campfire is used, limit to one site and keep it as small as reasonable. Build either a ‘pit’ or ‘mound’ type fire. Avoid use of rocks to ring fires.

Use down and dead firewood. Use small diameter wood for less waste.

Don't burn plastics or aluminum “pack it out” with other garbage.

Keep a clean camp and store food and garbage so it is unavailable to wildlife. Ensure items such as empty food containers are clean and odor free, never bury them.

Select travel routes between camp and fire and define clearly.

Carry water and bathe away from lakes and streams.

Personnel must not introduce soaps, shampoos, or other personal grooming chemicals into waterways.

Pick up and remove all flagging, garbage, litter, and equipment. Dispose of trash appropriately.

Clean fire pit of unburned materials and fill back in.
Naturalize campfire area by scattering “dead” ashes in nearby brush and returning site to a natural appearance.

In non-wilderness camps, minimize vehicle use in the camp area. Off-road vehicle use should be avoided when possible.

Aviation Management

A goal of Minimum Impact Suppression Tactics is to minimize the disturbance caused by air operations during an Incident.

Aviation use Guidelines

The use of aircraft in wilderness areas must be authorized at the Superintendent level.

Maximize back haul flights as much as possible.

Use long-line remote hook in lieu of constructed helispots for delivery or retrieval of supplies and gear.

Use natural openings for helispots and para-cargo landing zones as far as practical. If construction is necessary, avoid high visitor use areas.

Consider maintenance of existing helispots over creating new sites.

Buck and limb only what is necessary to achieve safe, practical operating space in and around the landing pad area.

Coordinate activities with the resource advisor to help address resource protection and safety concerns,

Retardant Use/Foaming Agents

During initial attack, fire managers must weigh the non-use of retardant with the probability of initial attack crews being able to successfully control or contain a wildfire. If it is determined that use of retardant may prevent a larger, more damaging wildfire, then the manager might consider retardant use even in sensitive areas. This decision must take into account all values at risk and the consequence of larger firefighting forces’ impact on the land.

Consider impacts of water drops versus use of foam/retardant. If foam/retardant is deemed necessary, consider use of foam before retardant use.

Do not drop retardant or other suppressants near surface waters, or springs.

Use caution when operating pumps or engines with foaming agents to avoid contamination of water sources,
Minimum Impact Considerations (After Suppression Disturbance)

Fire rehabilitation needs are normally identified by the fire rehabilitation team.

During implementation, the resource advisor should be available for expert advice and support of personnel doing this work as well as quality control.

Fire minimum impact objectives should be completed as part of ongoing MIST activities, mop-up, camp demob, and fireline close out.

Replace dug out soil and/or duff and obliterate any berms created during the suppression effort unless needed to reduce concentrated flows of water.

Where trees were cut or limbed, cut stumps flush with the ground, scatter limbs and boles out of sight in unburned area.

Camouflage stumps and tree boles using rocks, dead woody material, fragments of stumps, bolewood, limbs, soil and fallen or broken green branches. Scattered sawdust and shavings will assist in decomposition and be less noticeable.

Remove newly cut tree boles that are visible from trails or meadows.

Drag other highly visible woody debris created during the suppression effort into timbered areas and disburse.

Tree boles that are too large to move should be slant cut so a minimal amount of the cut surface is exposed to view. Chopping up the surface with an ax or pulaski, to make it jagged and rough, will speed natural decomposition.

Burned and partially burned fuels that were moved should be returned to a natural arrangement rather than a "bone yard" appearance.

Newly established trails created by suppression efforts should be covered with brush, limbs, small diameter poles, and rotten logs in a naturally appearing arrangement.

Tear out stumps or dams, where they have been used, and return site to a natural condition.

Replace any displaced rocks or streambed material that has been removed.

Reclaim streambed to its pre-disturbed state, when appropriate.

Where soil has been exposed and compacted, such as in camps, on user-trails, at helispots and pump sites, scarify the top 2 to 4 inches and scatter with needles, twigs, rocks, and dead branches.
Blend campsites with natural surroundings by filling in and covering latrine with soil, rocks, and other natural material.

If seeding is called for, utilize species compatible with long term ecosystem management of the area.

**Cultural Resources**

Cultural resources are frequently found within wilderness areas. Archaeological and historical sites are not renewable and cannot be replaced. Look, photograph, enjoy, but do not disturb. Climbing in, on, or around ruins will speed up destruction of the site. Practice minimum impact techniques and view from a distance. Avoid touching plaster walls as touching leaves oils from your skin on the rock. These oils hasten the deterioration of the artwork as well as the cultural/spiritual importance. Do not remove artifacts. Respect the time and energy these ancient inhabitants put into their work. It has survived for hundreds of years. Help preserve it for future generations.

**Demobilization**

Because demob is often a time when people are tired or when weather conditions are less than ideal, enough time must be allowed to do a good job. When moving people and equipment, choose the most efficient and least impacting method to both the landscape and the overall fire organization mission.

**Exit Review – MIST Evaluation**

An exit review of MIST practices is important for any fire occurrence so management can find out how things went. Activities involving data collection, documentation and recommendations will help identify areas needing Improvement, and to formulate strategies and to produce quality work in the future. This activity is especially important in wilderness and like sensitive areas due to their fragility and inclination to long-term damage by human Impacts.

Resource advisors with a good background in both wilderness and fire should take part in exit reviews for overhead teams as part of the MIST evaluation. They are the people who have the experience and knowledge to provide information required to make the evaluation meaningful and productive. This process and report can, in most cases, be fairly simple and to the point. The evaluation emphasis should be on the MIST actions and not on the effects of the fire or rehabilitation plans.

Evaluation should be completed on wildfires exceeding 100 acres and on a sample of fires less than 100 acres. It is appropriate to evaluate a diversity of fires, ranging from a spot fire suppressed by smoke chasers or jumpers to a large project fire managed by an overhead team.

Observations will be documented in a brief report to the line officer with a copy to the appropriate incident commander. In the report, the evaluator will include recommendations for ensuring fire suppression activities on similar lands. It is important that the evaluator recognizes
and commends the initial attack forces or overhead team for positive activities. Make special note of the extra efforts and sensitivity to suppression impacts.

**Leave No Trace**

**Plan Ahead and Prepare**

Learn about the regulations and issues that apply to the area you are visiting.

Avoid popular areas during times of high use.

Choose equipment and clothing in earthtone colors.

Repackage food into lightweight reusable containers to pack out with you.

**Travel Lightly**

Visit the backcountry in small groups.

Stay on designated trails. Walk single file in the middle of the path.

Do not cut across switchbacks.

Spread out to avoid creating trails when traveling cross-country.

Read your map and avoid marking trails with rock cairns, tree scars or ribbons.

Step to the downhill side of the trail and talk softly when encountering horseback riders.

**Campsite**

Choose an existing, legal site whenever possible. Restrict activities to the area where vegetation is compacted or absent.

Camp at least 75 paces (200 feet) from lakes, streams, and trails.

Always choose sites that will not be damaged by your stay.

Preserve the feeling of solitude by hiding your camp from view.

Do not construct structures, furniture, or dig trenches.

Remember, good campsites are found, not made. Altering the site should be unnecessary.

**Campfires**
Fire use can scar the backcountry. Use a lightweight stove for cooking.

Where fires are permitted, use existing fire rings, away from large rocks or overhangs.

Do not char rocks by building new rings. Make your fire in a metal roasting pan, or learn to construct a mound fire.

Gather sticks from the ground which are no larger than the diameter of your wrist.

Do not snap branches off live, dead or downed trees.

Put the fire out completely before leaving. Remove trash from the ring and scatter the cold ashes at least 75 paces (200 feet) from camp.

Sanitation

Deposit human waste at least 75 paces (200 feet) from water sources or camp and in cat-holes dug 6 to 8 inches deep. Cover and disguise the cat-hole when finished.

Use toilet paper sparingly. Bury it in the cat-hole or pack it out in plastic bags.

To wash dishes or yourself, carry water away from the source and use small amounts of biodegradable soap. Scatter dishwater after all food particles have been removed.

Large parties or long stays may require digging a latrine. Be sure to fill it in and disguise the hole before leaving.

Scour your campsite for trash and evidence of your stay. Pack out all the trash you can, even if it's not yours.

Keep the Wilderness Wild

Let nature's sounds prevail. Avoid loud voices and noises.

Leave pets at home.

Treat our natural heritage with respect. Leave plants, rocks, and historical artifacts where you find them.
Key Contacts

During a major fire incident, there are several key contacts for READs at Lake Mead. They are summarized here for ease of reference.

Lake Mead Lead READ: Sandee Dingman (cell 702-423-2372)
Regional READ/BAER Coordinator: Nelson Siefkin (415-623-2213)
Lake Mead Section 7 Coordinator (endangered species): Mike Boyles (702-293-8978)
Lake Mead SHPO/THPO Coordinator (cultural Resources): Steve Daron (702-293-8859)