PRESCRIBED FIRE PLAN

ADMINISTRATIVE UNIT NAME: GRAND CANYON NATIONAL PARK

PRESCRIBED FIRE NAME:
Prescribed Fire Unit (Ignition Unit): NORTH RIM SLOPES

PREPARED BY:
Name (print): CHRISTOHER MARKS Qualification/Currency: RXB2

Signature: CHRISTOPHER MARKS Digitally signed by CHRISTOPHER MARKS Date: 2020.09.21 15:05:01 -07'00' Date:

TECHNICAL REVIEW BY:
Name (print): VICTOR MORFIN Qualification/Currency: RXB1

Signature: VICTOR MORFIN Digitally signed by VICTOR MORFIN Date: 2020.09.22 16:31:24 -07'00' Date: 9/22/20

COMPLEXITY RATING: MODERATE

MINIMUM BURN BOSS QUALIFICATION: RXB2

APPROVED BY:
Name – Agency Administrator (print): Edward T. Keable

Signature – Agency Administrator: Date: 01.21.21

The Fire and Aviation Interdisciplinary Team has reviewed and been allowed the opportunity to address concerns about the North Rim Slopes Prescribed Fire Plan. The Interdisciplinary Team concurs with the plan and supports this project.

North Zone Fuels Specialist — Date: 10/16/20

Fire Ecologist — Date: 11/3/20

ELLEN BRENNAN Digitally signed by ELLEN BRENNAN Date: 2020.11.23 20:42:10 -07'00'

Fire Liaison — Date

The management personnel listed below has reviewed and been allowed the opportunity to address concerns about the North Rim Slopes Prescribed Fire Plan. The personnel listed below concur with the plan and support this project.

Reviewed by: _____ Date: 10/18/2020
North Zone Fire Management Officer

Reviewed by: _____ Date: 11/16/2020
Chief, Fire and Aviation

Recommended by: _____ Date: 12/8/20
Chief Ranger

Recommended by: JEANNETTE CALHOUN Digitally signed by JEANNETTE CALHOUN Date: 2020.11.30 10:59:57 -07'00' Date:
Chief, Division of Science and Resource Management

Recommended by: _____ Date: 1/21/2021
Deputy Superintendent

Table of Contents

Element 2A: Agency Administrator Ignition Authorization

Instructions: The Agency Administrator Ignition Authorization must be completed before a prescribed fire can be implemented. If ignition of the prescribed fire is not initiated prior to expiration date determined by the agency administrator, a new authorization will be required.

Prior to signature the agency administrator should discuss the following key items with the fire management officer (FMO) or burn boss. Attach any additional instructions or discussion documentation (optional) to this document.

Key Discussion Items

A.	Has anything changed since the Prescribed Fire Plan was approved or revalidated? *Such as drought or other climate indicators of increased risk, insect activity, new subdivisions/structures, smoke requirements, Complexity Analysis Rating.*
B.	Have compliance requirements and pre-burn considerations been completed? *Such as preparation work, NEPA mitigation requirements, cultural, threatened and endangered species, smoke permits, state burn permits/authorizations.*
C.	Can all of the elements and conditions specified in Prescribed Fire Plan be met? *Such as weather, scheduling, smoke management conditions, suitable prescription window, correct season, staffing and organization, safety considerations, etc.*
D.	Are processes in place to ensure all internal and external notifications and media releases will be completed?
E.	Have key agency staffs been fully briefed about the implementation of this prescribed fire?
F.	Are there circumstances that could affect the successful implementation of the plan? *Such as preparedness level restrictions, resource availability, other prescribed fire or wildfire activity*
G.	Have you communicated your expectations to the Burn Boss and FMO regarding if and when you are to be notified that contingency actions are being taken?
H.	Have you communicated your expectations to the Burn Boss and FMO regarding decisions to declare the prescribed fire a wildfire?

Implementation Recommended by:
FMO or Prescribed Fire Burn Boss Signature: _____ Date: 1/21/2021

I am authorizing ignition of this prescribed fire between the dates of 1/21/2021 and 4/23/2021 It is my expectation that the project will be implemented within this time frame and as discussed and documented and attached to this plan. If the conditions we discussed change during this time frame, it is my expectation you will brief me on the circumstances and an updated authorization will be negotiated if necessary.

Additional Instructions or Discussion Documentation attached (Optional): Yes ☑ No☐

Ignition Authorized by:
Agency Administrator Signature and Title: _____ Date: 01.21.21

Element 2B: Prescribed Fire Go/No-Go Checklist

Preliminary Questions	Circle YES or NO
A. Have conditions in or adjacent to the ignition unit changed, (for example: drought conditions or fuel loadings), which were not considered in the prescription development? If **NO** proceed with the Go/NO-GO Checklist below, if **YES** go to item B.	YES NO
B. Has the prescribed fire plan been reviewed, and an amendment been approved; or has it been determined that no amendment is necessary? If **YES**, proceed with checklist below. If **NO, STOP: Implementation is not allowed. An amendment is needed.**	YES NO

GO/NO-GO Checklist	Circle YES or NO
Have ALL permits and clearances been obtained?	YES NO
Have ALL the required notifications been made?	YES NO
Have ALL the pre-burn considerations and preparation work identified in the prescribed fire plan been completed or addressed and checked?	YES NO
Have ALL required current and projected fire weather forecast been obtained and are they favorable?	YES NO
Are ALL prescription parameters met?	YES NO
Are ALL smoke management specifications met?	YES NO
Are ALL planned operations personnel and equipment on-site, available and operational?	YES NO
Has the availability of contingency resources applicable to today's implementation been checked and are they available?	YES NO
Have ALL personnel been briefed on the project objectives, their assignment, safety hazards, escape routes, and safety zones?	YES NO

If all the questions were answered "**YES**" proceed with a test fire. Document the current conditions, location and results. If any questions were answered "**NO**", DO NOT proceed with the test fire: Implementation is not allowed.

After evaluating the test fire, in your judgment can the prescribed fire be carried out according to the prescribed fire plan and will it meet the planned objective? **Circle: YES or NO**

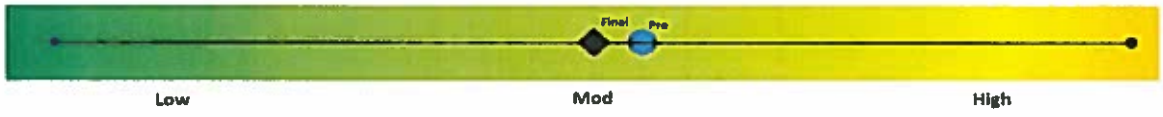
Burn Boss Signature:_____ Date:_____

Element 3: Complexity Analysis Summary and Final Complexity

North Rim Slopes RX		Quantity	Significance
Values	On-Site	Few	Mod
	Off-Site	Multiple	Mod
	Public/Political Interest	Multiple	Mod

Element	Preliminary Risk	Post-Plan Risk	Technical Difficulty	Calculated Rating
Safety	Mod	Mod	Mod	Mod
Fire Behavior	High	Mod	Mod	Mod
Resistance to Containment	Mod	Mod	Mod	Mod
Ignition Procedures and Methods	Mod	Mod	Mod	Mod
Prescribed Fire Duration	High	Mod	Mod	Mod
Smoke Management	High	High	Mod	High
Number and Dependence of Activities	Low	Low	Low	Low
Management Organization	Low	Low	Mod	Mod
Treatment/Resource Objectives	Mod	Mod	Mod	Mod
Constraints	Mod	Mod	Mod	Mod
Project Logistics	Mod	Mod	Mod	Mod

Calculated Summary Prescribed Fire Plan Complexity



Final Complexity Determination	Final Complexity Determination Rationale
Mod	One of the 11 elements is rated as high. The North Rim Slopes Prescribed Fire Project is a large landscape burn with high fuel loading, is adjacent to Hwy 67, and will create smoke impacts for forest and park visitors. The one element that was rated HIGH was about smoke management. Ignitions will occur in a Class 1 Airshed where visibility of the canyon is important to all visitors. Since only one element was rated high, and it's an element the fire staff at GRCA works with on every project, the summary complexity rating is Moderate. This project will then require a RXB2.

Signatures	
	Rx Burn Plan Preparer's Name: CHRISTOPHE R MARKS X _____ Preparer Date: _____
	Technical Reviewer's Name: Victor Morfin X //Victor Morfin Technical Reviewer Date: 9/22/20
	Agency Administrator's Name: _____ X _____ Agency Administrator Date: 9.21.21

Element 4: Description of Prescribed Fire Area

A. Physical Description

1. Location: The North Rim Slopes unit is located on the North Rim of GRCA directly west of Hwy 67 and the entrance station. It is located east of the W-4 road and north of The Basin.

Legal Location –
36 degrees, 19.28'
112 degrees, 07.88'

1. Size: The total size of the North Rim Slopes project area is 30,350 acres. The ignition portion of the unit is approximately 14,000 acres. Since there are no containment lines, fire may spread into areas outside of the ignition areas. Because of the seasonality of the burn and the desired weather parameters, the fire has a high likelihood to remain within project boundary. Even though the final size of the project will not be known until the fire program obtains a final perimeter after each fire is declared out, we expect some fires to grow on their own but growth should be slow and occur primarily during the short burn periods when temperatures are highest and there is full sun. The expected overall size of the burned area will depend on fuel moistures, weather conditions, and project timing and number of ignition operations.

2. Topography: The North Rim Slopes unit has mild to steep N, W, E, and S slopes. Other areas like drainage bottoms and ridgetops are flat. There are several drainages including Kanabownits Canyon, Spring Canyon and upper Milk Creek that run in a general northeast to southwest direction. Elevations within the unit range from 8200 ft. to 9000 ft.

3. Project area: The boundary of the project will include the Hwy 67, the GRCA/KNF boundary, the W1 & W4 roads areas between the W-1 and the rim (north of the dragon). The ignition portion of the unit includes ridgetops and slopes with southerly aspects. The project area is located within the proposed wilderness. See Project Map – Appendix A.

4. Ignition units: Ignition areas are defined by all forested areas with a southerly aspect.

B. Vegetation/Fuels Description:

On-site fuels data: Fuels within the project area but not targeted for ignition are, spruce-fir, aspen, and short grass meadow. Dead and down fuel loading is moderate to high with dense spruce understory and heavy dead and down fuel loading.

Fuels targeted for ignition include ponderosa pine, mixed conifer fuels, and dead and down fuels within aspen stands. Dead and down fuel loading is moderate to high with small areas of dense conifer understory and heavy dead and down fuel loading. A TL 3 & 4 best describes the expected fire behavior on the southerly aspects in the late fall and winter months with moderate load conifer litter and small downed logs. Below is the plot data from southerly aspects that best represents the ignition portion of the unit and the basis for our fire behavior, fuels consumption, and smoke modeling.

1. Percent of vegetative type:
   10% Ponderosa Pine
   15% Aspen
   15% Spruce/Fir
   60% Mixed Conifer

Plot	Status	Fuel loading (tons/acre) 1-, 10-, 100-hr TLFM	1000-hr TLFM (sound & rotten)	Duff & Litter	Total	Duff & Litter Depth (inches)
Fawn Spring 01	Pre	5.5	8.5	13.4	27.5	1.2
Fawn Spring 02	Pre	7.2	9.2	16.5	32.9	1.5
Fawn Spring 03	Pre	7.2	37.9	29.2	74.3	2.3
Fawn Spring 04	Pre	5.6	18.8	28.0	52.5	2.2
Fawn Spring 05	Pre	6.7	19.6	12.0	38.3	1.0
Fawn Spring 09	Pre	8.9	40.1	19.2	68.2	1.7
Fawn Spring 10	Pre	5.6	12.1	9.0	26.8	0.9
Fawn Spring 11	Pre	4.7	4.6	19.7	28.9	1.5
Fawn Spring 15	Pre	2.7	16.6	16.8	36.1	1.6
Range 05	Pre	1.9	0.0	29.9	31.8	3.2
Range 08	Pre	5.5	14.3	20.6	40.3	1.9
Range 09	Pre	6.1	24.3	23.8	54.2	2.0
Range 10	Pre	13.3	51.1	25.8	90.1	2.1
Range 12	Pre	3.6	5.1	22.3	31.1	2.1
Range 14	Pre	1.5	4.9	16.5	22.9	1.5
Range 17	Pre	8.3	13.3	7.7	29.3	0.8
Spring Canyon 01	Pre	3.7	32.4	14.7	50.8	1.2
Spring Canyon 04	Pre	4.9	6.9	32.8	44.6	2.6
Spring Canyon 06	Pre	5.6	10.5	37.9	54.0	3.2
Spring Canyon 07	Pre	5.4	30.5	23.9	59.8	2.1
Spring Canyon 08	Pre	4.6	2.0	22.8	29.4	1.8
Spring Canyon 09	Pre	1.8	18.0	46.2	66.0	3.7
Spring Canyon 13	Pre	1.7	4.1	23.0	28.8	2.5
Spring Canyon 15	Pre	0.6	13.3	23.9	37.8	1.9
Spring Canyon 16	Pre	4.6	5.4	23.0	32.9	2.1
Spring Canyon 19	Pre	5.0	13.1	46.9	65.0	4.5
Spring Canyon 20	Pre	7.4	20.7	11.1	39.2	1.3
PIEN 02	Pre	4.6	2.3	27.2	34.1	2.1
PIEN 04	Pre	3.2	16.9	17.4	37.5	1.5
PIEN 11	Pre	4.0	15.3	34.9	54.1	2.8
Mean ± 80% CI		**5.0 ± 0.6**	**15.7 ± 3.0**	**23.2 ± 2.3**	**44.0 ± 4.0**	**2.0 ± 0.2**
Minimum		**0.6**	**0.0**	**7.7**	**22.9**	**0.8**
Maximum		**13.3**	**51.1**	**46.9**	**90.1**	**4.5**

NOTES: 27 RAP plots and 3 FMH plots fall within the Slopes burn plan area. An additional 12 collaborative I&M plots are also within the project area, but data are not yet available for those plots. Fuel loading values and duff and litter depth are represented in this table. Overall, duff and litter loading are the largest dead fuel component followed by 1000-hr logs. Average total fuel loading for the 30 plots is 44 tons/acre. TLFM fuels are also defined as 1 hour = 0-1/4" size class, 10 hour11/4" to 1" size class, 100 hour = 1"-3" size class, 1000 hour=3+" size class.

Adjacent fuels data:

South of the project: The vegetation and fuels have experienced fires over the past 12 years. The fuel loading is lower than within the NR Slopes project area and ponderosa pine is the dominant species. Dead and down fuel loading is lower when compared to similar unburned areas within the Park. Spread potential for this area when in prescription is low to moderate.

East of the project: Spruce-fir forests dominate the area east of the project and have not experienced any fire disturbance in the past 100 years or more. Dead and down fuel loading is similar to the project area and can be described as moderate to heavy. Spread potential for this area when in prescription is moderate on the south and west slopes and low on the north and east slopes. Southeast of the unit is the 2000 Outlet fire that experienced large areas of high intensity fire creating high severity fire effects. The dead and down fuels

within this area are moderate to heavy but the overstory is made up of young aspen. Spread potential for this area when in prescription is low.

West of the project: The W-4 road is considered the western project boundary. Areas west of the W-4 road contain ponderosa pine and mixed conifer forests that burned in 2003 (Big and Rose Fires), 2008 (Walla Valley Rx), and 2014 (Galahad). Spread potential into this area is moderate since fuel loads of dead and down are moderate.

North of the project: The areas north of the project are in the Kaibab NF and those fuels will be similar to the project area. This area has not experienced fire in the past 100 years and the area can be described as mixed conifer. Spread potential for this area will be similar to the spread potential in the project area which would be moderate on south and west facing slopes and low on north and east facing slopes.

C. Description of Unique Features, Natural Resources, Values:

The prescribed fire unit contains approximately 13,250 acres of Mexican Spotted Owl Critical habitat. There is a mitigation measure associated with Mexican Spotted Owl critical habitat and burn severity effects that limits the amount of high and moderate/ high burn severity to no more than 30% of the critical habitat. Prior to development of this plan, approximately 18% of the habitat burned with high and moderate/high severity fire. Some high severity fire should be expected with this project as the fire regime for this area historically burned with mixed severity fire efffects. Fuel loading is high and there is an abundance of seedlings and saplings underneath the overstory trees due to exclusion of past fires in this area for more than 100 years. Monitoring fire intensity will occur during ignitions and the burn boss will determine if ignition operations will stop or continue during each operational shift.

Daytime and nighttime smoke impacts could potentially affect two Mexican Spotted Owl Protected Activity Centers (PAC) (Transept, Dragon). The Transept PAC was surveyed in 2012 and found no owls, and the Dragon PAC was surveyed in 2009 and found one male owl. Since this project will not occur during nesting season, smoke impacts to owls that are mobile should be minimal. Please see the North Rim Slope project map with MSO habitat coverage (Appendix A).

Areas within the burn unit include Kaibab Squirrel National Natural Landmark Areas. Information about the Kaibab Squirrel and wildland fire from the GRCA FEIS (2009) include the text below.

The Kaibab squirrel, a subspecies of Abert's squirrel, is dependent on ponderosa pine forests (Keith 1965). They occur at highest densities in forests with more than 120 trees per acre greater than 12 inches dbh with interlocking crowns (Patton 1977). These relatively dense stands also appear important for juvenile recruitment (Dodd et al. 1998). Dodd et al. (1998) and Chambers and Germaine (2003) also showed that the squirrels use more open forest habitat as well, particularly in summer in areas with high ponderosa pinecone production. In winter, squirrels moved back to areas of adjacent dense habitat. These findings emphasize the need for stand structure diversity across the larger landscape to provide desired Kaibab squirrel habitat. These squirrels can typically escape low intensity fires due to their ability to move about rapidly both on the ground and in tree canopy. There is no research literature on Abert's squirrel mortality due to fire.

D. Maps- Appendix A

1. Vicinity
2. Project/Ignition Units
3. Smoke Impact Area

Element 5: Objectives

A. GRCA General Management Plan Objectives (1995)

Objective: Preserve, protect, and interpret the park's natural and scenic resources and values, and its ecological processes.

Objective: Preserve and protect the genetic integrity and species composition within the park, consistent with natural ecosystem processes.

Objective: Manage ecosystems to preserve critical processes and linkages that ensure the preservation of rare, endemic, and specially protected (threatened/endangered) plant and animal species.

Objective: Conduct administrative activities, include research, search-and-rescue, emergencies, and fire management, in a manner that is consistent with NPS policies regarding wilderness management and the use of the minimum tool in wilderness areas.

B. GRCA Fire Management Plan Goals/Objectives (2012)

Goal 1 – Protect human health and safety, and private and public property

Objective: Conduct wildland fire management activities with the most current risk assessment and mitigation techniques available to ensure firefighter and public safety is the highest priority.

Objective: Minimize smoke impacts on human health

Objective: Provide fire management work force with training, equipment, operating procedures, safety measures, and information needed to manage risks and perform activities safely.

Goal 2 – Restore and maintain park ecosystems in a natural, resilient condition

Objective: Restore ecosystems that are not within the range of natural variability to desired conditions and maintain them through natural processes within policy constraints.

Goal 3 – Protect the park's natural, cultural, and social values

Objective: Manage the ecosystem and natural processes, these are the primary objectives that will lead to healthy critical habitat for listed threatened, endangered, and sensitive species.

Objective: Use minimum impact management techniques to reduce impacts to wilderness values, cultural and soil resources, and limit spread of invasive plant species.

Objective: Provide fire management work force with training, equipment, operating procedures, safety measures, and information needed to manage risks and perform activities safely.

C. Climate Adaptation Strategies and Approaches (Southwest FireClime)

Strategy 1 – Sustain fire as a fundamental ecological process

Approach: Restore or maintain fire in fire-adapted ecosystems

Approach: Develop fire use strategies in altered or novel ecosystems where fire can play a beneficial role

Strategy 3 – Reduce the risk of unacceptably severe fire

Approach: Alter forest structure and/or composition to reduce the risk of unacceptable severe wildfire.

Strategy 5 – Maintain and enhance structural, species, and community diversity

Approach: Maintain or increase structural diversity at the landscape scale

D. Climate Adaptation Plan: RESISTANCE RESILIENCE TRANSITION

E. Prescribed Fire Plan Goals

1. Provide for public and firefighter safety. Utilize fire as a tool to decrease risks to safety, life, property.
2. Explore innovative ways to reduce fuel loading and high severity fire potential and reintroduce fire into a fire adapted ecosystem on a landscape scale.
3. Enhance the protection and preservation of cultural and natural resources, including ecological processes, by reducing the threat of uncharacteristic fire effects over large landscapes.

F. Prescribed Fire Plan Objectives:

1 Reduce % of dead and downed woody fuels by weight in 1000-hour and larger fuel size classes immediately post-burn in ignition areas.	*25% +*

Element 6: Funding

A. Cost:

The information below are just estimates of the cost associated with treating and holding approximately 10,000 acres.

Projected total cost = $ 126,000
Projected cost per acre = $ 12.60

Costs will include:	24 hours flight over 5 years X $3500/hour	= $84,000
	Hazard Pay, Overtime	= $5,500
	Ignition Devices	= $10,000
	Misc. Ignitions/RAWS supplies	= $3,500
	Ground Ignition Opportunities	= $25,000

B. Funding Source:

This project will be funding with fuels allocations from the NPS IMR Fire Management Program.

Element 7: Prescription

The prescription elements were developed using the fire effects and weather data gathered on the Range and Thompson RX projects and through an analysis of weather data from the Bright Angel RAWS station for the same time periods as this project schedule (Oct – Feb), using Fire Family +.

All prescription elements will be evaluated using the Bright Angel RAWS Station weather data. This RAWS station best represents the southerly aspects in the South Slopes project area. All fuel moisture data will be calculated from the RAWS data as the burn areas will not be accessible.

A. Prescription Narrative:

1. Fire behavior needed to meet goals/objectives and minimize fire spread outside of ignition areas includes surface fire with slow to moderate rates of spread and flame lengths less than 5 feet. Fire behavior like this will create low and moderate low severity fire effects but will also create small patches of higher severity areas on steep slope areas with very high fuel loads.
   After three years of ignitions within the burn unit, fire personnel found that the best fire effects in which moderate low to moderate high burn severity fire effects occurred, were during times of full sun with temperatures near 60 and humidities near 20%. This project will continue to look for opportunities near these numbers, but it is realized that positive fire effects can be had during other weather events.

B. Prescription Parameters During Ignitions:

ELEMENT	RANGE
TEMPERATURE	45+ degrees Fahrenheit
60 MINUTE AVERAGE RELATIVE HUMIDITY	14-35%
WIND DIRECTION	All Directions
60 MINUTE AVERAGE 20 FT WINDSPEED (mph)	0-15 during ignition operations
FUEL MOISTURE	
1 HOUR	4-9% calculated from Bright Angel RAWS
1000 HOUR	Less than 20% calculated from BA RAWS

PRESCRIBED FIRE CHARACTERISTICS FROM COMPUTER MODELING (Behave 5.0)

CHARACTERISTIC	RANGE	
RATE OF SPREAD	Backing Fire 0.1 -0.2 chains/hour	Head Fire 1.3 – 2.4 chains/hour
FLAME LENGTH	Backing Fire 0.3-0.4 feet	Head Fire 0.9-1.4 feet
SPOTTING DISTANCE	0.3miles	
PROBABILITY OF IGNITION	69%	

Fuel models TL3 & 4 have been used for the Behave runs to most accurately describe the expected fire behavior for the ignition schedule (Oct. 15 – Feb. 15)

Element 8: Scheduling

A. Implementation Schedule:

Ignition Time Frames or Season - Ignition time is from October 15 to February 15.

B. Projected Duration: 5-10 days for ignition annually (Multi-year implementation)
3-20+ days until fire spread has stopped and smoke impacts become negligible

Since there are no containment lines directly adjacent to ignition areas, the fire may continue to spread until fuel loading, fuel moisture, or weather conditions inhibit fire spread. Some areas (stump holes, large logs, etc.) within the project area may smolder or burn for periods of up to an additional 3 weeks after the fire has stopped spreading.

C. Constraints:

Constraints that may keep this project from occurring include political and visitor use issues that would be heavily impacted by smoke. Other constraints include funding shortages, inability to obtain or order appropriate staff for the burn, national, regional, or local direction to stop this project. Federally listed and specified species of concern, cultural resource concerns, air quality concerns, and the inability to find an appropriate burn window are also recognized as constraints.

Smoke impacts could become significant in the Grand Canyon and/or on Hwy 67, so careful consideration of adjacent public use, existing air quality problems, wind directions, ventilation, and success of finding the right weather and fuel moisture window to minimize the spread of the fire outside of the ignition areas will occur.

Element 9: Pre-burn Considerations and Weather

A. Considerations:

1. **On-site**

Cultural Resources:

Potential Cultural Resource Concerns:

- Historic structures
- Archeological sites (historic and prehistoric)
- Ethnographic resources and Traditional Cultural Properties (TCP's)

Compliance procedures will follow those stated in the FMP and 2010 Grand Canyon National Park Final EIS, and the document *Programmatic Agreement by and Among the National Park Service, Grand Canyon National Park, and the Arizona State Historic Preservation Officer Regarding Fire Management Plan at Grand Canyon National Park (2009).* The Programmatic Agreement requires park staff to implement procedures to locate, identify, and protect cultural resources from adverse effects resulting from the implementation of fire management activities. Mitigations measures comply with Section 106 of the National Historic Preservation Act of 1966 (as amended) and Directors Order 28. These activities include inventory and identification of previously unidentified cultural resources, assessing potential effects to cultural resources from project implementation, consultation with traditionally associated tribes and the Arizona SHPO, and implementation of mitigation measures to prevent adverse effects. All such actions will be completed prior to project implementation by Grand Canyon cultural resource staff.

Some specific mitigation measures include flagging archaeological sites within project boundaries to ensure they are avoided and making site locations known to all project personnel by way of maps and briefing packets. If

previously unidentified or concealed archaeological resources are encountered during project activities, all necessary steps will be taken to protect them and to notify a Grand Canyon National Park archaeologist or the Cultural Resource Program Manager immediately following discovery if cultural personnel are not assigned to the project.

The Cultural Resource Program Manager or fire archaeologist will be notified in advance of project implementation so that cultural staff can be assigned to monitor project activities as necessary.

The burn boss is responsible for ensuring that all compliance measures are taken to protect sites that require protection prior to ignition and that an archaeologist is in the park during ignition near cultural resource sites. No ground disturbance is expected with this project. Utilizing changes of vegetation and fuel moisture associated with aspect will eliminate the need for containment lines and additional ground disturbance.

Please refer to the FMP for a complete list of mitigations for cultural resources.

Natural Resources:

Compliance procedures will follow those stated in the FMP, FEIS, and "Biological Opinion: Fire Management Program, Grand Canyon National Park". The Park Biologist or designee will work in conjunction with the fire management staff and project archaeologist to designate vehicle staging areas.

A variety of wildlife species such as Goshawks utilize the forested habitat of the North Rim for nesting and other activities critical to their survival. It is also recognized that the health of this forested habitat has been degraded due to the interruption of fire as a natural process since the intervention of modern fire suppression. For this reason, it is critical that all available windows of opportunity to return fire to this project area are explored. Measures to mitigate disturbance to nesting birds, post fledging-family areas, and foraging areas will be undertaken as much as is possible at the direction of the Park's Wildlife Program Manager. Since the project schedule only allows for treating fuels after nesting season, there are no survey requirements.

2. Off-site

National Environmental Policy Act Compliance:

A programmatic Environmental Impact Statement was prepared to develop a program of work and assess the impacts of that work for the Grand Canyon National Park Fire Management Program. The assessment of effects in the FEIS shows that some major adverse and beneficial effects may occur during fire management projects. Grand Canyon National Park has also completed programmatic consultation with the USFWS and SHPO.

PRE-BURN

TASK	RESPONSIBLE	√
7 OR MORE DAYS		
Cultural Resource clearance has been received – Mitigation measures implemented.	Burn Boss/Archeologist	
Biological Resource clearance has been received – Mitigation measures implemented.	Burn Boss/Biologist	
Monitor short-term and long-term weather and fuel conditions.	Burn Boss	
Develop press release of upcoming burn.	B Boss or Zone Fire Staff	
Locate helispots that may be used for emergencies	Helibase Manager	
Day 2-3		
Agency Administrator GO/NO-GO completed and signed	Burn Boss/FMO	
Monitor weather conditions/fuel conditions/test fuel moistures	Lead Monitor/ RAWS	
Check on additional resource availability.	Burn Boss	
Coordinate public information and interpretive programs.	B Boss or Zone Fire Staff	
Mark helispots for use if necessary. Ensure helispot locations are on project maps.	Helibase Manager	
Day 1		
Monitor weather conditions – request spot weather forecast.	Lead Monitor or Burn Boss	
Contact NWS for updated forecast/special concerns (nighttime concerns).	Burn Boss	
Verify all mitigation measures are complete.	Burn Boss	
Check on resource availability.	Burn Boss	
Develop ICS Form 215A- LCES Analysis	Burn Boss	
Develop IAP and make copies.	Burn Boss	
Develop & submit burn request to ADEQ	Prescribed Fire Manager	
Complete prescribed fire notification list. * Ensure Smoke Sensitive residents/employees near project area are notified*	Burn Boss/Dispatch	
Place prescribed fire and smoke warning signs on Highway 67, and other assigned roads, if applicable.	Burn Boss	
Give a copy of the burn plan and IAP to the dispatch center.	Burn Boss	
Prepare specific press releases and public service announcement and distribute to local radio station newspapers.	Fire Mgmt Staff	
Out of zone or out of park resources will wash their vehicles at the North Rim or before they travel on unpaved roads.	Burn Boss	
Burn Day		
Monitor weather/fuel conditions – request spot weather forecast and provide feedback on previous day's spot forecast.	Burn Boss	
Verify compliance with ADEQ – daily burn approval.	Burn Boss	
Verify weather forecast with NWS.	Burn Boss	
Present operational briefing with ALL burn personnel.	Burn Boss	
Check area for visitors prior to ignition.	Burn Boss	
Complete GO/NO-GO checklist.	Burn Boss	
Start test burn – notify dispatch of test burn.	Burn Boss	
Request spot weather forecast for evening and next day burn period. Provide feedback on previous spot forecast.	Fire Mgmt Staff	

B. Method and Frequency for Obtaining Weather and Smoke Management Forecast(s):

Long term weather monitoring and forecasting will occur with conversations from the burn boss/ FMO to the NWS, SWCC Fire Weather Forecasters, and/or computer models to look at long term weather forecasts, seasonal fuel conditions, drought forecasts, and predictions for season ending events. The burn boss will utilize the Bright Angel RAWS station. Resulting weather data will be forwarded to National Weather Service to fine-tune spot weather forecasts for affected area. ADEQ will be contacted with resulting forecasts to ensure the Smoke Management Forecast will be applicable and appropriate

C. Notifications:

See Appendix G

Element 10: Briefing

A. Briefing Checklist; including, but not limited to: (additional items may be added)

Burn organization and assignments
Prescribed Fire objectives and prescription
Description of prescribed fire project area
Expected weather and fire behavior
Communications
Ignition plan
Holding plan
Contingency plan and assignments
Wildfire declaration
Safety and medical plan
Aerial ignition briefing (if aerial ignition devices will be used)

In addition to the items listed above, the daily safety briefing and project briefing will be held prior to work on the project during each phase of the project. Items that may be covered during these briefings include but are not limited to:

Escape routes and safety zones.
Spot fires, slopovers, and escapes.
Fire/ Aviation related hazards (stump holes, snags, open flames, tour route aircraft, etc.).
Animal hazards (wasps, bees, rattlesnakes, condors etc.).
Fuel storage (drip torches, bulk storage, saw gas, etc.).
Firing techniques and devices (drip torches, aerial ignition devices, veri pistols, etc.).
Vehicles (lights on, slow driving, traffic conditions, visitors, smoke, parking areas, etc.).
Health hazards (smoke inhalation, dehydration, injuries, etc.).
Equipment hazards such as chain saws, drip torches, etc.
Snags.
Incident within an Incident

Element 11: Organization and Equipment

Internal Aerial Ignitions

A. Positions:

Example Burn Day Forces (on-site)
Burn Boss Type 2 (RXB2)
Firing Boss (may be accomplished by the burn boss)
Holding Boss-Single Resource Boss & ICT4 (may be accomplished by the burn boss)
PLDO Operator
Pilot
Type 6 engine or larger (within 2-hour response)

B. Equipment: Helicopter
Aerial Ignition Machine

C. Supplies: Plastic Ignition Spheres

Ignition Operations that occur adjacent to Hwy 67

A. Positions:

Example Burn Day Forces (on-site)
Burn Boss Type 2 (RXB2)
Firing Boss
Holding Boss- Single Resource Boss &ICT4
Two or more igniters
1 Type 6 or Type 3 Engine (if roads are engine accessible)

B. Equipment: UTV

C. Supplies: Drip Torches and burn fuel

Element 12: Communication

A. Radio Frequencies:

All radio frequencies will be assigned prior to the project by the Williams Interagency Dispatch Center. These frequencies will be included in a communication plan for all IAP's.

1. Command Frequency(s): To be assigned by Williams Dispatch
   Potentially 172.4250 / 164.6750

2. Tactical Frequency(s): To be assigned by Williams Dispatch
   Potentially 168.200 / 168.200

3. Air Operations Frequency(s): To be assigned by Williams Dispatch
   Potentially 171.4750 / 171.4750

B. Telephone Numbers: N/A

Element 13: Public and Personnel Safety, Medical

A. Safety Hazards and Mitigation: Measures Taken to Reduce the Hazards:

Smoke impacts may occur below the canyon rim and on Hwy 67. Additional signs, fire information, or an increase in ranger staff may need to be utilized to help mitigate safety hazards associated with smoke impacts. The burn boss, safety officer (if assigned), and the GRCA Ranger Staff will work together in the event an evacuation is necessary, road closures are required, or additional safety measures are implemented.

All standard wildland fire safety rules will be strictly enforced. Project personnel will wear appropriate personal protective equipment (PPE) during all phases of the project. **The Burn Boss will ensure no person will be allowed into the project area during preparation or execution without the proper PPE and supervision.** If the complexity of the project indicates that a safety officer is necessary, then one will be assigned. See attached Job Hazard Analysis (JHA) (Appendix C).

The burn boss and the GRCA Fire Management Staff will analyze and resolve safety concerns such as, snag safety along open roads prior to and during the project. Additional positions may be filled within the burn organization for the purpose of mitigating identified safety concerns. The Burn Boss will assign a Safety Officer and /or "Public Safety Specialist" as appropriate. Many of the safety issues associated with this project are standard for wildland fire operations, but how they are mitigated will remain fluid throughout all parts of this project. See attached Job Hazard Analysis (JHA) (Appendix C).

The burn boss will work with and through appropriate line supervisors to institute any corrective safety measures associated with this project, such as traffic control on roads (Highway 67, W-1 and W-4 roads) and other visitor use areas in or around the project area within the park and the forest. If a serious safety issue cannot be resolved prior to ignition of any portion of this project, ignition will not take place. If a safety issue occurs during the life of the project, it will be mitigated with the most reasonable measures possible that will provide for safety of the public and employees.

The need to close any park trails or roads will be assessed by the Burn Boss and GRCA fire management staff prior to ignition. If appropriate, the Burn Boss will consult with the Chief Ranger (or acting) and then recommend to the Superintendent, temporary closures of trails or roads adjacent to or within the prescribed fire project area. Official trail and/or road closures will be posted at the closure locations prior to ignition and shared with the GRCA Public Affairs Office for additional outreach if appropriate. The Backcountry Reservations Office will be notified of the planned burn schedule and of any approved closures.

B. Emergency Medical Procedures:

An incident medical plan will be included in all incident action plans (IAP) and will be reviewed before each shift. The Burn Boss will review and approve the IAP and all sections within. See the Incident Medical Plan in Appendix H. The medical plan will cover topics such as identifying EMT's, location of ambulances, life-flight availability, location of clinics/hospitals, procedures to follow in case of injury, and steps to take in case a major injury occurs. Job hazard Analysis for Prescribed Fire Projects will be included in Appendix C. All personnel will be required to sign a copy of the JHA prior to ignition.

Should evacuations be necessary, Burn Boss will coordinate with Grand Canyon Ranger Staff to alert the public. Law Enforcement personnel will evacuate affected public via established Law Enforcement procedures.

C. Emergency Evacuation Methods:

HWY 67. north to Jacob Lake will be the primary evacuation route for all visitors. NPS Rangers will assist with facilitating any evacuations from the Park.

D. Emergency Facilities:

The North Rim Emergency Services Building (Station 3) houses the park ambulance and it will be the primary medical response vehicle for most areas within this project area. The park helicopter may be the primary medical response vehicle on remote roads or in the event a serious injury occurs.

Element 14: Test Fire

A. Planned Location:

The test fire and/or observations from the current/recent fire activity will be completed before deciding to execute or continue the project. On the first day of ignitions, a test fire in the project area will be conducted to observe fire behavior and ensure objectives can be met. The "first day" test fire will be ignited with ground resources at a location within the prescribed fire area that is representative of the site. If results of the test fire are unacceptable, the test fire will be terminated, the prescription will be reevaluated, and the prescribed fire postponed and/or rescheduled. Evaluating recent fire effects and active fire behavior from recent past firing operations within the project area can be used as the test fire for subsequent ignition days.

B. Test Fire Documentation:

1. Weather conditions at time of test fire
2. Test fire results

Element 15: Ignition Plan

A. Firing Methods:

1. Techniques, sequences and patterns

Ignitions will occur only in designated areas (southerly aspects) as identified on the project map (See Appendix A). Ignitions will only occur on the ridgetops if the fire is actively backing downslope. If the fire is not actively backing down the slopes, additional ignitions may occur to bring fire down the slope. The burn boss will continuously monitor the fire activity and may change firing patterns to meet the project objectives. Firing will occur by hand if the defined ignition area is close to a road and accessible by foot, otherwise all firing will be completed through aerial ignition. The exact procedure will depend on factors such as safety, topography, wind, fuel moistures, fire behavior, or other factors.

The ignition areas will be chosen prior to any of the day's ignitions start. Ignition areas for the daily ignition operations may be spread out throughout the unit to create the mosaic of burned and unburned areas. Multiple ignition days may occur, but each day's ignition area will be defined after the previous ignition operation is complete. Prioritizing areas to be burned for each ignition operation will be discussed with the fire management staff, the SRM fire liaison, and other resource specialists as needed.

Areas that could be considered priority ignition areas may include but are not limited to I&M plot locations, Rapid Assessment plot locations, areas near management actions points from past wildland fires, areas near values at risk of future wildfires, areas that may show the most potential for high severity fire effects during future wildfires. Additional factors affecting ignition capabilities and duration may include staffing requirements and

availability, funding availability, time of season, weather forecasts, impacts to visitors, and impacts to Kaibab NF lands.

Aerial Ignition will be covered in the Aerial Ignition Plan in Appendix F.

B. Devices:

Aerial ignition devices will include an aerial ignition machine and plastic ignition spheres.
Ground ignition devices will include drip torches.

C. Minimum Ignition Staffing:

Staffing shall consist of a Firing Boss/Burn Boss/holding boss, an engine within two-hour response time, pilot and PLDO operator for internal aerial ignition operations. A Burn Boss, Firing Boss, Holding Boss, an Engine, and igniters will be used if ground-based ignition operations occur.

Element 16: Holding Plan

A. General Procedures for Holding:

The burn boss and North Zone fire staff will determine holding strategies, tactics and resources to be used. Since most ignitions will not occur immediately adjacent to roads and trails, and there are no established holding lines immediately adjacent to ignition areas, there will be no holding actions unless the fire threatens HWY 67 or a value at risk. If fire threatens a road or is forecasted to threaten a road, or ignitions occur adjacent to a road that is also a project boundary (W-1, W-4 and Hwy 67) local holding resources will be used. The lack of holding opportunities for most of the project area is the primary reason why ignition operations will not occur until late fall and into the winter. It is expected that snow or high fuel moistures on the northern aspects, short burn periods, and/or cold, moist weather conditions will stop or significantly slow the fire spread. A long-term forecast will be requested several days prior to ignition to ensure that the weather does not change so dramatically that holding actions along roads does not becomes excessively problematic.

Holding actions (if deemed necessary along roads) include all standard fire suppression actions approved within the current Fire Management Plan. In general, Minimum Impact Suppression Tactics (MIST) will be used whenever it is safe and effective to do so. Holding resources may include the use of aircraft, engines, water tenders, and pumps/hoselays, HWY 67, the W-1 and W-4 roads, and the NPS/USFS boundary will be used as project boundaries. 80% of the project area has established containment lines, and those containment lines are the established roads listed above. All fires will be allowed to back down southerly slopes, until the lack of fuels, high fuel moistures, cooler weather, or precipitation stops the fire spread inside the project area.

In extreme circumstances, when required by ADEQ to minimize smoke emissions, or if the burn boss thinks future smoke impacts will be increasing above required emissions limits, actions to reduce smoke impacts will take place. This will happen with close coordination and planning with ADEQ officials. If mop-up does occur, crews will work the burned area with hand tools and water handling equipment. Mop-up may occur along project unit boundaries where accessible, and within the project interior.

Within the project area, all fuels will be allowed to burn out naturally, if possible. In many cases it will be more effective to burn out problem fuels than to perform traditional mop-up. Due to the lack of nearby water sources, accessibility for firefighters to the ignition areas, and the extended travel time for water tenders or engines to get water, mop-up with water may be limited. The lack of water also means that "dry-mopping" with hand tools could be utilized extensively if mop-up is required by ADEQ or the Superintendent. The use of hand tools for mop-up will mean increased soil disturbance. The need for mop-up mitigation measures will be determined through an IDT team decision process.

Night operations will be conducted if it is safe to do so and if weather and fire conditions necessitate such staffing. Determination of the need for a night shift will be based on the success and progress of day shift operations, and the assessment of expected fire behavior and potential nighttime hazards like smoke impacts to park roads. Night operation assignments will be implemented by the Burn Boss after consulting the holding boss, and the Fire Management Officer (FMO).

B. Critical Holding Points and Actions:

The entrance station building, the associated cabin & garage, and lookout tower & cabin are the most critical protection areas near the burn unit boundaries. All three areas have experienced fuel reduction projects and that thinning slash has been burned. The Thompson RX fire (2012) further reduced fuels near the cabin and lookout tower. The fuel loading immediately adjacent to the structures is light except for areas where hazard trees have recently been felled. All structures mentioned above are considered historic buildings.

Additional critical holding area like fire sensitive cultural resource sites will be identified and discussed with the entire project staff. Additional resources may be ordered, or existing resources may be redeployed to assist with holding these critical areas.

C. Minimum Organization or Capabilities Needed:

Example Burn Day Forces

Internal aerial ignitions

Positions:

Burn Boss Type 2 (RXB2)
Firing Boss (If assigned, or may be accomplished by the Burn Boss)
Holding Boss-Single Resource Boss & ICT4 (If assigned, or may be accomplished by the Burn Boss)
Type 6 engine or larger (within 2-hour response)

Ignition operations occurring adjacent to Hwy 67

Positions:

Burn Boss Type 2 (RXB2)
Firing Boss
Holding Boss- Single Resource Boss &ICT4
Two or more igniters
1 Type 6 or Type 3 engine (if roads are engine accessible)

Holding resources needed for operations after ignitions are complete:

Fire Status Category	Fire/Weather Elements	Minimum Required Personnel
Holding Status	• Problem fire behavior exhibited throughout night shift operations. • Active fire behavior in unburned islands within 500 feet of control lines. • Torching or spotting are common occurrences near control lines. • Potential for escape is high or moderate.	1. RXB2/ICT3 2. One staffed local engine on the North Zone 2. Aerial reconnaissance daily.

Patrol Status	• Torching and spotting are rare occurrences within 1000 feet of the northern, western, and eastern perimeters. • Fire activity is reduced to smoldering or creeping adjacent to control lines. • No problematic weather events are forecasted.	1. RXB2 orICT4 One staffed local engine on the North Zone 2. Aerial reconnaissance every other day.
Monitor Status	• No torching or spotting has occurred for 24 hours. • Fire activity is reduced to smoldering or creeping adjacent to control lines. • Interior fire activity is reduced to creeping and smoldering with rare events of moderate fire activity (flame lengths greater than 2"). • Fire activity is flanking or backing	1. ICT4 2. Aerial reconnaissance twice a week.
Extended Monitor Status	• Interior fire activity is reduced to creeping and smoldering and until the fire is declared out.	1. ICT4 available in the park or on the North Zone. 2. Aerial reconnaissance as needed until declared out.

Aircraft may be used to hold portions of this project when holding capabilities of engines and hand crews are exceeded or expected to exceed their capabilities, or engine access is limited, or roads are closed. If aircraft are utilized, their cost will be absorbed by project dollars. If the prescribed fire is declared an escaped wildland fire, aircraft costs will be absorbed as suppression expenses at the time the fire is declared a wildfire.

Patrol or monitoring (aerial) of the project will continue until the fire is out or the weather conditions have stopped all fire spread and fire spread potential. The burn boss will not declare the prescribed burn out until 72 hours pass without a smoke.

Element 17: Contingency Plan

Management Action Points or Limits:

If fire threatens HWY 67 or parts of the W-1 or W-4 roads that are parts of the project boundary, the holding specialist and/or burn boss will supervise suppression actions utilizing local holding forces. A size-up of spot fires or slopovers that develop outside of the project area will be communicated to the burn boss as part of the initial response. If those spot fires and/or slopovers cannot be controlled with on-site resources by the end of the next burning period, the burn boss will convert the fire to wildfire status.

Contingency resources will be identified in a separate ICS204 within the IAP. These resources may be on scene and could be helping with normal holding operations, but those resources will be attached to a contingency group supervisor and will remain part of that contingency group. The contingency group is not part of the example organization listed in Element 16-Holding Plan.

B. Actions Needed:

Before the start of the test fire, the Burn Boss will notify the Williams Interagency Dispatch Center (WDC) and ensure contingency resources are available and able to assist within the defined maximum response times. WDC will provide the Burn Boss with a list of additional resources from the local area that are available to serve as contingency resources. If spot fires or slopovers cannot be contained or controlled quickly with the existing holding forces, ignition will cease, and all fire personnel will suppress the spot fires and/or slopeovers.

If necessary, the Burn Boss will notify WDC that contingency resources are needed to assist with holding operations. Those resources will be ordered and dispatched accordingly.

C. Minimum Contingency Resources and Maximum Response Time(s):

The burn boss will notify Williams Dispatch prior to ignition to determine locations and response times of additional resources. Contingency resources will include a workforce that can accomplish a production rate of at least 6 chains/hour and can be on-site within 6 hours (Fireline Handbook, FM10 – 1 ch/hour/person). The additional resources may include additional engines from the North Zone Fire Management Organization, South Rim/Tusayan RD, the Coconino NF, Arizona Strip District, Zion National Park, and the park helicopter (if they are not already committed).

Specific additional resources that may be ordered by Williams Dispatch and example resources with response times may include:

- Type 3 Helicopter: AZ-GCP: H368: Response 1 hour
- Type 3 / Type 6 Engine(s): AZ-KNF (NKRD): Response 1.5 hour
- Type 3 / Type 6 Engine(s): South Rim/ KNF/COF/PNF/ZNP: Response 6 hours

Element 18: Wildfire Declaration

A. Wildfire Declared By:

If spot fires and/or slopovers cannot be controlled with on-site resources by the end of the next burning period, the burn boss will convert the fire to wildfire status. Any suppression actions will be in accordance with the Grand Canyon National Park Fire Management Plan. Goals for the escaped fire will be to safely contain it at the smallest possible size while protecting cultural and natural resources. Firefighter and public safety will remain the highest priority.

B. IC Assignment:

If the prescribed fire is converted to a wildland fire, the burn boss will make the declaration and assume the role of Incident Commander until relieved by an Incident Commander Type 3 (ICT3) if he/she is not a qualified ICT3. If the burn boss is not a qualified ICT3 prior to ignition of the prescribed fire, he/she will ensure that one will be available on the North Zone or South Rim during the ignition phase of the project and within a 6-hour response time during holding and patrolling activities.

All section leaders (holding, firing) will ensure the safety of ALL personnel assigned to them. All personnel will be assigned holding or suppression duties.

C. Notifications:

The burn boss will immediately notify Williams Interagency Zone Dispatch and the Zone and Park FMO of the change in status to a wildfire and will order resources through Williams Dispatch.

D. Extended Attack Actions and Opportunities to Aid in Fire Suppression (Optional):

In the event an escape moves into extended attack operations, there will be some opportunities to find natural barriers, trails, road systems past fire history areas, near the burn unit that will aid with containing the fire. Actions to suppress the fire may include line construction, aerial retardant drops, and/or burnouts/backfires. There are limited fire suppression support staff still working so late in the fall and into the winter months throughout the Southwest that could be utilized for extended attack operations so building a large organization and travel times to the incident could take extended amount of time.

Element 19: Smoke Management and Air Quality

A. Compliance:

A burn permit for all burning, regardless of size, will be obtained from ADEQ. Emissions have been modeled using the EPM and/or SASEM software (See Appendix E.)

Smoke observations will be recorded by personnel at overlooks or from the helicopter during ignitions operations. At any point, if unforeseen smoke intrusion occurs, ignition may be curtailed. National Weather Service predictions on mixing heights for smoke dispersal are included into the go/no-go decision-making process. Smoke will be managed to protect public health and enjoyment as well as to mitigate health and safety concerns related to hazardous accumulations of natural fuels.

Measures to be taken by the burn boss or North Zone Fire Management staff include but are not limited to:

1. Actions will be taken to close areas of the park with significant potential smoke impacts in order to negate impacts to human health.
2. Area residents will be notified of possible smoke impacts via the radio, television, posted site bulletins, written media, or personal contacts.
3. All burn requests will be in consultation with ADEQ personnel.
4. Monitoring of smoke conditions will occur from overlooks or from the park helicopter. Heavy smoke may warrant reduced speed limits and/or pilot car escorts on Hwy 67 (if open). Monitoring of smoke impacts to Highway 89A may also occur if forecasted wind directions and forecasted smoke impacts occur.

B. Permits to be Obtained:

Daily burn approvals from ADEQ will be obtained prior to each ignition operation.

B. Smoke-Sensitive Receptors:

Critical receptor sites for this project include Highway 67, North Rim Entrance Station, DeMotte Park/Kaibab Lodge, and the North Rim Developed Area. SASEM smoke modeling runs and smoke dispersion maps with plume trajectories are attached to this project plan. Page, Marble Canyon, and Highway 89 may also be impacted by smoke if forecasted wind directions and forecasted smoke production combine to move large amounts of smoke toward those sites.

Diurnal impacts and daytime impacts if the wind direction has a northerly component are most likely to affect Hwy 67 and backcountry users in the inner canyon, west of Phantom Ranch. If good or excellent ventilation does not materialize to disperse smoke from the project, moderate to heavy impacts could occur at these receptor sites. Impacts would lessen each day after the ignition operations are complete.

See Smoke Documentation Appendix E.

C. Potential Impacted Areas:

The areas directly adjacent to the burn unit will see the highest impacts. These areas include Hwy 67, the North Rim Entrance Station, and inner canyon visitors. Because this project does not have any holding boundaries directly adjacent to the ignition areas, smoke impacts could exist for several weeks at the impacted areas.

D. Mitigation Strategies and Techniques to Reduce Smoke Impacts:

Because the timing of this project will be in the late fall and winter, weather conditions may not facilitate large-scale smoke dispersion so impacts to critical receptor sites should be expected for extended periods of time. As with any prescribed fire close to the rim of the Grand Canyon the potential for diurnal smoke impacts in the canyon exists. Some potential for health impacts to park visitors and staff does exist. If smoke rises well and dispersion is in a northerly direction, smoke will be carried away from many visitor use areas like the NR developed area. However, nocturnal smoke drainage into the Hwy 67 corridor and in the inner canyon could negatively affect visitors. Some minor smoke impacts may be expected for periods of up to one month. Long-term impacts of smoke will be directly related to the duration of fire spread.

Element 20: Monitoring

A. Fuels Information Required and Procedures:

Prior to the planned ignition of the burn unit fuels data will need to be obtained. The expected treatment window for this unit is expected to occur in the fall and winter months. The fire management program at Grand Canyon NP has an active fuel sampling program on the North Rim. In order to verify if the area is within prescription, fuel moisture samples will be taken from the burn unit or fuel sampling sites, or from the Bright Angel RAWS station.

B. Weather Monitoring (Forecasted and Observed) Required and Procedures:

Long term weather monitoring and forecasting will occur with conversations to the NWS, SWCC Fire Weather Forecasters, and/or computer models to look at long term weather forecasts, seasonal fuel conditions, drought conditions and forecasts, and predictions for season ending events.

A Fire Effects Monitor (FEMO) may be assigned to the burn unit during the execution of this project. The FEMO will implement the methods and procedures outlined in the 2010 Grand Canyon NP Wildland and Prescribed Fire Monitoring and Research Plan. A daily Spot Weather forecast will be obtained for each day of the ignition operations by the burn boss until conditions no longer warrant. Additionally, weather observations will be recorded prior to the planned ignition date and daily Spot Weather forecasts will be obtained for those days to provide the National Weather Service (NWS) officials more precise weather information in forecasting weather conditions for the planned ignition day. The Bright Angel RAWS station will be used to provide the weather observations for the Spot Weather Forecast if on-site weather monitoring does not occur. At the completion of each shift, a summary report will be compiled relating to fire weather and provided to the Burn Boss.

C. Fire Behavior Monitoring Required and Procedures:

Project staff will implement the methods and procedures outlined in the 2010 Grand Canyon NP Wildland and Prescribed Fire Monitoring and Research Plan for monitoring fire behavior. Project staff will record various observed elements of fire behavior on the Grand Canyon or Interagency Fire Behavior Observations form. Elements recorded may include: Flame Length, Fire Type (B/F/H), ROS, Flame Zone Depth, Primary carrier, % Consumption and Spotting Distance. At the completion of each shift a summary report will be complied relating to fire behavior and passed along to the Burn Boss.

D. Monitoring Required to Ensure that Prescribed Fire Plan Objectives are Met:

Within the prescribed fire unit, permanent and semi-permanent fire effects monitoring and Inventory and Monitoring Program plots have been established. The long-term vegetation and fuels objectives identified in the 2010 Grand Canyon NP Wildland and Prescribed Fire Monitoring and Research Plan for each monitoring type will be measured pre- and post-burn on a pre-determined schedule as specified in the 2010 Grand Canyon NP Wildland and Prescribed Fire Monitoring and Research Plan.

Measurements will be collected during each monitoring event (pre- and post-burn) and then summarized for the entire monitoring type or treatment subunit (depending on plot type). A written report on the effectiveness of prescribed fire within each monitoring type or treatment subunit will be provided at the end of the field season and no later than January 30 of each year.

Rapid assessment plots have been established in the burn unit to measure pre and post project fuel loads. Plots have been and will be measured pre-burn and immediate post burn (if accessible and staff available) by the fire effects crew. This information will assist the fire management program to determine the success of the project in meeting the 1000 hr. fuel reduction objective. These plots also measured overstory and pole tree density, conifer seedling density, shrub and herbaceous cover, and exotic/invasive species cover. Even though many of the items measured in the rapid assessment plots are not specifically covered in the project objectives, a report of the findings of each plot element will be presented in the year-end monitoring report.

E. Smoke Dispersal Monitoring Required and Procedures:

The FEMO or project staff will implement the methods and procedures outlined in the 2010 Grand Canyon NP Wildland and Prescribed Fire Monitoring and Research Plan for monitoring smoke. The FEMO will record various observed elements of smoke on the Grand Canyon or Interagency Fire Behavior Observations form. Elements recorded may include wind direction, wind speed, approx. smoke column height, volume and any observed smoke impacts on sensitive areas.

See Appendix E for modeled smoke impacts using SASEM 5.1. A smoke forecast map was also developed to display estimated smoke travel utilizing our most common wind direction (SW) (Appendix A). The project prescription includes all wind directions.

Element 21: Post-burn Activities

A. Post-Burn Activities that must be Completed:

TASK	RESPONSIBLE	1.
Burn accomplishment report faxed to ADEQ + Zone (Daily).	Burn Boss	
Fire patrolled with an update to dispatch/burn boss.	Burn Boss	
Copies of weather, fire and smoke observations sent to unit FMO	Lead Fire Monitor	
All signs and information posters are removed.	Burn Boss	
DI-1202 completed and copies given to Unit FMO.	Burn Boss	
Project accomplishment report entered into NFPORS.	Unit FMO	
Operational impacts are rehabilitated.	Burn Boss	
Daily fire weather and fire behavior observation summary report.	Fire Monitor/Burn Boss	
Post project evaluation	Burn Boss	
ICS-214 Unit Logs – Daily from all project staff	All Project Staff	

Prescribed Fire Plan Appendices

A. Maps – Project, Project (Ignition), Smoke
B. Complexity Analysis
C. GRCA JHA's
D. Fire Behavior Modeling Documentation/Fuel Consumption Modeling
E. Smoke Modeling Documentation
F. Aerial Ignition Plan
G. GRCA Notification List
H. Medical Plan
I. Technical Reviewer Checklist
J. GRCA IDT Reviewer Comments and Reponses
K. Agency Administrator Go/Nogo Checklist
L. RX Fire Go-NoGo Checklist
M. Post Burn Summary Report