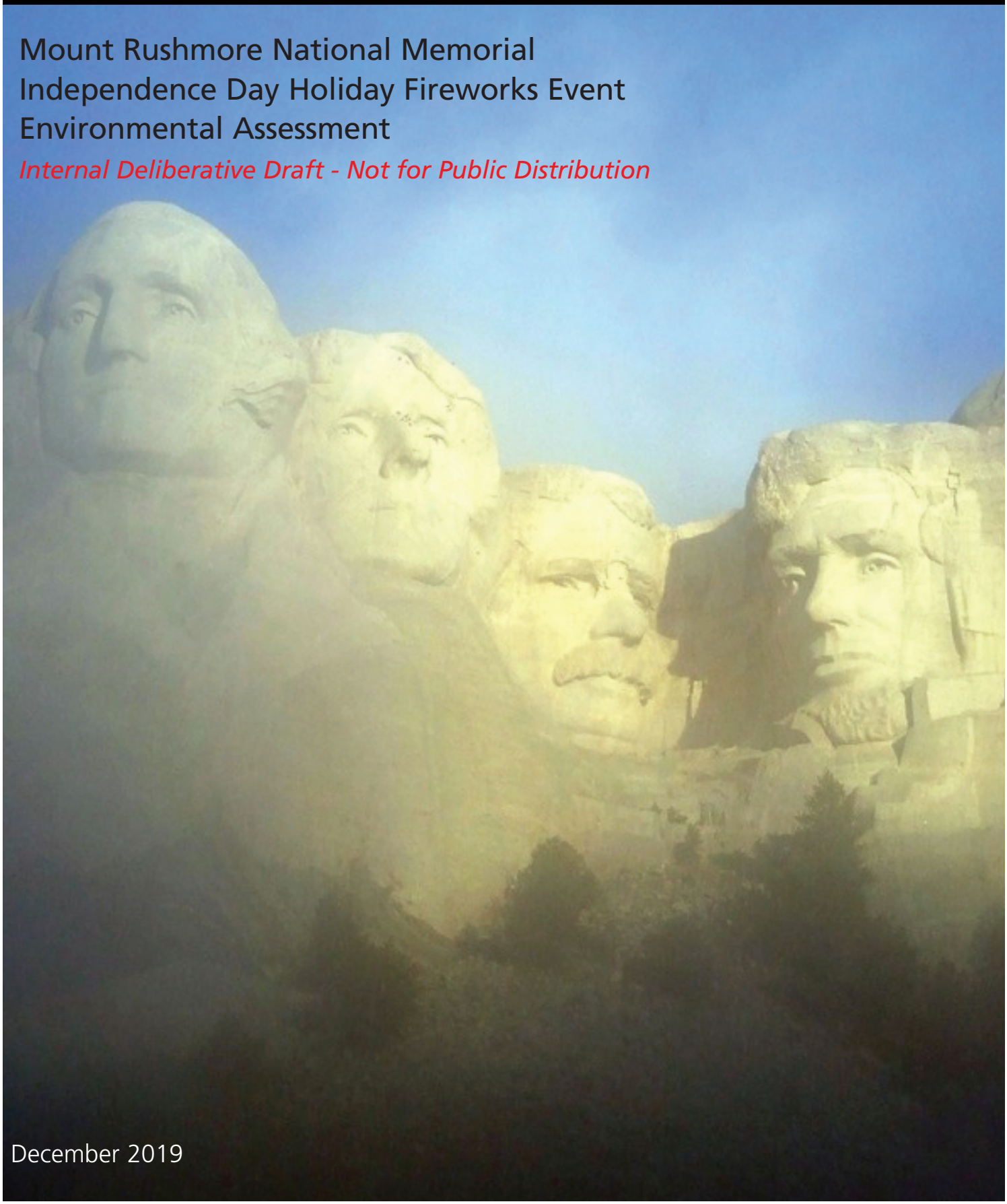
National Park Service
U.S. Department of the Interior

Rocky Mountain National Park
Colorado

Mount Rushmore National Memorial Independence Day Holiday Fireworks Event Environmental Assessment

Internal Deliberative Draft - Not for Public Distribution



December 2019

Mount Rushmore National Memorial
13000 Highway 244
Building 31, Suite 1
Keystone, SD 57751

National Park Service
U.S. Department of the Interior

MOUNT RUSHMORE NATIONAL MEMORIAL
INDEPENDENCE DAY HOLIDAY FIREWORKS EVENT

Environmental Assessment

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If you wish to comment on this Environmental Assessment (EA), you may post comments online using the National Park Service Planning, Environment and Public Comment (PEPC) website at: http://parkplanning.nps.gov/morufireworks; or mail comments to: Superintendent, Mount Rushmore National Memorial, 13000 Hwy 244, Keystone, SD 57751.

This EA will be available for public review and comments for 30 days. Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made available to the public at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effect
BMP	Best Management Practice
DO	Director's Order
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
Memorial	Mount Rushmore National Memorial
MPB	mountain pine beetle
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NPS	National Park Service
NRCS	Natural Resources Conservation Service
PA	Programmatic Agreement
PEPC	Planning, Environment, and Public Comment
Sculpture	The granite statues of Washington, Jefferson, Lincoln, and Roosevelt
SHPO	State Historic Preservation Program
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WFDSS	Wildland Fire Decision Support System

Mount Rushmore National Memorial Independence Day Holiday Fireworks Event Environmental Assessment

Chapter 1. Introduction

Mount Rushmore National Memorial (Memorial) hosted annual July 4th holiday fireworks displays from 1998 to 2009, with the exception of 2002 when the displays were cancelled. These displays were extremely popular events, drawing thousands of visitors to the Memorial and commanding wide television viewership. After 2009, the annual event was cancelled due to elevated concerns about wildfire in the wake of pine beetle outbreak as well as other resource and public safety concerns. On May 6, 2019, the Secretary of the Interior signed a Memorandum of Agreement (MOA) with South Dakota Governor Kristi Noem to work to reinstate a fireworks event at the Memorial during Independence Day celebrations. The MOA states that "the State of South Dakota and the Department of the Interior have committed to an agreement to exercise their full authorities under State and Federal law to work to return fireworks to the Memorial in a safe and responsible manner on July 3, July 4, or July 5, beginning in the year 2020." In accordance with National Park Service (NPS) regulations, the Memorial must approve a Special Use Permit submitted by the state of South Dakota to reinstate a fireworks event at the Memorial. This Environmental Assessment (EA) assesses the impacts of a proposed fireworks event at the Memorial (project area) and evaluates two alternatives: a no action alternative and a preferred alternative. Under Alternative 1 (the preferred alternative), the Memorial would permit and host an Independence Day celebration, including a fireworks display and other acts, on the evening of July 3, 2020, and similar events in subsequent years, if permitted by the Memorial. Under Alternative 2 (the no action alternative), no ticketed fireworks event would be scheduled, and the non-ticketed performances and activities the Memorial has hosted from 2010 to 2018 would occur again in 2020.

This EA has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that (1) analyzes a reasonable range of alternatives to meet the objectives of the proposal, (2) evaluates potential issues and impacts on resources and values, and (3) identifies mitigation measures to lessen the degree or extent of these impacts.

The 1,278-acre Memorial is surrounded by the Black Hills National Forest and is northeast of the Black Elk Wilderness and Norbeck Wildlife Preserve (Figure 1). Nearby communities include Keystone (2 miles northeast of the Memorial) and Hill City (12 miles northwest of the Memorial), South Dakota. The Memorial includes a variety of visitor and administrative facilities including visitor parking, information and visitor centers, an amphitheater, walking trails, and administrative buildings (Figure 2).

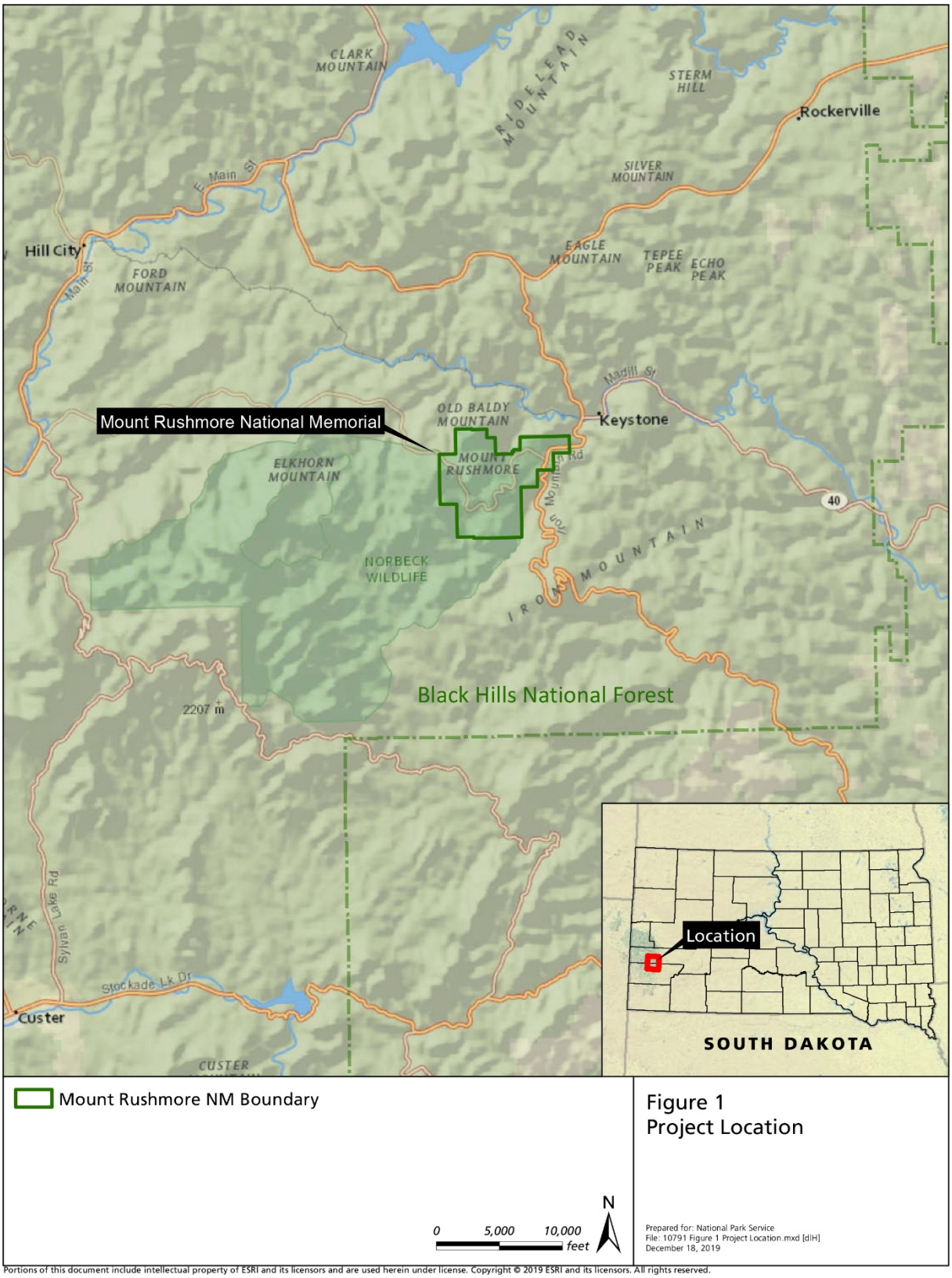


Figure 1. Project Location

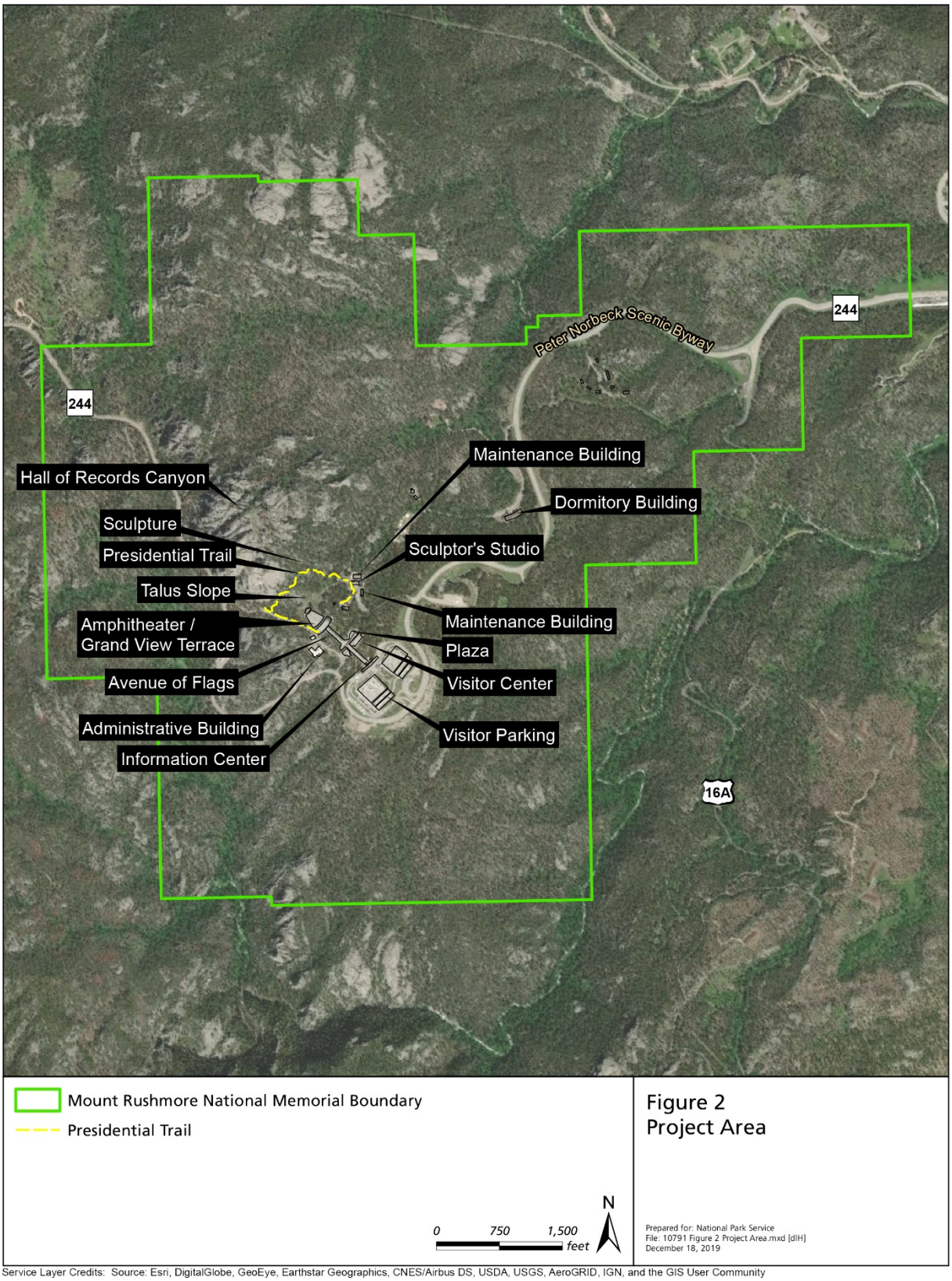


Figure 2. Project Area

1.1 Need for Action and Issues Analyzed

The need for the action is to allow for a fireworks event at the Memorial, for the purpose of celebrating the spirit of Independence Day, and to provide for the education of and enjoyment by the public in a manner that ensures safety and resource protection.

1.2 Issues Analyzed in this Environmental Assessment

Issues related to wildfire potential, environmental contaminants, human health and safety, and cultural resources are analyzed in detail in this EA. Issues associated with vegetation are covered under the wildfire issue, and issues associated with wildlife are covered under both the wildfire and environmental contaminants issue.

1.3 Issues Dismissed from Detailed Analysis

Issues related to socioeconomics, visitor experience, percussive impacts, night skies, wilderness character, threatened and endangered species, and air quality were dismissed from detailed analysis as described below.

1.3.1 Socioeconomics

The preferred alternative analyzed in this EA assumes the proposed 2020 fireworks event would be a ticketed event on July 3rd for about 2,000 visitors (see Section 2.1, Alternative 1 (Proposed Action and Preferred Alternative): Host an Independence Day Fireworks Event on July 3rd for an Amphitheater Audience for a description of the preferred alternative). On the day of the event, the Memorial would be open to the public until approximately 3:00 pm with ticket holder entry to start at 5:00 pm. Notice of the 3:00 pm public closure would be posted on the Memorial website and social media, as well as other local and state websites and media sources. Vehicular access along a portion of South Dakota Highway (SD) 244 and visitor access to the Memorial for the event would be limited to ticket holders. Visitors without a ticket would not be permitted to congregate outside the Memorial along SD 244 or view the proposed fireworks event from the nearby hillsides.

Due to the limited size of the proposed 2020 fireworks event, parking and visitor turnover in the town of Keystone and attendance at 4th of July activities in other nearby communities would not be affected. In addition to the limited capacity, the proposed 2020 fireworks event would occur on July 3rd and likely would not conflict with the 13 nearby community fireworks displays in Pennington or Custer County. In 2018, Rapid City and nearby communities hosted fireworks displays on June 28th, July 2nd, and July 4th. The town of Custer hosted Custer's Old Time Country Fourth of July Celebration firework display on July 4th.

Memorial parking garage traffic volume data and daily visitation estimates from July 3, 2019 and a three-year July 3rd average (2017 through 2019) were reviewed to estimate the proportion of visitors that would be impacted by the 3:00 pm public Memorial closing and the impact on Memorial concessions revenue. Visitors to the Memorial include those who arrive in private vehicles or commercial tour buses and visit the Memorial facilities, as well as visitors viewing the granite statues of Washington, Jefferson, Lincoln, and Roosevelt (sculpture) from various locations along SD 244. Based on July 3, 2019 traffic volume data, about 51 percent of the estimated total 20,706 daily visitors arrived on commercial tour buses or visited the sculpture, but did not enter, the Memorial facilities. No data are available to determine the timing of commercial

bus tours and visitors to the Memorial outside of the Memorial facilities. It is assumed that commercial bus tour operators would be aware of and adapt to the 3:00 pm public closure under the preferred alternative, and impacts on Memorial concessions revenue would be minimal. Visitation changes to those viewing the sculpture from SD 244 would not affect Memorial concessions revenue.

The remaining 49 percent of the total 20,706 daily visitors on July 3, 2019 arrived in private vehicles and parked in the visitor parking garage. Based on arrival time data from the parking garage, approximately 75 percent of these visitors arrived at the Memorial before 3:00 pm, with peak visitation (more than 53 percent) occurring between 8:30 am and 1:00 pm. According to the three-year July 3rd average, approximately 12 percent (about 3,500 visitors) of the average total daily visitation would occur after 3:00 pm from visitors arriving in private vehicles and parking in the visitor parking garage. It is anticipated that the proposed fireworks event would allow approximately 2,000 guests into the Memorial after 3:00 pm, a difference of 1,500 fewer visits compared to the three-year July 3rd average.

In summary, the limited size, duration, and parking restrictions of the proposed 2020 fireworks event would substantially reduce the potential impact on Memorial concessions revenue. Keeping the Memorial open to the public until 3:00 pm on July 3rd and efforts to notify the public of the closing would help minimize closure impacts on visitors and Memorial concessioners. Visitors aware of the closure would likely come before 3:00 pm on July 3rd or on a different day during their trip to the area. However, visitors that are unaware of the closure or are only able to visit after 3:00 pm on July 3rd would be affected.

1.3.2 Visitor Experience

Under the preferred alternative, normal operations on July 3rd would continue until approximately 3:00 pm, at which time the Memorial would be closed to non-ticketed visitors. The three-year average July 3rd visitation estimate for arrivals after 3:00 pm suggest that approximately 3,500 visitors parking private vehicles in the Memorial's parking garage would be displaced, plus a small, but unspecified, number of visitors arriving by commercial bus or on foot (see Socioeconomics above). Compared to the approximately 2,000 ticketed visitors attending the proposed fireworks event, approximately 1,500 visitors would be displaced. Compared to total daily visitors (28,000 daily in the three-year average), this is a minor displacement effect. Non-ticketed visitors required to leave the Memorial after 3:00 pm would have other events in nearby communities available to them, or could return to the Memorial on July 4th. Therefore, adverse impacts on the visitor experience would be minimal. In addition, ticketed visitors would have a unique experience viewing fireworks at the Memorial, as would a large television audience.

1.3.3 Percussive Impacts

Concerns about the potential percussive effects of fireworks during the 1998 to 2009 fireworks events led to a study of the structural stability of the sculpture (Poluga et al. 2018). This study examined a variety of rock stability characteristics, including a probabilistic analysis of the sculpture's response to seismic conditions. The study concluded the following:

> The overall slope probabilistic analysis, evaluating the effects of seismic loading on the stability of the entire slopes on which the [Memorial] sculptures are located, indicates that all of the slopes are safe against failure. This study assumes that if the slopes are stable against the earthquake force modeled, the vibrations produced by air blasts from fireworks will not cause failures along the slopes. In light of these

> results, vibrations caused by the Fourth of July fireworks celebrations at [the Memorial] do not pose a threat to the stability.

Based on this finding, the percussive impact of fireworks, and other noise-producing activities, such as a potential military overflight, are assumed to have no impact on the sculpture, and this topic is dismissed from detailed analysis.

1.3.4 Night Skies

Every evening, the Memorial illuminates the sculpture year-round in the immediate area where the fireworks would occur under the preferred alternative. Additional impacts on night skies under the preferred alternative would be negligible and short term (about 15 to 20 minutes). For these reasons, this topic was dismissed from detailed analysis.

1.3.5 Wilderness Character

There is no designated wilderness within the boundaries of the Memorial. While there is a low probability of accidental wildfire affecting designated United States Forest Service (USFS) Wilderness west of the Memorial, these potential effects are analyzed in more detail under the impact topic Wildfire. No planned activities would occur in designated wilderness under the preferred alternative; therefore, no meaningful effects on wilderness or wilderness character are anticipated, and this topic was dismissed from detailed analysis.

1.3.6 Threatened and Endangered Species

The northern long-eared bat (*Myotis septentrionalis*) is listed as threatened under the Endangered Species Act (ESA) and is present at the Memorial. The bat is known to occur in areas within the fallout zone[1], subject to fireworks and aircraft noise, and areas subject to fire risk, as described in Section 3.3, Wildfire (Figure 3). However, wildfire effects are temporary, of low probability, and do not constitute incidental or purposeful take, as defined in the 2016 U.S. Fish and Wildlife Service (USFWS) Programmatic Biological Opinion for the northern long-eared bat (USFWS 2016). No tree removal is planned with regard to preparation of launch sites under the preferred alternative, and hibernating bats would not be affected.

Concurrently with this EA, the NPS consulted with the USFWS under Section 7 of the ESA and received a letter from the USFWS on December 4, 2019 indicating that the proposed fireworks event is consistent with activities analyzed in the northern long-eared bat Programmatic Biological Opinion (USFWS 2016, 2019). The USFWS concurred with the determination that the event may affect the northern long-eared bat, but that any take that may occur as a result is not prohibited under the northern long-eared bat 4(d) rule (USFWS 2019).

The USFWS species list accessed through the Information for Planning and Consultation (IPaC) system on December 4, 2019 (USFWS 2019) indicates that four additional ESA-protected species could occur at the Memorial: the least tern (*Sterna antillarium*), the red knot *(Calidris canutus rufa*), the whooping crane *(Grus americana*), and Leedy's roseroot (*Rhodiola integrifolia* ssp. *Leedyi*).

[1] The fallout zone is where normal or hazardous debris, duds, and other effects from a fireworks display are expected to land, based on the assumption that the sizes, types, and styles of fireworks are chosen correctly for the display site and anticipated weather conditions.

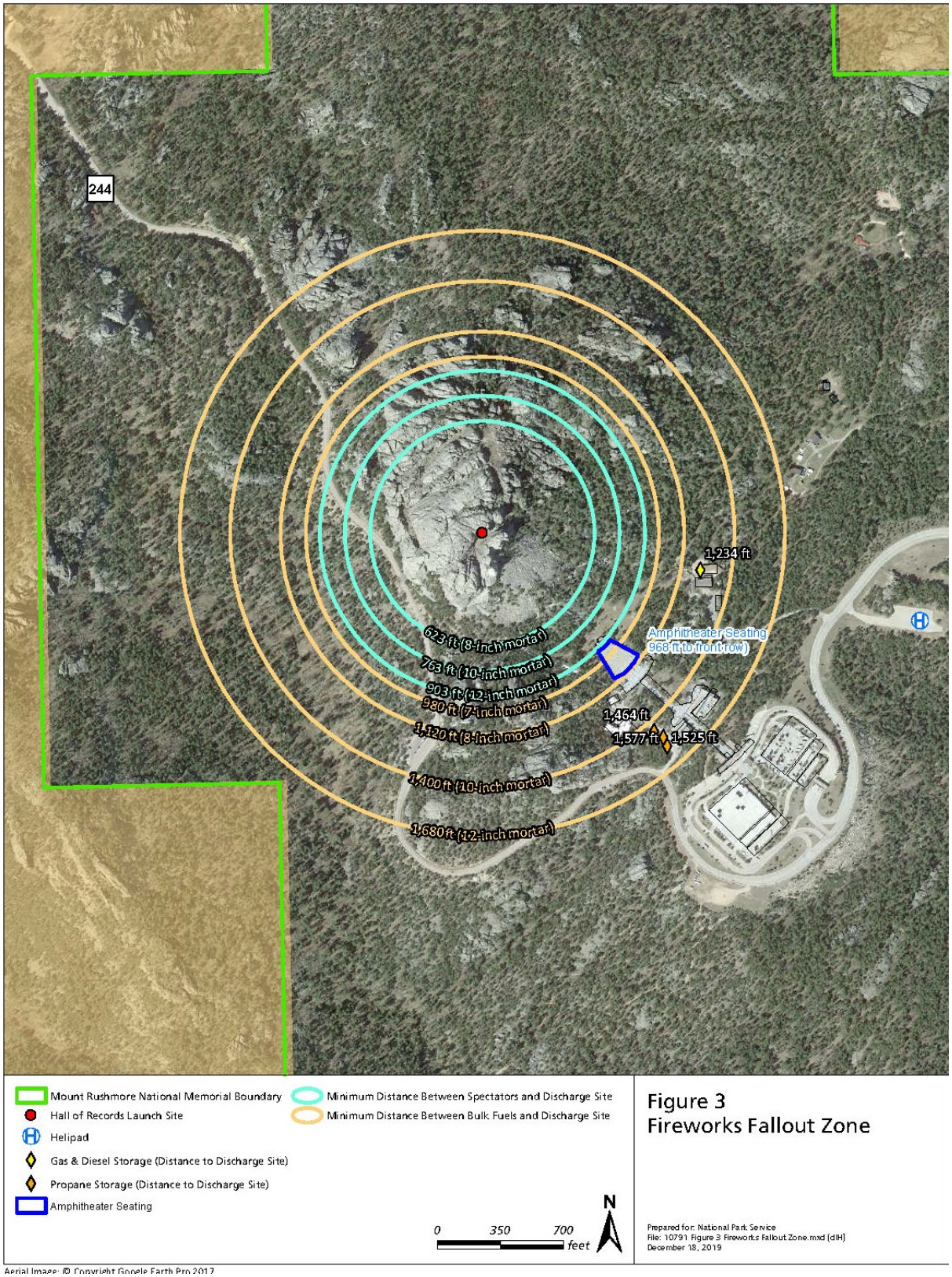


Figure 3. Fireworks Fallout Zone

Surveys for the least tern, red knot, and whooping crane were conducted as part of the Memorial's comprehensive bird inventory (Panjabi 2006), and these species are not known to occur at the Memorial. The red knot and least tern are both shorebirds, and suitable habitat for these species does not occur at the Memorial. The only known wild population of whooping cranes nests in Canada and winters in Texas. Their migration occurs several months after the proposed fireworks event (in the fall), and their migration route is not known to include the Memorial. Leedy's roseroot also is not known to occur at the Memorial (NPS 2002; Marriott and Mayer 2005) and is found only in Minnesota and New York. The NPS has determined that the proposed fireworks event would have no effect on these four listed species. Additionally, the IPaC tool (USFWS 2019) indicated that no critical habitat for any of these species occurs in the project area.

For these reasons, this topic was dismissed from detailed analysis. General effects on wildlife and wildlife habitat are discussed in Section 3.3, Wildfire and Section 3.4, Environmental Contaminants of this EA.

1.3.7 Air Quality

Air quality may be affected by emissions from visitors' vehicles, fireworks contractors, and NPS and event partners before, during, and after the event. These impacts would be no greater than, and possibly less than, normal Memorial operations because of the limited number of visitors on that day. There may be air quality impacts from the potential use of helicopters for event staging and teardown, and by military aircraft from a potential flyover. These impacts would be a negligible addition to regular aircraft traffic in the region. Air quality could also be affected by smoke from the fireworks display; however, these effects are expected to be short-term and negligible. The topic was therefore dismissed from detailed analysis.

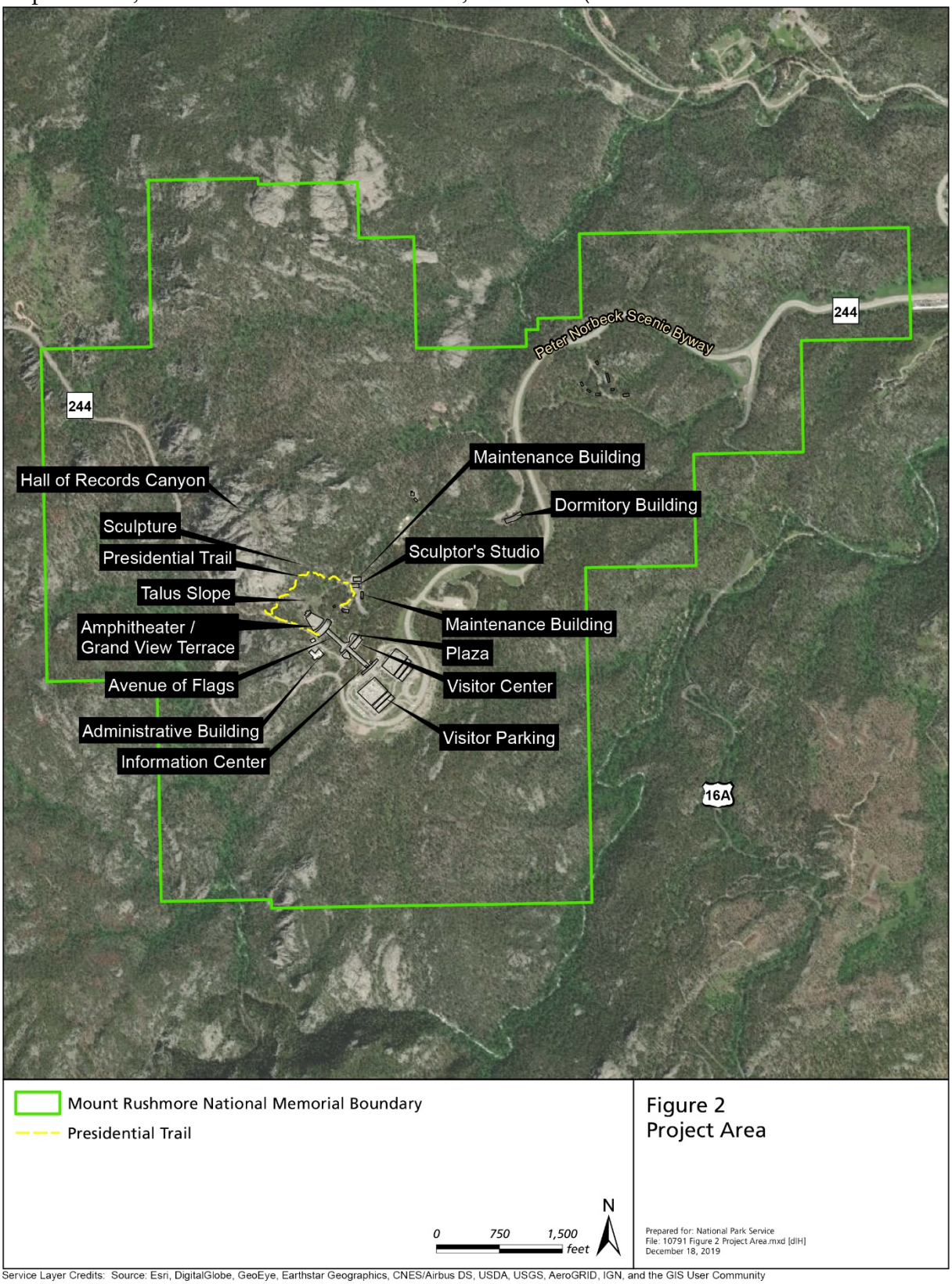
Chapter 2. Alternatives

2.1 Alternative 1 (Proposed Action and Preferred Alternative): Host an Independence Day Fireworks Event on July 3rd for an Amphitheater Audience

2.1.1 Event Operations

Under the preferred alternative, the Memorial would permit and host an Independence Day celebration, including a fireworks display and other acts, on the evening of July 3, 2020, and similar events in subsequent years, if permitted by the Memorial. The ticketed event would accommodate approximately 2,000 visitors. The primary audience seating area would be in the

amphitheater, which can accommodate about 1,800 visitors (



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 2). Some limited additional seating could be used on the Terrace, holding another 200 visitors for a total of about 2,000 visitors. All attending visitors would use the Memorial's garage parking, which holds about 1,100 vehicles. The event also would be filmed and televised the following day to a nationwide broadcast audience.

The state-sponsored fireworks event would include approximately 15 to 20 minutes of fireworks and proximal pyrotechnics display. A military flyover, depending on aircraft availability, may also occur. Other types of performance acts would occur before the fireworks, such as music and reenactments for visitors and viewers. This intermittent amphitheater programming before the fireworks display would not be expected to have measurable environmental impacts. The event is expected to be filmed for viewing audiences, through either live and/or delayed broadcast, using satellite trucks and cameras on-site.

2.1.2 Visitor and Traffic Management

The NPS and South Dakota Highway Patrol, along with other emergency and security partners, would establish a perimeter around the Memorial facilities for event security. The Memorial would be closed to non-ticket holders after 3:00 pm. All vehicles would undergo a security screening at one of two access points to the Memorial: (1) at the SD 244 and Iron Mountain Road intersection, and (2) at the western Memorial boundary along SD 244 or at Horsethief Lake. Ticketed visitors who choose to visit the Memorial before 3:00 pm would be required to exit the Memorial along with other non-ticketed visitors, and to reenter through the security screening locations along with other ticketed visitors.

2.1.3 Event Timing

The following operational schedule (Table 1) is an example of event-day timing.

Table 1. Fireworks Event Timeline.

Time	Activity
5:00 am – 3:00 pm	Normal operations
3:00 pm	All visitors exit Memorial grounds
5:00 pm	Vehicles are restricted on SD 244 and vehicle screening begins; ticketed visitors are allowed to enter once screened
9:00 pm	Main event begins with a welcome speech, national anthem, and sculpture lighting
9:45 pm – 10:00 pm	Fireworks display

2.1.4 Launch Sites and Fireworks Types

NPS hired a third-party contractor to conduct a professional evaluation of potential discharge sites of aerial fireworks and proximate pyrotechnics within the Memorial. Discharge sites were evaluated for compliance with the National Fire Protection Association (NFPA) codes as well as best practices in the design and discharge of fireworks. (Weeth & Associates (Weeth) 2019).

Fireworks are typically considered those used in traditional aerial fireworks displays.

Pyrotechnics are typically considered those used in proximate pyrotechnic performances such as in stadium and theater settings. Pyrotechnics generally produce significantly less smoke and debris than fireworks.

Ground level fireworks include illuminations, "Niagara Falls," line rockets, and similar effects.

Low level aerial fireworks include pyrotechnic shells, comets, fountains, and mines that are 2 inches or less.

Medium level aerial fireworks include aerial shells, comets, mines, and Roman candles that are larger than 2 inches.

High level aerial fireworks include aerial shells 8 inches and larger.

Based on this report, and other resource protection and logistical factors, NPS proposes to allow the discharge of fireworks and/or proximate pyrotechnics at up to three areas: the amphitheater area, the talus slope and Presidential Trail area, and the Hall of Records Canyon area. The use of these discharge areas are subject to the safety limitations identified in the report, and subject to display design by a licensed fireworks operator and operational planning by NPS.

2.1.4.1 Amphitheater Area

The amphitheater seating would be the primary visitor viewing area for the fireworks event. Potential discharge positions in the amphitheater area include the stage and backstage, and areas off the road behind the amphitheater. The stage and backstage area would only be suitable for proximate pyrotechnics, and the amphitheater road position would be suitable for ground level fireworks and pyrotechnics 2 inches or less. Temporary free-standing racks may be required in these locations. Protective blankets or similar fire retardant material at the launch location may also be required to prevent scarring or burning during ignition. The road must remain accessible for emergency egress.

2.1.4.2 Talus Slope and Presidential Trail

A number of potential sites are between the amphitheater area and the base of the talus slope in openings in the tree canopy, which may be suitable for fireworks discharge. The Presidential Trail area is approximately 400 to 500 feet from the amphitheater and 600 feet long with openings at various points in the tree canopy. The talus slope is across the base of the mountain and roughly 500 feet wide and long, and 500 feet from the amphitheater. A number of other tree canopy openings between the amphitheater and talus slope may also be used. All potential launch sites would be suitable for ground level fireworks and some pyrotechnics 2 inches or less. Temporary free-standing racks may be required in these locations. Protective blankets or similar gear may also be required to prevent scarring or burning during ignition.

2.1.4.3 Hall of Records Area

Portions of this area were found to be feasible for the launch of aerial fireworks 2 inches to 5 inches, subject to safety and resource considerations detailed in the NFPA report.

A platform or temporary rack system would likely be required for some types of fireworks at this location. Platforms or racks would be temporary and free-standing; no bolting to the rock or the sculpture would be allowed. Protective blankets or similar fire retardant material may also be required to prevent scarring or burning during ignition.

The logistics of transporting materials to and from this site are considerable; fireworks would need to be hauled to the site by helicopter or ropes teams. Team members handling fireworks material would be required to have the appropriate certifications for fireworks handling.

2.1.5 Setup/Spotting/Cleanup/Fireworks Monitoring

The NPS would work with the fireworks contractor and staff to develop a plan for event staging, igniting, and demobilizing. All launch locations would be closed to public access for a pre-determined time before and after the event, as fireworks are staged and cleaned up. The fireworks contractor would need to deliver and remove the fireworks and other materials using vehicles, packs, and/or other means. At the Hall of Records Canyon area, this may include the use of a helicopter.

As part of the event, the fireworks contractor would assign staff to monitor fireworks for any unexploded shells, spot fires, and other concerns. The NPS would establish a quick response wildland fire team to respond to any unplanned ignitions.

2.1.6 Monitoring of Environmental Contaminants

The NPS is working with the United States Geological Survey (USGS) to conduct additional water quality and soil monitoring at the Memorial. Baseline data would be collected in spring or early summer 2020, prior to the fireworks event, and monitoring would continue after the event(s) on a schedule determined by USGS and NPS staff. This monitoring program would evaluate the event's impacts on levels of potassium perchlorate, and possibly other chemicals or metals in soils and surface water and groundwater, which are typically present in fireworks. This monitoring would supplement groundwater and drinking water testing that currently occurs at the Memorial.

2.1.7 Stipulations and Mitigations

The event would be conditioned on appropriate weather and wildland fire conditions on July 3, 2020. The NPS and partners would develop an incident management team for this event, and create a Go/No-Go checklist to ensure fuel loads are at an acceptable level for wildfire risk, and that the risk of severe weather is acceptable for the event to proceed.

Other stipulations and mitigations for the event would include required certifications for all fireworks contractors and staff; requirements on the size, type, and makeup of the fireworks; the duration of the fireworks; and required cleanup activities after the event (see Appendix B for the current list of mitigations). Additional conditions and mitigations may be required through the NPS permit issued for the event.

2.2 Alternative 2 (No Action Alternative)

Under the no action alternative, no ticketed fireworks event would be scheduled, and the non-ticketed performances and activities the Memorial has hosted from 2010 to 2018 would occur again in 2020. These celebrations have included military bands, presidential reenactments, and a lighting ceremony of the sculpture for an amphitheater audience. (No event was held in 2019 due

to a significant construction project underway at the time.) The Memorial would be open to visitors during regular hours. There are also approximately 13 other fireworks shows and similar events in Pennington and Custer Counties that would continue to draw visitors to the area.

2.3 Alternative Elements Considered but Eliminated from Detailed Study

2.3.1 Hosting the Event on July 4th

The MOA specifies that fireworks will occur on July 3rd, 4th, or 5th. In discussion with South Dakota officials and local area emergency managers, it was determined that July 3, 2020 is the preferred date and that no "rain date" would be scheduled. It was determined that prior commitments precluded assistance with security and emergency response preparation on July 4th, making this event day infeasible. July 3rd was agreed on as feasible to provide the necessary support for the event. Future events would most likely occur on July 3rd.

2.3.2 Larger Event Size or Non-Ticketed Event

Previous fireworks events at the Memorial were not ticketed, but visitors to the event were limited to approximately 8,300 people inside the Memorial, based on an egress capacity provided by the Rapid City Fire Department. Many more people occupied various vantage points outside the Memorial where the fireworks display could be viewed. There were a number of significant concerns associated with hosting this number of visitors, including:

- Capacity was reached typically in early morning, and visitors would spend the entire day exposed to heat and other weather conditions.
- There was no ability to shelter this number of visitors on-site in case of inclement weather or other emergency conditions.
- The capacity of parking areas was exceeded during these events, and vehicles were parked on the side of the road and at further distances from the Memorial facilities. Large numbers of pedestrians walking along the side of the highway delayed the exit of visitors from the Memorial and created unacceptable safety concerns.
- The human waste exceeded the bathroom and wastewater capacity of the Memorial.
- Many visitors, despite being inside the Memorial, did not have a vantage point to view the fireworks display.

In consultation with South Dakota representatives, it was agreed that a ticketed event based on a viewing audience primarily located in the amphitheater would allow for a safe and high-quality event that would not exceed the operational capacity of the Memorial. A larger event was dismissed as unreasonable because it would exceed the operational capacity of the Memorial and would not allow for enjoyment by the public in a manner that ensures safety and resource protection.

2.3.2.1 Alternative Launch Sites

A number of fireworks launch sites were considered as alternatives, evaluated by Weeth (2019), and dismissed from detailed analysis for the reasons listed below.

- Indian Camp – This site is an important cultural resource site, is in a poor location for fireworks viewing relative to the amphitheater audience, is difficult to access for event

preparation, and would require large aerial fireworks with a large fallout area in order to be visible to an amphitheater audience.

- Middle Marker Road/Middle Marker Trail – These sites are located behind the sculpture, requiring the use of larger diameter aerial shell fireworks to be seen by an amphitheater audience. Aerial shells approximately 10 inches or larger would be required and shells of this size would have a greater potential for impacts related to environmental contaminants and wildfire risk. The fallout area from shells fired from this location includes forested areas adjacent to and potentially including the Black Elk Wilderness.
  - As stated in the Weeth report (2019) regarding both Middle Marker sites: "Although the minimum separation distances [from the audience] may provide for larger aerial shells, the other factors at this display site, the differences in elevations between this discharge site and the Amphitheater necessitating using larger diameter aerial shells, the mountainous forest with a heavy fuel load, the likely conditions in early July, the challenges with spotting hazardous debris, the limitations on fire prevention and fire protection measures, and the potential for equipment failures and fireworks malfunctions, firing larger aerial shells pose a significant and unacceptable risk."
- Profile Parking Lot – This site is west of the sculpture. In order for fireworks launched from this location to be visible to an amphitheater audience, approximately 10-inch-diameter aerial shells would be required. Shells of this size would have a greater potential for impacts related to water contaminants and fire risk. The fallout area from shells fired from this location includes forested areas adjacent to and potentially including the Black Elk Wilderness, creating considerable fire risk.

  As stated in the Weeth report (2019): "It is quite likely that any such attempt to fire large diameter shells at such steep angles would result in the shells bursting on or striking the rock formations, the forest, the carvings, and possibly even into the Amphitheater and surrounding areas with buildings and spectators. Any aerial fireworks 8 inches or larger that burst low or on the ground would likely result in starting a wildland fire in a multitude of locations over many hundreds of feet wide."
- Sculpture – The Weeth report (2019) noted that some types of fireworks could be suspended from the sculpture or edges of the sculpture. Using these sites would require unacceptable risks to contractors' safety and risk damage to the sculpture, which is the primary cultural resource identified in the Memorial's enabling legislation. Past experience shows that fireworks ignited in contact with the sculptures can cause visible rock scarring.

2.3.2.2 Laser Light Show

The Memorial hosted a laser light show in 2002. However, this event was not deemed to be successful because the Memorial is located at the end of the power grid line, resulting in power fluctuations from 98 to 120 volts. Laser lights require consistent power for a vivid display. In addition, the MOA specifies that the NPS and the state of South Dakota will work to return fireworks displays to the Memorial. A laser light show could become part of the event in the future, but was dismissed because it is infeasible due to power limitations and fails to meet the need for taking action.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter describes the resources or conditions potentially impacted by the preferred alternative and no action alternative. This chapter is organized by issues that were identified during internal scoping and from previous fireworks displays.

This section describes the current conditions and analyzes the potential environmental consequences that would occur as a result of implementing the preferred alternative or no action alternative. Cumulative impacts are analyzed for each issue topic below.

3.2 Cumulative Impacts

Cumulative impacts are defined as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 Code of Federal Regulations 1508.7). Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. The Council on Environmental Quality regulations that implement NEPA require assessment of cumulative impacts in the decision-making process for federal projects.

The geographic scope of the analysis includes actions in the project area as well as other actions in the Memorial or surrounding lands, including the Black Hills National Forest, where overlapping resource impacts are possible. The temporal scope includes actions within a range of approximately 10 years.

3.2.1 Past, Present, and Reasonably Foreseeable Future Actions

The following past, present, and reasonably foreseeable future actions are considered in the cumulative impacts analysis and are based on actions developed during internal scoping.

3.2.1.1 Past and Present Actions

3.2.1.1.1 Previous Fireworks Displays

Previous fireworks displays at the Memorial were held from 1998 through 2001 and 2003 to 2009. No fireworks displays occurred after 2009 due to extreme fire danger from mountain pine beetle (MPB) kill in the region, as well as fireworks operator safety concerns and visitor experience issues. Previous displays resulted in permanent effects on the sculpture (burn marks on the tops of the "heads"), unexploded ordnance and debris remaining in the forests within and surrounding the Memorial, and various operational challenges for Memorial staff. Attendance at previous events overwhelmed parking, viewing, and sanitary facilities. The effects of past displays on water and soil quality are discussed in Section 3.4, Environmental Contaminants.

3.2.1.1.2 Previous Wildfires in or Near the Memorial

A significant wildfire has not occurred in the area within and surrounding the Memorial in more than a century. Most wildfires have been suppressed (see Section 3.3, Wildfire), resulting in an abundance of litter and heavy fuels in the surrounding forests. Previous fireworks displays resulted in 21 wildfire ignitions, which were quickly suppressed for safety and structural protection purposes. While the Memorial has recently developed a Prescribed Fire Plan for the Presidential and Xanterra burn units (NPS 2019), recent wet conditions have not allowed for prescribed burns in 2019. The Memorial has conducted fuel removal to protect existing utility lines for a prescribed burn.

3.2.1.1.3 Forest Management Actions – Forest Thinning, Prescribed Burns, and MPB Mitigation Measures

Although the Memorial has engaged in mechanized tree thinning, chipping, and removal efforts and recently developed a Prescribed Fire Plan (NPS 2019) for two burn units, these efforts at the Memorial have not changed the overall environment for wildfire risk. The risk of wildfire is dependent on weather, precipitation, wind, and other environmental factors at the time of the fireworks event. Wildfire risk is also dependent on the Memorial's ability to reduce fuel loading prior to the event through prescribed fire, pile burning, or other forest management actions. Recent wet conditions have not been conducive for prescribed fire; however, there could be an opportunity in late winter 2019 or spring 2020. Some limited pile burning occurred in 2019 north of the sculpture, and pile burning is planned for winter. Similar actions would continue in 2020 as conditions allow, prior to the event.

3.2.1.2 Reasonably Foreseeable Future Actions

3.2.1.2.1 Memorial Fireworks Displays

Although future fireworks displays have not been specifically planned or earmarked in NPS funding, future fireworks displays (beyond 2020) are assumed for the purposes of this analysis, and would be similar in nature to the preferred alternative for this EA.

The analysis area for this EA differs by resource topic and, in some cases, extends beyond the project area, such as the analysis area for wildfire risk. This is because of the nature of wildfire and the potential for fire to spread once ignited. The analysis area is indicated for each impact topic below.

3.3 Wildfire

3.3.1 Current General Conditions – Wildfire Risk

The analysis area for wildfire risk includes the 1,278-acre Memorial, eastern portions of the 13,426-acre Black Elk Wilderness contiguous to the Memorial, northeast portions of the contiguous 35,000-acre Norbeck Wildlife Preserve, and private lands in the vicinity of Keystone, South Dakota.

For the purposes of the wildfire risk analysis, impacts of wildfire on vegetation, fish and wildlife, soils, and cultural resources are included in this section due to the nature of wildfire and its potential to affect these resources. See also Section 3.4, Environmental Contaminants for an analysis of project impacts on wildlife and Section 3.6, Cultural Resources for an analysis of project impacts on cultural resources.

3.3.1.1 Vegetation

The Memorial is in the Black Hills Plateau ecoregion, which consists of a mixture of warm, dry pine forest and mixed grasslands (Shepperd and Battaglia 2002; Graham et al. 2016). Dominant tree species include ponderosa pine (*Pinus ponderosa*), while white spruce (*Picea glauca*), paper birch (*Betua papyrifera*), aspen (*Populus tremuloides*), and bur oak (*Quercus macrocarpa*) occupy cool, moist areas along the fringes of meadows and open areas. Dominant understory species include graminoids such as Richardson's sedge (*Carex richardsonii*), Ross's sedge (*C. rossii*), and poverty oatgrass (*Danthonia spicata*), and shrubs such as common juniper (*Juniperus communis*) and kinnikinnick (*Arctostaphylos uva-ursi*) (Narumalani et al. 2009).

Ponderosa pine dominates the forested area and is a fire-adapted species (Arno 2000), evolving to be dependent on frequent low-intensity fires to control seedlings, reduce forest floor debris, and recycle forest nutrients. Historically, fire was the most important ecological process that shaped the composition and structure of plant communities in the Black Hills. These plant communities evolved with frequent wildfire, and are often dependent on fire for overall health. The historical fire regime at Mount Rushmore (1529-1893) would be characterized as frequent (fires every 2 to 20 years) low-severity surface fires with occasional patches (less than 100 hectares) of passive crown fire (Brown et al. 2000). The Memorial contains the second largest area of old growth ponderosa pine forest in the Black Hills, covering 66 percent of the Memorial (Symstad and Bynum 2007).

Ponderosa pine is highly flammable and burns with great intensity and severity in the summer season in a typical dry year (2000, 2002, 2007, and 2012). Fire intensity is the energy output from a fire, whereas fire severity is the effect of the fire on the biological system, for example, organic matter loss in the vegetation and substrate, crown scorch, or alteration of soil properties.

3.3.1.2 Fish and Aquatic Invertebrates

Fish species expected to occur at the Memorial include longnose dace (*Rhinichthys cataractae*), white sucker (*Catostomus commersonii*), mountain sucker (*C. platyrhynchus*), common carp (*Cyprinus carpio*), and brook trout (*Salvelinus fontinalis*) (White et al. 2002). Fish surveys in 2002 documented brook trout and longnose dace in Grizzly Bear Creek and brook trout in Beaver Dam Creek in Starling Basin. No fish were found in the small unnamed stream in Lafferty Gulch, although brook trout habitat is present (White et al. 2002). While brook trout individuals could be present in Lafferty Gulch, it is unlikely due to the ephemeral nature of the stream. Lafferty Gulch flows into Battle Creek, which is part of the Middle Cheyenne Spring Creek watershed. This watershed contains seventeen fish species, including some species that are not native to the region (Narumalani et al. 2009).

Aquatic invertebrates found in streams in the Memorial include mayflies (order Ephemeroptera), stoneflies (order Plecoptera), caddisflies (order Trichoptera), dragonflies and damselflies (order Odonata), and true flies (order Diptera) (Rust 2006). Surveys of aquatic invertebrates in the Memorial in 2006 found Grizzly Creek had the highest quality habitat and highest diversity of aquatic invertebrates of the streams in the Memorial, while the small unnamed stream in Lafferty Gulch had the lowest diversity (Rust 2006).

3.3.1.3 Wildlife

A variety of wildlife inhabit the forests and grasslands of the Memorial including ungulates, small mammals, birds, reptiles, amphibians, and invertebrates. Common mammal species include mule deer (*Odocoileus hemionus*), American red squirrel (*Tamiasciurus hudsonicus*), least chipmunk

(*Tamias minimus*), mountain goat (*Oreamnos americanus*), and yellow-bellied marmot (*Marmota flaviventrus*). Common bird species at the Memorial include American robin (*Turdus migratorius*), black-capped chickadee (*Poecile atricapillus*), chipping sparrow (*Spizella passerina*), dark-eyed junco (*Junco hyemalis*), mourning dove (*Zenaida macroura*), and many others. Amphibians found at the Memorial include chorus (*Pseudacris triseriata*) and northern leopard (*Lithobates pipiens*) frogs. Eleven bat species have been detected at the Memorial including northern long-eared bat (*Myotis septentrionalis*), particularly in Starling Basin where a diverse habitat encourages a wide range of bats.

For a discussion of threatened and endangered species at the Memorial, see the Issues Dismissed from Detailed Analysis section in Chapter 1.

3.3.1.4 Soils

The parent material for soils in the central Black Hills is generally granite or mica schist. Granite is very hard and breaks down slowly through decomposition. Mica schist is a softer metamorphic rock that breaks down more readily and creates well-drained soils. This type of soil is ideal for ponderosa seedlings. In many areas, the bedrock beneath the soil is deeply fractured. Joints and fissures in this rock fill with water that has passed through the soil, and are an important source of water for ponderosa pine root systems (NPS 2016).

While parent material gives soil its original properties, climate and plant life can also influence it. The climate of the Black Hills is cold and dry (although the ponderosa pine forest is warm and dry compared to cool, moist arboreal forests of Canada). In such a climate dead plant material, or detritus, decomposes slowly and nutrients take longer to return to the soil. Pine needles with their thick, waxy coating take even longer to break down, often resulting in a thick layer on the ground. When water from rain and melting snow pass through this layer, humic acid is formed, resulting in a slight decrease in soil pH. Minerals, particularly aluminum and iron, are removed from the soil by growing ponderosa pines, making the soil more and more acidic over time. With the exception of pine seedlings, the acidic soil prevents understory plants from getting a start. Young ponderosa seedlings are able to tolerate the acidic soil and to outcompete other plant life. The Black Hills region experiences the single most prolific ponderosa pine regeneration in the world, with aggressive seedlings quickly taking over open areas following overstory mortality including wildfires if seed sources survive (Wright and Bailey 1982, Arno 2000).

Major soils in the Memorial are Marshbrook and Cordeston (NPS 2008). Marshbrook soils are subject to soil compaction and rutting from operation of heavy equipment. The very steep side slopes have a high erosion potential when disturbed. Erosion-control measures are needed to reduce erosion and stream sedimentation. Area soils are dominated by decomposing granite. Hydrophobicity likely follows a wildfire in coarse soils. Four factors commonly influence the formation of a hydrophobic layer. These include a thick layer of plant litter prior to the fire, high-intensity surface and crown fires, prolonged periods of intense heat, and coarse-textured soils. Very high temperatures are required to produce the gas that penetrates the soil and forms a hydrophobic layer. The gas is forced into the soil by the heat of the fire. Soils that have large pores, such as sandy soils and decomposing granite, are more susceptible to the formation of hydrophobic layers because the soils transmit heat more readily than heavy, textured soils, such as clay. The coarse-textured soils also have larger pores that allow deeper penetration of the gas. The high concentrations of chipped material in the duff and dead and down trees from the MPB (*Dendroctonus ponderosae*) epidemic may influence soil effects by prolonged heating as fire residence times over Marshbrook and Cordeston soils could negatively impact soils and contribute to erosion in the short term (NPS 2008).

On the other hand, decomposing granite and underlying granite are not especially susceptible to chemical or physical changes due to heating from fires on the surface, even hot fires with a long, sustained residence time over a given area of ground.

3.3.1.5 Cultural Resources

For a description of the affected environment for cultural resources, see Section 3.6, Cultural Resources.

3.3.1.6 Wildfire Risk Factors

Wildfire risk throughout the analysis area has greatly increased over the years as a result of numerous factors. Over the past 100 years, interference with natural fire regimes and aggressive fire suppression in dry forests throughout the western United States, including those in the Memorial, have resulted in substantial changes in forest structure, density, composition, and function (Arno 2000; Shepperd and Battaglia 2002; Graham et al. 2016). These changes include increased tree density, closed crowns, increased forest floor duff and debris depth, and an increase in heavy fuels on the ground in the form of dead trees and limbs. Fuel loading overall has been measured at up to 30 tons per acre—three times the historical loading for the Memorial—and is a direct contributor to fire size and severity (Narumalani et al. 2009). Forest changes can also occur from fuel treatments such as chipping, limbing, chunking, and pruning.

As a result of fire suppression, many stands have dense thickets of small trees and have experienced insect infestations and disease epidemics. The most recent infestation of MPB began on the north side of the Black Hills near Sturgis, South Dakota in 1996 and ended near the Custer, South Dakota area in 2016. MPB was exacerbated by a robust pine engraver beetle (*Ips pini*) infestation beginning in 2009 that has affected the area over several years, particularly in younger and denser thickets of trees.

The NPS response to the MPB and pine engraver beetle infestation has been aggressive. Foresters identified infested trees, which were then either cut and hauled out by helicopter, cut and chipped in place, or piled and burned. The NPS sprayed living trees in developed areas with carbaryl to prevent further tree mortality. As a result of the chipping treatments used to combat the MPB infestation, the amount of duff on the forest floor increased. This increase in duff, in some places 3 feet deep, can greatly exacerbate the severity of a fire by causing hydrophobic conditions in coarser soils, including decomposed granite, and by depleting organic material and seed sources.

Fuel loading in the analysis area ranges from light to heavy, with 8 to 30 tons per acre throughout (Narumalani et al. 2009). Fuel loading is generally three times heavier than historic levels. As a result of the MPB infestation, tree mortality in the Memorial, the Black Elk Wilderness, and the Norbeck Wildlife Preserve was severe. This tree mortality greatly increased the fuel loading by restructuring the forests, from live aerial fuels to dead and down fuels. The Black Elk Wilderness consists mostly of older and mature pine trees. Where there are no granite formations, the canopy is generally closed with pine seedlings proliferating in open areas. Live and dead fuel loading is high.

Like the Black Elk Wilderness, the Norbeck Wildlife Preserve is predominantly old growth and mature timber with thickets of younger trees in the understory. The terrain in both the Black Elk Wilderness and the Norbeck Wildlife Preserve consists of domed granite structures, broken granite formations, steep gullies and channels, and broken and undulating terrain that is either fireproof or especially resistant to fire suppression activities. In areas where the forest canopy

opened in the wake of the tree mortality, new seedlings and shrubs proliferated on the ground and added to the "ladder" fuels effect that provide continuous fire material from the forest floor to the crowns of the trees.

The high fuel loading and potential for ladder fuels in the analysis area increase the risk of a stand-replacing fire, which is defined as a fire that consumes approximately 80 percent or more of the aboveground dominant vegetation (Arno 2000).

A significant wildfire has not occurred in the analysis area in more than a century. The Battle Creek Fire in 2002 and the Mount Rushmore 1 Fire in 2006 are the most proximate and recent large fires. The Battle Creek Fire in particular burned at high intensity and high severity. Pre-fire conditions have not returned 17 years later, although pine seedlings are beginning to occupy burned slopes. Because of the lack of significant wildfires in the analysis area, an escaped wildfire at the Memorial would be expected to profoundly change the vegetative structure of the Memorial's forests, resulting in stand replacement across much of the area and the loss of many, if not most, of the mature trees and much of the pine reproduction. While such a fire would not be expected to affect the sculpture, it would certainly affect current visual management expectations by reducing mature pine trees and cleaning out the often overly dense understory.

3.3.1.6.1 Fire Mitigation Activities

Ecological restoration and fuel reduction programs attempt to approximate conditions before successful fire suppression efforts by reducing tree densities and hazardous fuels, and reintroducing fire to fire-deficit landscapes. It is widely understood that treatments including mechanized tree thinning and prescribed fire can help restore more resilient forest conditions.

Recent efforts at the Memorial have greatly reduced the potential for passive and active crown fire by increasing crown base heights, but the overall risk for wildfires is still high. These efforts include thinning, chipping, and tree removal. Figure 4 below illustrates that previous fuel reduction treatments have improved the standing fuel load but have also left heavy fuel loading in the form of chipped material and downed and dead material.

While efforts have been widespread, the net effect has not changed wildfire risk since surface fuel loading has continued to increase yearly with more than 100 years of fire suppression at the Memorial. A prescribed fire would lessen the risk of damaging wildfire across the Memorial (Arno 2000;). While the Memorial recently completed a Prescribed Fire Plan (NPS 2019) for two burn units in preparation for the proposed fireworks display, recent wet conditions have not allowed for implementation of the plan. The condition of the regional forest communities and lack of natural or prescribed fires at the Memorial are the greatest contributors to overall wildfire risk.

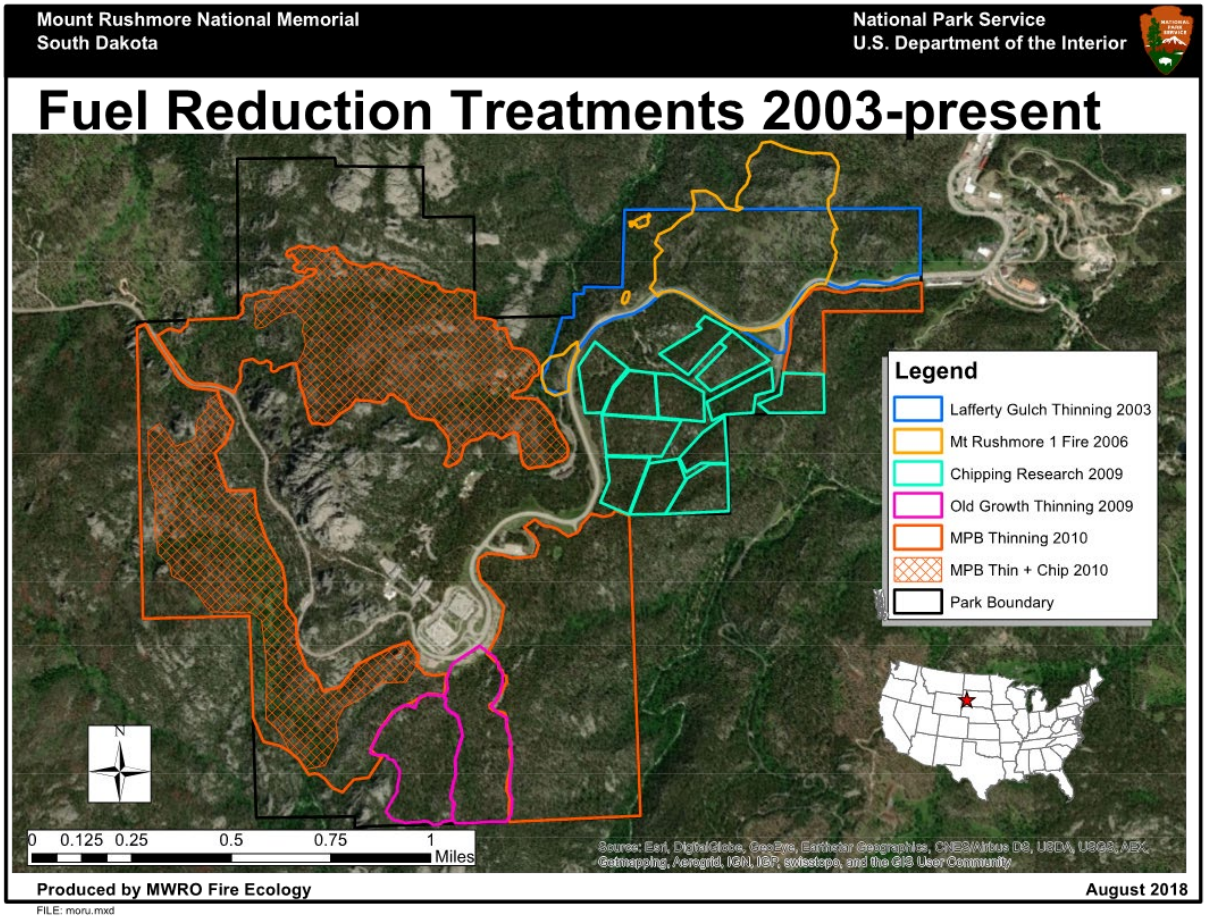


Figure 4. Fuel Reduction Treatment 2003 to Present

3.3.1.6.2 Emergency Preparedness

The USFS, NPS, other Department of the Interior agencies, and tribes, along with local and state agencies, including Custer and Pennington Counties and the South Dakota Division of Wildland Fire Suppression, participate in annual wildfire exercises involving the wilderness and the Memorial. The exercises are held because of the potential catastrophic impacts of a wildfire that could escape control efforts and burn to the top of Black Elk Peak, overwhelm Keystone, or run across the basin to Hill City. Due to the presence of the Memorial, Black Elk Wilderness, Norbeck Wildlife Preserve, and intermingled private property in the analysis area, the risk of severe wildfire damage is high. As a result, fires are managed with a full suppression objective, and prescribed fire has not been used as a management tool in the past to meet natural resource objectives. All wildfires are fought aggressively and extinguished as quickly as possible.

Fire response services in the area are robust, highly trained, and skilled. Interagency partners train together, fight fire together, and offer mutual aid and support through a number of memoranda of understanding and interagency agreements. These fire response resources are served by the Northern Great Plains Interagency Dispatch Center with the ability to shift resources, including people and equipment, to high-risk areas and active fires without regard to agency sponsorship. Additionally, dispatchers can call on fire response services in four states for response within 24

hours, and nationally within 72 hours. Other air assets, including heavy and very heavy air tankers, are available to respond based on priorities including the political sensitivity and cultural importance of resources threatened by a given fire. The Memorial and surrounding area would be a high priority for local, regional, and national fire control resources.

3.3.2 Impacts of Wildfire Risk in Alternative 1

3.3.2.1 Determining the Scope of the Analysis

For the purposes of this fire impacts analysis, the Wildland Fire Decision Support System (WFDSS), an integrated computer model (model), was used, which was developed for use in fighting modern wildfires to approximate where a wildfire would burn if it escaped initial attack (see Appendix A for a discussion of the model and outputs). The model exercise helped to determine specific areas to assess impacts and outcomes that could realistically occur in various weather conditions. The model was used to simulate fires resulting from the fireworks displays in three representative years: a dry year in 2012, a normal precipitation year in 2013, and a wet year in 2018. The model was used to look at weather analysis and fire behavior prediction tools that provide information on fire season duration, fire size probabilities, fire spread paths and short-term arrival times, fire danger forecasts, and economic impact assessments (Pence and Zimmerman 2011). The model helps answer common questions about wildfires and helps decision makers understand what to expect from an escaped wildfire. The model helped to identify the wildfire analysis area for analyzing the impacts of wildfire for Alternative 1 (the preferred alternative) and assess the potential wildfire risks and impacts as a result of the preferred alternative.

3.3.2.2 Potential Magnitude of Wildfire from Alternative 1

Figure 5 illustrates the potential escaped fire area from an ignition in Starling Basin on July 3rd in a dry year resulting from mortar shrapnel or unexploded ordnance in the fallout zone. Figure 3 is a gross model depiction of relative fire sizes and is for illustration only. Maps of the analysis area are available in Chapter 1, Introduction of this EA.

The results of the model reveal a low probability of a high-consequence wildfire event, and high probability of a low-consequence wildfire event. In other words, the chances of a major wildfire burning over the top of Keystone, South Dakota or Horsethief Campground would be quite low—less than 0.02 percent, while the chances of a more modest wildfire are much higher—in excess of 60 percent. The most likely wildfire scenario would be confined entirely to the Memorial. The model shows likely containment of any unplanned fire in the immediate vicinity of the fireworks fallout zone. This is consistent with the successful containment of small wildfires in previous years that resulted from fireworks displays.

There is a very slight chance (0.02 percent) that an unplanned fire would exceed local emergency services capacity and burn through to Keystone, burn into the Black Elk Wilderness, burn south into Custer State Park, or burn northwest toward Horsethief Campground and Old Hill City Road. Fires would only reach the extent shown in the model if no fire suppression action occurred. Firefighters would aggressively fight any fire resulting from the fireworks show.

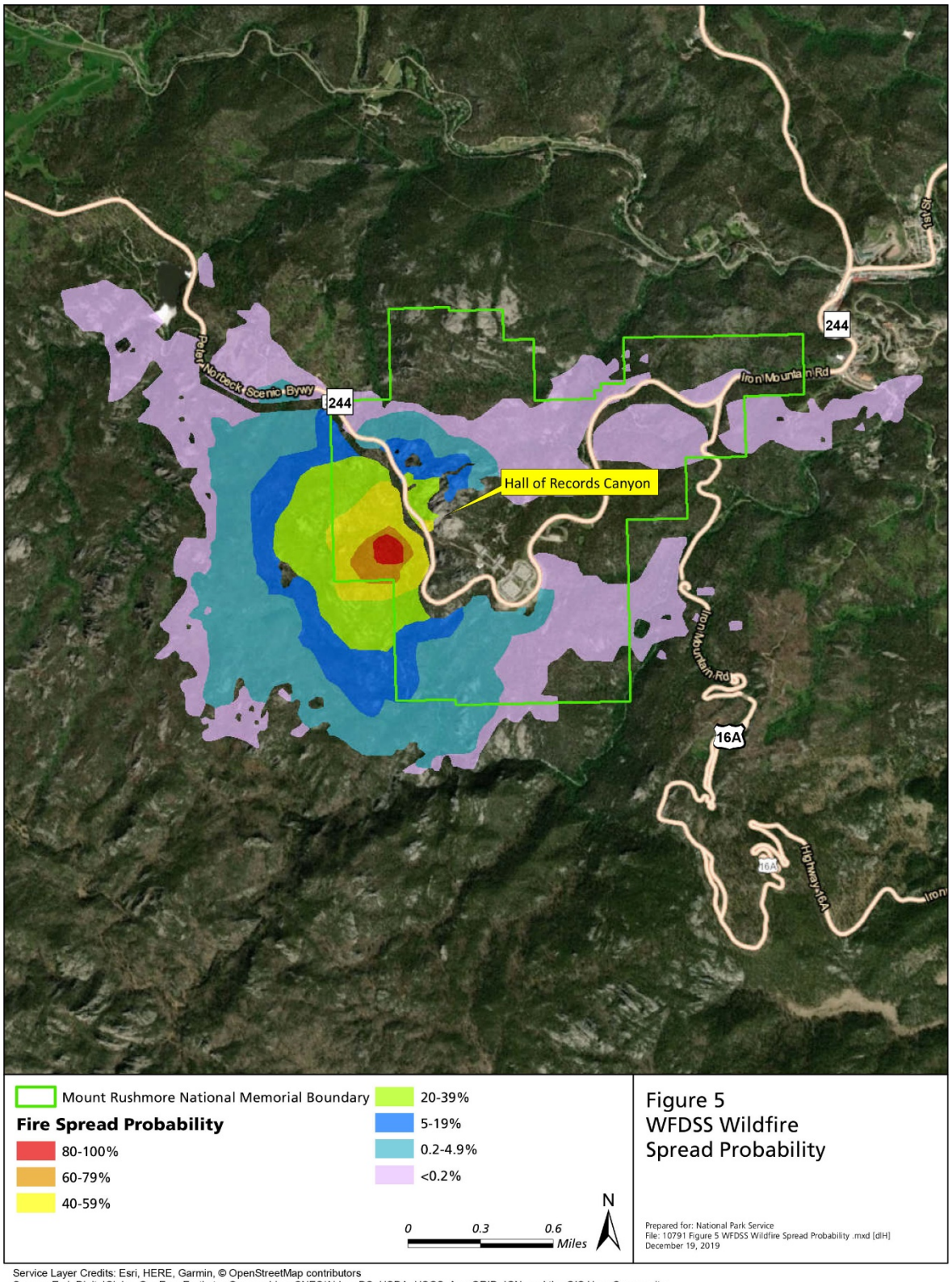


Figure 5. WFDSS Wildfire Spread Probability.

Source: Alan Stover, NPS, AFMO

3.3.2.3 Impact Scenarios – Escaped Fire on July 3rd

The model roughly portrays the expected size of an escaped wildfire on July 3rd in one of three climatic years: a normal year, a wet year, and a dry year. The model simulates 2,000 fires in each year using slightly changed parameters for each fire to establish the probable footprint of a single escaped fire in a given year.

3.3.2.3.1 Normal Year

In a normal year, escaped fires would be unlikely. Firefighters on hand during the fireworks displays would be able to quickly engage and extinguish any fire starts, limiting fire sizes and duration to the evening and possibly the next day following the fireworks. In this scenario, fire would be limited to local effects in the area of ignition plus impacts from fire suppression activities such as building a fireline, cutting trees to deny the fire-available fuel, and using aircraft to deliver water and fire retardant to the fire. The total of these effects would be expected to be localized and minimal, as witnessed in previous years.

3.3.2.3.2 Wet Year

In a wet year, the likelihood of an escaped fire is more remote than a normal year. Wet and dry fuel moisture levels, low temperatures, high relative humidities, and fire suppression efforts by firefighters would quickly extinguish any foreseeable fire ignitions.

3.3.2.3.3 Dry Year

A wildfire in a dry year would be more likely to result in a high-consequence fire burning outside the boundaries of the Memorial and into the town of Keystone, South Dakota, up the northeast aspect of Black Elk Peak, or into the basin near Horsethief Lake. This outcome would be expected to take place over three days or longer. It is not expected that this event would occur, as management action points would be built into a Go/No-Go decision matrix for the fireworks event. The Go/No-Go decision matrix would preclude fireworks when fuel moistures, air temperatures, energy release component (based on changes in moisture content of the various fuels present - both live and dead), and other indicators would cause the NPS, incident command team, or the state (the permittee) to call off the fireworks display.

3.3.2.3.4 Vegetation Impacts

Wildfire acts as a "release" agent, thinning remaining trees, opening the canopy, encouraging growth of surviving trees, and stimulating new growth of understory vegetation. However, wildfires may also have unintended impacts such as killing large old growth trees and creating conditions suitable for encouraging noxious weeds, native and nonnative.

Most of the understory species within the analysis area are fire tolerant. A wildfire in July in a dry year would severely harm warm season vegetation species and favor cool season species such as Kentucky bluegrass (a naturalized species). In general, the post-fire succession of species would manifest as grasses and sedges, moving to shrubs, then to aspen and birch, and finally to ponderosa pine. Because ponderosa pine is so aggressive and opportunistic, the species quickly dominates even severely burned areas at the elevations and in conditions found at the Memorial, except in very severe wildfires where seed sources are destroyed.

Surface water quantities increased by 12 percent for several years following the 1990 Cicero Peak fire in one study in Custer State Park (Neary et al. 2008). Abundant water, atypical for dry ponderosa pine forests, coupled with increased nutrients, means that living trees that survive a fire are stronger, healthier, and more vigorous. Fire-weakened trees remain a target for MPB for

several years following a fire. The 60,000-acre Oil Creek Fire in the Western Black Hills resulted in a total post-fire mortality from MPB of less than 200 mature trees (Carroll 2016).

A fire occurring within the model parameters would have environmental consequences, but flora in general would recover well over several years. Even following a severe fire, the overall impacts would not be expected to cause a major change in vegetation communities. There are several reasons for this, but primarily the broken nature of the terrain and the resulting discrete islands of trees among the granite formations throughout the Memorial would ensure some continuity for seed sources following a fire.

3.3.2.3.5 Fish, Aquatic Invertebrates, and Wildlife

Fires affect fish and wildlife mainly through impacts on their habitat. Fires often cause short-term increases in food that contribute to increases in populations of some animals (Graham et al. 2016). Recovering grasses and shrubs greatly increase forage which, in turn, favors grazers like deer and elk, leading to proportionate increases in cougar and coyote populations. The increased visibility in the fire area allows raptors to better see and hunt prey more effectively. Woodpecker species thrive as they forage for insects that help wood decompose. These increases depend on the animals' ability to thrive in the altered, often simplified, habitat. The extent of fire impacts on animal communities generally depends on the extent of change in habitat structure and species composition. Stand-replacement fires usually cause greater changes in the vegetation communities of forests than in those of grasslands. Within forests, stand-replacement fires usually alter the wildlife community more dramatically than understory fires. Fires that leave standing or downed dead trees and patches of early successional plants provide important habitat for a range of wildlife species.

Fires generally kill or injure a small proportion of wildlife populations. Small mammals with limited mobility living aboveground appear to be most vulnerable to fire-caused injury and mortality, but occasionally even large mammals are killed by fire. Because mortality rates of mammals are low, direct fire-caused mortality has little influence on populations of these species as a whole. The ability of mammals to survive fire depends on their mobility and on the uniformity, severity, size, and duration of the fire. Most small mammals avoid fire by using underground tunnel systems, whereas large mammals must find a safe location in unburned patches or outside the burn. Rabbits, harvest mice, and woodrats (dusky-footed, desert, and white-throated) are more vulnerable to fire-caused mortality than deeper-nesting species, especially because their nests are constructed of dry flammable materials. Woodrats are particularly susceptible to fire mortality because of their reluctance to leave their houses even when a fire is actively burning (Wright and Bailey 1982; Arno 2000; Shepperd and Battaglia 2002; Graham et al. 2016). Many bat species roost under the bark of snags or live trees and are able to escape fire through flight. Bat species of the Northern Great Plains rear their pups in June and July (including during the Memorial's Independence Day event), and pups may not be able to escape in the event of a wildfire.

Fire-caused bird mortality depends on the season, uniformity, and severity of burning. Mortality of adult songbirds is rare, but mortality of nestlings and fledglings does occur. Nest destruction and mortality of young have been reported for several ground-nesting species. Wild turkeys rarely re-nest if their nests are destroyed after two to three weeks of incubation. For this reason, many biologists consider turkeys more vulnerable to fire. Underground nests are likely safe from most fires. In forested areas, fire impacts on birds depend largely on fire severity. The young of ground-nesting birds in low vegetation are vulnerable even to understory fire during the nesting season.

Species nesting in the canopy could be injured by intense surface and/or crown fires, but these types of fire are more common in late summer than during the early nesting season.

There are few reports of fire-caused injury to herpetofauna, even though many of these animals, particularly amphibians, have limited mobility. The vulnerability of snakes to fire may increase while they are in ecdysis (the process of shedding skin). Species in ecosystems that no longer experience high-frequency, low-severity fires may not be adapted to avoid fire.

The vulnerability of insects and other invertebrates to fire depends on their location at the time of the fire. While adults can burrow or fly to escape injury, species with immobile life stages that occur in surface litter or aboveground plants are more vulnerable. However, aboveground microsites, such as the unburned center of a grass clump, can provide protection.

In general, fire impacts on wildlife under any of the model scenarios would be minimal and limited to changes in wildlife habitat in the analysis area. A low-consequence wildfire would have localized impacts on wildlife habitat and would not likely result in the death of individual species in the analysis area. The surrounding forest lands and prairies would provide retreat habitat for individual species, and most wildlife species would quickly repopulate the fire area as plant regrowth occurs following a fire.

3.3.2.3.6 Soils

Localized hydrophobicity would be expected from a severe wildfire in the analysis area. Wildlife walking on the surface, rainfall, and wind-driven pruning of trees would break up the hydrophobic soil, reestablishing normal hydrologic function. Long-term impacts resulting from wildfire would be insignificant due to the dominance of the granitic soils and rock formations throughout much of the Memorial. No long-lasting impacts were observed in soils in previous area fires (pers. obser. F. Carroll 2019).

The Battle Creek Fire occurred northwest of the Memorial (2002), and the Cicero Fire (1990) and the Galena Fire (1998) occurred southeast of the Memorial. Though these were stand-replacing, high-severity, and high-intensity wildfires, the most notable fire impacts were limited to vegetation. No long-lasting impacts were observed in soils, and hydrophobicity was short term.

3.3.2.3.7 Water Quality

Wildfire impacts on water quality result from increased erosion from burned areas and resulting increases in sedimentation. Small escaped wildfires would not likely affect water quality in the drainage basins at the Memorial, or the larger watershed. A larger escaped fire could affect the water quality of local water supplies and systems including streams, local reservoirs and treatment plants. In a study published in May 2016, USGS scientists noted the presence of multiple trace metals in post-fire storm water. They discovered elevated levels of iron, lead, nickel, and zinc in the streams and traced the contaminants back to a nearby wildfire (USGS 2016a). In general, changes in the magnitude and timing of snowmelt runoff influence when water supply reservoirs are filled. Large fires can increase sediment loading of water supply reservoirs, shorten reservoir lifetime, and increase maintenance costs. Fires increase nutrient loading of streams with dissolved organic carbon, major ions, and metals. Post-fire erosion and transport of sediment and debris to downstream water treatment plants, water supply reservoirs, and aquatic ecosystems could occur. Increased turbidity (cloudiness caused by suspended material) or heightened iron and manganese concentrations may increase chemical treatment requirements and produce larger volumes of sludge, both of which would raise operating costs. Changes in source water chemistry can alter drinking water treatment requirements (USGS 2016a).

There would be slight adverse impacts on water quantity resulting from an escaped fire. Surface water quantities in the analysis area would increase for a period following a fire, as much as 12 percent in studies conducted in Custer State Park following the Cicero Peak Fire (Neary 2008). Because dead trees no longer use available water, more water is available to the system for other uses, other plants, and for increased stream flows. This is a function of fewer plants competing for the water, the ease of rain drops to penetrate the canopy following the fire, and hydrophobic soil conditions that encourage overland flow. Ponderosa pine trees easily absorb water from the ground and return sugar to the roots.

3.3.2.3.8 Black Elk Wilderness/Norbeck Wildlife Preserve

A wildfire burning for three days is not projected to reach the Harney Lookout Tower or move over the top of Black Elk Peak toward Custer. Dominant winds in the area are from the northwest to southeast, as demonstrated by the model and by the 2002 Battle Creek Fire northwest of the Memorial. It is a USFS priority to keep any escaped fire out of the wilderness as topography, weather, fuels, and access issues make fighting fire in the wilderness problematic. Both the NPS and USFS have full administrative authority to fight fire in these areas as aggressively as necessary, but heavy equipment use in the wilderness is precluded both by the terrain and the *Black Hills National Forest Land and Resource Management Plan* (USFS 2006).

A major fire in the Norbeck Wildlife Preserve would be expected to be stand replacing, and tree mortality would be high in July in a dry year. While there is a low probability that an escaped fire would burn for more than 24 hours following ignition, such an event would be a wind-driven fire characterized by fire burning in the crowns of the trees, killing the trees and spreading quickly by spotting and wind-driven embers. Fires escape initial attack due to high winds more than other factors. When the winds die or become calm, fires are easily contained. Prominent examples of large fires in the area over the past 20 years demonstrate what would be expected from such fires. The forest would be badly burned in a large wildfire and replaced by grasses and shrubs for decades following the fire. The area of the 2002 Battle Creek Fire northwest of the Memorial is largely meadowland with grass and shrubs. Regrowth of pine trees is progressing but is not expected to be widespread for at least 25 more years.

3.3.2.3.9 Other

The power and communications infrastructure is susceptible to wildfire as it is located aboveground. Both an active fire and related suppression activities would potentially compromise the infrastructure.

Fuel storage areas include aboveground tanks containing thousands of gallons of propane and fuel. Memorial personnel have successfully mitigated potential impacts on fuel storage through site maintenance and protection of key facilities. It is anticipated that the Memorial would successfully protect fuel storage both from the short-duration fireworks displays and from any resulting wildfire by clearing and treating fuels in the immediate vicinity and stationing rapid response teams/assets in these locations (point protection and prepositioning resources).

3.3.2.4 Cumulative Impacts

Experience with extensive aerial fireworks in the analysis area, including large mortar-fired displays, has demonstrated that fireworks can be safely and successfully performed over a wide variety of changing weather conditions, from very wet years to moderately dry years. Fireworks were halted after 2009 because of increasingly dry conditions, which was the only other example of a cancellation, with the exception of 2002, from inception to the end of the practice. While more than 20 fires started as a result of fireworks over the years, all of these fires were quickly

contained and resulted in localized impacts, from single tree torching to localized small ground fires. A fireworks display in 2020 would contribute minimally to wildfire risk in the cumulative effects analysis area, assuming all conditions and mitigations developed by the incident management team are met and followed.

Forest conditions have steadily deteriorated across the region of the Black Hills of South Dakota and Wyoming, and in the Bear Mountains to the northwest. Conditions across the ponderosa pine forests of the West described in detail by Arno (2000), Shepperd and Battaglia (2002), Graham et al. (2016), and most famously by Wright and Bailey (1982) are true for the ponderosa pine forests of the analysis area. These conditions are intensified by the unique character of the adjacent Black Elk Wilderness and Norbeck Wildlife Preserve, and high level of recreational use in the area.

Any major fire resulting from the fireworks display and affecting the Memorial would be expected to severely impact the surface vegetation, reduce or eliminate organic matter in the soil, increase hydrological damage in the short term from erosion, and add to the decline of old growth and mature trees. Fire resulting from the fireworks display would have a moderate adverse contribution to already deteriorated forest conditions. Forest recovery to pre-fire conditions would likely be slow and sporadic. Conversely, any prescribed burns that are implemented prior to the fireworks display would have a beneficial contribution to cumulative effects of wildfire in the analysis area.

3.3.3 Impacts of Wildfire in Alternative 2

Under the no action alternative, there would be no potential for wildfires ignited from an Independence Day celebration fireworks display. Wildfire risks from normal operations at the Memorial are part of ongoing fire planning for the Northern Great Plains Interagency Dispatch Center and normal Memorial operations. The overall risk of a severe wildfire would range from low to high within the Memorial, depending on the weather conditions in the region and the effectiveness of prescribed burning activities.

3.3.3.1 Cumulative Impacts

Previous fireworks displays have resulted in more than 20 small wildfires, each less than an acre. These small wildfires were extinguished with minimal impact on resources due to readily available emergency fire response teams and favorable weather conditions. There would be no contribution to the cumulative effects of wildfire under the no action alternative.

3.4 Environmental Contaminants

The analysis area for environmental contaminants includes the 1,278-acre Memorial, including the three drainage basins described below (Lafferty Gulch, Starling Gulch, and Unnamed tributary to Grizzly Bear Creek).

3.4.1 Current General Conditions – Environmental Contaminants

3.4.1.1 Water Quality and Soil

The Memorial is in the east-central region of the Black Hills and consists of Precambrian-age bedrock of granite, pegmatite sills and dikes, and schist. Three drainage basins are identified within the Memorial: Lafferty Gulch in the north and drains to the north, Starling Gulch in the southwest and drains to the south, and the Unnamed tributary to Grizzly Bear Creek in the

southeast and drains to the east. Groundwater occurs in localized aquifers within the bedrock, and flow is controlled by secondary permeability caused by fracturing and weathering which, along with surficial deposits of colluvium, can rapidly transmit large quantities of recharged water. The groundwater system at West Fork Lafferty Gulch is isolated from downgradient movement by an igneous sill, which acts as a groundwater dam. Precipitation in the Memorial averaged about 21.5 inches annually during 1981 to 2010.

Groundwater wells used for production of drinking water are located within the West Fork Lafferty Gulch and are designated Well#1 (200 feet deep and sampled as L-3) and Well#2 (500 feet deep and sampled as L-4) (see Figure 6). A spring (L-2) is upstream of the production wells, originates from the same groundwater source as the production wells, and creates a shallow stream in West Fork Lafferty Gulch. Stream sampling site L-5 is downstream of the spring and production wells on the main Lafferty Gulch channel near the northern Memorial boundary downstream from the confluence with West Fork Lafferty Gulch. Production water pumped from Well#1 and Well#2 is treated at the Memorial's water treatment plant, and sampling site L-7 represents the water quality following treatment. Along the main stem of Lafferty Gulch, stream water quality sampling has been conducted at two locations (L-1 and L-8). Site L-8 is the closest water sampling site in proximity to the fireworks launch area in the Hall of Records Canyon. Surface water quality sampling has also been conducted within the Starling Gulch drainage basin at two locations (S-1 and S-2), the Unnamed tributary to Grizzly Bear Creek drainage basin at one spring (G-1), and one surface water location (G-2). The geology of spring G-1 is similar to that of spring L-2 where an igneous sill blocks the downstream flow of groundwater, resulting in springflow.

3.4.1.1.1 Firework Contaminants

A firework is the combination of a fuel (typically a metal or metalloid) and an oxidizer (typically a perchlorate or nitrate salt) to enhance combustion along with binders, stabilizers, and anticaking agents. A propellant supplies a lifting charge to launch the fireworks. Combustion products associated with the firing of fireworks include the release of numerous metals and metal compounds used as fuels and coloring agents, and numerous salts used as oxidizers (PB Energy Storage Services, Inc. (PB Energy) 2011). Environmental contaminants associated with fireworks include perchlorate, metals, thiocyanates, and nitrate compounds, as well as numerous other compounds within the resulting fallout due in part to incomplete combustion of the fireworks. Additionally, fireworks that do not ignite when launched can create debris and unexploded aerial shells within the fallout zone that, if not retrieved, can break down over time and release contaminants (see Figure 3).

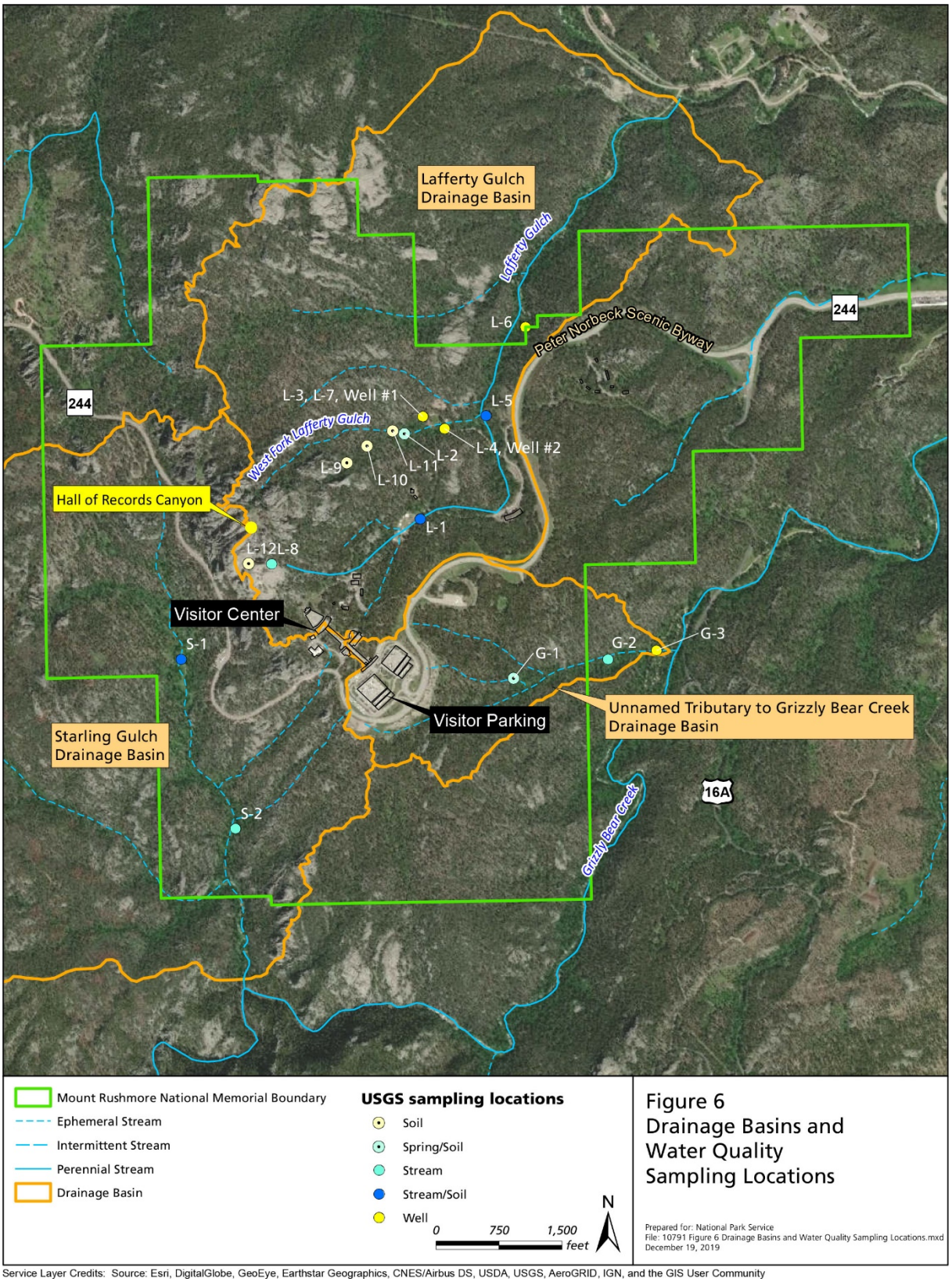


Figure 6. Drainage Basins and Water Quality Sampling Locations

3.4.1.1.2 Perchlorate

Perchlorate is both a naturally occurring and man-made anion that is typically found in the form of perchloric acid and salts such as ammonium perchlorate, potassium perchlorate, and sodium perchlorate. Perchlorate is both highly soluble and stable in water and functions as an oxidizer in fireworks. In their study of soil and water quality at the Memorial, the USGS (2016b) concluded that past fireworks displays are the most probable source of the perchlorate contamination measured. In soil samples collected, perchlorate soil results were greatest (0.0023 and 0.0017 milligrams per kilogram (mg/kg)) in the samples collected in the West Fork Lafferty Gulch drainage with concentrations about one order of magnitude higher than results from the reference site located outside the Memorial (USGS 2016b).

The U.S. Environmental Protection Agency's (EPA) Interim Drinking Water Health Advisory benchmark for perchlorate is 15 micrograms per liter (µg/L). The EPA published a notice of proposed rulemaking in the Federal Register on June 26, 2019 seeking public input on a range of options regarding the regulation of perchlorate in public drinking water systems. The EPA requested comments by August 26, 2019 on a proposed National Primary Drinking Water Regulation (NPDWR) for perchlorate to establish a Maximum Contaminant Level (MCL) and a health-based Maximum Contaminant Level Goal (MCLG) at 56 µg/L (EPA 2019a). Stated alternatives include two other MCLs, 18 and 90 µg/L, as well as the withdrawal of its determination to regulate perchlorate. The final NPDWR and MCLG are anticipated by June 2020.

Water samples collected from the Memorial have been analyzed for the presence of perchlorate since 2011. As noted by the USGS (2016b), the aquifer underlying the West Fork Lafferty Gulch is highly susceptible to contamination due to the hydrogeologic conditions of an igneous intrusive body acting to dam and limit groundwater movement, which in turn limits the ability of environmental contaminants to be flushed out of the groundwater system. Similar to the soil sample results, water samples collected from the Lafferty Gulch basin contained the highest concentrations of perchlorate when studied by the USGS (2016b). Perchlorate has been measured in Well#1 (sample location L-3) from 11 to 38 µg/L, in production water after treatment between 12 and 29 µg/L, in surface water collected at L-5 between 6 and 18 µg/L, and in spring water collected at L-2 between 12 and 54 µg/L. The perchlorate monitoring data collected at individual water sampling sites display an overall decreasing trend with time.

No perchlorate data were collected at the Memorial prior to or during the fireworks shows conducted from 1998 to 2009. Therefore, the timing and magnitude of perchlorate concentrations in environmental media immediately following a fireworks display at the Memorial are not known. From samples collected prior to and immediately following a fireworks display adjacent to a lake in Oklahoma, Wilkin et al. (2007) reported an increase in surface water perchlorate levels of 24 to 1,028 times the mean background level within 14 hours after a fireworks show and perchlorate concentrations decreasing toward the background level within 20 to 80 days following the show due to natural attenuation.

3.4.1.1.3 Nitrate

Nitrate is a naturally occurring compound, and various nitrate salts are used as ingredients in fireworks. The EPA MCL for nitrate is 10 mg/L (EPA 2019b). Nitrate data have been collected annually by the Memorial since 1991 for the finished drinking water supply, which is sourced from groundwater. Nitrate levels from 1991 to 2019 ranged from less than 0.5 mg/L to 1.35 mg/L. Nitrate data for environmental media such as groundwater, surface water, and soils have not been collected.

3.4.1.1.4 Thiocyanate

Thiocyanate is a sulfur cyanate anion. Potassium thiocyanate was listed by PB Energy (2011) as a potential propellant used in fireworks. Thiocyanate salts have not been analyzed in samples collected at the Memorial and it is unknown if thiocyanate is present.

3.4.1.1.5 Metals

Various metals are used as coloring ingredients in fireworks. As part of the USGS (2016b) study, soil samples were collected for 25 metals within the Memorial as well as reference sites located outside the Memorial. The USGS reported that 22 of 25 metal concentrations in soil were greater at sites located within the Memorial than in samples collected at reference sites outside the Memorial. The USGS found that copper and lead (83 and 100 mg/kg, respectively) within soils collected at the sampling site closest to the former fireworks launch site were about an order of magnitude greater than all other sample locations analyzed. In addition, titanium and barium concentrations (1,200 and 190 mg/kg, respectively) were greatest in two sites located within the Lafferty Gulch drainage basin (USGS 2016b).

In water samples collected, the USGS concluded that reference site metal concentrations collected outside the Memorial had concentrations within the same range as sites within the Memorial, indicating little evidence of metal contamination of water due to anthropogenic factors within the Memorial.

3.4.1.2 Fish and Wildlife

See Section 3.3, Wildfire for a description of the affected environment for fish and wildlife.

3.4.2 Impacts of Environmental Contaminants in Alternative 1

Under the preferred alternative, a fireworks show would occur at the Memorial in 2020. The size of the display would be smaller than the previously conducted shows so that the show complies with national fire codes and standards, federal and state laws, and NPS policies (Weeth 2019). The types of aerial fireworks used under the preferred alternative are assumed to be of similar composition to that previously used, with the addition of pyrotechnics that may not have been used in previous years.

3.4.2.1 Water Quality

Fireworks contain potential contaminants that when detonated will fall out into the environment. In addition, fireworks that do not detonate after launch, and are not recovered, can degrade over time and release contaminants into the environment. The fireworks contaminants perchlorate and nitrate are highly soluble and can quickly dissolve into water, while metals generally have a lower solubility in water. The USGS (2016b) concluded that past fireworks displays are the most probable source of perchlorate measured in soil, surface water, and groundwater at the Memorial. Additionally, the USGS (2016b) noted that the groundwater system at the Memorial is highly susceptible to contamination due to the hydrogeologic conditions present. The total mass of environmental contaminants released as a result of the preferred alternative would be dependent on many factors such as the size of the fireworks display, the efficiency of combustion, and the composition and quality of the fireworks used.

The preferred alternative would result in the release of chemicals to environmental media within the Memorial, proportional to the size of the display. It is unknown if the mass of chemicals released to the environment would be large enough to be detected, or to increase concentrations within environmental media to levels exceeding regulatory standards. Whether future perchlorate

concentrations in groundwater used for drinking water will meet regulatory standards will in part be dependent on the EPA's decision regarding the regulatory standard for perchlorate. The increase in concentration in soils, surface water, and groundwater of potential chemicals released to the environment would be due, in part, to the size of the fireworks display as well as the solubility, infiltration rate, and attenuation of a given chemical. Different types of fireworks include different chemical compositions and in varying concentrations. The combination of these factors makes it difficult to predict precisely the impact of any particular fireworks program. The NPS has limited the length of the fireworks display, limited the size of fireworks to be used, and implemented a monitoring protocol to ensure early detection of perchlorate contamination.

Monitoring of environmental media following implementation of the preferred alternative would help quantify changes in environmental contaminant concentrations relative to those measured prior to implementation of the preferred alternative. The NPS has proposed to implement a study with the USGS to conduct pre- and post-display monitoring of soil, surface water, and groundwater within potentially impacted areas from the display. This monitoring program would evaluate the event's impacts on environmental contaminants and would supplement existing groundwater and drinking water testing that currently occurs at the Memorial.

3.4.2.2 Human Health Impacts

3.4.2.2.1 Perchlorate, Nitrate, and Thiocyanate

Perchlorate is known to disrupt the thyroid hormone homeostasis in several species including humans (Park et al. 2016; Leung et al. 2014). The path for human exposure to perchlorate at the Memorial would most likely be through the drinking water supply, which could potentially contain elevated levels of perchlorate following a fireworks display, as described above. The potential adverse impacts of perchlorate on thyroidal health in humans, particularly among pregnant and lactating women and in infants, are unconfirmed (Pleus and Corey 2018; Leung et al. 2014; Tarone et al. 2010). Nitrate and thiocyanate also decrease the ability of the thyroid to transport iodide, by the same mechanism as perchlorate (Tarone et al. 2010; Tonacchera et al. 2004). The mode of action of all three anions is additive, with no evidence of synergistic effects (Tarone et al. 2010). The potential exists that perchlorate, nitrate, or thiocyanate levels in drinking water could become elevated following a future fireworks display, especially when considering the existing elevated levels of nitrate in the Memorial's drinking water. As previously described, the risk of future exposure would depend on many factors such as the size of the fireworks display, the efficiency of combustion, and the composition and quality of the fireworks used. The risks of exposure through drinking water at the Memorial would be reduced by limiting the number and size of fireworks and by implementing monitoring for contaminants and mitigation measures as described in Appendix B. As previously described, the NPS has proposed to implement pre- and post-event monitoring of surface water within the area potentially affected by the fireworks display. With the implementation of monitoring and mitigation measures such as water filtration or reverse osmosis, human exposure to harmful levels of these contaminants could be reduced.

3.4.2.2.2 Metals

As previously described, the USGS (2016b) concluded that reference site metal concentrations collected outside the Memorial had concentrations within the same range as sites within the Memorial, indicating little evidence of metal contamination of water due to anthropogenic factors within the Memorial. Future fireworks events would be unlikely to increase metal contamination in the Memorial.

3.4.2.3 Ecological Impacts

3.4.2.3.1 Perchlorate

As previously described, perchlorate levels in surface water collected from Lafferty Gulch from 2011 to 2015 (near the past fireworks launch site) were higher than the EPA Interim Drinking Water Health Advisory level of 15 µg/L (USGS 2016b). The NPS has not set ecological screening values for perchlorate in water or soil (NPS 2018). Perchlorate levels in Starling Gulch were elevated compared to background levels, ranging from 0.61 to 19 µg/L, while surface water samples from Grizzly Bear Creek showed no signs of contamination. No fish are present in Lafferty Gulch; however, adverse impacts on mammals, amphibians, and invertebrates could result from increased perchlorate levels following future fireworks displays.

Studies have found that perchlorate affects many species of wildlife, including mammals, amphibians, fish, and invertebrates (Acevedo-Barrios et al. 2017; Jomaa et al. 2014; Eck 2015; Srinivasan and Viraraghavan 2009); and perchlorate toxicity varies widely according to species. Exposure to perchlorate could affect the metabolism, reproduction, and development of the exposed species, causing irreversible damage to many organisms and disrupting the absorption of iodine in the thyroid gland, which is responsible for regulating metabolism, growth, and development (Gholamian et al. 2011; Lumen et al. 2013; Chen et al. 2014 cited in Acevedo-Barrios et al. 2017). The degree and severity of impacts would depend on the chemical composition and number of fireworks used, and other variables such as the degree of combustion, as previously described. Impacts could affect individual mammals, amphibians, or small groups of invertebrates localized in and near Lafferty Gulch and near the launch site. Impacts would generally occur beginning after the fireworks display, and would be expected to attenuate over time, as the concentrations of perchlorate decline.

3.4.2.3.2 Nitrate

Potential adverse impacts on aquatic life from elevated levels of nitrate could include enhanced algae growth, resulting in decreased dissolved oxygen concentration in the aquatic environment, which leads to increased fish mortality rates. High levels of nitrate could also have toxic effects on aquatic organisms from the conversion of oxygen-carrying pigments (such as hemoglobin) (Carmago et al. 2005) and thyroid effects. Carmago et al. (2005) reviewed the published data on nitrate toxicity to aquatic species and found that long-term exposure to concentrations of 10 mg/L of nitrate (the EPA drinking water standard) can adversely affect aquatic invertebrates, fish, and amphibians. A safe level of 2 mg/L was recommended to protect freshwater aquatic organisms (Carmago et al. 2005). The NPS has not selected ecological screening values for nitrate (NPS 2018).

Limited data are available on nitrate levels in surface water at the Memorial. Water quality sampling in 2006 found that nitrate levels averaged 1.87 mg/L in the small unnamed stream in Lafferty Gulch, while levels in Beaver Dam Creek in Starling Basin and in Grizzly Creek, which are further from past fireworks displays, were below 0.10 mg/L (Rust 2006). These limited data suggest that past fireworks displays may have contributed to increased nitrate levels in Lafferty Gulch, which is consistent with the results of the USGS study that found elevated levels of perchlorate in Lafferty Gulch (USGS 2016b). Although elevated, the nitrate levels measured in 2006 in Lafferty Gulch were below the 2.0 mg/L level recommended to protect freshwater aquatic organisms.

3.4.2.3.3 Thiocyanate

Thiocyanate exposure can adversely affect fish and other aquatic organisms. Potential impacts on fish exposed to thiocyanate in water could include negative impacts such as impaired thyroid

function and reduced hemoglobin levels (Lanno and Dixon 1996). The NPS has not selected ecological screening values for thiocyanate (NPS 2018).

3.4.2.3.4 Metals

Copper is highly toxic to fish and amphibians, while lead also has adverse impacts on aquatic organisms (EPA 2019c). As previously described, concentrations of metals in surface water samples collected at the Memorial were not substantially different from levels outside the Memorial following past fireworks displays. This suggests that ten years of fireworks displays from 1998 through 2009 either did not elevate metals or elevated metals such that they attenuated before the first year of USGS monitoring in 2011. While it is possible that adverse impacts on aquatic organisms from elevated levels of metals could occur from future fireworks displays, these effects would likely be less than two years in duration, if they occurred. The degree and severity of impacts would depend on the chemical composition and number of fireworks used, and other variables such as the degree of combustion, as previously described for other contaminants. As previously described, the NPS has proposed to implement pre- and post-event monitoring of surface water within the area potentially affected by the fireworks display.

Elevated levels of copper and lead (83 and 100 mg/kg, respectively) were found in soils at the sampling site closest to the fireworks launch site in Lafferty Gulch (USGS 2016b). These levels exceeded the NPS ecological screening values for birds (28 mg/kg for copper and 56 mg/kg for lead) and mammals (49 mg/kg for copper and 11 mg/kg for lead). Potential adverse impacts of copper exposure include reduced growth rates, lowered egg production, and developmental abnormalities in birds; and liver cirrhosis, necrosis in kidneys and the brain, gastrointestinal distress, lesions, low blood pressure, and fetal mortality in mammals (EPA 2019c). Potential adverse impacts on birds and mammals from lead exposure include damage to the nervous system, kidneys, and liver; sterility; growth inhibition; developmental retardation; and detrimental effects in blood; however, these impacts are generally the result of exposure from ingesting lead shot, sinkers, or paint, rather than food chain exposure from inorganic lead (EPA 2019c). Because elevated copper and lead concentrations were found at the site closest to the past fireworks launch site, future copper and lead contamination would be expected to be greatest in the areas closest to the launch site. Impacts on birds and mammals from ingestion of copper and lead would be expected to be localized near the launch site and within the fallout zone and would affect individuals rather than populations. The degree and severity of impacts would depend on the chemical composition and number of fireworks used, and other variables such as the degree of combustion, as previously described for other contaminants.

3.4.2.4 Cumulative Impacts

As discussed above, previous fireworks displays contributed to water quality contamination and impacts on natural resources within the Memorial. Future displays would contribute to these impacts; the level of impact would depend on absorption rates and any mitigation measures implemented, such as use of fireworks that do not contain perchlorate or other contaminants of concern.

3.4.3 Impacts of Environmental Contaminants in Alternative 2

Under the no action alternative, no new contaminants would be released to the environment from an Independence Day celebration fireworks display. Existing contaminants from previously conducted fireworks shows would continue to persist for an unknown time. Due to the terrain, unexploded ordnance within the fallout zone not previously collected would likely persist and degrade in the environment, potentially further leaching contaminants to the soil, surface water,

and groundwater. Contaminants would persist in the environment until they naturally attenuate. No new impacts on human health or wildlife would be expected.

3.4.3.1 Cumulative Impacts

As discussed above, previous fireworks displays contributed to water quality contamination and impacts on natural resources within the Memorial. There would be no new impacts under the no action alternative.

3.5 Human Health and Safety

The analysis area for human health and safety is the 1,278-acre Memorial area. This area encompasses the fallout zone for the proposed fireworks event (Figure 5); staging and transportation areas for fireworks and associated infrastructure transport (e.g., elevated launch pad and fireworks racks); and visitor and staff ingress/egress points.

3.5.1 Current General Conditions – Human Health and Safety

In accordance with NPS *Management Policies 2006*, fireworks events will be considered unless they pose an unacceptable risk of wildland or structural fire, or will cause unacceptable impacts on Memorial resources or values, or jeopardize public safety. This section analyzes impacts on visitor and fireworks operator safety as a result of the proposed fireworks event. The affected environment description for this resource is based on more recent Independence Day celebrations with no fireworks events (2010 through 2019) and previous firework displays (1998 through 2009) to provide a basis for impacts of the preferred alternative. For a description of wildfire risk on local communities, see Section 3.3, Wildfire. For a description of human health and safety impacts from environmental contaminants, see Section 3.4, Environmental Contaminants.

3.5.1.1 Visitor Health and Safety

3.5.1.1.1 Previous Fireworks Events (1998 through 2009)

Previous firework events drew attendance of up to 8,300 visitors within a small area. Visitors viewed the fireworks display and associated pre-display acts in the amphitheater (capacity of about 1,800) and Terrace (capacity of 200), with the remainder of the visitors filling into other areas of the Visitor Center Complex including the Avenue of Flags, Plaza, and pedestrian walkways (Figure 4) in a "standing room only" manner. This impacted emergency egress and limited the potential for emergency sheltering of visitors during dangerous weather.

The Memorial maintains a parking garage with a capacity of about 1,100 vehicles, which includes spaces for recreational vehicles. In addition to vehicular traffic, many visitors would travel from Keystone (about 2 miles away) to the Memorial on foot on the day of the fireworks display, resulting in a mix of pedestrian and vehicular traffic on SD 244 from Keystone. Pedestrian and vehicular ingress and egress are from SD 244, which runs north and south into the Memorial. Emergency response vehicles (for emergency medical and wildfire response purposes) also used SD 244 before and during the event. Emergency response vehicle ingress and egress during visitor arrival and departure periods was restricted because SD 244 is the only option in and out of the Memorial.

On the day of the event, the Memorial opened at 6:00 a.m., and visitors were lined up at the Memorial entrance to secure a viewing spot for the evening show, which started about 9:00 p.m. Following the show (usually about 10:00 p.m.), Memorial staff and local law enforcement

personnel hired to help with the event allowed pedestrians to leave the Memorial while visitors with vehicles were instructed to wait until all pedestrians were off the road (typically a couple of hours later).

3.5.1.1.2 More Recent Independence Day Celebrations (2010 through 2019)

More recent Independence Day celebrations have included entertainment such as military bands, presidential reenactments, and lights on the sculpture. The event schedule is a rotation of 45 minutes of entertainment and 45 minutes of break throughout the day until about 9:00 pm. Park attendance during the 2010 through 2019 Independence Day celebrations ranged from 29,000 to 36,000 visitors. The entertainment schedule allowed for more frequent rotations of visitors throughout the day, who then would likely visit the neighboring towns outside of the Memorial. The rotation of entertainment resulted in less visitor and traffic congestion at any one time throughout the day than the previous fireworks events, with few ingress and/or egress issues.

3.5.1.2 Fireworks Operator Health and Safety

3.5.1.2.1 Previous Fireworks Events (1998 through 2009)

Previous fireworks displays were launched from the Hall of Records Canyon, which is about 40 feet across at the widest part of the canyon. The NFPA report Section 1123 5.1.4.7 stipulates that "The area selected for the discharge of aerial shells shall be located so that the trajectory of the shells shall not come within 25 ft. (7.6 m) of any overhead object." Based on this guidance, and the width of the Hall of Records Canyon, with walls that vary in depth from about 80 to 120 feet from the Hall of Records, the minimum width to ignite fireworks within the canyon is 50 feet. Furthermore, the NFPA report, which assessed each proposed launch site (Weeth 2019), noted that "No portion of the Hall of Records, other than the small area outside the fence in the Entry by the top of the steps, has anything that could be considered a Means of Egress, an Exit or a Means of Escape during a fireworks display." Other considerations such as angle of mortar being fired, were not considered in previous displays from the Hall of Records Canyon. Recoil can drive the mortar into the ground or change the angle of the mortar, which created a hazardous situation for fireworks operators during previous displays launched from the canyon.

Prior to previous fireworks displays, delivery of fireworks into the Hall of Records Canyon was challenging and laborious based on the terrain and high elevation of the launch site. Fireworks, mortar racks, and firing equipment were transported into the canyon using a complex rope and pulley system, which took several days leading up to the display. A helicopter also was used at one point to transport items, but this practice was discontinued due to safety concerns such as uneven terrain, difficult landing area, and uncertain weather conditions. NPS staff transporting fireworks were not trained or certified in the safe handling and transport of fireworks, per NFPA code, and transported them within an unsafe distance from visitors.

Although local law enforcement agencies were hired to help with crowd and traffic control, the limited number of Memorial staff available were needed to help with the large number of visitors throughout that day. The total number of visitors on the event day is less than typical for a summer day at the Memorial; however, during a typical summer day, visitors would spend 1 to 2 hours at the Memorial, and on July 3rd, visitors would arrive when the Memorial opened and spend 16 to 17 hours at the Memorial, resulting in crowded conditions.

The Weeth report (2019) concluded that many of the past practices were not in compliance with NFPA codes and standards. Visitor and operator safety concerns outlined in the report included:

- Inadequate separation distances to spectator viewing areas from an elevated discharge site, especially with wind (i.e., spectators located within the fallout zone)
- Hazards of aerial shells bouncing off of overhanging canyon walls
- Safety of the fireworks operator crew firing from within the actual Hall of Records, including night operations
- Safe capacity and egress of the Visitor Center Complex for spectators

Other safety concerns with previous displays includes unexploded ordnance and shell debris, which remain in areas of the Memorial, as mortars do not always explode and fall to the ground. It is unknown how much debris and unexploded ordnance from previous displays remains within forested and other areas within the Memorial.

3.5.1.2.2 More Recent Independence Day Celebrations (2010 through 2019)

No fireworks events occurred from 2010 through 2019. Entertainment provided in those years did not have unusual or hazardous operational concerns.

3.5.2 Impacts on Human Health and Safety of Alternative 1

3.5.2.1 Visitor Health and Safety

3.5.2.1.1 Previous Fireworks Events (1998 through 2009)

Under Alternative 1, the preferred alternative, visitor attendance would be limited to about 2,000 people in the amphitheater and Terrace, which would be within design capacity and result in less crowding than previous fireworks events, especially in the plaza and walkway areas. Parking would be limited to the capacity of the parking structure, resulting in less vehicle/pedestrian conflict and safer, less congested ingress and egress from the Memorial before and after the display than in previous years. Emergency responder access to and from the Memorial would be maintained on the area roads and internal paths. This would allow for adequate visitor safety and emergency response in the event of medical or fire emergencies, an improvement from previous fireworks events.

The fireworks event would be designed so the visitor viewing areas are not in the fallout zone, ensuring the safety of visitors watching the display, with minimal risk of danger from fireworks debris. As in previous years, the NPS and partners would implement an incident management decision-making structure, including a Go/No-Go Action Plan on the day of the display to account for severe weather conditions, such as high winds or lightning.

3.5.2.1.2 More Recent Independence Day Celebrations (2010 through 2019)

Under the preferred alternative, relative to more recent Independence Day celebrations, visitor attendance, parking, ingress/egress, and emergency response would likely be about the same at any one time throughout the day due to the rotation of entertainment and cycling of visitors through the Memorial, until 3pm when the Memorial would be closed. There would still be a greater risk to visitor and operator safety from fireworks launching, although this risk would likely be minimal due to the nature of the fireworks used and safety precautions implemented per NFPA codes and the incident management structure.

3.5.2.2 Fireworks Operator Health and Safety

3.5.2.2.1 Previous Fireworks Events (1998 through 2009)

Under the preferred alternative, discharge of fireworks and/or proximate pyrotechnics would occur at up to three areas: the Amphitheater area, using pyrotechnics of 2 inches or less; the talus

slope and Presidential Trail area, using ground level fireworks and some pyrotechnics of 2 inches or less; and the Hall of Records area, using aerial fireworks 2 to 5 inches. The use of these discharge areas is subject to the safety limitations identified in the Weeth report (2019), and subject to future display design by a licensed fireworks operator and operational planning by the NPS. Working within the constraints of NFPA codes would result in acceptable operator safety during the event.

The NPS would work with the certified fireworks contractor to develop a plan for staging, igniting, and demobilizing for all locations. All launch locations would be closed to public access for some time before and after the event, as fireworks are staged and cleaned up, which would improve visitor safety relative to previous displays. The fireworks contractor would need to deliver and remove the fireworks and other materials using vehicles, packs, and other means. At the Hall of Records Canyon, this may include the use of a helicopter. Transport of the fireworks and other materials using a rope and pulley system and helicopter would have some risk for the contractor; however, training and safety precautions taken in the use of these techniques would minimize this risk. Memorial staff would solicit assistance from other agencies such as the South Dakota Department of Transportation, local law enforcement, and state emergency personnel. Fire and emergency responders would be staged east and west of SD 244 closures, which would reduce the risk of restricted access for emergency situations that may arise.

Launching fireworks from the ledge above the Hall of Records, or from an elevated platform in the Hall of Records Canyon, would eliminate the hazards of aerial shells bouncing off of overhanging canyon walls, increasing safety for fireworks operators compared to previous events.

As part of the event, the fireworks contractor would assign staff to monitor fireworks for any unexploded shells, spot fires, and other concerns. The NPS would establish a quick response wildland fire team to respond to any unplanned ignitions, as in previous years. These actions would reduce risks associated with unexploded shells and wildfire.

3.5.2.2.2 More Recent Independence Day Celebrations (2010 through 2019)

Under the preferred alternative, fireworks operators would transport fireworks to the Hall of Records Canyon, resulting in some risk to operators, based on the terrain, limited accessibility of the canyon, and handling of fireworks, compared to more recent Independence Day celebrations where no fireworks events occurred. During the fireworks event, handling and launching of fireworks would increase risk to operators. The requirement for operators to be certified handlers would decrease these risks as they would be trained in the proper transport, handling, and ignition of fireworks. Construction and use of a platform in the canyon as a launching spot would increase risk to operators due to the height and risk of falls; proper certification by operators also would help to mitigate this risk.

3.5.2.3 Cumulative Impacts

Previous fireworks events posed a health and safety risk to visitors, Memorial staff, and fireworks operators; however, the preferred alternative may result in additional unexploded ordnance and debris within the Memorial and may contribute to cumulative impacts on human health and safety. Unexploded ordnance and debris from previous fireworks events would persist, which poses a risk to visitor and Memorial staff safety. Present and future forest management actions such as MPB mitigations and forest thinning may reduce the risk of a catastrophic wildfire, resulting in a beneficial effect on human health and safety. Prescribed fire and other treatments proposed for the Memorial prior to a fireworks event (if possible based on weather conditions) would have a beneficial contribution to cumulative effects when combined with other forest

management actions, although weather conditions have not yet made it possible for the Memorial to implement these management actions.

3.5.3 Impacts on Human Health and Safety of Alternative 2

Under the no action alternative, the Independence Day celebration at the Memorial would not include a fireworks display and would be similar to recent years with various performances and activities in the amphitheater. There would be no risk to visitor and staff health and safety from fireworks or an increased risk of wildfire danger. There would be no increase in unexploded ordnance within the Memorial, although unexploded ordnance from previous fireworks displays would persist within the Memorial, posing a potential risk to visitors.

3.5.3.1 Cumulative Impacts

Past, present, and reasonably foreseeable future actions that would contribute to cumulative effects under the no action alternative would be similar to the preferred alternative; however, in the absence of a fireworks event in 2020, no additional health and safety impacts on visitors and Memorial staff would occur. Unexploded ordnance and debris from previous fireworks events would persist, which poses a risk to visitor and Memorial staff safety.

3.6 Cultural Resources

The NPS has defined the area of potential effect for cultural resources as the boundaries of the Memorial or about 1,278 acres within the Black Hills of South Dakota. The Memorial was established in 1925 to commemorate democratic ideals and institutions and to memorialize four presidents who best represented those ideals – Washington, Jefferson, Lincoln, and Roosevelt. The sculpture was the idea of Doane Robinson, State Historian for South Dakota, who originally considered constructing the sculpture in Custer State Park. However, Danish-American Gutzon Borglum selected Mount Rushmore and led the planning and construction of the sculpture. Planning and execution of the sculpture took place from 1925 to 1941 (Paula S. Reed & Associates 2016). Much of the Memorial's infrastructure was built by the Civilian Conservation Corps in the late 1930s and early 1940s.

The period of significance for the cultural resources of the Memorial extends from 3,500 BC to AD 1967 in recognition of the precontact archeological resources within the Memorial through the Mission 66 era (Historic Resources Group, Inc. 2013). Periods of significance include sculpture construction (1925 – 1941), Mission 66 program era (1956 – 1966), and Parkscape USA program (1967 – 1972) (Carr et al. 2015).

3.6.1 Current General Conditions – Cultural Resources

3.6.1.1 Mount Rushmore Historic District and Cultural Landscape

The Memorial's historic district was administratively nominated for listing in the National Register of Historic Places in 1966, affirmed for listing in 1984 under Criterion A (American values and federal work programs), Criterion B (Gutzon Borglum), Criterion C (work of a master and rustic and modern architecture), and Criterion D (archeological data) (NPS 1966, 1984). The historic district was updated in 2013 to encompass the entire Memorial. The 2013 nomination update increased the number of contributing resources from 8 to 33 (Historic Resources Group, Inc. 2013).

Contributing buildings, structures, and objects include the original eight nominated in 1984: Shrine of Democracy sculpture, Hall of Records, Sculptor's Studio, residence, lift platform, historic compressor (object), two water reservoirs (one added in 2013), and stairways. Buildings, structures, sites, and objects listed under the 2013 updated nomination include an apartment building for Memorial personnel, a maintenance garage, the Flank restroom, a residence garage, a talus slope of sculpture debris below the sculptures, Observation Point (and associated path), Iron Mountain Road, South Dakota Highway 244, Profile view pull-off, service roads, stone culverts, stone retaining walls, curbing and steps, a guard shack, and the Borglum Memorial View Terrace. Contributing objects include sculpture tools and equipment, searchlights, and telephone poles. Twenty-four buildings and structures are noncontributing to the historic district.

A Cultural Landscape Inventory was conducted in 2014, which identified Spatial Organization, Natural Systems and Features, Cultural Traditions, Circulation, Vegetation, Topography, Buildings & Structures, Small Scale Features, and Views & Vistas as contributing characteristics of the landscape (NPS 2014). The landscape is significant for its preservation of natural resources and the natural setting of the Black Hills. Exposed granite that forms the raw material for the sculptures, rugged terrain, and old growth ponderosa pine are integral components of the natural setting. The vegetation is particularly significant to the setting and feeling. Ponderosa pine was planted in the 1960s to better frame the view toward the sculptures and to screen the talus slope below the sculptures. Old growth ponderosa pine is now extremely rare for the Black Hills (see Section 3.3, Wildfire).

The cultural landscape is also significant for its association with numerous Native American tribes, most notably with the Lakota Sioux who occupied the Black Hills at the time of Euro-American arrival. By the time of Euro-American entry into the area, the Lakota had occupied the Black Hills (or *paha sapa*) since the end of the 18th century. The Black Hills are the "heart of everything that is" (*Wamakaognaka E'Cante*) to the Lakota and is the dwelling place of the Great Spirit (*Wakan Tanka*). The 1868 Treaty of Fort Laramie signed between the federal government and the Sioux tribes established a reservation of 26 million acres, including the Black Hills, but persistent encroachment by white settlers slowly reduced the size of the reservation, eventually excluding the Black Hills. The significance of the Black Hills to tribes cannot be overstated, especially considering that the American Indian Movement of the 1970s was focused on the Black Hills (NPS 2014). Today, 13 sovereign tribal nations are associated with the Memorial.

3.6.1.2 Archeological Resources

The updated 2013 historic district nomination includes six significant archeological sites, including two precontact Native American artifact scatters, two mining-related sites, and segments of the Horse Thief Lake Road (replaced by SD 244) (Historic Resources Group 2013). The updated nomination also identifies a general area original to the carving and early tourism period (referred to as the visitor core) that requires further study to determine what is original and what was adaptively reused by the NPS. Cultural resource data provided by the Midwest Archeological Center identify a total of 34 archeological resources within the Memorial boundary. Of these, only two archeological sites date from the precontact period; the remaining sites are historical and predominantly mining related. The number of significant archeological resources is comparatively few given the size of the Memorial and when compared to the surrounding region (Rom et al. 1996).

3.6.2 Impacts on Cultural Resources of Alternative 1

The preferred alternative has the potential to cause both direct and indirect impacts on contributing resources to the historic district and cultural landscape. Short-term impacts would occur on the Hall of Records from construction of a platform from which the fireworks mortars would be launched from within the canyon leading to the Hall of Records. Permanent impacts would occur from the anchoring used to secure the platform to the canyon wall. The fireworks show would lead to the deposition of unexploded ordnance and mortar debris within the fallout zone, causing adverse impacts on the historic district and cultural landscape. Although it would be the responsibility of the fireworks contractor to remove unexploded ordnance and fireworks debris from the fallout zone, the rugged topography of the area would preclude complete recovery of unexploded ordnance and debris. Unexploded ordnance fallout and fireworks malfunction have the potential to cause impacts on buildings, structures, and the cultural landscape from burn marks and scorching. A fireworks malfunction within the Hall of Records Canyon could cause adverse impacts on the walls and the entrance to the Hall of Records.

Access and staging for the fireworks show would cause short-term impacts on the cultural landscape.

Impacts on the historic district and cultural landscape could occur from unexploded ordnance fallout, the ignition of wildfires, and the subsequent response to contain and extinguish the wildfire. Wildfire has the potential to impact contributing resources to the historic district, especially combustible resources such as buildings, and to adversely impact the cultural landscape, including vegetation, natural systems, views and vistas, and cultural traditions. Wildfire response could require overland access by brush trucks and the excavation of hand lines to contain the fire. See Section 3.3, Wildfire for additional information on the impacts of wildfire.

The few significant archeological resources within the Memorial would not likely be impacted by fireworks directly, and likely would not be adversely affected by wildfire or wildfire response. These few resources would be avoidable using specific response measures, including construction of hand lines rather than using large mechanized equipment (see Appendix B).

3.6.2.1 Cumulative Impacts

Past, present, and reasonably foreseeable future actions include past fireworks shows (1998 to 2001 and 2003 to 2009) that have left unexploded ordnance and debris across the historic district and cultural landscape. Much of the past unexploded ordnance and debris has fallen on the talus slope, a contributing resource to the historic district and cultural landscape. Past fireworks events have left burn marks on top of the sculpture. The preferred alternative would result in additional unexploded ordnance and debris on the landscape. MPB infestation has already led to the loss of ponderosa pine forest, increasing the risk of wildfire and the loss of vegetation that contributes to the cultural landscape (see Section 3.3, Wildfire). Impacts from previous displays would persist, including burn marks on the top of the sculpture.

3.6.3 Impacts on Cultural Resources of Alternative 2

Under the no action alternative, the Independence Day celebration at the Memorial would not include a fireworks display and would be similar to recent years with various performances and activities in the amphitheater. There would be no additional impacts on cultural resources from unexploded ordnance or fireworks debris, or additional risk of wildfire from a fireworks display. Impacts from previous displays would persist, including burn marks on the top of the sculpture.

3.6.3.1 Cumulative Impacts

Past, present, and reasonably foreseeable future actions that would contribute to cumulative effects under the no action alternative would be similar to the preferred alternative; however, in the absence of a fireworks display in 2020, no additional unexploded ordnance or debris or other cumulative effects on cultural resources would occur.

Chapter 4. Consultation and Coordination

Personnel from the NPS Regional Office (Department of the Interior Unified Regions 3, 4, and 5); Mount Rushmore National Memorial; and the Environmental Quality Division were involved with the preparation of this EA. The NPS also coordinated with the following agencies and American Indian tribes for preparation of this EA:

- Black Hills National Forest
- Crow Creek Sioux Tribe
- Fort Peck Assiniboine and Sioux Tribes
- He Sapa Pow Wow
- Lower Brule Sioux Tribe
- Northern Arapaho
- Northern Cheyenne Tribe
- Sisseton Wahpeton Oyate
- South Dakota Secretary of Tribal Relations
- South Dakota State Historic Preservation Office
- State of South Dakota Governor's Office
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Geological Survey

The Memorial held a television interview on July 1, 2019 and visitor outreach has been occurring since July 2019. A press release was issued on XX, 2020 to announce availability of the EA for a 30-day public review period. Approximately XX comments were received.

Chapter 5. List of Preparers and Contributors

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U.S. Department of the Interior, Unified Regions 3, 4, and 5
ERO Resources Corporation

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Chapter 7. Appendices

Appendix A. Wildland Fire Decision Support System (WFDSS) Materials

Introduction

The Wildland Fire Decision Support System (WFDSS) is an integrated computer model (model) used to approximate where a potential wildfire caused by fireworks debris would burn if the wildfire escaped initial containment and suppression activities. The model was used to simulate fires resulting from the fireworks displays in three representative years: a dry year in 2012, a normal precipitation year in 2013, and a wet year in 2018. The model uses weather analysis and fire behavior prediction data that provide information on fire season duration, fire size probabilities, fire spread paths and fire short-term arrival times, fire danger forecasts, and economic impact assessments. The model helped to identify the wildfire analysis area for analyzing the impacts of wildfire for Alternative 1 (the preferred alternative) and assess the potential wildfire risks and impacts as a result of the preferred alternative.

WFDSS Assumptions

The following is a summary of the assumptions used in the WFDSS.

Potential fire ignitions were modeled after wildfire ignitions from fireworks displays from 2000 to 2009. The three-day Fire Spread Probability (FSPro) Model used Mark Finney's protocols for tree-crown fire initiation, and the three years representative of various weather and fuels conditions. Modeling runs were unedited to take into account the recent mountain pine beetle mortality in dead and down pockets of combustible vegetation in the area or recent fuel treatments. The runs are approximately representative of a wildfire occurring from July 3rd to July 5th using well above average burning conditions. The model assumed no fire suppression action was taken.

WFDSS Results

7.1.1 2012 Dry Year

Figure A1 (also shown in Figure 3 of the EA) illustrates the potential escaped fire area from an ignition in Starling Basin on July 3 in a dry year resulting from mortar shrapnel or unexploded ordnance in the fallout zone. Figure A1 is a gross model depiction of relative fire sizes and is for illustration only.

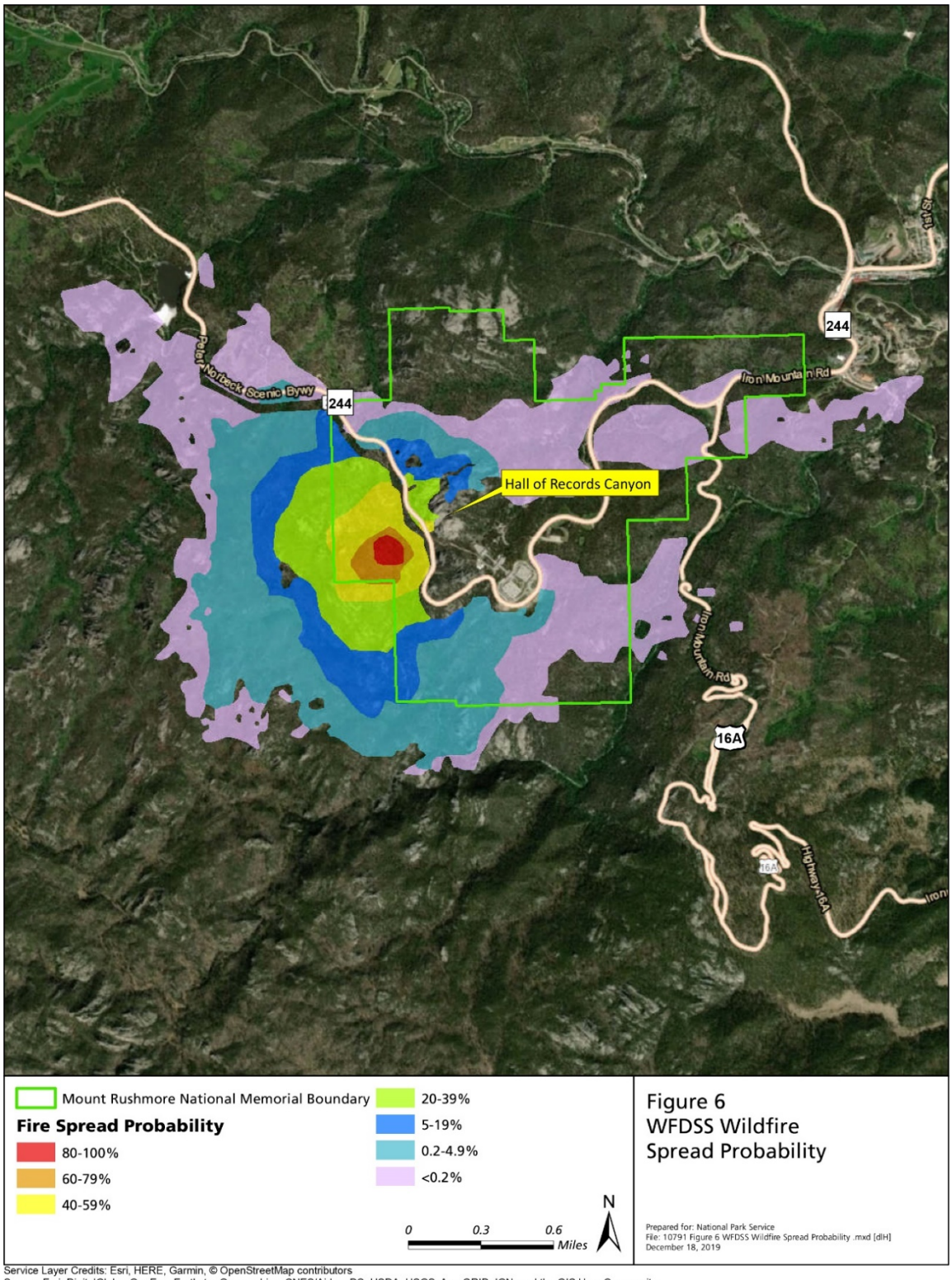


Figure A1. WFDSS 2012 Dry Year Wildfire Spread Probability

Figure A2 displays the Energy Release Component (ERC) for the year from the WFDSS model. The ERC is around 60 (90th percentile) on July 3 in the representative model. ERCs above the 90th percentile could be added to the Go/No-Go decision matrix for similar events in subsequent years, if permitted by the Memorial. The ERC reflects fuel moisture changes to dead and live fuel components.

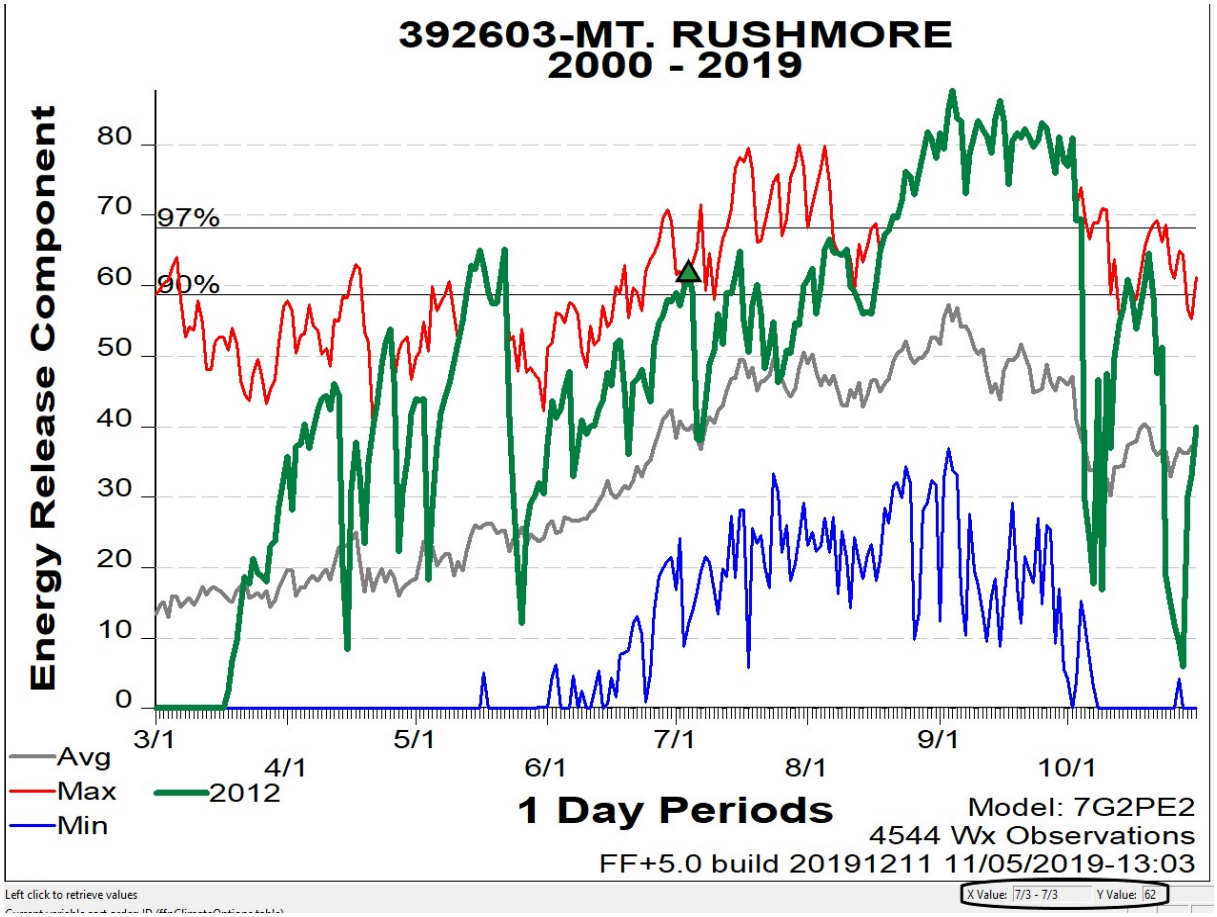


Figure A2. Energy Release Component for WFDSS 2012 Dry Year

Below is the full WFDSS 2012 Analysis Report.

Analysis Report

Incident Information

Return

Incident Information

NAME	VALUE
Incident Name	MORU Test
Unique Fire Identifier	2019-SDMRP-190001
Responsible Unit Name	Mount Rushmore National Monument
FireCode	
P-Code	
Point of Origin	43.87917 N / 103.45917 W
Incident Size	0.1 acres
Latest Perimeter Size	0 acres
Incident Cause	Unknown
Incident Type	Wildfire
Incident Discovery	07/03/2019 22:00
Contained	
Controlled	
Out	
Jurisdictional Unit	SDMRP - Mount Rushmore National Monument
Jurisdictional Agency(s)	NPS, USFS
Geographic Area (prep level)	Rocky Mountain (2)
Owner Name(s)	Al Stover

Analysis Information

Return

FSPro Information Annotations

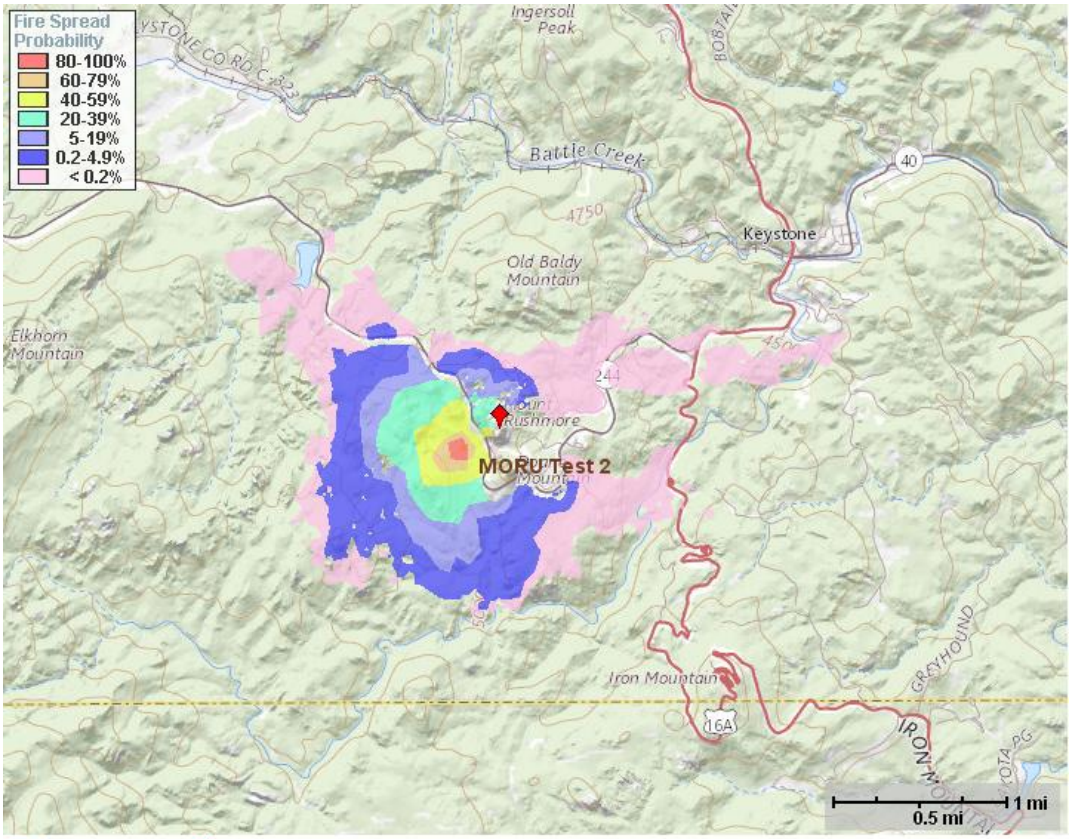
Time (CST)	User	Annotation
11/06/2019 12:59	Stover, Al	Ignition was modeled as a single point in Starling Basin that could represent either a misfire during the display or a spot fire from an existing wildfire start..

FSPro General Information

NAME	VALUE
Analysis Name	MORU Test 2012 Starling Basin
Analyst Name	Stover, Al
Completed	11/06/2019 13:04
Analysis Status	Complete
Analysis Start	07/03/2012
Duration	3 days
Simulations	2000 fires
Crown Fire Method	Finney (1998)
Ignition	MORU Test 2
Barrier	No barrier specified
ERC Station	392603 - MT. RUSHMORE (0.5 miles)
Winds Station	392603 - MT. RUSHMORE (0.5 miles)
Landscape Resolution	30 meters

FSPro Analysis 'MORU Test 2012 Starling Basin'

Time (CST)	User	Note
11/06/2019 13:04	Stover, Al	This 3 day FSPro Model uses Finney for crown fire initiation and 2012 weather. Fuels were not edited to take into account recent beetle kill/dead and down, scattered pockets of burnable vegetation in the developed area or current fuel treatments. Run could be fairly representative of a fire scenario from a single ignition in Starling Basin on July 3rd-5th under well above average burning conditions. The model assumes no suppression action and is intended for planning purposes only.



Contact Information

No contacts exist.

History

Time (CST)	Status	User	Comments
11/05/2019 12:26:33	Assigned	Stover, Al	Use 30 meter resolution, 2012 weather and a single ignition in Starling Basin.
11/05/2019 12:29:31	Queued	Stover, Al	
11/05/2019 12:29:33	In Process		
11/05/2019 12:31:01	Processing Results		
11/05/2019 12:31:12	Review		
11/06/2019 13:04:50	Complete	Stover, Al	This 3 day FSPro Model uses Finney for crown fire initiation and 2012 weather. Fuels were not edited to take into account recent beetle kill/dead and down, scattered pockets of burnable vegetation in the developed area or current fuel treatments. Run could be fairly representative of a fire scenario from a single ignition in Starling Basin on July 3rd-5th under well above average burning conditions. The model assumes no suppression action and is intended for planning purposes only.

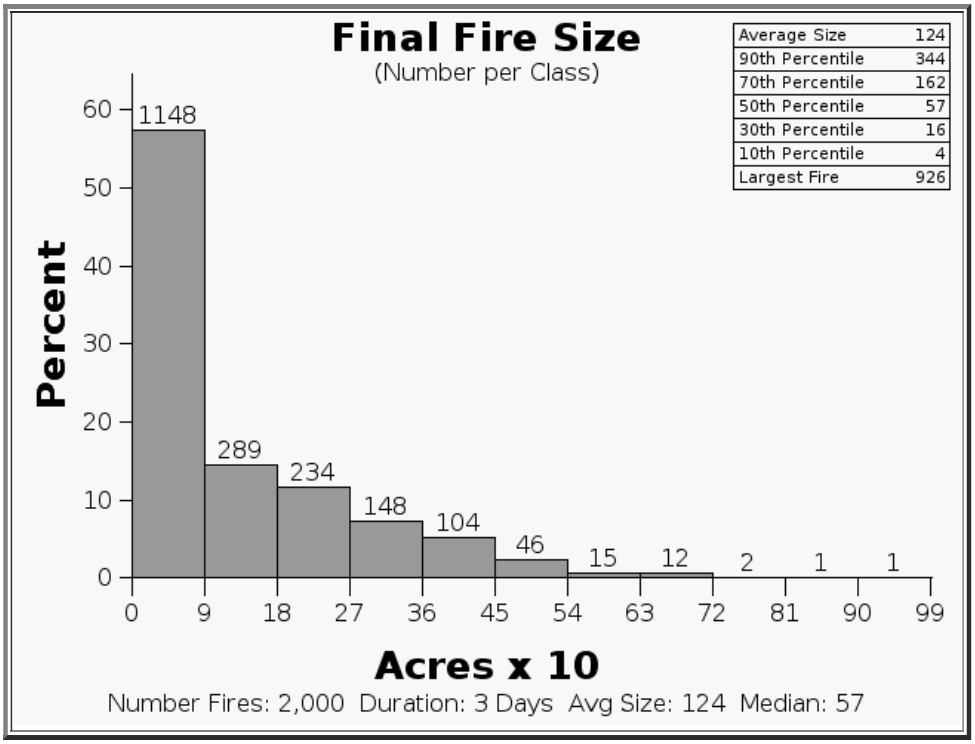
FSPro Results

FSPro Fire Sizes

FIRE SIZE	ACRES
Average Size	124
90th Percentile	344
70th Percentile	162
50th Percentile	57
30th Percentile	16
10th Percentile	4
Largest Fire	926

FSPro Histogram

FSPro Histogram



Daily Acres List

Date	Average Acres	Minimum Acres	Maximum Acres	No Burn Days
07/03/2012	20.4	0	269.1	116
07/04/2012	49.2	0.4	423.9	241
07/05/2012	76.3	0.2	888.5	404

FSPro ERC Classes

ERC Classes Annotations

No notes exist.

ERC Station Information

NAME	VALUE
ERC Station Name	392603 - MT. RUSHMORE (0.5 miles)
Latitude	43.8778 N
Longitude	103.44946 W
Elevation	5,071 feet
Aspect	Southwest
Position on Slope	Mid-Slope
Average Precipitation	18.00 inches
Forecast Zone	262
Climate Class	2 : Subhumid
Green Up Month/Day	05/24
Grass Type	P : Perennial
Slope Class	2: 26 - 40%
Station Type	4 - NFDRS Satellite

ERC Classes Filter

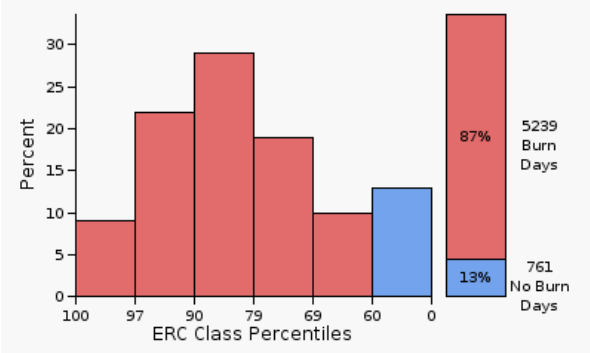
NAME	VALUE
Year Range	2000 to 2019
Date Range	03/01 to 10/31
Maximum Lag	30 days
Degrees of Fit	9

ERC Classes

ERC Classes

%ile	Min ERC	1 Hour	10 Hour	100 Hour	Herb FM	Woody FM	Burn Period	Spot Prob	Delay
97	69	3.7	4.3	6.3	67.4	92.2	360	0.15	0
90	61	4.6	5.4	7.7	83.6	106.2	300	0.10	0
79	54	5.3	6.1	8.8	97.4	118.1	240	0.05	0
69	49	5.9	6.8	9.9	106.7	126.2	180	0.01	0
60	45	6.5	7.4	10.9	112.4	131.1	120	0.00	0

ERC Class Burn Days Summary



%ile	Min ERC	Burn Days	%
97	69	513	9
90	61	1290	22
79	54	1715	29
69	49	1119	19
60	45	602	10
		5239	87

761 No-Burn Days (13 %)

2000 fires X 3 non-forecast days = 6000 days

ERC Percentiles

%ile	ERC	1 Hour	10 Hour	100 Hour	1000 Hour	Herb	Woody
100	87.0	3.45	3.87	5.79	7.62	32.36	61.46
99	76.0	3.33	3.90	6.32	9.20	30.66	69.17
98	71.0	3.65	4.45	6.53	9.80	28.60	70.13
97	69.0	4.32	5.01	6.89	9.81	33.42	72.97
96	67.0	4.01	4.84	7.13	10.33	35.59	75.28
95	66.0	4.48	5.28	7.48	10.40	34.48	76.05
94	64.0	4.49	5.30	7.79	10.57	38.09	76.89
93	63.0	4.63	5.41	7.96	10.80	38.45	79.52
92	62.0	4.75	5.35	7.89	11.03	45.35	82.20
91	61.0	5.43	6.10	8.16	10.97	37.52	79.12
90	61.0	5.43	6.10	8.16	10.97	37.52	79.12
89	60.0	4.60	5.40	8.51	11.52	38.71	83.73
88	59.0	5.73	6.43	8.09	11.46	45.94	85.95
87	59.0	5.73	6.43	8.09	11.46	45.94	85.95
86	58.0	4.60	5.52	8.57	12.07	41.97	86.23
85	57.0	6.19	6.81	8.87	11.57	39.70	82.68
84	56.0	5.88	6.63	8.87	12.00	42.51	88.83
83	56.0	5.88	6.63	8.87	12.00	42.51	88.83
82	55.0	5.33	6.19	9.12	12.45	35.69	84.26
81	55.0	5.33	6.19	9.12	12.45	35.69	84.26
80	54.0	5.42	6.28	9.30	12.65	38.43	85.37
79	54.0	5.42	6.28	9.30	12.65	38.43	85.37
78	53.0	5.61	6.47	9.44	12.83	39.43	87.20
77	53.0	5.61	6.47	9.44	12.83	39.43	87.20
76	52.0	5.95	6.78	9.65	12.93	39.52	89.08
75	52.0	5.95	6.78	9.65	12.93	39.52	89.08
74	51.0	6.08	6.90	9.67	13.15	46.73	94.48
73	51.0	6.08	6.90	9.67	13.15	46.73	94.48
72	50.0	5.79	6.72	10.11	13.43	43.34	92.35
71	50.0	5.79	6.72	10.11	13.43	43.34	92.35
70	49.0	6.10	7.03	10.68	13.42	45.06	89.76
69	49.0	6.10	7.03	10.68	13.42	45.06	89.76
68	48.0	6.14	7.15	10.82	13.67	48.64	95.93
67	48.0	6.14	7.15	10.82	13.67	48.64	95.93
66	47.0	6.08	7.05	10.64	14.11	45.98	96.14
65	47.0	6.08	7.05	10.64	14.11	45.98	96.14
64	47.0	6.08	7.05	10.64	14.11	45.98	96.14
63	46.0	6.66	7.77	11.23	14.00	43.90	93.16
62	46.0	6.66	7.77	11.23	14.00	43.90	93.16
61	45.0	6.96	7.77	10.80	14.42	49.53	95.89
60	45.0	6.96	7.77	10.80	14.42	49.53	95.89
59	44.0	6.77	7.73	11.29	14.68	43.83	92.36

ERC Percentiles

%ile	ERC	1 Hour	10 Hour	100 Hour	1000 Hour	Herb	Woody
58	44.0	6.77	7.73	11.29	14.68	43.83	92.36
57	44.0	6.77	7.73	11.29	14.68	43.83	92.36
56	43.0	7.25	8.12	11.64	14.69	51.17	99.97
55	43.0	7.25	8.12	11.64	14.69	51.17	99.97
54	42.0	7.38	8.35	11.79	14.92	51.91	100.92
53	42.0	7.38	8.35	11.79	14.92	51.91	100.92
52	41.0	7.39	8.54	12.46	15.04	45.34	94.99
51	41.0	7.39	8.54	12.46	15.04	45.34	94.99
50	41.0	7.39	8.54	12.46	15.04	45.34	94.99
49	40.0	7.29	8.42	12.14	15.62	47.76	98.09
48	40.0	7.29	8.42	12.14	15.62	47.76	98.09
47	39.0	8.29	9.20	12.25	15.61	44.76	93.55
46	39.0	8.29	9.20	12.25	15.61	44.76	93.55
45	38.0	8.26	9.17	12.65	15.85	44.19	94.53
44	38.0	8.26	9.17	12.65	15.85	44.19	94.53
43	38.0	8.26	9.17	12.65	15.85	44.19	94.53
42	37.0	7.66	8.86	13.00	16.28	46.55	100.17
41	37.0	7.66	8.86	13.00	16.28	46.55	100.17
40	36.0	8.12	9.13	13.38	16.44	41.24	95.03
39	36.0	8.12	9.13	13.38	16.44	41.24	95.03
38	35.0	8.93	10.02	13.63	16.41	41.96	96.46
37	35.0	8.93	10.02	13.63	16.41	41.96	96.46
36	35.0	8.93	10.02	13.63	16.41	41.96	96.46
35	34.0	10.56	11.14	13.87	16.13	47.93	101.88
34	34.0	10.56	11.14	13.87	16.13	47.93	101.88
33	33.0	9.98	10.96	14.18	16.61	48.11	98.35
32	33.0	9.98	10.96	14.18	16.61	48.11	98.35
31	32.0	9.84	10.82	14.36	17.01	48.38	100.86
30	32.0	9.84	10.82	14.36	17.01	48.38	100.86
29	31.0	9.65	11.06	14.71	17.37	44.45	96.69
28	31.0	9.65	11.06	14.71	17.37	44.45	96.69
27	30.0	10.08	11.13	14.80	17.65	50.14	102.20
26	30.0	10.08	11.13	14.80	17.65	50.14	102.20
25	29.0	11.26	11.93	15.04	17.61	49.17	101.71
24	29.0	11.26	11.93	15.04	17.61	49.17	101.71
23	28.0	10.25	11.45	16.01	18.03	49.25	99.73
22	27.0	11.01	12.02	16.24	18.06	58.08	101.59
21	27.0	11.01	12.02	16.24	18.06	58.08	101.59
20	26.0	10.73	11.89	15.68	19.01	57.75	102.48
19	25.0	14.15	14.56	16.08	17.86	67.55	115.55
18	25.0	14.15	14.56	16.08	17.86	67.55	115.55
17	24.0	11.72	12.76	16.88	19.12	62.96	106.28
16	23.0	15.14	15.43	16.73	18.52	58.19	107.73
15	22.0	15.40	15.72	17.03	18.65	71.14	108.91
14	21.0	16.49	16.92	17.24	18.66	64.80	106.47
13	20.0	17.28	17.67	17.02	19.07	72.78	115.04
12	19.0	17.02	17.57	18.89	19.12	59.91	99.08
11	18.0	16.94	18.06	19.01	19.59	65.94	110.54
10	17.0	22.38	23.39	17.78	18.44	65.98	98.83
9	15.0	20.66	21.40	18.72	19.69	70.41	108.45
8	14.0	21.08	21.68	18.70	20.32	58.00	95.66
7	13.0	26.44	27.08	18.91	18.82	60.92	93.76
6	11.0	28.15	28.43	19.43	18.96	62.43	92.65
5	10.0	29.40	29.87	20.41	19.07	72.03	106.97
4	8.0	27.58	27.82	21.01	20.70	78.93	106.16
3	6.0	29.93	30.01	22.45	20.85	57.93	93.42
2	3.0	31.90	32.14	23.21	22.67	68.16	91.87
1	0.0	35.00	35.00	26.54	23.69	65.04	90.07

FSPro ERC Stream

ERC Stream Annotations

Time (CST)	User	Annotation
11/06/2019 13:00	Stover, Al	Used Mt Rushmore RAWS and weather from 2012.

ERC Stream

Date	Avg ERC	Std Dev	ERC
03/01/2012	36.72	15.87	49
03/02/2012	38.83	13.11	48
03/03/2012	38.94	14.50	46
03/04/2012	39.18	17.90	46
03/05/2012	41.00	15.77	55
03/06/2012	38.89	17.87	56
03/07/2012	40.44	15.10	51
03/08/2012	38.78	16.74	58
03/09/2012	36.61	18.64	64
03/10/2012	39.24	19.78	69
03/11/2012	41.17	17.80	66
03/12/2012	43.33	16.17	68
03/13/2012	42.83	17.24	70
03/14/2012	44.78	15.49	70
03/15/2012	41.28	15.46	71
03/16/2012	38.22	17.99	73
03/17/2012	38.94	17.80	74
03/18/2012	39.22	17.11	75
03/19/2012	42.47	17.72	74
03/20/2012	39.71	17.85	72
03/21/2012	41.17	16.73	77
03/22/2012	37.71	16.59	79
03/23/2012	35.89	16.35	70
03/24/2012	37.83	18.14	73
03/25/2012	35.39	16.78	65
03/26/2012	35.50	13.56	61
03/27/2012	33.47	17.17	56
03/28/2012	35.56	17.87	63
03/29/2012	36.89	16.44	61
03/30/2012	36.11	17.00	66
03/31/2012	36.89	16.85	70
04/01/2012	36.33	18.53	73
04/02/2012	33.33	20.01	59
04/03/2012	36.11	19.14	71
04/04/2012	35.61	21.09	69
04/05/2012	34.94	21.11	71
04/06/2012	35.67	18.74	64
04/07/2012	33.28	18.46	67
04/08/2012	34.53	19.42	69
04/09/2012	35.83	19.42	70
04/10/2012	34.22	18.95	69
04/11/2012	33.78	18.83	65
04/12/2012	37.39	17.45	68
04/13/2012	41.22	17.30	64
04/14/2012	40.94	13.48	33
04/15/2012	38.44	14.28	24
04/16/2012	38.11	16.37	36
04/17/2012	32.83	16.72	43
04/18/2012	28.50	16.03	39
04/19/2012	31.94	9.15	28
04/20/2012	31.94	11.41	40
04/21/2012	31.83	12.25	45
04/22/2012	32.24	15.08	50
04/23/2012	30.41	16.83	55
04/24/2012	32.00	16.12	58
04/25/2012	29.82	17.84	60
04/26/2012	29.00	15.27	51
04/27/2012	29.00	14.75	17
04/28/2012	31.71	13.83	36
04/29/2012	30.44	14.33	42
04/30/2012	32.35	14.76	49
05/01/2012	32.35	13.53	51
05/02/2012	33.06	13.70	50
05/03/2012	32.82	13.60	50
05/04/2012	33.35	13.77	22
05/05/2012	30.06	17.53	15

ERC Stream

Date	Avg ERC	Std Dev	ERC
05/06/2012	33.56	15.16	40
05/07/2012	33.11	15.57	45
05/08/2012	31.28	16.07	48
05/09/2012	27.78	17.64	49
05/10/2012	27.39	16.20	53
05/11/2012	29.94	15.70	54
05/12/2012	29.56	17.19	58
05/13/2012	33.22	14.74	63
05/14/2012	34.61	15.74	66
05/15/2012	33.41	15.51	66
05/16/2012	34.94	14.36	69
05/17/2012	34.35	15.68	66
05/18/2012	31.00	19.09	61
05/19/2012	32.78	14.45	60
05/20/2012	33.44	12.27	60
05/21/2012	30.33	13.79	64
05/22/2012	30.28	13.89	68
05/23/2012	28.72	16.50	43
05/24/2012	27.28	16.20	21
05/25/2012	31.00	13.78	16
05/26/2012	28.39	14.35	13
05/27/2012	30.44	13.59	35
05/28/2012	26.11	15.51	39
05/29/2012	27.12	14.36	40
05/30/2012	29.06	10.20	42
05/31/2012	30.39	11.17	39
06/01/2012	31.17	11.61	46
06/02/2012	28.71	16.20	52
06/03/2012	29.11	16.12	49
06/04/2012	31.94	14.83	50
06/05/2012	29.06	17.68	53
06/06/2012	30.28	17.26	56
06/07/2012	29.83	15.60	38
06/08/2012	29.78	13.33	43
06/09/2012	29.72	16.18	46
06/10/2012	29.44	15.99	44
06/11/2012	30.22	15.88	45
06/12/2012	31.72	14.62	45
06/13/2012	32.22	17.84	48
06/14/2012	35.00	15.42	48
06/15/2012	34.33	13.80	52
06/16/2012	33.82	14.59	50
06/17/2012	33.56	15.22	56
06/18/2012	33.83	16.79	57
06/19/2012	32.29	17.46	49
06/20/2012	33.44	14.39	39
06/21/2012	35.00	15.86	50
06/22/2012	35.61	14.51	50
06/23/2012	36.17	18.70	51
06/24/2012	35.33	18.93	48
06/25/2012	38.11	15.98	46
06/26/2012	41.17	15.96	55
06/27/2012	42.56	14.82	58
06/28/2012	43.41	14.52	59
06/29/2012	43.65	14.59	61
06/30/2012	41.33	14.32	60
07/01/2012	41.56	13.98	62
07/02/2012	40.59	14.17	60
07/03/2012	41.17	13.94	62
07/04/2012	42.89	13.11	64
07/05/2012	40.76	15.11	61
07/06/2012	38.06	12.32	40
07/07/2012	41.56	10.35	39
07/08/2012	41.89	12.15	45
07/09/2012	39.11	12.60	50
07/10/2012	41.78	13.70	52
07/11/2012	42.28	15.85	58

ERC Stream

Date	Avg ERC	Std Dev	ERC
07/12/2012	44.83	13.61	53
07/13/2012	47.28	13.12	61
07/14/2012	47.28	15.78	60
07/15/2012	50.33	14.64	63
07/16/2012	51.28	13.99	67
07/17/2012	48.17	16.04	56
07/18/2012	49.22	12.76	52
07/19/2012	45.94	11.56	59
07/20/2012	48.17	12.66	61
07/21/2012	49.50	11.37	57
07/22/2012	45.17	17.61	18
07/23/2012	48.50	15.02	46
07/24/2012	48.67	12.89	50
07/25/2012	46.59	13.69	43
07/26/2012	46.71	11.66	45
07/27/2012	44.12	14.13	48
07/28/2012	44.59	13.08	48
07/29/2012	48.59	12.78	53
07/30/2012	50.71	12.13	53
07/31/2012	50.59	11.23	59
08/01/2012	51.06	11.89	60
08/02/2012	49.47	12.49	61
08/03/2012	49.12	10.50	55
08/04/2012	46.06	13.74	59
08/05/2012	46.94	13.19	65
08/06/2012	48.35	11.34	66
08/07/2012	45.11	11.68	64
08/08/2012	43.82	10.90	64
08/09/2012	45.06	10.52	64
08/10/2012	46.22	13.73	64
08/11/2012	45.18	9.89	59
08/12/2012	46.82	13.37	59
08/13/2012	46.24	13.09	57
08/14/2012	45.24	14.67	56
08/15/2012	46.28	14.28	56
08/16/2012	47.18	11.95	56
08/17/2012	46.12	9.81	60
08/18/2012	47.28	10.75	64
08/19/2012	46.72	11.03	67
08/20/2012	49.22	9.92	68
08/21/2012	50.83	10.17	70
08/22/2012	51.89	11.13	69
08/23/2012	53.11	10.77	72
08/24/2012	50.89	11.95	76
08/25/2012	52.11	13.11	75
08/26/2012	51.06	14.88	73
08/27/2012	49.72	14.12	76
08/28/2012	50.67	13.75	78
08/29/2012	53.53	10.59	81
08/30/2012	53.72	10.49	80
08/31/2012	53.89	15.32	78
09/01/2012	55.89	12.06	81
09/02/2012	58.35	11.14	79
09/03/2012	58.33	11.77	85
09/04/2012	57.78	14.91	87
09/05/2012	56.67	13.15	83
09/06/2012	55.39	15.90	83
09/07/2012	53.35	15.59	73
09/08/2012	52.06	16.43	78
09/09/2012	50.35	17.19	81
09/10/2012	53.78	14.24	83
09/11/2012	49.56	18.14	82
09/12/2012	47.28	19.37	81
09/13/2012	45.28	19.19	79
09/14/2012	43.83	17.93	84
09/15/2012	47.11	17.81	86
09/16/2012	49.11	14.22	83

ERC Stream

Date	Avg ERC	Std Dev	ERC
09/17/2012	48.81	11.02	74
09/18/2012	49.50	13.97	81
09/19/2012	52.53	14.97	82
09/20/2012	52.71	13.80	81
09/21/2012	49.59	13.22	82
09/22/2012	42.41	19.49	81
09/23/2012	45.63	14.20	80
09/24/2012	43.61	17.11	81
09/25/2012	48.94	14.06	83
09/26/2012	48.47	15.53	82
09/27/2012	47.19	16.42	80
09/28/2012	48.50	15.93	76
09/29/2012	49.76	16.05	81
09/30/2012	48.94	19.07	78
10/01/2012	49.71	17.42	77
10/02/2012	45.94	17.35	81
10/03/2012	41.71	18.91	69
10/04/2012	43.59	17.12	70
10/05/2012	41.59	15.02	60
10/06/2012	39.50	16.71	48
10/07/2012	39.00	18.30	58
10/08/2012	35.76	18.65	60
10/09/2012	40.12	15.00	55
10/10/2012	39.29	17.28	63
10/11/2012	37.65	15.23	48
10/12/2012	38.59	17.76	61
10/13/2012	38.47	20.17	65
10/14/2012	43.38	15.17	65
10/15/2012	44.33	14.01	69
10/16/2012	45.06	11.51	66
10/17/2012	45.94	10.71	60
10/18/2012	48.12	10.54	63
10/19/2012	44.22	14.12	66
10/20/2012	43.11	16.79	71
10/21/2012	43.61	14.25	63
10/22/2012	40.84	13.04	51
10/23/2012	44.42	12.20	55
10/24/2012	42.24	12.15	24
10/25/2012	43.22	10.77	23
10/26/2012	44.82	11.21	30
10/27/2012	42.76	15.71	34
10/28/2012	43.72	17.72	39
10/29/2012	40.84	17.87	42
10/30/2012	45.41	14.26	43
10/31/2012	42.32	15.78	50

Weather Forecast Data

No weather forecasts have been saved.

FSPro Winds

Winds Annotations

Time (CST)	User	Annotation
11/06/2019 13:00	Stover, Al	Used Mt Rushmore RAWS ten minute average winds.

Winds Station Information

NAME	VALUE
Winds Station Name	392603 - MT. RUSHMORE (0.5 miles)
Latitude	43.8778 N
Longitude	103.44946 W
Elevation	5,071 feet
Aspect	Southwest
Position on Slope	Mid-Slope
Forecast Zone	262
Station Type	4 - NFDRS Satellite

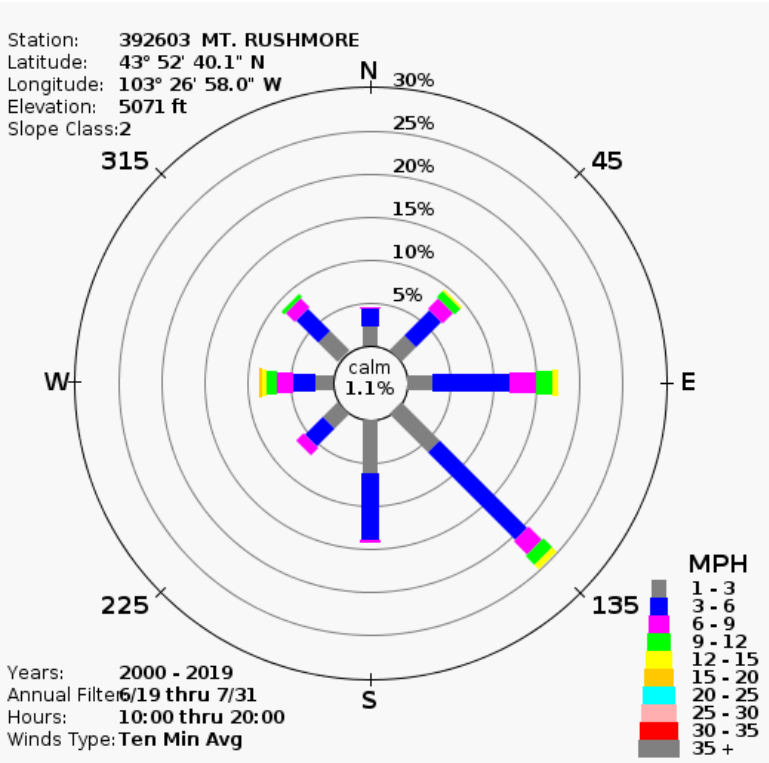
Winds Filter

NAME	VALUE
Year Range	2000 to 2019
Date Range	06/19 to 07/31
Hour Range	10 to 20
Winds Type	Ten Min Avg
Calm Wind Threshhold	1 mph
Calm Weight	1.15
Total Weight	100.01

Winds Matrix

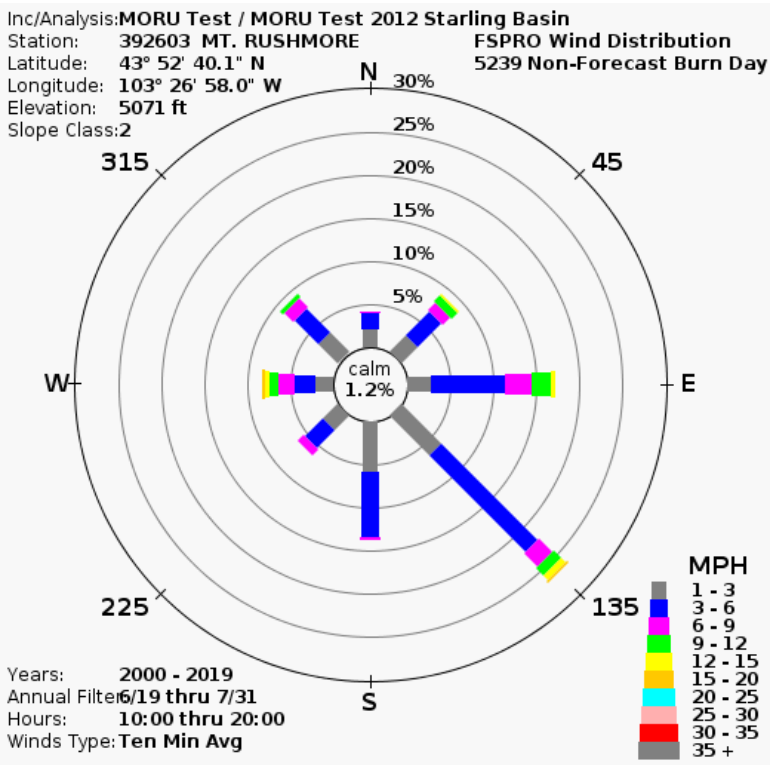
Speed	45	90	135	180	225	270	315	360
3	2.47	3.03	6.46	6.21	2.46	2.20	3.39	2.31
6	4.23	8.99	14.61	7.83	3.08	2.70	3.89	2.10
9	1.71	3.23	2.24	0.37	1.28	1.93	1.51	0.24
12	1.02	1.95	1.67	0.00	0.21	1.28	0.56	0.00
15	0.32	0.69	0.82	0.00	0.01	0.61	0.10	0.00
20	0.20	0.05	0.23	0.00	0.01	0.45	0.01	0.00
25	0.03	0.00	0.00	0.00	0.00	0.13	0.01	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00

Station Wind Rose



FSPro Wind Rose

FSPro Wind Rose



FSPro Landscape

Landscape Annotations

Time (CST)	User	Annotation
11/06/2019 12:59	Stover, Al	Used LandFire 2014 1.4.0 at a 30 meter resolution with no fuel edits

Landscape Information

NAME	VALUE
Landscape Source	LANDFIRE 2014 1.4.0
Upper Latitude	43.9317 N
Lower Latitude	43.8561 N
Left Longitude	103.5427 W
Right Longitude	103.3642 W
Fuel Model	40
Resolution	30 meters

Landscape Editor Annotations

No notes exist.

Landscape Editor Rules

No Landscape Editor Rules exist.

Values at Risk

NAME	VALUE
Incident Name	MORU Test
Analysis Name	MORU Test 2012 Starling Basin
Author	Stover, Al
Analyst	Stover, Al
Latitude	43.87917
Longitude	103.45917
Geographical Area	Rocky Mountain
Values Generated Time	11/06/2019 13:05

Values List

Values List

Category	80-100%	60-79%	40-59%	20-39%	5-19%	0.2-4.9%	< 0.2%	Expected Value
Building Clusters: Pennington, SD	no data	no data	no data	no data	no data	no data	no data	no data
Campgrounds	0	0	0	0	0	1	4	0.03
County: Pennington, SD	8 acres	18 acres	72 acres	147 acres	181 acres	476 acres	837 acres	136 acres
Jurisdictional Agency: NPS	8 acres	18 acres	60 acres	51 acres	62 acres	135 acres	342 acres	76.7 acres
Jurisdictional Agency: USFS	0 acres	0 acres	14 acres	98 acres	122 acres	342 acres	424 acres	61.0 acres
Mgmt Req	0 acres	0 acres						0.0 acres
Mgmt Req: MA 1.1A			14 acres	98 acres	122 acres	331 acres	184 acres	60.4 acres
NPS Admin Boundaries: MORU	8 acres	18 acres	60 acres	51 acres	62 acres	135 acres	342 acres	76.7 acres
Natl Recreation Trails	0.0 miles	0.0 miles	0.0 miles	0.0 miles	0.2 miles	1.9 miles	0.2 miles	0.07 miles
Natl Scenic Byways	0.0 miles	0.0 miles	0.0 miles	0.1 miles	0.1 miles	0.3 miles	0.5 miles	0.05 miles
Other Areas: Norbeck Wildlife Preserve	0 acres	0 acres	14 acres	98 acres	122 acres	342 acres	493 acres	61.0 acres
Roads	0.0 miles	0.0 miles	0.0 miles	0.1 miles	0.0 miles	0.3 miles	0.6 miles	0.04 miles
Wilderness: Black Elk Wilderness	0 acres	0 acres	14 acres	98 acres	122 acres	332 acres	184 acres	60.5 acres

Currency/Coverage of Values Reported

Category	Data Source	Currency	Coverage
Building Clusters	US Counties / FGDC Cadastral Subcomm.		Available counties - No data available for Pennington, SD
Campgrounds	BLM (FAMS) and USFS INFRA	6/01/2018	National (BLM and USFS only)
County	US Census Bureau, TIGER/Line	2018	National
Jurisdictional Agency	Various	05/29/2015	National
Mgmt Req		Current	Unit Level
NPS Admin Boundaries	NPS	09/30/2018	National
Natl Recreation Trails	NPS	2/28/2019	National
Natl Scenic Byways	NPS	2/28/2019	National
Other Areas	USGS PADUS 1.4	03/13/2019	National
Roads	NAVTEQ	11/2012	National
Wilderness	Wilderness.net	01/31/2019	National

Coverage of Values Queried that Produced No Results

AK Fire Mgmt Options (Alaska only), Aqua Retardant Avoidance (National (USFS Units only)), BIA Admin Boundaries (National), BLM Buildings (BLM Lands), BLM Horse and Burro (National), BLM Mgmt Requirements (National (BLM Land Only)), BLM Oil / Gas Leases (National), BLM Range Allotments (National), Canada / Mexico (National), Class 1 Airsheds (National), Communication Towers (National), Electric Power Plants (National), Electric Sub Stations (National), Electric Transmission Lines (National), Estimated Population (National), Habitat (National), IRA (National), Mines (National), NRA (National), Natl Historic Trails (National), Natl Scenic Trails (National), Oil and Gas Pipelines (National), Ozone Non-Attainment (National), Particulates Non-Attainment (National), Responsible Agency (AK, CA, ID, MT, NM, MN), Retardant Avoidance (National (USFS Units only)), Sage Grouse Habitat (National), TNC Lands (National), USFS Buildings (National), USFWS Admin Boundaries (National), USFWS Trails (National), WSA (National)

Return

7.1.2 2013 Normal Year

Figure A3 displays the ERC for 2013 from the WFDSS model. The ERC is around 40 on July 3 in the representative model.

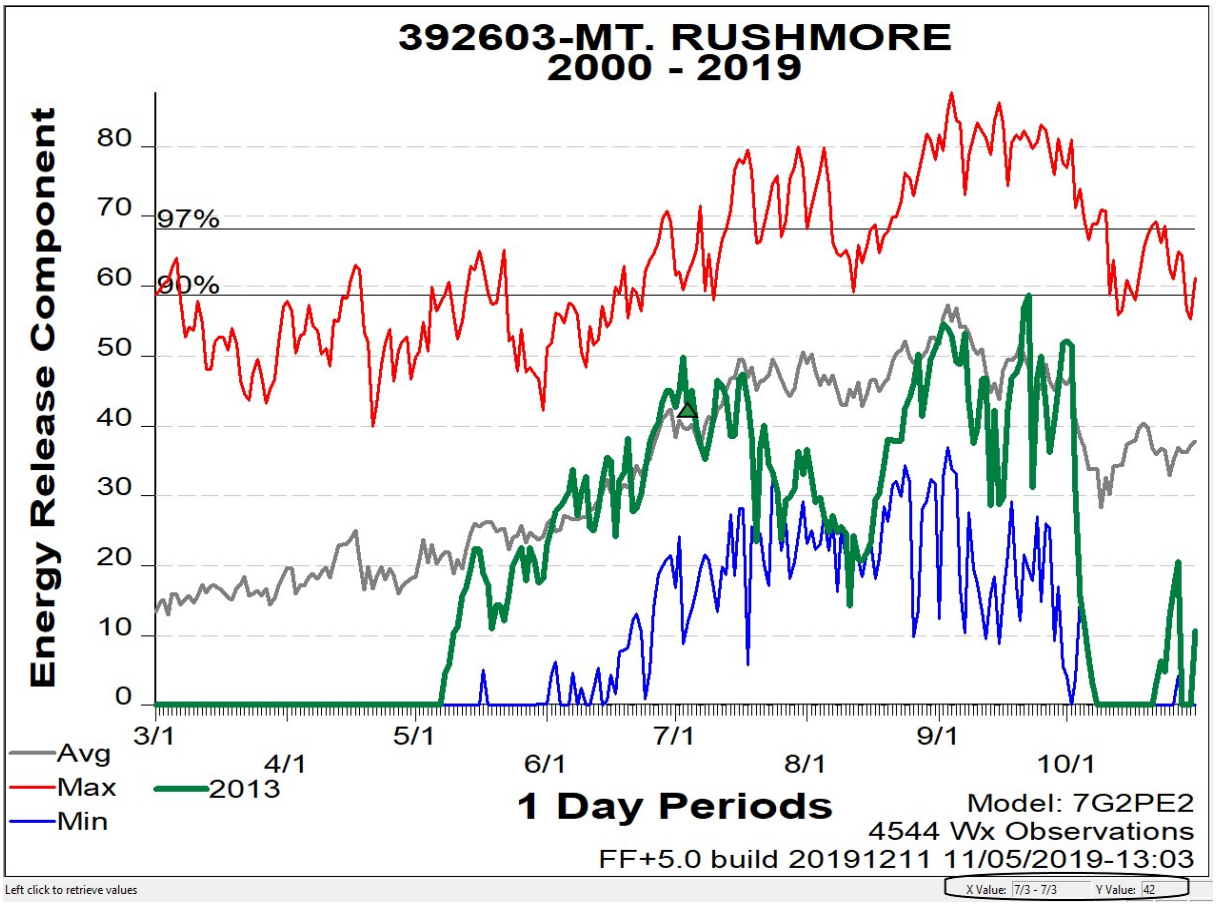


Figure A3. Energy Release Component for WFDSS 2013 Normal Year

Below is the full WFDSS 2013 Analysis Report.

Analysis Report

Incident Information

Return

Incident Information

NAME	VALUE
Incident Name	MORU Test
Unique Fire Identifier	2019-SDMRP-190001
Responsible Unit Name	Mount Rushmore National Monument
FireCode	
P-Code	
Point of Origin	43.87917 N / 103.45917 W
Incident Size	0.1 acres
Latest Perimeter Size	0 acres
Incident Cause	Unknown
Incident Type	Wildfire
Incident Discovery	07/03/2019 22:00
Contained	
Controlled	
Out	
Jurisdictional Unit	SDMRP - Mount Rushmore National Monument
Jurisdictional Agency(s)	NPS, USFS
Geographic Area (prep level)	Rocky Mountain (2)
Owner Name(s)	Al Stover

Analysis Information

Return

FSPro Information Annotations

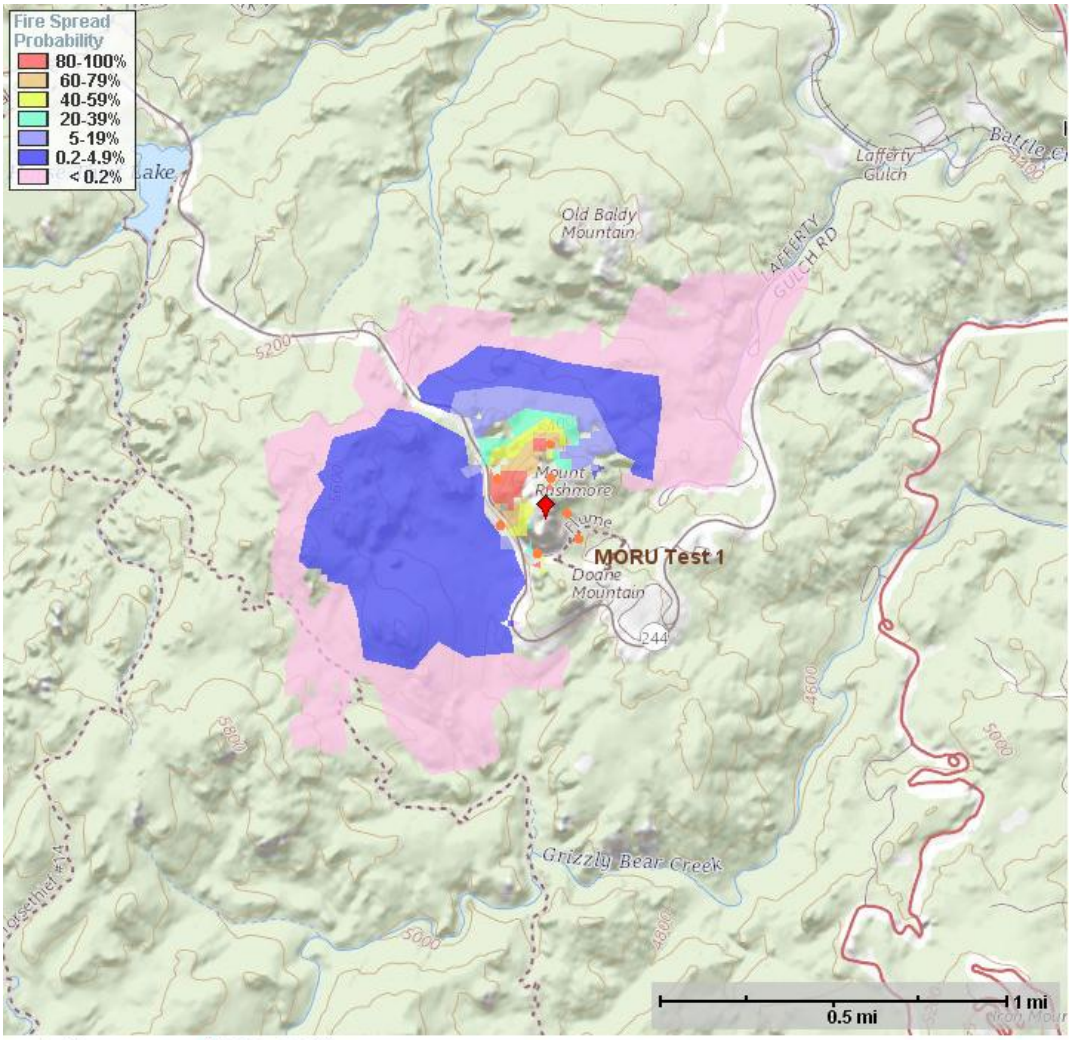
Time (CST)	User	Annotation
11/06/2019 11:54	Stover, Al	Ignitions were modeled after historic wildfire start locations from 2000-2009 fireworks displays.

FSPro General Information

NAME	VALUE
Analysis Name	MORU Test 2013 HighRes
Analyst Name	Stover, Al
Completed	11/06/2019 12:39
Analysis Status	Complete
Analysis Start	07/03/2013
Duration	3 days
Simulations	2000 fires
Crown Fire Method	Finney (1998)
Ignition	MORU Test 1
Barrier	No barrier specified
ERC Station	392603 - MT. RUSHMORE (0.5 miles)
Winds Station	392603 - MT. RUSHMORE (0.5 miles)
Landscape Resolution	30 meters

FSPro Analysis 'MORU Test 2013 HighRes'

Time (CST)	User	Note
11/06/2019 12:39	Stover, Al	This 3 day FSPro Model uses Finney for crown fire initiation and 2013 weather. Fuels were not edited to take into account recent beetle kill/dead and down, scattered pockets of burnable vegetation in the developed area or current fuel treatments. Run could be fairly representative of a fire scenario July 3rd-5th under near average burning conditions. The model assumes no suppression action and is intended for planning purposes only.



Contact Information

No contacts exist.

History

Time (CST)	Status	User	Comments
11/05/2019 11:20:18	Assigned	Stover, Al	Use 10 meter resolution and 2013 weather.
11/05/2019 11:24:00	Queued	Stover, Al	
11/05/2019 11:24:01	In Process		
11/05/2019 11:25:54	Processing Results		
11/05/2019 11:26:12	Review		
11/06/2019 12:39:23	Complete	Stover, Al	This 3 day FSPro Model uses Finney for crown fire initiation and 2013 weather. Fuels were not edited to take into account recent beetle kill/dead and down, scattered pockets of burnable vegetation in the developed area or current fuel treatments. Run could be fairly representative of a fire scenario July 3rd-5th under near average burning conditions. The model assumes no suppression action and is intended for planning purposes only.

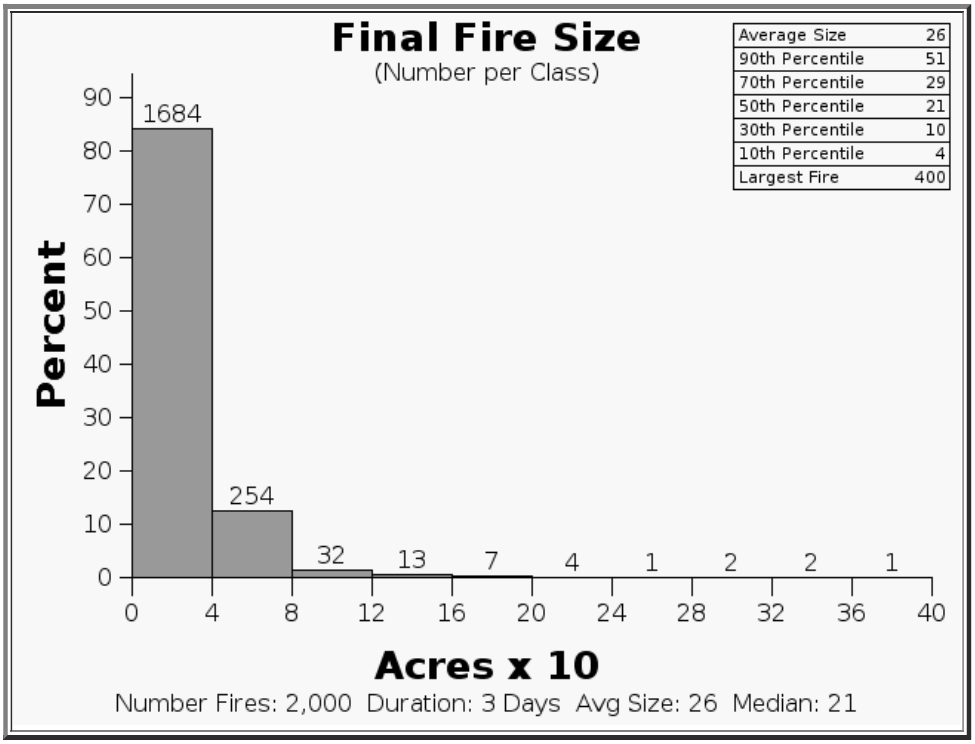
FSPro Results

FSPro Fire Sizes

FIRE SIZE	ACRES
Average Size	26
90th Percentile	51
70th Percentile	29
50th Percentile	21
30th Percentile	10
10th Percentile	4
Largest Fire	400

FSPro Histogram

FSPro Histogram



Daily Acres List

Date	Average Acres	Minimum Acres	Maximum Acres	No Burn Days
07/03/2013	12.3	4.4	87.2	734
07/04/2013	12.1	2.9	222.6	888
07/05/2013	17	3.1	247.1	960

FSPro ERC Classes

ERC Classes Annotations

No notes exist.

ERC Station Information

NAME	VALUE
ERC Station Name	392603 - MT. RUSHMORE (0.5 miles)
Latitude	43.8778 N
Longitude	103.44946 W
Elevation	5,071 feet
Aspect	Southwest
Position on Slope	Mid-Slope
Average Precipitation	18.00 inches
Forecast Zone	262
Climate Class	2 : Subhumid
Green Up Month/Day	05/24
Grass Type	P : Perennial
Slope Class	2: 26 - 40%
Station Type	4 - NFDRS Satellite

ERC Classes Filter

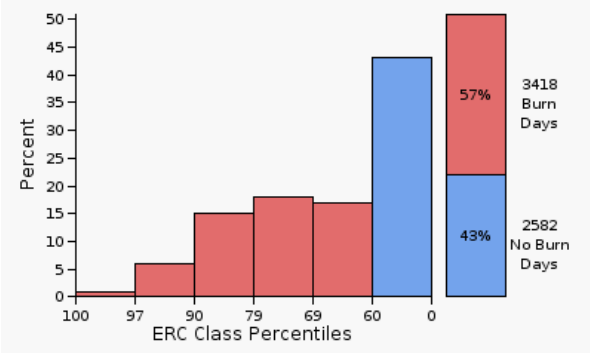
NAME	VALUE
Year Range	2000 to 2019
Date Range	03/01 to 10/31
Maximum Lag	30 days
Degrees of Fit	9

ERC Classes

ERC Classes

%ile	Min ERC	1 Hour	10 Hour	100 Hour	Herb FM	Woody FM	Burn Period	Spot Prob	Delay
97	69	3.7	4.3	6.3	67.4	92.2	360	0.15	0
90	61	4.6	5.4	7.7	83.6	106.2	300	0.10	0
79	54	5.3	6.1	8.8	97.4	118.1	240	0.05	0
69	49	5.9	6.8	9.9	106.7	126.2	180	0.01	0
60	45	6.5	7.4	10.9	112.4	131.1	120	0.00	0

ERC Class Burn Days Summary



%ile	Min ERC	Burn Days	%
97	69	49	1
90	61	345	6
79	54	915	15
69	49	1092	18
60	45	1017	17
		3418	57

2582 No-Burn Days (43 %)
2000 fires X 3 non-forecast days = 6000 days

ERC Percentiles

%ile	ERC	1 Hour	10 Hour	100 Hour	1000 Hour	Herb	Woody
100	87.0	3.45	3.87	5.79	7.62	32.36	61.46
99	76.0	3.33	3.90	6.32	9.20	30.66	69.17
98	71.0	3.65	4.45	6.53	9.80	28.60	70.13
97	69.0	4.32	5.01	6.89	9.81	33.42	72.97
96	67.0	4.01	4.84	7.13	10.33	35.59	75.28
95	66.0	4.48	5.28	7.48	10.40	34.48	76.05
94	64.0	4.49	5.30	7.79	10.57	38.09	76.89
93	63.0	4.63	5.41	7.96	10.80	38.45	79.52
92	62.0	4.75	5.35	7.89	11.03	45.35	82.20
91	61.0	5.43	6.10	8.16	10.97	37.52	79.12
90	61.0	5.43	6.10	8.16	10.97	37.52	79.12
89	60.0	4.60	5.40	8.51	11.52	38.71	83.73
88	59.0	5.73	6.43	8.09	11.46	45.94	85.95
87	59.0	5.73	6.43	8.09	11.46	45.94	85.95
86	58.0	4.60	5.52	8.57	12.07	41.97	86.23
85	57.0	6.19	6.81	8.87	11.57	39.70	82.68
84	56.0	5.88	6.63	8.87	12.00	42.51	88.83
83	56.0	5.88	6.63	8.87	12.00	42.51	88.83
82	55.0	5.33	6.19	9.12	12.45	35.69	84.26
81	55.0	5.33	6.19	9.12	12.45	35.69	84.26
80	54.0	5.42	6.28	9.30	12.65	38.43	85.37
79	54.0	5.42	6.28	9.30	12.65	38.43	85.37
78	53.0	5.61	6.47	9.44	12.83	39.43	87.20
77	53.0	5.61	6.47	9.44	12.83	39.43	87.20
76	52.0	5.95	6.78	9.65	12.93	39.52	89.08
75	52.0	5.95	6.78	9.65	12.93	39.52	89.08
74	51.0	6.08	6.90	9.67	13.15	46.73	94.48
73	51.0	6.08	6.90	9.67	13.15	46.73	94.48
72	50.0	5.79	6.72	10.11	13.43	43.34	92.35
71	50.0	5.79	6.72	10.11	13.43	43.34	92.35
70	49.0	6.10	7.03	10.68	13.42	45.06	89.76
69	49.0	6.10	7.03	10.68	13.42	45.06	89.76
68	48.0	6.14	7.15	10.82	13.67	48.64	95.93
67	48.0	6.14	7.15	10.82	13.67	48.64	95.93
66	47.0	6.08	7.05	10.64	14.11	45.98	96.14
65	47.0	6.08	7.05	10.64	14.11	45.98	96.14
64	47.0	6.08	7.05	10.64	14.11	45.98	96.14
63	46.0	6.66	7.77	11.23	14.00	43.90	93.16
62	46.0	6.66	7.77	11.23	14.00	43.90	93.16
61	45.0	6.96	7.77	10.80	14.42	49.53	95.89
60	45.0	6.96	7.77	10.80	14.42	49.53	95.89
59	44.0	6.77	7.73	11.29	14.68	43.83	92.36

ERC Percentiles

%ile	ERC	1 Hour	10 Hour	100 Hour	1000 Hour	Herb	Woody
58	44.0	6.77	7.73	11.29	14.68	43.83	92.36
57	44.0	6.77	7.73	11.29	14.68	43.83	92.36
56	43.0	7.25	8.12	11.64	14.69	51.17	99.97
55	43.0	7.25	8.12	11.64	14.69	51.17	99.97
54	42.0	7.38	8.35	11.79	14.92	51.91	100.92
53	42.0	7.38	8.35	11.79	14.92	51.91	100.92
52	41.0	7.39	8.54	12.46	15.04	45.34	94.99
51	41.0	7.39	8.54	12.46	15.04	45.34	94.99
50	41.0	7.39	8.54	12.46	15.04	45.34	94.99
49	40.0	7.29	8.42	12.14	15.62	47.76	98.09
48	40.0	7.29	8.42	12.14	15.62	47.76	98.09
47	39.0	8.29	9.20	12.25	15.61	44.76	93.55
46	39.0	8.29	9.20	12.25	15.61	44.76	93.55
45	38.0	8.26	9.17	12.65	15.85	44.19	94.53
44	38.0	8.26	9.17	12.65	15.85	44.19	94.53
43	38.0	8.26	9.17	12.65	15.85	44.19	94.53
42	37.0	7.66	8.86	13.00	16.28	46.55	100.17
41	37.0	7.66	8.86	13.00	16.28	46.55	100.17
40	36.0	8.12	9.13	13.38	16.44	41.24	95.03
39	36.0	8.12	9.13	13.38	16.44	41.24	95.03
38	35.0	8.93	10.02	13.63	16.41	41.96	96.46
37	35.0	8.93	10.02	13.63	16.41	41.96	96.46
36	35.0	8.93	10.02	13.63	16.41	41.96	96.46
35	34.0	10.56	11.14	13.87	16.13	47.93	101.88
34	34.0	10.56	11.14	13.87	16.13	47.93	101.88
33	33.0	9.98	10.96	14.18	16.61	48.11	98.35
32	33.0	9.98	10.96	14.18	16.61	48.11	98.35
31	32.0	9.84	10.82	14.36	17.01	48.38	100.86
30	32.0	9.84	10.82	14.36	17.01	48.38	100.86
29	31.0	9.65	11.06	14.71	17.37	44.45	96.69
28	31.0	9.65	11.06	14.71	17.37	44.45	96.69
27	30.0	10.08	11.13	14.80	17.65	50.14	102.20
26	30.0	10.08	11.13	14.80	17.65	50.14	102.20
25	29.0	11.26	11.93	15.04	17.61	49.17	101.71
24	29.0	11.26	11.93	15.04	17.61	49.17	101.71
23	28.0	10.25	11.45	16.01	18.03	49.25	99.73
22	27.0	11.01	12.02	16.24	18.06	58.08	101.59
21	27.0	11.01	12.02	16.24	18.06	58.08	101.59
20	26.0	10.73	11.89	15.68	19.01	57.75	102.48
19	25.0	14.15	14.56	16.08	17.86	67.55	115.55
18	25.0	14.15	14.56	16.08	17.86	67.55	115.55
17	24.0	11.72	12.76	16.88	19.12	62.96	106.28
16	23.0	15.14	15.43	16.73	18.52	58.19	107.73
15	22.0	15.40	15.72	17.03	18.65	71.14	108.91
14	21.0	16.49	16.92	17.24	18.66	64.80	106.47
13	20.0	17.28	17.67	17.02	19.07	72.78	115.04
12	19.0	17.02	17.57	18.89	19.12	59.91	99.08
11	18.0	16.94	18.06	19.01	19.59	65.94	110.54
10	17.0	22.38	23.39	17.78	18.44	65.98	98.83
9	15.0	20.66	21.40	18.72	19.69	70.41	108.45
8	14.0	21.08	21.68	18.70	20.32	58.00	95.66
7	13.0	26.44	27.08	18.91	18.82	60.92	93.76
6	11.0	28.15	28.43	19.43	18.96	62.43	92.65
5	10.0	29.40	29.87	20.41	19.07	72.03	106.97
4	8.0	27.58	27.82	21.01	20.70	78.93	106.16
3	6.0	29.93	30.01	22.45	20.85	57.93	93.42
2	3.0	31.90	32.14	23.21	22.67	68.16	91.87
1	0.0	35.00	35.00	26.54	23.69	65.04	90.07

FSPro ERC Stream

ERC Stream Annotations

Time (CST)	User	Annotation
11/06/2019 11:59	Stover, Al	Used Mt Rushmore RAWS and weather from 2013.

ERC Stream

Date	Avg ERC	Std Dev	ERC
03/01/2013	33.06	17.03	52
03/02/2013	36.72	15.87	53
03/03/2013	38.83	13.11	54
03/04/2013	38.94	14.50	53
03/05/2013	39.18	17.90	53
03/06/2013	41.00	15.77	54
03/07/2013	38.89	17.87	56
03/08/2013	40.44	15.10	52
03/09/2013	38.78	16.74	53
03/10/2013	36.61	18.64	58
03/11/2013	39.24	19.78	57
03/12/2013	41.17	17.80	61
03/13/2013	43.33	16.17	61
03/14/2013	42.83	17.24	64
03/15/2013	44.78	15.49	66
03/16/2013	41.28	15.46	41
03/17/2013	38.22	17.99	20
03/18/2013	38.94	17.80	52
03/19/2013	39.22	17.11	47
03/20/2013	42.47	17.72	55
03/21/2013	39.71	17.85	48
03/22/2013	41.17	16.73	33
03/23/2013	37.71	16.59	17
03/24/2013	35.89	16.35	39
03/25/2013	37.83	18.14	41
03/26/2013	35.39	16.78	43
03/27/2013	35.50	13.56	50
03/28/2013	33.47	17.17	49
03/29/2013	35.56	17.87	52
03/30/2013	36.89	16.44	46
03/31/2013	36.11	17.00	49
04/01/2013	36.89	16.85	51
04/02/2013	36.33	18.53	53
04/03/2013	33.33	20.01	56
04/04/2013	36.11	19.14	54
04/05/2013	35.61	21.09	59
04/06/2013	34.94	21.11	57
04/07/2013	35.67	18.74	46
04/08/2013	33.28	18.46	38
04/09/2013	34.53	19.42	38
04/10/2013	35.83	19.42	33
04/11/2013	34.22	18.95	14
04/12/2013	33.78	18.83	11
04/13/2013	37.39	17.45	35
04/14/2013	41.22	17.30	34
04/15/2013	40.94	13.48	34
04/16/2013	38.44	14.28	27
04/17/2013	38.11	16.37	24
04/18/2013	32.83	16.72	9
04/19/2013	28.50	16.03	19
04/20/2013	31.94	9.15	27
04/21/2013	31.94	11.41	14
04/22/2013	31.83	12.25	17
04/23/2013	32.24	15.08	19
04/24/2013	30.41	16.83	25
04/25/2013	32.00	16.12	33
04/26/2013	29.82	17.84	36
04/27/2013	29.00	15.27	41
04/28/2013	29.00	14.75	40
04/29/2013	31.71	13.83	37
04/30/2013	30.44	14.33	37
05/01/2013	32.35	14.76	33
05/02/2013	32.35	13.53	35
05/03/2013	33.06	13.70	42
05/04/2013	32.82	13.60	44
05/05/2013	33.35	13.77	47

ERC Stream

Date	Avg ERC	Std Dev	ERC
05/06/2013	30.06	17.53	50
05/07/2013	33.56	15.16	47
05/08/2013	33.11	15.57	50
05/09/2013	31.28	16.07	46
05/10/2013	27.78	17.64	49
05/11/2013	27.39	16.20	46
05/12/2013	29.94	15.70	49
05/13/2013	29.56	17.19	50
05/14/2013	33.22	14.74	53
05/15/2013	34.61	15.74	55
05/16/2013	33.41	15.51	53
05/17/2013	34.94	14.36	45
05/18/2013	34.35	15.68	40
05/19/2013	31.00	19.09	30
05/20/2013	32.78	14.45	34
05/21/2013	33.44	12.27	33
05/22/2013	30.33	13.79	29
05/23/2013	30.28	13.89	33
05/24/2013	28.72	16.50	37
05/25/2013	27.28	16.20	38
05/26/2013	31.00	13.78	38
05/27/2013	28.39	14.35	32
05/28/2013	30.44	13.59	38
05/29/2013	26.11	15.51	35
05/30/2013	27.12	14.36	30
05/31/2013	29.06	10.20	30
06/01/2013	30.39	11.17	35
06/02/2013	31.17	11.61	37
06/03/2013	28.71	16.20	39
06/04/2013	29.11	16.12	40
06/05/2013	31.94	14.83	40
06/06/2013	29.06	17.68	41
06/07/2013	30.28	17.26	44
06/08/2013	29.83	15.60	35
06/09/2013	29.78	13.33	38
06/10/2013	29.72	16.18	41
06/11/2013	29.44	15.99	33
06/12/2013	30.22	15.88	32
06/13/2013	31.72	14.62	35
06/14/2013	32.22	17.84	39
06/15/2013	35.00	15.42	42
06/16/2013	34.33	13.80	41
06/17/2013	33.82	14.59	29
06/18/2013	33.56	15.22	38
06/19/2013	33.83	16.79	39
06/20/2013	32.29	17.46	44
06/21/2013	33.44	14.39	32
06/22/2013	35.00	15.86	32
06/23/2013	35.61	14.51	34
06/24/2013	36.17	18.70	38
06/25/2013	35.33	18.93	42
06/26/2013	38.11	15.98	44
06/27/2013	41.17	15.96	45
06/28/2013	42.56	14.82	47
06/29/2013	43.41	14.52	49
06/30/2013	43.65	14.59	48
07/01/2013	41.33	14.32	46
07/02/2013	41.56	13.98	48
07/03/2013	40.59	14.17	53
07/04/2013	41.17	13.94	45
07/05/2013	42.89	13.11	48
07/06/2013	40.76	15.11	42
07/07/2013	38.06	12.32	40
07/08/2013	41.56	10.35	37
07/09/2013	41.89	12.15	40
07/10/2013	39.11	12.60	43
07/11/2013	41.78	13.70	49

ERC Stream

Date	Avg ERC	Std Dev	ERC
07/12/2013	42.28	15.85	48
07/13/2013	44.83	13.61	46
07/14/2013	47.28	13.12	40
07/15/2013	47.28	15.78	40
07/16/2013	50.33	14.64	48
07/17/2013	51.28	13.99	49
07/18/2013	48.17	16.04	45
07/19/2013	49.22	12.76	40
07/20/2013	45.94	11.56	24
07/21/2013	48.17	12.66	38
07/22/2013	49.50	11.37	41
07/23/2013	45.17	17.61	35
07/24/2013	48.50	15.02	34
07/25/2013	48.67	12.89	31
07/26/2013	46.59	13.69	24
07/27/2013	46.71	11.66	30
07/28/2013	44.12	14.13	30
07/29/2013	44.59	13.08	32
07/30/2013	48.59	12.78	37
07/31/2013	50.71	12.13	34
08/01/2013	50.59	11.23	37
08/02/2013	51.06	11.89	33
08/03/2013	49.47	12.49	30
08/04/2013	49.12	10.50	30
08/05/2013	46.06	13.74	28
08/06/2013	46.94	13.19	25
08/07/2013	48.35	11.34	28
08/08/2013	45.11	11.68	25
08/09/2013	43.82	10.90	26
08/10/2013	45.06	10.52	25
08/11/2013	46.22	13.73	15
08/12/2013	45.18	9.89	25
08/13/2013	46.82	13.37	22
08/14/2013	46.24	13.09	21
08/15/2013	45.24	14.67	22
08/16/2013	46.28	14.28	24
08/17/2013	47.18	11.95	30
08/18/2013	46.12	9.81	31
08/19/2013	47.28	10.75	35
08/20/2013	46.72	11.03	39
08/21/2013	49.22	9.92	38
08/22/2013	50.83	10.17	38
08/23/2013	51.89	11.13	38
08/24/2013	53.11	10.77	43
08/25/2013	50.89	11.95	45
08/26/2013	52.11	13.11	46
08/27/2013	51.06	14.88	51
08/28/2013	49.72	14.12	42
08/29/2013	50.67	13.75	46
08/30/2013	53.53	10.59	50
08/31/2013	53.72	10.49	51
09/01/2013	53.89	15.32	53
09/02/2013	55.89	12.06	55
09/03/2013	58.35	11.14	54
09/04/2013	58.33	11.77	53
09/05/2013	57.78	14.91	50
09/06/2013	56.67	13.15	49
09/07/2013	55.39	15.90	54
09/08/2013	53.35	15.59	44
09/09/2013	52.06	16.43	38
09/10/2013	50.35	17.19	40
09/11/2013	53.78	14.24	47
09/12/2013	49.56	18.14	47
09/13/2013	47.28	19.37	29
09/14/2013	45.28	19.19	43
09/15/2013	43.83	17.93	30
09/16/2013	47.11	17.81	30

ERC Stream

Date	Avg ERC	Std Dev	ERC
09/17/2013	49.11	14.22	42
09/18/2013	48.81	11.02	46
09/19/2013	49.50	13.97	47
09/20/2013	52.53	14.97	49
09/21/2013	52.71	13.80	57
09/22/2013	49.59	13.22	58
09/23/2013	42.41	19.49	18
09/24/2013	45.63	14.20	44
09/25/2013	43.61	17.11	48
09/26/2013	48.94	14.06	42
09/27/2013	48.47	15.53	35
09/28/2013	47.19	16.42	40
09/29/2013	48.50	15.93	44
09/30/2013	49.76	16.05	51
10/01/2013	48.94	19.07	52
10/02/2013	49.71	17.42	51
10/03/2013	45.94	17.35	31
10/04/2013	41.71	18.91	23
10/05/2013	43.59	17.12	33
10/06/2013	41.59	15.02	40
10/07/2013	39.50	16.71	10
10/08/2013	39.00	18.30	35
10/09/2013	35.76	18.65	38
10/10/2013	40.12	15.00	35
10/11/2013	39.29	17.28	11
10/12/2013	37.65	15.23	33
10/13/2013	38.59	17.76	30
10/14/2013	38.47	20.17	9
10/15/2013	43.38	15.17	22
10/16/2013	44.33	14.01	31
10/17/2013	45.06	11.51	32
10/18/2013	45.94	10.71	34
10/19/2013	48.12	10.54	39
10/20/2013	44.22	14.12	34
10/21/2013	43.11	16.79	36
10/22/2013	43.61	14.25	35
10/23/2013	40.84	13.04	34
10/24/2013	44.42	12.20	28
10/25/2013	42.24	12.15	37
10/26/2013	43.22	10.77	39
10/27/2013	44.82	11.21	42
10/28/2013	42.76	15.71	25
10/29/2013	43.72	17.72	21
10/30/2013	40.84	17.87	23
10/31/2013	45.41	14.26	28

Weather Forecast Data

No weather forecasts have been saved.

FSPro Winds

Winds Annotations

Time (CST)	User	Annotation
11/06/2019 12:00	Stover, Al	Used Mt Rushmore RAWS ten minute average winds.

Winds Station Information

NAME	VALUE
Winds Station Name	392603 - MT. RUSHMORE (0.5 miles)
Latitude	43.8778 N
Longitude	103.44946 W
Elevation	5,071 feet
Aspect	Southwest
Position on Slope	Mid-Slope
Forecast Zone	262
Station Type	4 - NFDRS Satellite

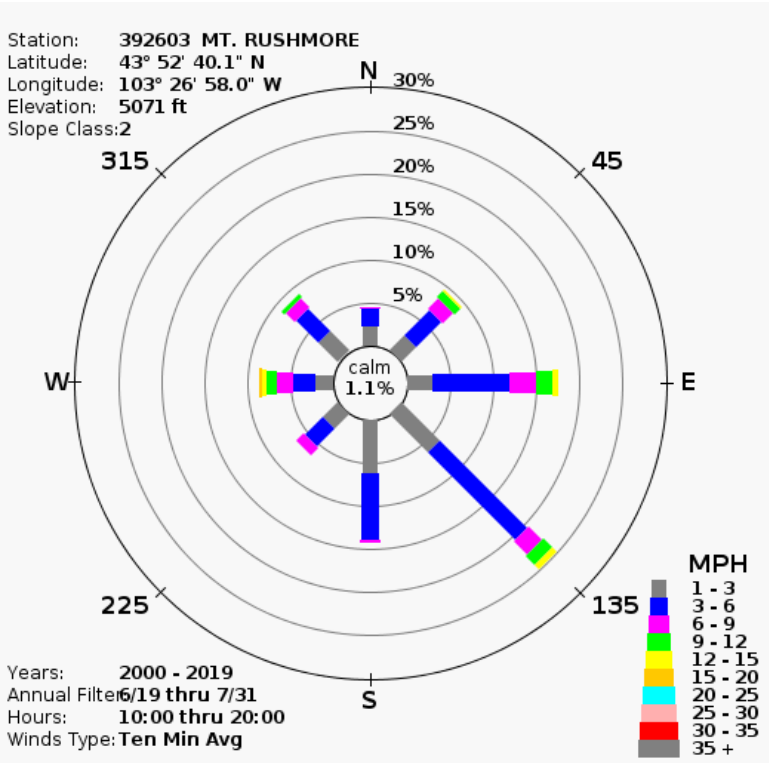
Winds Filter

NAME	VALUE
Year Range	2000 to 2019
Date Range	06/19 to 07/31
Hour Range	10 to 20
Winds Type	Ten Min Avg
Calm Wind Threshhold	1 mph
Calm Weight	1.15
Total Weight	100.01

Winds Matrix

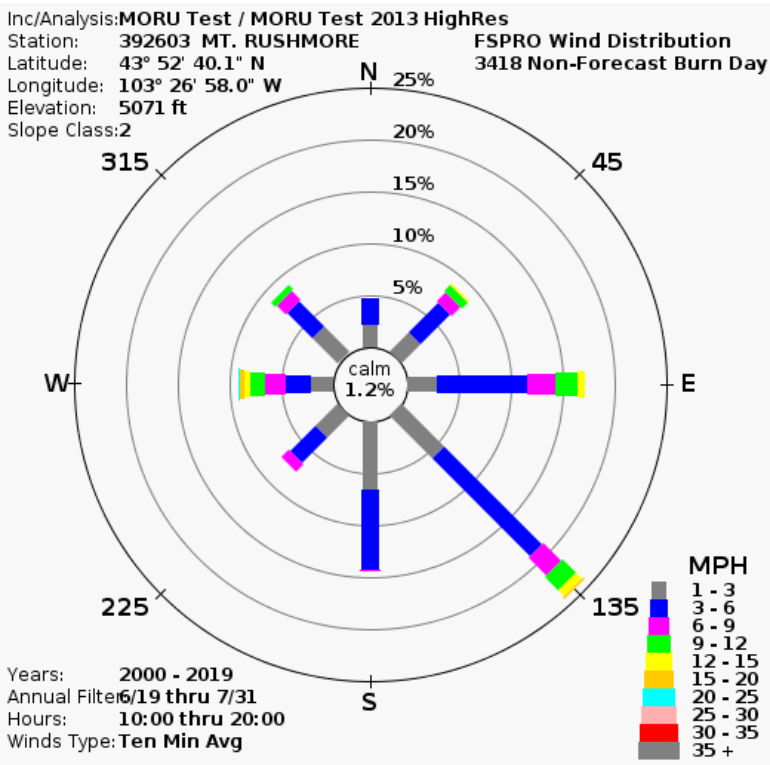
Speed	45	90	135	180	225	270	315	360
3	2.47	3.03	6.46	6.21	2.46	2.20	3.39	2.31
6	4.23	8.99	14.61	7.83	3.08	2.70	3.89	2.10
9	1.71	3.23	2.24	0.37	1.28	1.93	1.51	0.24
12	1.02	1.95	1.67	0.00	0.21	1.28	0.56	0.00
15	0.32	0.69	0.82	0.00	0.01	0.61	0.10	0.00
20	0.20	0.05	0.23	0.00	0.01	0.45	0.01	0.00
25	0.03	0.00	0.00	0.00	0.00	0.13	0.01	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00

Station Wind Rose



FSPro Wind Rose

FSPro Wind Rose



FSPro Landscape

Landscape Annotations

Time (CST)	User	Annotation
11/06/2019 11:58	Stover, Al	Used LandFire 2014 1.4.0 at a 30 meter resolution with no fuel edits.

Landscape Information

NAME	VALUE
Landscape Source	LANDFIRE 2014 1.4.0
Upper Latitude	43.9317 N
Lower Latitude	43.8561 N
Left Longitude	103.5427 W
Right Longitude	103.3642 W
Fuel Model	40
Resolution	30 meters

Landscape Editor Annotations

No notes exist.

Landscape Editor Rules

No Landscape Editor Rules exist.

Values at Risk

NAME	VALUE
Incident Name	MORU Test
Analysis Name	MORU Test 2013 HighRes
Author	Stover, Al
Analyst	Stover, Al
Latitude	43.87917
Longitude	103.45917
Geographical Area	Rocky Mountain
Values Generated Time	11/06/2019 12:40

Values List

Values List

Category	80-100%	60-79%	40-59%	20-39%	5-19%	0.2-4.9%	< 0.2%	Expected Value
Building Clusters: Pennington, SD	no data	no data	no data	no data	no data	no data	no data	no data
County: Pennington, SD	6 acres	7 acres	8 acres	10 acres	30 acres	269 acres	370 acres	28.4 acres
Jurisdictional Agency: NPS	6 acres	7 acres	8 acres	10 acres	30 acres	180 acres	155 acres	25.9 acres
Jurisdictional Agency: USFS	0 acres	0 acres	0 acres	0 acres	0 acres	92 acres	216 acres	2.61 acres
Mgmt Req	0 acres	0 acres	0 acres	0 acres	0 acres			0.0 acres
Mgmt Req: MA 1.1A						92 acres	154 acres	2.55 acres
NPS Admin Boundaries: MORU	6 acres	7 acres	8 acres	10 acres	30 acres	180 acres	155 acres	25.9 acres
Natl Recreation Trails	0.0 miles	0.0 miles	0.0 miles	0.0 miles	0.0 miles	0.0 miles	0.4 miles	0.00 miles
Natl Scenic Byways	0.0 miles	0.0 miles	0.0 miles	0.1 miles	0.1 miles	0.1 miles	0.1 miles	0.05 miles
Other Areas: Norbeck Wildlife Preserve	0 acres	0 acres	0 acres	0 acres	0 acres	92 acres	216 acres	2.61 acres
Roads	0.0 miles	0.0 miles	0.0 miles	0.0 miles	0.0 miles	0.1 miles	0.1 miles	0.00 miles
Wilderness: Black Elk Wilderness	0 acres	0 acres	0 acres	0 acres	0 acres	92 acres	154 acres	2.55 acres

Currency/Coverage of Values Reported

Category	Data Source	Currency	Coverage
Building Clusters	US Counties / FGDC Cadastral Subcomm.		Available counties - No data available for Pennington, SD
County	US Census Bureau, TIGER/Line	2018	National
Jurisdictional Agency	Various	05/29/2015	National
Mgmt Req		Current	Unit Level
NPS Admin Boundaries	NPS	09/30/2018	National
Natl Recreation Trails	NPS	2/28/2019	National
Natl Scenic Byways	NPS	2/28/2019	National
Other Areas	USGS PADUS 1.4	03/13/2019	National
Roads	NAVTEQ	11/2012	National
Wilderness	Wilderness.net	01/31/2019	National

Coverage of Values Queried that Produced No Results

AK Fire Mgmt Options (Alaska only), Aqua Retardant Avoidance (National (USFS Units only)), BIA Admin Boundaries (National), BLM Buildings (BLM Lands), BLM Horse and Burro (National), BLM Mgmt Requirements (National (BLM Land Only)), BLM Oil / Gas Leases (National), BLM Range Allotments (National), Campgrounds (National (BLM and USFS only)), Canada / Mexico (National), Class 1 Airsheds (National), Communication Towers (National), Electric Power Plants (National), Electric Sub Stations (National), Electric Transmission Lines (National), Estimated Population (National), Habitat (National), IRA (National), Mines (National), NRA (National), Natl Historic Trails (National), Natl Scenic Trails (National), Oil and Gas Pipelines (National), Ozone Non-Attainment (National), Particulates Non-Attainment (National), Responsible Agency (AK, CA, ID, MT, NM, MN), Retardant Avoidance (National (USFS Units only)), Sage Grouse Habitat (National), TNC Lands (National), USFS Buildings (National), USFWS Admin Boundaries (National), USFWS Trails (National), WSA (National)

Return

7.1.3 2018 Wet Year

Figure A4 displays the ERC for 2018 from the WFDSS model. The ERC is around 30 on July 3 in the representative model.

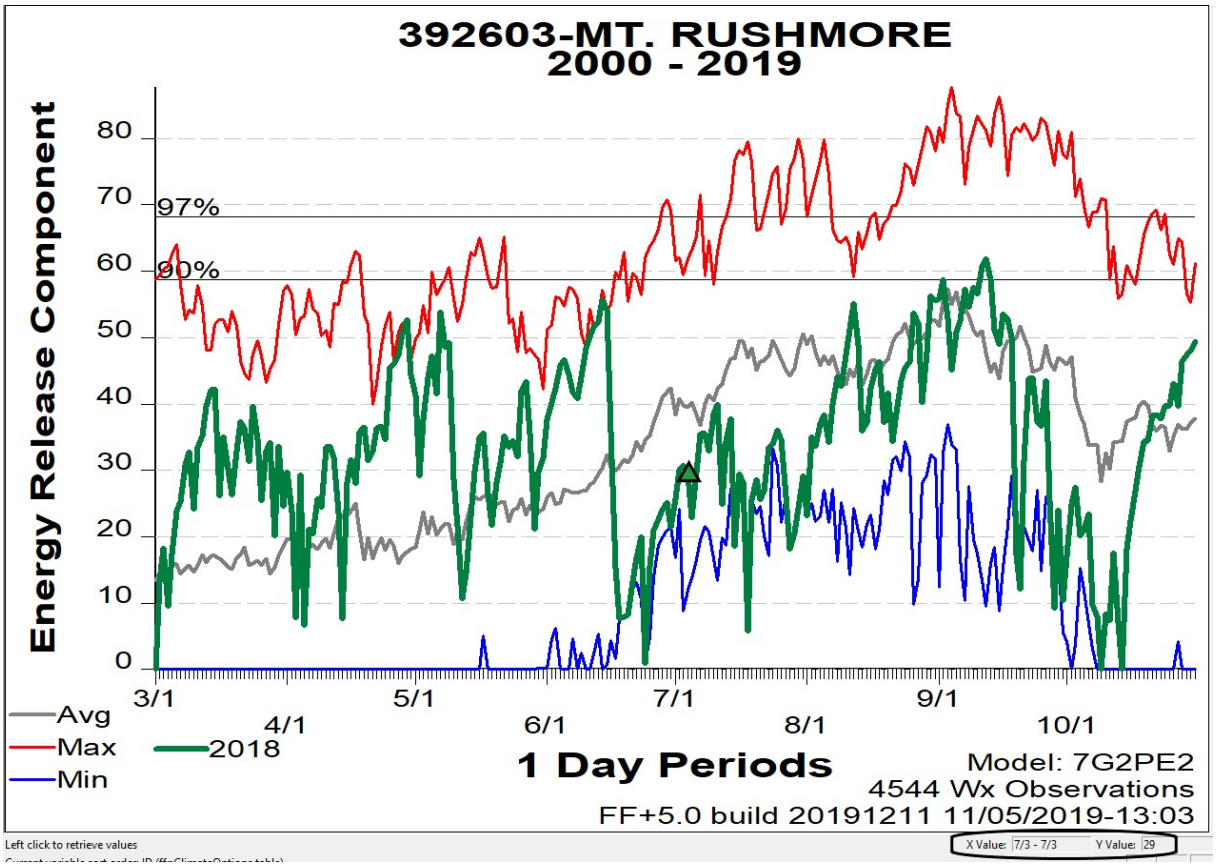


Figure A4. Energy Release Component for WFDSS 2018 Wet Year

Below is the full WFDSS 2018 Analysis Report.

Analysis Values inventory generated

Analysis Report

Incident Information

Return

Incident Information

NAME	VALUE
Incident Name	MORU Test
Unique Fire Identifier	2019-SDMRP-190001
Responsible Unit Name	Mount Rushmore National Monument
FireCode	
P-Code	
Point of Origin	43.87917 N / 103.45917 W
Incident Size	0.1 acres
Latest Perimeter Size	0 acres
Incident Cause	Unknown
Incident Type	Wildfire
Incident Discovery	07/03/2019 22:00
Contained	
Controlled	
Out	
Jurisdictional Unit	SDMRP - Mount Rushmore National Monument
Jurisdictional Agency(s)	NPS, USFS
Geographic Area (prep level)	Rocky Mountain (2)
Owner Name(s)	Al Stover

Analysis Information

Return

FSPro Information Annotations

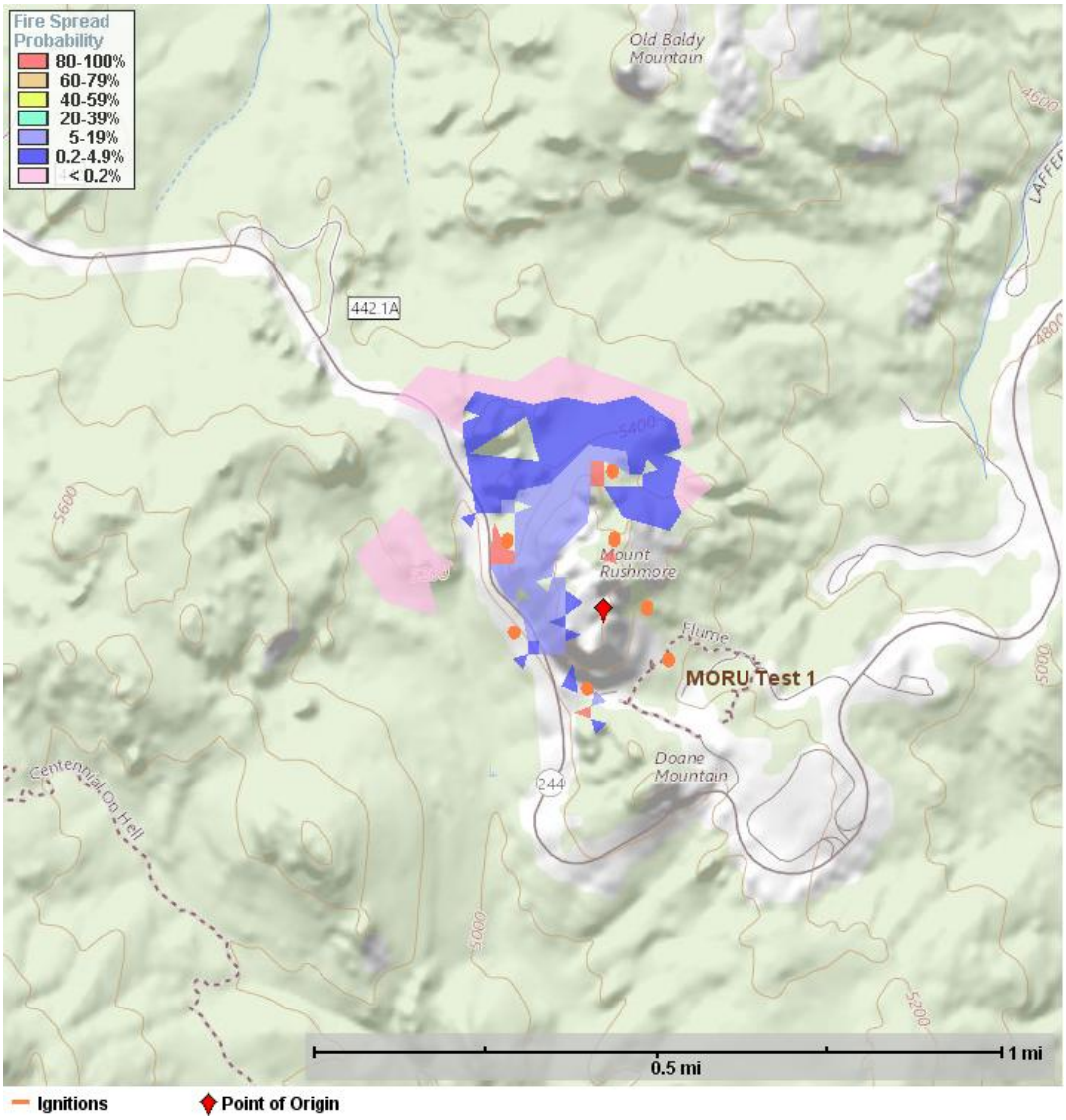
Time (CST)	User	Annotation
11/06/2019 12:48	Stover, Al	Ignitions were modeled after historic wildfire start locations from 2000-2009 fireworks displays.

FSPro General Information

NAME	VALUE
Analysis Name	MORU Test 2018 HighRes
Analyst Name	Stover, Al
Completed	11/06/2019 12:51
Analysis Status	Complete
Analysis Start	07/03/2018
Duration	3 days
Simulations	2000 fires
Crown Fire Method	Finney (1998)
Ignition	MORU Test 1
Barrier	No barrier specified
ERC Station	392603 - MT. RUSHMORE (0.5 miles)
Winds Station	392603 - MT. RUSHMORE (0.5 miles)
Landscape Resolution	30 meters

FSPro Analysis 'MORU Test 2018 HighRes'

Time (CST)	User	Note
11/06/2019 12:51	Stover, Al	This 3 day FSPro Model uses Finney for crown fire initiation and 2018 weather. Fuels were not edited to take into account recent beetle kill/dead and down, scattered pockets of burnable vegetation in the developed area or current fuel treatments. Run could be fairly representative of a fire scenario July 3rd-5th under well below average burning conditions. The model assumes no suppression action and is intended for planning purposes only.



Contact Information

No contacts exist.

History

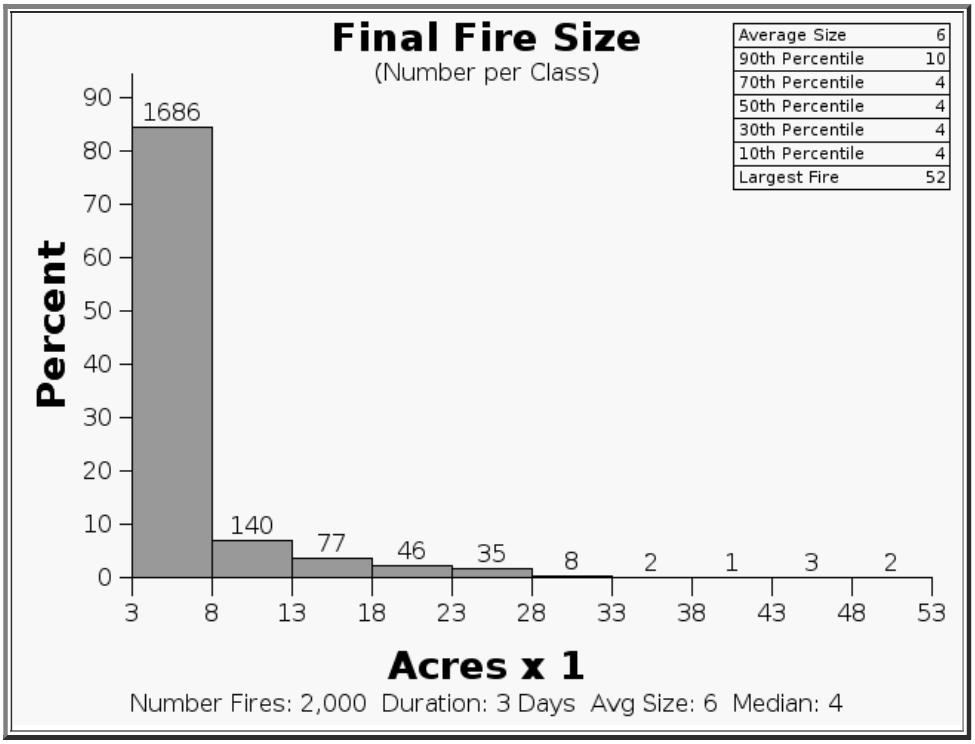
Time (CST)	Status	User	Comments
11/05/2019 12:16:03	Assigned	Stover, Al	Use 30 meter resolution and 2018 weather
11/05/2019 12:18:37	Queued	Stover, Al	
11/05/2019 12:18:38	In Process		
11/05/2019 12:20:45	Processing Results		
11/05/2019 12:20:52	Review		
11/06/2019 12:51:51	Complete	Stover, Al	This 3 day FSPro Model uses Finney for crown fire initiation and 2018 weather. Fuels were not edited to take into account recent beetle kill/dead and down, scattered pockets of burnable vegetation in the developed area or current fuel treatments. Run could be fairly representative of a fire scenario July 3rd-5th under well below average burning conditions. The model assumes no suppression action and is intended for planning purposes only.

FSPro Results

FSPro Fire Sizes

FIRE SIZE	ACRES
Average Size	6
90th Percentile	10
70th Percentile	4
50th Percentile	4
30th Percentile	4
10th Percentile	4
Largest Fire	52

FSPro Histogram



Daily Acres List

Date	Average Acres	Minimum Acres	Maximum Acres	No Burn Days
07/03/2018	7.8	4.4	17.1	1,914
07/04/2018	8.7	4.7	27.6	1,844
07/05/2018	10.4	4.9	30.7	1,789

FSPro ERC Classes

ERC Classes Annotations

No notes exist.

ERC Station Information

NAME	VALUE
ERC Station Name	392603 - MT. RUSHMORE (0.5 miles)
Latitude	43.8778 N
Longitude	103.44946 W
Elevation	5,071 feet
Aspect	Southwest
Position on Slope	Mid-Slope
Average Precipitation	18.00 inches
Forecast Zone	262
Climate Class	2 : Subhumid
Green Up Month/Day	05/24
Grass Type	P : Perennial
Slope Class	2: 26 - 40%
Station Type	4 - NFDRS Satellite

ERC Classes Filter

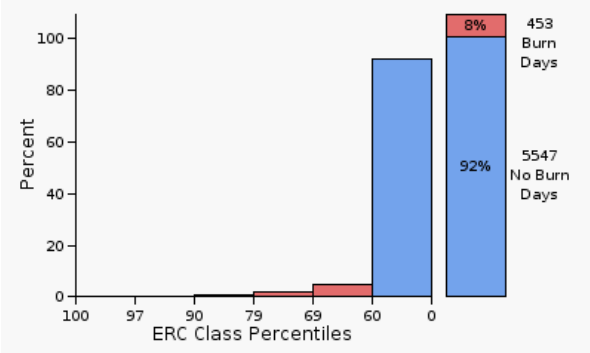
NAME	VALUE
Year Range	2000 to 2019
Date Range	03/01 to 10/31
Maximum Lag	30 days
Degrees of Fit	9

ERC Classes

ERC Classes

%ile	Min ERC	1 Hour	10 Hour	100 Hour	Herb FM	Woody FM	Burn Period	Spot Prob	Delay
97	69	3.7	4.3	6.3	67.4	92.2	360	0.15	0
90	61	4.6	5.4	7.7	83.6	106.2	300	0.10	0
79	54	5.3	6.1	8.8	97.4	118.1	240	0.05	0
69	49	5.9	6.8	9.9	106.7	126.2	180	0.01	0
60	45	6.5	7.4	10.9	112.4	131.1	120	0.00	0

ERC Class Burn Days Summary



%ile	Min ERC	Burn Days	%
97	69	0	0
90	61	5	0
79	54	47	1
69	49	121	2
60	45	280	5
		453	8

5547 No-Burn Days (92 %)
2000 fires X 3 non-forecast days = 6000 days

ERC Percentiles

%ile	ERC	1 Hour	10 Hour	100 Hour	1000 Hour	Herb	Woody
100	87.0	3.45	3.87	5.79	7.62	32.36	61.46
99	76.0	3.33	3.90	6.32	9.20	30.66	69.17
98	71.0	3.65	4.45	6.53	9.80	28.60	70.13
97	69.0	4.32	5.01	6.89	9.81	33.42	72.97
96	67.0	4.01	4.84	7.13	10.33	35.59	75.28
95	66.0	4.48	5.28	7.48	10.40	34.48	76.05
94	64.0	4.49	5.30	7.79	10.57	38.09	76.89
93	63.0	4.63	5.41	7.96	10.80	38.45	79.52
92	62.0	4.75	5.35	7.89	11.03	45.35	82.20
91	61.0	5.43	6.10	8.16	10.97	37.52	79.12
90	61.0	5.43	6.10	8.16	10.97	37.52	79.12
89	60.0	4.60	5.40	8.51	11.52	38.71	83.73
88	59.0	5.73	6.43	8.09	11.46	45.94	85.95
87	59.0	5.73	6.43	8.09	11.46	45.94	85.95
86	58.0	4.60	5.52	8.57	12.07	41.97	86.23
85	57.0	6.19	6.81	8.87	11.57	39.70	82.68
84	56.0	5.88	6.63	8.87	12.00	42.51	88.83
83	56.0	5.88	6.63	8.87	12.00	42.51	88.83
82	55.0	5.33	6.19	9.12	12.45	35.69	84.26
81	55.0	5.33	6.19	9.12	12.45	35.69	84.26
80	54.0	5.42	6.28	9.30	12.65	38.43	85.37
79	54.0	5.42	6.28	9.30	12.65	38.43	85.37
78	53.0	5.61	6.47	9.44	12.83	39.43	87.20
77	53.0	5.61	6.47	9.44	12.83	39.43	87.20
76	52.0	5.95	6.78	9.65	12.93	39.52	89.08
75	52.0	5.95	6.78	9.65	12.93	39.52	89.08
74	51.0	6.08	6.90	9.67	13.15	46.73	94.48
73	51.0	6.08	6.90	9.67	13.15	46.73	94.48
72	50.0	5.79	6.72	10.11	13.43	43.34	92.35
71	50.0	5.79	6.72	10.11	13.43	43.34	92.35
70	49.0	6.10	7.03	10.68	13.42	45.06	89.76
69	49.0	6.10	7.03	10.68	13.42	45.06	89.76
68	48.0	6.14	7.15	10.82	13.67	48.64	95.93
67	48.0	6.14	7.15	10.82	13.67	48.64	95.93
66	47.0	6.08	7.05	10.64	14.11	45.98	96.14
65	47.0	6.08	7.05	10.64	14.11	45.98	96.14
64	47.0	6.08	7.05	10.64	14.11	45.98	96.14
63	46.0	6.66	7.77	11.23	14.00	43.90	93.16
62	46.0	6.66	7.77	11.23	14.00	43.90	93.16
61	45.0	6.96	7.77	10.80	14.42	49.53	95.89
60	45.0	6.96	7.77	10.80	14.42	49.53	95.89
59	44.0	6.77	7.73	11.29	14.68	43.83	92.36

ERC Percentiles

%ile	ERC	1 Hour	10 Hour	100 Hour	1000 Hour	Herb	Woody
58	44.0	6.77	7.73	11.29	14.68	43.83	92.36
57	44.0	6.77	7.73	11.29	14.68	43.83	92.36
56	43.0	7.25	8.12	11.64	14.69	51.17	99.97
55	43.0	7.25	8.12	11.64	14.69	51.17	99.97
54	42.0	7.38	8.35	11.79	14.92	51.91	100.92
53	42.0	7.38	8.35	11.79	14.92	51.91	100.92
52	41.0	7.39	8.54	12.46	15.04	45.34	94.99
51	41.0	7.39	8.54	12.46	15.04	45.34	94.99
50	41.0	7.39	8.54	12.46	15.04	45.34	94.99
49	40.0	7.29	8.42	12.14	15.62	47.76	98.09
48	40.0	7.29	8.42	12.14	15.62	47.76	98.09
47	39.0	8.29	9.20	12.25	15.61	44.76	93.55
46	39.0	8.29	9.20	12.25	15.61	44.76	93.55
45	38.0	8.26	9.17	12.65	15.85	44.19	94.53
44	38.0	8.26	9.17	12.65	15.85	44.19	94.53
43	38.0	8.26	9.17	12.65	15.85	44.19	94.53
42	37.0	7.66	8.86	13.00	16.28	46.55	100.17
41	37.0	7.66	8.86	13.00	16.28	46.55	100.17
40	36.0	8.12	9.13	13.38	16.44	41.24	95.03
39	36.0	8.12	9.13	13.38	16.44	41.24	95.03
38	35.0	8.93	10.02	13.63	16.41	41.96	96.46
37	35.0	8.93	10.02	13.63	16.41	41.96	96.46
36	35.0	8.93	10.02	13.63	16.41	41.96	96.46
35	34.0	10.56	11.14	13.87	16.13	47.93	101.88
34	34.0	10.56	11.14	13.87	16.13	47.93	101.88
33	33.0	9.98	10.96	14.18	16.61	48.11	98.35
32	33.0	9.98	10.96	14.18	16.61	48.11	98.35
31	32.0	9.84	10.82	14.36	17.01	48.38	100.86
30	32.0	9.84	10.82	14.36	17.01	48.38	100.86
29	31.0	9.65	11.06	14.71	17.37	44.45	96.69
28	31.0	9.65	11.06	14.71	17.37	44.45	96.69
27	30.0	10.08	11.13	14.80	17.65	50.14	102.20
26	30.0	10.08	11.13	14.80	17.65	50.14	102.20
25	29.0	11.26	11.93	15.04	17.61	49.17	101.71
24	29.0	11.26	11.93	15.04	17.61	49.17	101.71
23	28.0	10.25	11.45	16.01	18.03	49.25	99.73
22	27.0	11.01	12.02	16.24	18.06	58.08	101.59
21	27.0	11.01	12.02	16.24	18.06	58.08	101.59
20	26.0	10.73	11.89	15.68	19.01	57.75	102.48
19	25.0	14.15	14.56	16.08	17.86	67.55	115.55
18	25.0	14.15	14.56	16.08	17.86	67.55	115.55
17	24.0	11.72	12.76	16.88	19.12	62.96	106.28
16	23.0	15.14	15.43	16.73	18.52	58.19	107.73
15	22.0	15.40	15.72	17.03	18.65	71.14	108.91
14	21.0	16.49	16.92	17.24	18.66	64.80	106.47
13	20.0	17.28	17.67	17.02	19.07	72.78	115.04
12	19.0	17.02	17.57	18.89	19.12	59.91	99.08
11	18.0	16.94	18.06	19.01	19.59	65.94	110.54
10	17.0	22.38	23.39	17.78	18.44	65.98	98.83
9	15.0	20.66	21.40	18.72	19.69	70.41	108.45
8	14.0	21.08	21.68	18.70	20.32	58.00	95.66
7	13.0	26.44	27.08	18.91	18.82	60.92	93.76
6	11.0	28.15	28.43	19.43	18.96	62.43	92.65
5	10.0	29.40	29.87	20.41	19.07	72.03	106.97
4	8.0	27.58	27.82	21.01	20.70	78.93	106.16
3	6.0	29.93	30.01	22.45	20.85	57.93	93.42
2	3.0	31.90	32.14	23.21	22.67	68.16	91.87
1	0.0	35.00	35.00	26.54	23.69	65.04	90.07

FSPro ERC Stream

ERC Stream Annotations

No notes exist.

ERC Stream

ERC Stream

Date	Avg ERC	Std Dev	ERC
03/01/2018	33.06	17.03	42
03/02/2018	36.72	15.87	43
03/03/2018	38.83	13.11	45
03/04/2018	38.94	14.50	29
03/05/2018	39.18	17.90	36
03/06/2018	41.00	15.77	43
03/07/2018	38.89	17.87	42
03/08/2018	40.44	15.10	47
03/09/2018	38.78	16.74	49
03/10/2018	36.61	18.64	38
03/11/2018	39.24	19.78	48
03/12/2018	41.17	17.80	49
03/13/2018	43.33	16.17	53
03/14/2018	42.83	17.24	55
03/15/2018	44.78	15.49	54
03/16/2018	41.28	15.46	35
03/17/2018	38.22	17.99	45
03/18/2018	38.94	17.80	39
03/19/2018	39.22	17.11	34
03/20/2018	42.47	17.72	41
03/21/2018	39.71	17.85	46
03/22/2018	41.17	16.73	44
03/23/2018	37.71	16.59	38
03/24/2018	35.89	16.35	47
03/25/2018	37.83	18.14	41
03/26/2018	35.39	16.78	31
03/27/2018	35.50	13.56	38
03/28/2018	33.47	17.17	39
03/29/2018	35.56	17.87	24
03/30/2018	36.89	16.44	38
03/31/2018	36.11	17.00	29
04/01/2018	36.89	16.85	34
04/02/2018	36.33	18.53	27
04/03/2018	33.33	20.01	10
04/04/2018	36.11	19.14	33
04/05/2018	35.61	21.09	9
04/06/2018	34.94	21.11	24
04/07/2018	35.67	18.74	23
04/08/2018	33.28	18.46	28
04/09/2018	34.53	19.42	27
04/10/2018	35.83	19.42	36
04/11/2018	34.22	18.95	36
04/12/2018	33.78	18.83	34
04/13/2018	37.39	17.45	26
04/14/2018	41.22	17.30	9
04/15/2018	40.94	13.48	30
04/16/2018	38.44	14.28	33
04/17/2018	38.11	16.37	30
04/18/2018	32.83	16.72	38
04/19/2018	28.50	16.03	38
04/20/2018	31.94	9.15	33
04/21/2018	31.94	11.41	34
04/22/2018	31.83	12.25	38
04/23/2018	32.24	15.08	38
04/24/2018	30.41	16.83	36
04/25/2018	32.00	16.12	47
04/26/2018	29.82	17.84	47
04/27/2018	29.00	15.27	49
04/28/2018	29.00	14.75	52
04/29/2018	31.71	13.83	54
04/30/2018	30.44	14.33	45
05/01/2018	32.35	14.76	42
05/02/2018	32.35	13.53	30
05/03/2018	33.06	13.70	38
05/04/2018	32.82	13.60	45
05/05/2018	33.35	13.77	48
05/06/2018	30.06	17.53	42

ERC Stream

Date	Avg ERC	Std Dev	ERC
05/07/2018	33.56	15.16	55
05/08/2018	33.11	15.57	49
05/09/2018	31.28	16.07	50
05/10/2018	27.78	17.64	29
05/11/2018	27.39	16.20	22
05/12/2018	29.94	15.70	11
05/13/2018	29.56	17.19	15
05/14/2018	33.22	14.74	24
05/15/2018	34.61	15.74	30
05/16/2018	33.41	15.51	35
05/17/2018	34.94	14.36	36
05/18/2018	34.35	15.68	27
05/19/2018	31.00	19.09	22
05/20/2018	32.78	14.45	28
05/21/2018	33.44	12.27	31
05/22/2018	30.33	13.79	35
05/23/2018	30.28	13.89	34
05/24/2018	28.72	16.50	35
05/25/2018	27.28	16.20	32
05/26/2018	31.00	13.78	42
05/27/2018	28.39	14.35	44
05/28/2018	30.44	13.59	36
05/29/2018	26.11	15.51	21
05/30/2018	27.12	14.36	30
05/31/2018	29.06	10.20	32
06/01/2018	30.39	11.17	38
06/02/2018	31.17	11.61	40
06/03/2018	28.71	16.20	42
06/04/2018	29.11	16.12	46
06/05/2018	31.94	14.83	47
06/06/2018	29.06	17.68	44
06/07/2018	30.28	17.26	42
06/08/2018	29.83	15.60	41
06/09/2018	29.78	13.33	44
06/10/2018	29.72	16.18	48
06/11/2018	29.44	15.99	50
06/12/2018	30.22	15.88	52
06/13/2018	31.72	14.62	52
06/14/2018	32.22	17.84	56
06/15/2018	35.00	15.42	54
06/16/2018	34.33	13.80	36
06/17/2018	33.82	14.59	18
06/18/2018	33.56	15.22	4
06/19/2018	33.83	16.79	5
06/20/2018	32.29	17.46	5
06/21/2018	33.44	14.39	10
06/22/2018	35.00	15.86	14
06/23/2018	35.61	14.51	17
06/24/2018	36.17	18.70	0
06/25/2018	35.33	18.93	14
06/26/2018	38.11	15.98	19
06/27/2018	41.17	15.96	20
06/28/2018	42.56	14.82	22
06/29/2018	43.41	14.52	23
06/30/2018	43.65	14.59	19
07/01/2018	41.33	14.32	24
07/02/2018	41.56	13.98	28
07/03/2018	40.59	14.17	29
07/04/2018	41.17	13.94	28
07/05/2018	42.89	13.11	21
07/06/2018	40.76	15.11	28
07/07/2018	38.06	12.32	34
07/08/2018	41.56	10.35	34
07/09/2018	41.89	12.15	32
07/10/2018	39.11	12.60	37
07/11/2018	41.78	13.70	38
07/12/2018	42.28	15.85	24

ERC Stream

Date	Avg ERC	Std Dev	ERC
07/13/2018	44.83	13.61	33
07/14/2018	47.28	13.12	36
07/15/2018	47.28	15.78	18
07/16/2018	50.33	14.64	29
07/17/2018	51.28	13.99	27
07/18/2018	48.17	16.04	5
07/19/2018	49.22	12.76	25
07/20/2018	45.94	11.56	28
07/21/2018	48.17	12.66	25
07/22/2018	49.50	11.37	26
07/23/2018	45.17	17.61	33
07/24/2018	48.50	15.02	33
07/25/2018	48.67	12.89	35
07/26/2018	46.59	13.69	34
07/27/2018	46.71	11.66	25
07/28/2018	44.12	14.13	18
07/29/2018	44.59	13.08	20
07/30/2018	48.59	12.78	24
07/31/2018	50.71	12.13	29
08/01/2018	50.59	11.23	23
08/02/2018	51.06	11.89	35
08/03/2018	49.47	12.49	33
08/04/2018	49.12	10.50	36
08/05/2018	46.06	13.74	38
08/06/2018	46.94	13.19	34
08/07/2018	48.35	11.34	40
08/08/2018	45.11	11.68	44
08/09/2018	43.82	10.90	42
08/10/2018	45.06	10.52	47
08/11/2018	46.22	13.73	51
08/12/2018	45.18	9.89	55
08/13/2018	46.82	13.37	49
08/14/2018	46.24	13.09	36
08/15/2018	45.24	14.67	37
08/16/2018	46.28	14.28	42
08/17/2018	47.18	11.95	45
08/18/2018	46.12	9.81	46
08/19/2018	47.28	10.75	37
08/20/2018	46.72	11.03	41
08/21/2018	49.22	9.92	34
08/22/2018	50.83	10.17	38
08/23/2018	51.89	11.13	43
08/24/2018	53.11	10.77	45
08/25/2018	50.89	11.95	46
08/26/2018	52.11	13.11	53
08/27/2018	51.06	14.88	52
08/28/2018	49.72	14.12	40
08/29/2018	50.67	13.75	48
08/30/2018	53.53	10.59	56
08/31/2018	53.72	10.49	55
09/01/2018	53.89	15.32	56
09/02/2018	55.89	12.06	59
09/03/2018	58.35	11.14	53
09/04/2018	58.33	11.77	45
09/05/2018	57.78	14.91	51
09/06/2018	56.67	13.15	52
09/07/2018	55.39	15.90	57
09/08/2018	53.35	15.59	54
09/09/2018	52.06	16.43	57
09/10/2018	50.35	17.19	56
09/11/2018	53.78	14.24	61
09/12/2018	49.56	18.14	62
09/13/2018	47.28	19.37	59
09/14/2018	45.28	19.19	51
09/15/2018	43.83	17.93	49
09/16/2018	47.11	17.81	53
09/17/2018	49.11	14.22	52

ERC Stream

Date	Avg ERC	Std Dev	ERC
09/18/2018	48.81	11.02	50
09/19/2018	49.50	13.97	17
09/20/2018	52.53	14.97	12
09/21/2018	52.71	13.80	31
09/22/2018	49.59	13.22	43
09/23/2018	42.41	19.49	43
09/24/2018	45.63	14.20	37
09/25/2018	43.61	17.11	36
09/26/2018	48.94	14.06	43
09/27/2018	48.47	15.53	25
09/28/2018	47.19	16.42	9
09/29/2018	48.50	15.93	24
09/30/2018	49.76	16.05	10
10/01/2018	48.94	19.07	17
10/02/2018	49.71	17.42	24
10/03/2018	45.94	17.35	27
10/04/2018	41.71	18.91	20
10/05/2018	43.59	17.12	20
10/06/2018	41.59	15.02	23
10/07/2018	39.50	16.71	10
10/08/2018	39.00	18.30	8
10/09/2018	35.76	18.65	0
10/10/2018	40.12	15.00	8
10/11/2018	39.29	17.28	7
10/12/2018	37.65	15.23	17
10/13/2018	38.59	17.76	7
10/14/2018	38.47	20.17	0
10/15/2018	43.38	15.17	17
10/16/2018	44.33	14.01	22
10/17/2018	45.06	11.51	26
10/18/2018	45.94	10.71	30
10/19/2018	48.12	10.54	33
10/20/2018	44.22	14.12	34
10/21/2018	43.11	16.79	38
10/22/2018	43.61	14.25	38
10/23/2018	40.84	13.04	38
10/24/2018	44.42	12.20	39
10/25/2018	42.24	12.15	40
10/26/2018	43.22	10.77	43
10/27/2018	44.82	11.21	40
10/28/2018	42.76	15.71	46
10/29/2018	43.72	17.72	47
10/30/2018	40.84	17.87	48
10/31/2018	45.41	14.26	49

Weather Forecast Data

No weather forecasts have been saved.

FSPro Winds

Winds Annotations

Time (CST)	User	Annotation
11/06/2019 12:49	Stover, Al	Used Mt Rushmore RAWS ten minute average winds.
11/06/2019 12:49	Stover, Al	Used Mt Rushmore RAWS and weather from 2018.

Winds Station Information

NAME	VALUE
Winds Station Name	392603 - MT. RUSHMORE (0.5 miles)
Latitude	43.8778 N
Longitude	103.44946 W
Elevation	5,071 feet
Aspect	Southwest
Position on Slope	Mid-Slope
Forecast Zone	262
Station Type	4 - NFDRS Satellite

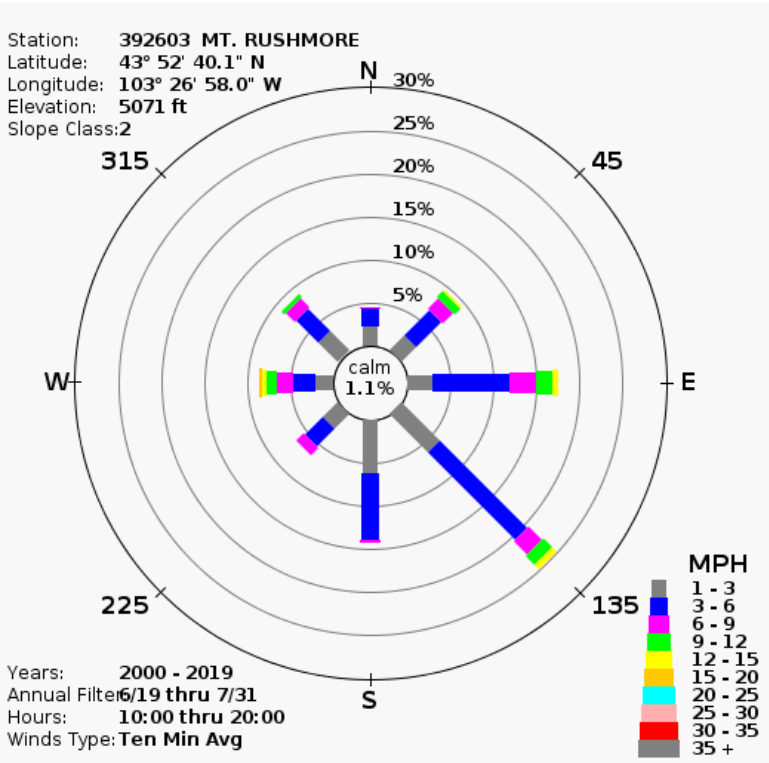
Winds Filter

NAME	VALUE
Year Range	2000 to 2019
Date Range	06/19 to 07/31
Hour Range	10 to 20
Winds Type	Ten Min Avg
Calm Wind Threshhold	1 mph
Calm Weight	1.15
Total Weight	100.01

Winds Matrix

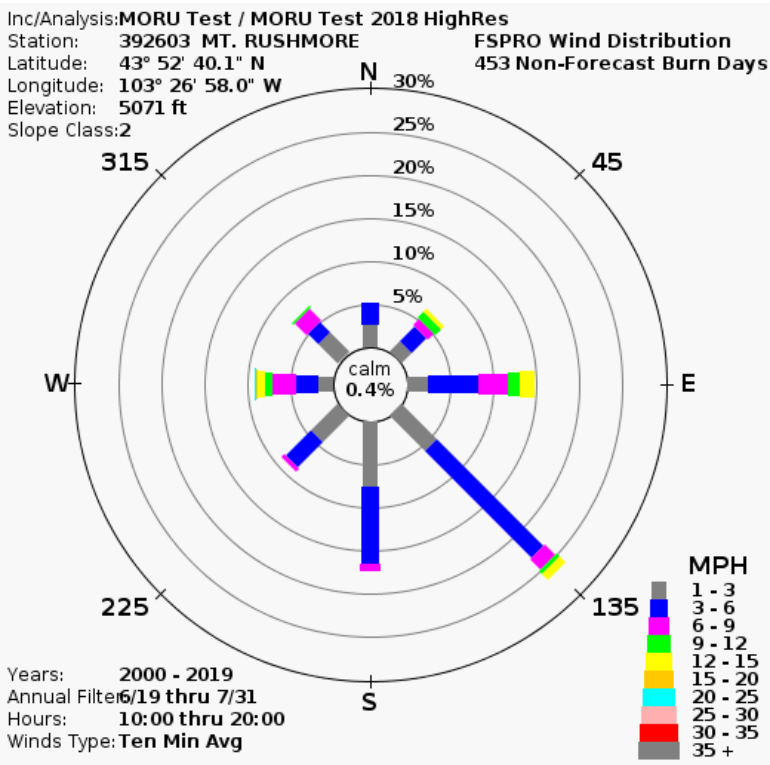
Speed	45	90	135	180	225	270	315	360
3	2.47	3.03	6.46	6.21	2.46	2.20	3.39	2.31
6	4.23	8.99	14.61	7.83	3.08	2.70	3.89	2.10
9	1.71	3.23	2.24	0.37	1.28	1.93	1.51	0.24
12	1.02	1.95	1.67	0.00	0.21	1.28	0.56	0.00
15	0.32	0.69	0.82	0.00	0.01	0.61	0.10	0.00
20	0.20	0.05	0.23	0.00	0.01	0.45	0.01	0.00
25	0.03	0.00	0.00	0.00	0.00	0.13	0.01	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00

Station Wind Rose



FSPro Wind Rose

FSPro Wind Rose



FSPro Landscape

Landscape Annotations

Time (CST)	User	Annotation
11/06/2019 12:49	Stover, Al	Used LandFire 2014 1.4.0 at a 30 meter resolution with no fuel edits

Landscape Information

NAME	VALUE
Landscape Source	LANDFIRE 2014 1.4.0
Upper Latitude	43.9317 N
Lower Latitude	43.8561 N
Left Longitude	103.5427 W
Right Longitude	103.3642 W
Fuel Model	40
Resolution	30 meters

Landscape Editor Annotations

No notes exist.

Landscape Editor Rules

No Landscape Editor Rules exist.

Values at Risk

NAME	VALUE
Incident Name	MORU Test
Analysis Name	MORU Test 2018 HighRes
Author	Stover, Al
Analyst	Stover, Al
Latitude	43.87917
Longitude	103.45917
Geographical Area	Rocky Mountain
Values Generated Time	11/06/2019 12:52

Values List

Values List

Category	80-100%	60-79%	40-59%	20-39%	5-19%	0.2-4.9%	< 0.2%	Expected Value
Building Clusters: Pennington, SD	no data				no data	no data	no data	no data
County: Pennington, SD	2 acres				15 acres	24 acres	21 acres	4.32 acres
Jurisdictional Agency: NPS	2 acres				15 acres	24 acres	21 acres	4.32 acres
NPS Admin Boundaries: MORU	2 acres				15 acres	24 acres	21 acres	4.32 acres
Natl Scenic Byways	0.0 miles				0.0 miles	0.1 miles	0.1 miles	0.00 miles
Roads	0.0 miles				0.1 miles	0.0 miles	0.1 miles	0.01 miles

Currency/Coverage of Values Reported

Category	Data Source	Currency	Coverage
Building Clusters	US Counties / FGDC Cadastral Subcomm.		Available counties - No data available for Pennington, SD
County	US Census Bureau, TIGER/Line	2018	National
Jurisdictional Agency	Various	05/29/2015	National
NPS Admin Boundaries	NPS	09/30/2018	National
Natl Scenic Byways	NPS	2/28/2019	National
Roads	NAVTEQ	11/2012	National

Coverage of Values Queried that Produced No Results

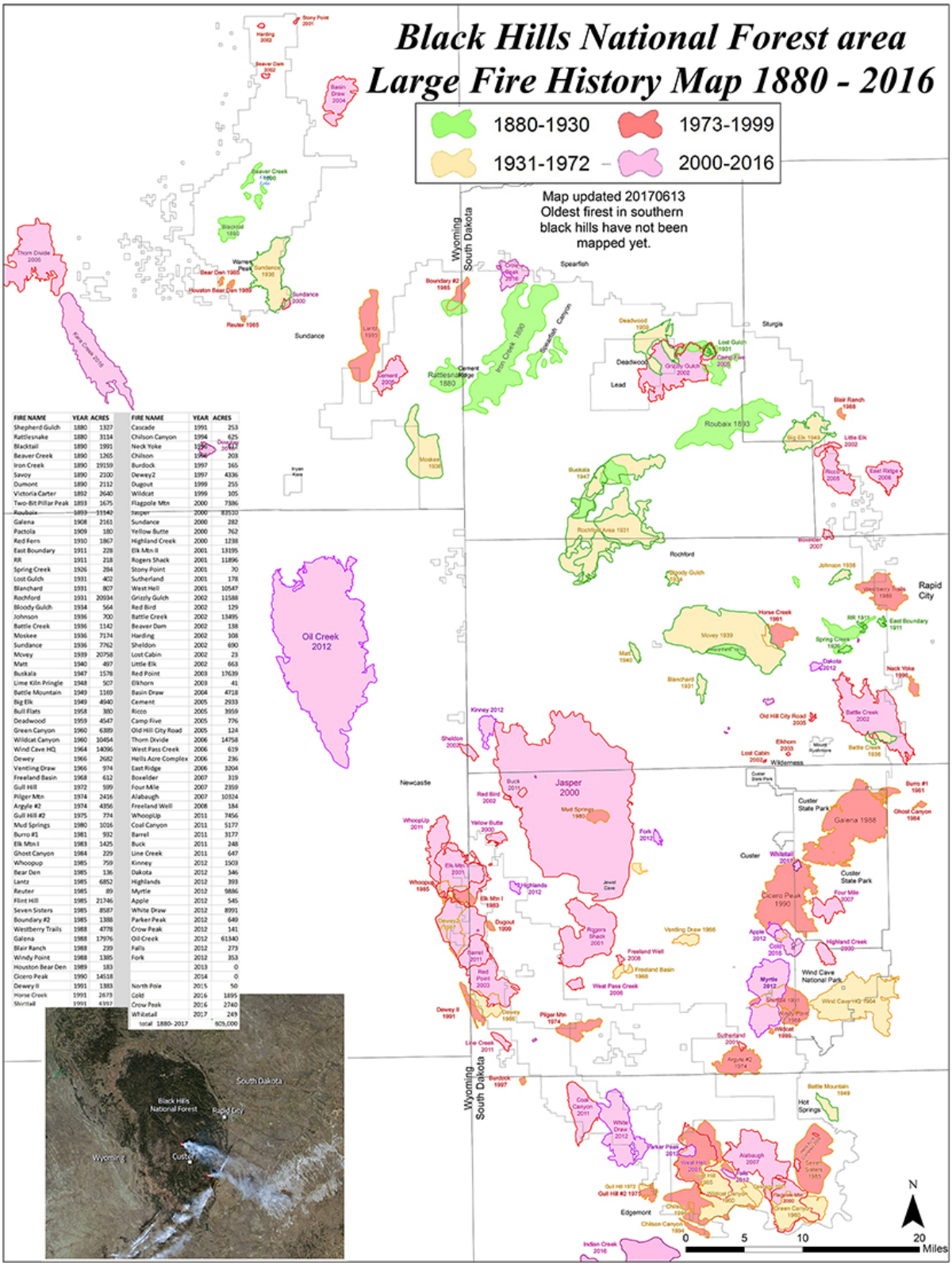
AK Fire Mgmt Options (Alaska only), Aqua Retardant Avoidance (National (USFS Units only)), BIA Admin Boundaries (National), BLM Buildings (BLM Lands), BLM Horse and Burro (National), BLM Mgmt Requirements (National (BLM Land Only)), BLM Oil / Gas Leases (National), BLM Range Allotments (National), Campgrounds (National (BLM and USFS only)), Canada / Mexico (National), Class 1 Airsheds (National), Communication Towers (National), Electric Power Plants (National), Electric Sub Stations (National), Electric Transmission Lines (National), Estimated Population (National), Habitat (National), IRA (National), Mgmt Req (Unit Level), Mines (National), NRA (National), Natl Historic Trails (National), Natl Recreation Trails (National), Natl Scenic Trails (National), Oil and Gas Pipelines (National), Other Areas (National), Ozone Non-Attainment (National), Particulates Non-Attainment (National), Responsible Agency (AK, CA, ID, MT, NM, MN), Retardant Avoidance (National (USFS Units only)), Sage Grouse Habitat (National), TNC Lands (National), USFS Buildings (National), USFWS Admin Boundaries (National), USFWS Trails (National), WSA (National), Wilderness (National)

Return

7.1.4 WFDSS Supporting Materials

The following materials were used in assessing existing wildfire conditions and potential wildfire impacts.

Figure A5 was created by Ken Marchand of the Black Hills National Forest. It is a graphic representation of the historical fires in the area, showing the location of large fires relative to the Memorial, and the date and size of each major fire.



FIRE NAME	YEAR	ACRES
Shepherd Gulch	1880	1327
Rattlesnake	1880	3134
Blacktail	1890	1991
Beaver Creek	1890	1265
Iron Creek	1890	19159
Savoy	1890	2100
Dumont	1890	2132
Victoria Carter	1892	2640
Two-Bit Pillar Peak	1893	1675
Roubaix	1893	11142
Galena	1908	2161
Pactola	1909	180
Red Fern	1910	1867
East Boundary	1911	228
RR	1911	218
Spring Creek	1926	284
Lost Gulch	1931	402
Blanchard	1931	807
Rochford	1931	20934
Bloody Gulch	1934	564
Johnson	1936	700
Battle Creek	1936	1142
Moskee	1936	7174
Sundance	1936	7762
Movey	1939	20758
Matt	1940	497
Buskala	1947	1578
Lime Kiln Pringle	1948	507
Battle Mountain	1949	1169
Big Elk	1949	4940
Bull Flats	1958	380
Deadwood	1959	4547
Green Canyon	1960	6389
Wildcat Canyon	1960	10454
Wind Cave HQ	1964	14096
Dewey	1966	2682
Venting Draw	1966	974
Freeland Basin	1968	612
Gull Hill	1972	599
Pilger Mtn	1974	2416
Argyle #2	1974	4356
Gull Hill #2	1975	774
Mud Springs	1980	3016
Burro #1	1981	932
Elk Mtn I	1983	1425
Ghost Canyon	1984	229
Whoopup	1985	759
Bear Den	1985	136
Lantz	1985	6852
Reuter	1985	89
Flint Hill	1985	21746
Seven Sisters	1985	8587
Boundary #2	1985	1388
Westberry Trails	1988	4778
Galena	1988	17976
Blair Ranch	1988	239
Windy Point	1988	1385
Houston Bear Den	1989	183
Cicero Peak	1990	14538
Dewey II	1991	1383
Horse Creek	1991	2673
Shirttail	1991	4397
Cascade	1991	253
Chilson Canyon	1994	625
Neck Yoke	1996	3647
Chilson	1996	203
Burdock	1997	165
Dewey2	1997	4336
Dugout	1999	255
Wildcat	1999	105
Flagpole Mtn	2000	7386
Jasper	2000	83520
Sundance	2000	282
Yellow Butte	2000	762
Highland Creek	2000	1238
Elk Mtn II	2001	13195
Rogers Shack	2001	11896
Stony Point	2001	70
Sutherland	2001	178
West Hell	2001	10547
Grizzly Gulch	2002	11588
Red Bird	2002	129
Battle Creek	2002	13495
Beaver Dam	2002	138
Harding	2002	108
Sheldon	2002	690
Lost Cabin	2002	23
Little Elk	2002	663
Red Point	2003	17639
Elkhorn	2003	41
Basin Draw	2004	4718
Cement	2005	2933
Ricco	2005	3959
Camp Five	2005	776
Old Hill City Road	2005	124
Thorn Divide	2006	14758
West Pass Creek	2006	619
Hells Acre Complex	2006	236
East Ridge	2006	3204
Boxelder	2007	319
Four Mile	2007	2359
Alabaugh	2007	10324
Freeland Well	2008	184
WhoopUp	2011	7456
Coal Canyon	2011	5177
Barrel	2011	3177
Buck	2011	248
Line Creek	2011	647
Kinney	2012	1503
Dakota	2012	346
Highlands	2012	393
Myrtle	2012	9886
Apple	2012	545
White Draw	2012	8991
Parker Peak	2012	649
Crow Peak	2012	141
Oil Creek	2012	61340
Falls	2012	273
Fork	2012	353
	2013	0
	2014	0
North Pole	2015	50
Cold	2016	1895
Crow Peak	2016	2740
Whitetail	2017	249
total 1880- 2017		605,000

Figure A5. Black Hills National Forest, Large Fire History Map (1880 - 2016)

Figure A6 shows the WFDSS Organization Assessment, which provides an overview of the recommended emergency response, highlighting the relative risks, implementation difficulty, and social and political concerns of a wildfire incident at the Memorial.

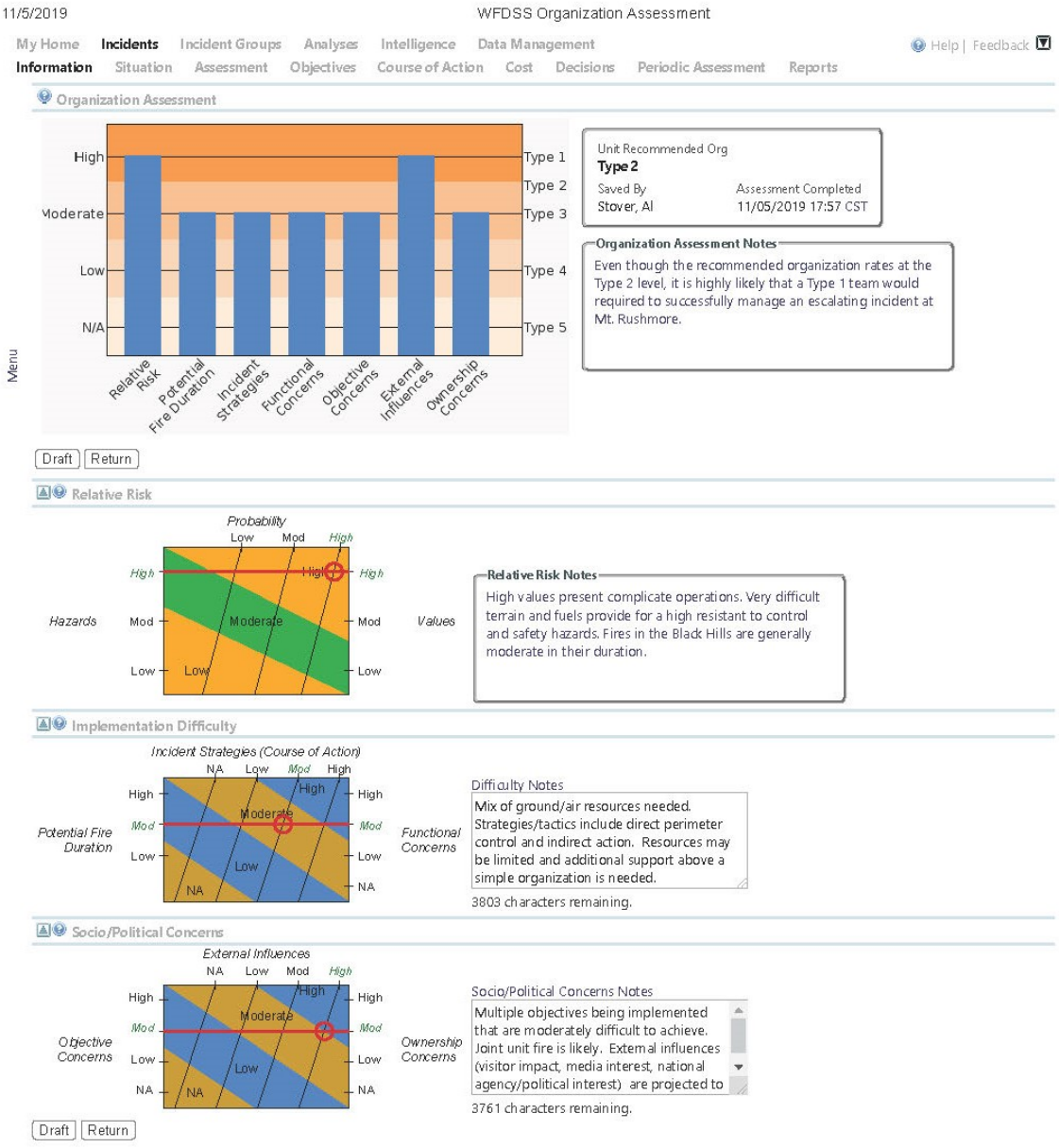
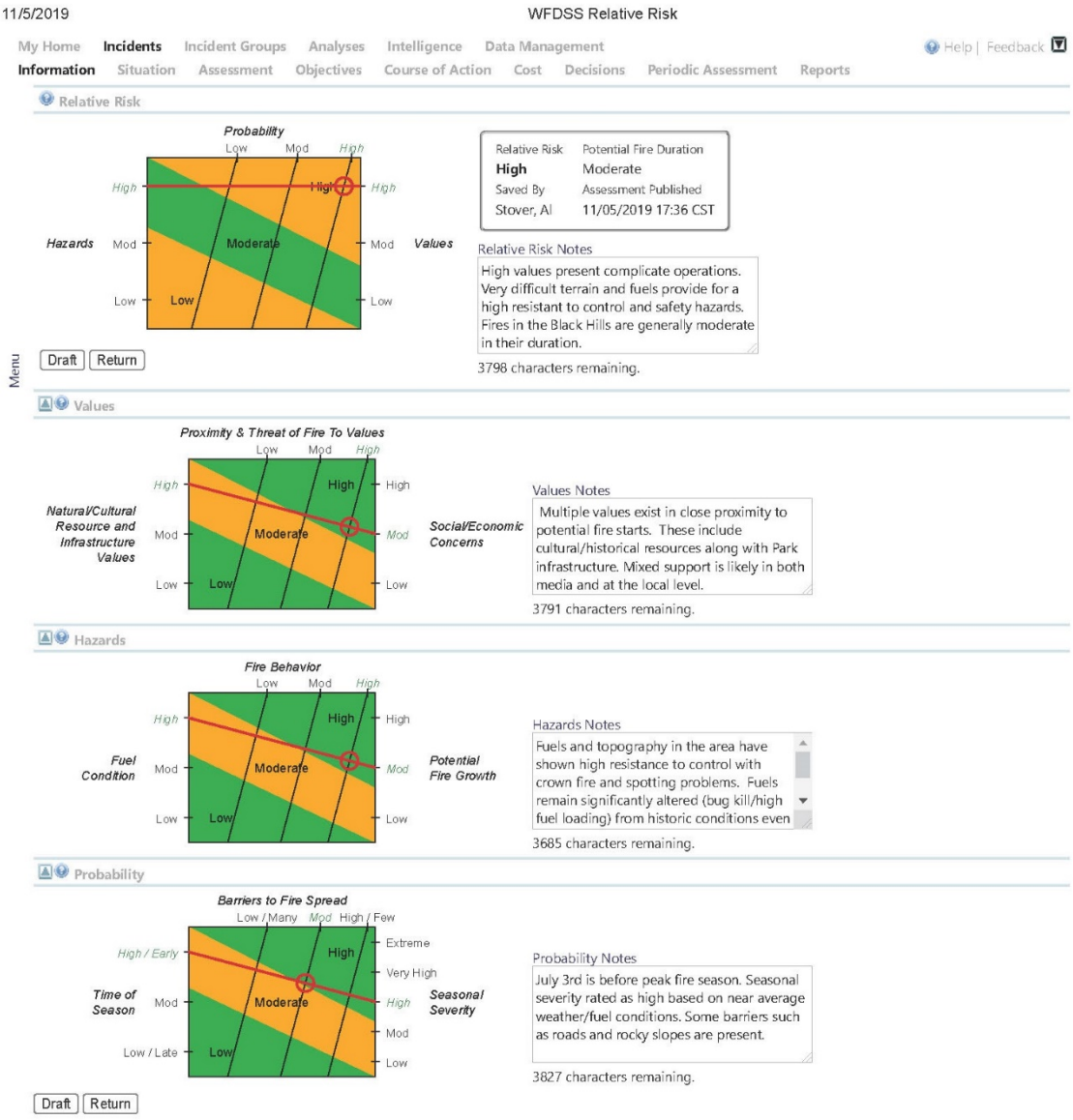


Figure A6. WFDSS Organization Assessment

Figure A7 shows the WFDSS Relative Risk assessment which considers the proximity at threat of fire to sensitive resources (values), the potential fire behavior, and the probability of fire occuring.

1



2

3 **Figure A7. WFDSS Relative Risk Assessment**

1

Appendix B. Mitigation Measures and Best Management Practices

The following mitigation measures and best management practices (BMPs) will be implemented to reduce the potential for adverse impacts on various resources.

Wildfire Mitigation Measures and BMPs

- Fire suppression activities such as building a fire line, cutting trees to deny the fire-available fuel, and using aircraft to deliver water and fire retardant to the fire would limit the impacts of a potential wildfire.
- Implement prescribed burns as specified in the Prescribed Burn Plan (NPS 2019), which would greatly decrease fuel loading and render most fires, including severe fires from outside the Memorial, low- to moderate-intensity.

Environmental Contaminants Mitigation Measures and BMPs

- The fireworks contractor will submit safety data sheets and a list of fireworks ingredients to the National Park Service (NPS) prior to the event.
- The fireworks contractor will remove unexploded ordnance from the fallout zone to the extent possible and remove fireworks debris from the launch site.

Cultural Resource Protection Measures

- Protect known sensitive resources or structures with fire-resistant blankets or other protective material.
- To lessen potential impacts on unknown buried artifacts, use hand lines rather than large mechanized equipment to fight a potential wildfire.

Human Health and Safety Measures

- The fireworks contractor will have firework handling certification. Mount Rushmore National Memorial staff will not handle fireworks.

As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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