Date of Report: 12/7/2021

BURNED-AREA REPORT

BOUNDARY FIRE 2021
SALMON-CHALLIS NATIONAL FOREST


Photos from inciweb.com. Left: August 19, Right: August 31.

PART I - TYPE OF REQUEST

A. Type of Report

☒ 1. Funding request for estimated emergency stabilization funds
☐ 2. No Treatment Recommendation

B. Type of Action

☒ 1. Initial Request (Best estimate of funds needed to complete eligible stabilization measures)

☐ 2. Interim Request #___
☐ Updating the initial funding request based on more accurate site data or design analysis

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Boundary Fire

B. Fire Number: ID-SCF-021230

C. State: Idaho

D. County: Valley, Custer

E. Region: 4 (Intermountain)

F. Forest: Salmon-Challis

G. District: Middle Fork

H. Fire Incident Job Code:

I. Date Fire Started: August 10, 2021

J. Date Fire Contained: Est. November 2021

K. Suppression Cost: $12,002,000

L. Fire Suppression Damages Repaired with Suppression Funds (estimates):

1. **Fireline repaired (miles):** See table below
2. **Other (identify):** See table below

FeatureCategory	RepairStatus	Miles
Management Action Point	Unknown	1.75
Management Action Point	Unknown	1.75
Planned Secondary Line	Unknown	4.13

M. Watershed Numbers:

Table 1: Acres Burned by Watershed

HUC #	Watershed Name	Total Acres	Acres Burned	% of Watershed Burned
170602050203	Wyoming Creek-Bear Valley Creek	16,509	698	4.2%
170602050204	Fir Creek-Bear Valley Creek	12,938	7	0.1%
170602050401	Fall Creek-Middle Fork Salmon River	17,534	12286	70.1%
170602050402	Boundary Creek-Middle Fork Salmon River	19,225	14053	73.1%
170602050404	Lower Sulphur Creek	18,022	6001	33.3%
170602050405	Elkhorn Creek	16,226	146	0.9%
170602050406	Velvet Creek-Middle Fork Salmon River	15,156	2574	17.0%
170602050407	Soldier Creek	13,484	12975	96.2%
170602050408	Greyhound Creek-Middle Fork Salmon River	16,227	3471	21.4%
170602050501	Upper Rapid River	20,568	82	0.4%
170602050502	Seafoam Creek-Rapid River	20,441	6685	32.7%
170602050503	Middle Rapid River	24,505	14826	60.5%
170602050504	Lower Rapid River	12,731	5975	46.9%
170602050901	Lake Creek-Middle Fork Salmon River	15,918	86	0.5%
170602050902	Little Soldier Creek-Middle Fork Salmon River	13,483	4819	35.7%
170602050903	Thomas Creek-Middle Fork Salmon River	14,541	7892	54.3%
170602050905	Lower Little Loon Creek	11,474	799	7.0%

N. Total Acres Burned:

*Table 2: Total Acres Burned by Ownership**

OWNERSHIP	ACRES
NFS	92,709
OTHER FEDERAL (LIST AGENCY AND ACRES)	0
STATE	0
PRIVATE	667
TOTAL	93,376

** These numbers reflect the area within the burn boundary (outer perimeter of the fire). The area within the burn boundary includes about 21,000 acres classified as unburned/undetectable. The number of burned acres as published by the SCNF based on infrared mapping was 84,756 on 9/30/2021. While the infrared mapping excludes many of the unburned areas within the burn boundary, the BARC burn boundary used for this analysis does not.*

O. Vegetation Types: Approximately 78% of the burned area consists of forested cover types, with the dominant tree species being Douglas Fir. Lodgepole Pine and spruce/fire forests occur at the higher elevations. Open slopes of bunchgrass/fescue are common in the northern portion of the burned area, and barren cover types exist on the high peaks at the head of the Soldier Creek drainage.

Cover Types	Acres	Percent
Douglas-fir	45961	49.2%
Lodgepole Pine	14551	15.6%
Bunchgrass/Fescue	9360	10.0%
Barren	4643	5.0%
Spruce/Fir	4609	4.9%
Conifer/Mountain Big Sage	2865	3.1%
Grass/Forb	2119	2.3%
Ponderosa Pine	1806	1.9%
Dry Shrub/Bunchgrass	1289	1.4%
Fescue	1021	1.1%
Aspen	819	0.9%

Whitebark Pine	804	0.9%
Mountain Big Sage	763	0.8%
Fescue/Conifer	723	0.8%
Conifer/Fescue	471	0.5%
Conifer/Aspen	437	0.5%
Other Cover Types (<0.5% each)	1135	1.2%
TOTAL	**93,374**	

P. Dominant Soils: Soils in the burned area are described based on Landtypes shown in the table below. 75% of the burned area is defined by Salmon-Challis National Forest landtypes. Landtype data are not available for the other 25% of the burned area. The fire burned in rugged terrain consisting of mountain slopelands, canyonlands, ridgelands, mountain cirques, and glacial sideslopes of the highly dissected upper Middle Fork Salmon River area. Soils consist mostly of loam and sand, with decomposed granite parent material in much of the area, and soil depth and texture are dependent on aspect and slope.

Landtype Description - SCNF	Landtype	Acres	Percent
Moderately dissected mountain slopelands- timbered, moderately deep to deep- loamy-skeletal and sandy-skeletal soils	GF23	6653	7.1%
Strongly dissected mountain slope land- shallow and moderately deep sandy soils over soft bedrock	120c	6473	6.9%
Scoured cirque basinland- timbered, modertely deep- loamy-skeletal and sandy-skeletal soils	GG03	4497	4.8%
Oversteepened canyonlands- timbered, moderately deep- sandy-skeletal soils	GF13	4188	4.5%
Moderately dissected mountain slopeland, moderately deep- sandy and loamy-skeletal soils	GF21	3703	4.0%
Glacial rocky ridgeland, shallow- loamy-skeletal and sandy-skeletal soils	GG06	3107	3.3%
Strongly dissected mountain lsope land- moderately deep and deep sandy and coarse loamy soils	120c-1	3033	3.2%
Moderately dissected glacial sideslopes- timbered, shallow to moderately deep- loamy-skeletal soils	GG23	2947	3.2%
Moderately dissected mountain slope land- shallow sandy soils over soft bedrock	120b-1	2730	2.9%
Cryoplanated ridgeland, shallow to moderately deep- sandy-skeletal soils	GC01	2650	2.8%
Weakly dissected glacial sideslopes- timbered, moderately deep- coarse loamy and loamy-skeletal soils	GG18	2516	2.7%
Weakly dissected mountain slopeland- timbered, moderately deep to deep-loamy and loamy-skeletal soils	GF18	2471	2.6%
Moderately dissected cryoplanated mountain sideslopes- timbered, shallow to deep- loamy-skeletal soils	GC23	2439	2.6%
Moderately dissected glacial sideslopes, shallow to deep- loamy-skeletal and sandy-skeletal soils	GG21	2347	2.5%
Moderately dissected mountain slope land- moderately deep sandy soils	120b	2282	2.4%
Oversteepened canyonlands, shallow to moderately deep- loamy-skeletal and sandy-skeletal soils	GF11	1564	1.7%
Wide glaciated valleys with entrenched streams, steep to very steep sideslopes with moderately steep to steep valley gradients	G06-4	1426	1.5%
Moderately dissected mountain slope land- moderately deep and shallow sandy xeric soils	120b-3	1284	1.4%
Scoured cirque basinlands, shallow to moderately deep- loamy-skeletal and sandy-skeletal soils	GG01	1255	1.3%
Cryoplanated ridgelands- timbered, moderately deep to deep- loamy-skeletal soils	GC03	1203	1.3%
Steep canyon lands- shallow and moderately deep sandy soils	124	1129	1.2%
Moderately dissected cryoplanated mountain slopes- deep skeletal sandy and loamy soils	109b-1	1057	1.1%
Strongly dissected glacial sideslopes, moderately deep- sandy-skeletal and loamy-skeletal soils	GG26	1024	1.1%
Valley Trains, moderately deep to deep- loamy-skeletal soils	GD31	984	1.1%
OTHER LANDTYPES – SCNF (less than 1% each)		7161	7.7%
LANDTYPES NOT AVAILABLE		23,255	24.9
TOTAL		**93,376**	

Q. Geologic Types: Geologic types in the burned area are defined by Landtype Geology. 75% of the burned area is represented by Salmon-Challis National Forest Landtypes. Landtype data are not available for the other 25% of the burned area.

Granitic Landtypes	54,917 acres	59%
Volcanic Landtypes	11,541 acres	12%
Alluvial Landtypes	3,663 acres	4%
LANDTYPES NOT AVAILABLE	23,255 acres	25%

R. Miles of Stream Channels by Order or Class:

Table 3: Miles of Stream Channels by Order or Class

STREAM TYPE	MILES OF STREAM
PERENNIAL	208.1
INTERMITTENT/EPHEMERAL	62.6
OTHER (DEFINE)	0

S. Transportation System:

Trails: *National Forest (miles):* 110.4 *Other (miles):* 0

Most trails in the burned area are non-motorized, and most are within the Frank Church-River of No Return Wilderness

Roads: *National Forest (miles):* 46.0 *Other (miles):* 0

Includes 23.1 miles of open roads, 20.3 miles of closed roads, and 2.6 miles of unauthorized roads

PART III - WATERSHED CONDITION

A. Burn Severity (acres):

BARC Model: The BAER Team used BARC (Burned Area Reflectance Classification) data derived from the Forest Service Remote Sensing Applications Center (RSAC) as a basis for analyzing burn intensity (vegetative scorch) and burn severity (fire impacts to the soil). BARC data were derived from a comparison of Sentinel 2A satellite imagery on 9/30/2021 with pre-fire Sentinel 2B satellite imagery from 9/30/2020. The original classification thresholds of the BARC model are as follows:

Original BARC thresholds: Unburned/Undetectable 0-76, Low 77-126, Moderate 127-209, High 210+

Burn Intensity: BARC data verification of burn intensity was conducted during field visits to the Boundary Creek area on October 6, 2021 and the Seafoam area on October 13, 2021. In general, burn intensity was determined to be well represented by the BARC map, but a few locations were identified in the Boundary Creek area where the BARC map indicated moderate intensity while field observations suggested high intensity. The BARC map was adjusted slightly for the entire burned area to better represent burn intensity in these areas. The adjusted classification thresholds are as follows:

Adjusted BARC thresholds: Unburned/Undetectable 0-76, Low 77-126, Moderate 127-203, High 204+

Burn Severity: Limited field sampling of burn severity (soil burn severity testing) was conducted on the October 6 field visit to establish a relationship between burn intensity as shown in the BARC model and the effects of the fire on the soil (burn severity). Snow cover on the October 13 field visit precluded soil burn severity testing. The BAER Team was able to make the assumptions shown below regarding burn severity based on field observations, and soil burn severity was determined to be roughly equivalent to burn intensity using the adjusted BARC thresholds shown above.

High Intensity/High Severity
Areas burned at high intensity and high severity generally occurred on steeper slopes, with full consumption of much of the downed log component on the forest floor. Light colored soils in these areas were the result of high temperatures and prolonged smoldering of downed logs. These soils are hydrophobic.

Moderate Intensity/Moderate Severity
Areas burned at moderate intensity and moderate severity typically experienced full consumption of needles on trees and fine fuels on the ground, but downed trees on the forest floor were not typically consumed. Impacts to the soils in these areas were mixed, with hydrophobic soils developing only in areas where prolonged smoldering of downed trees did occur.

Low Intensity/Low Severity
Areas burned at low intensity and low severity resulted in consumption of some fine fuels and charring of tree trunks, but larger material was not consumed. Soils were lightly impacted, and the roots of grasses and shrubs remained intact. However, scattered single tree torching did result in full consumption of some standing trees and roots, resulting in localized impacts to the soil.

Table 4: Burn Severity Acres by Ownership

Soil Burn Severity	NFS	Other Federal (List Agency)	State	Private	Total	% within the Fire Perimeter
Unburned	20,745	0	0	318	21,063	23%
Low	33,296	0	0	201	33,497	36%
Moderate	31,539	0	0	117	31,656	34%
High	7,129	0	0	31	7,160	8%
Total	**92,709**	**0**	**0**	**667**	**93,376**	

B. Water-Repellent Soil (acres):

Approximately 10,000 acres. Water repellent soils are likely present in areas of high burn severity, as well as some areas of moderate burn severity where heavy ground fuels caused extended periods of smoldering.

C. Soil Erosion Hazard Rating: Landtype Association Erosion Hazard Ratings for the burned area are shown in the table below:

LTA Erosion Hazard Rating	Acres	Percent
Low	3,663	4%
Moderate	20,185	22%
High	39,360	42%
Very High	6,912	7%
Data not available	23,255	25%
TOTAL	**93,376**	

D. Erosion Potential: Up to 1.48 tons/acre*
** Based on ERMiT modeling for high burn severity on representative slopes, at the 20% probability that the sediment yield will be exceeded.*

E. Sediment Potential: Up to 701 cubic yards/square mile

F. Estimated Vegetative Recovery Period (years): 1-3 (grasses), 2-5 (woody), 10-50 (conifers)

G. Estimated Hydrologic Response (brief description):

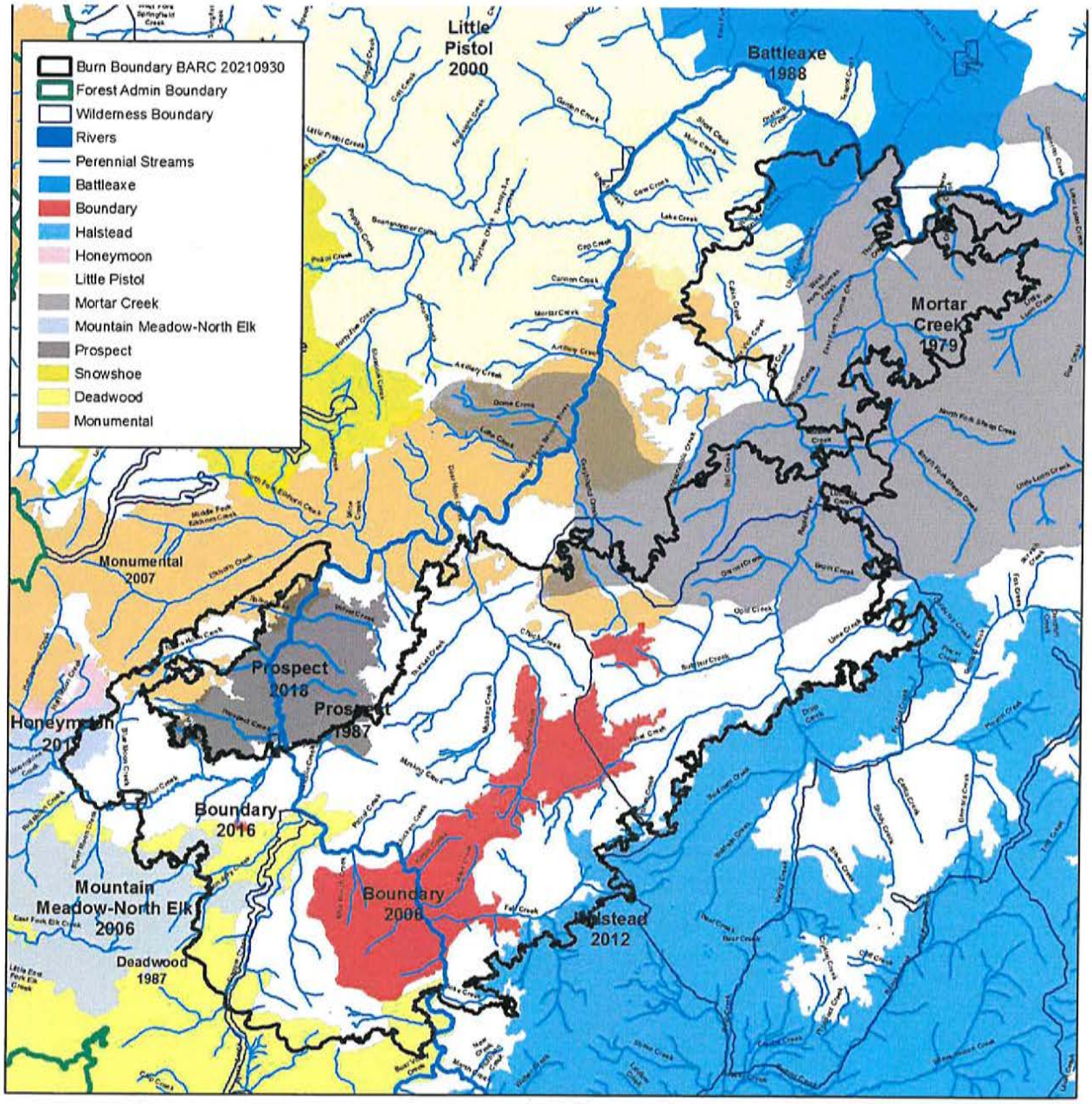
The Boundary Fire burned in an extensive area of mostly Wilderness in the upper Middle Fork Salmon River watershed in central Idaho. The fire burned in a mosaic pattern, with 23% of the fire area mapped as unburned/undetectable. Wildfires are very common in this area, with past fires covering nearly the entire landscape. The Boundary Fire burned through the one area that has not burned within the last 100 years (see map below). Fires such as this have shaped the morphology of the Middle Fork Salmon River canyons for thousands of years through processes of wildfire, floods, debris flows, mass wasting, sediment transport, woody debris transport, and vegetative regrowth.

Approximately 8% of the fired burned at high severity, which is typical for fires in this area. The hydrological response will be most pronounced in watersheds that were more completely burned, had a higher component of high severity burn, and consist of steep topography. Soldier Creek, Little Soldier Creek, and Thomas Creek, all tributaries of the Middle Fork Salmon River, are at the highest risk of post-fire flooding and/or debris flows, as these watersheds burned almost completely, with 4.4%, 18.7%, and 7.6% of each watershed burned at high severity, respectively (see table below). Short duration, high intensity storm events, common in late summer, can result in excessive overland flow in these burned areas. Dependent on storm patterns, debris flows are likely to occur, which can carry a slurry of sediment, rock, and trees down to the Middle Fork Salmon River. These types of events are a common occurrence on the Middle Fork Salmon River, shaping the morphology of the alluvial fans, terraces, and the river bed. As an example in this same area, a very large debris flow on Lake Creek, a tributary of the Middle Fork Salmon River, occurred in 2006 after a fire in that watershed in 2000, delivering a massive amount of logs into the river that formed the infamous Pistol Creek Rapid logjam.

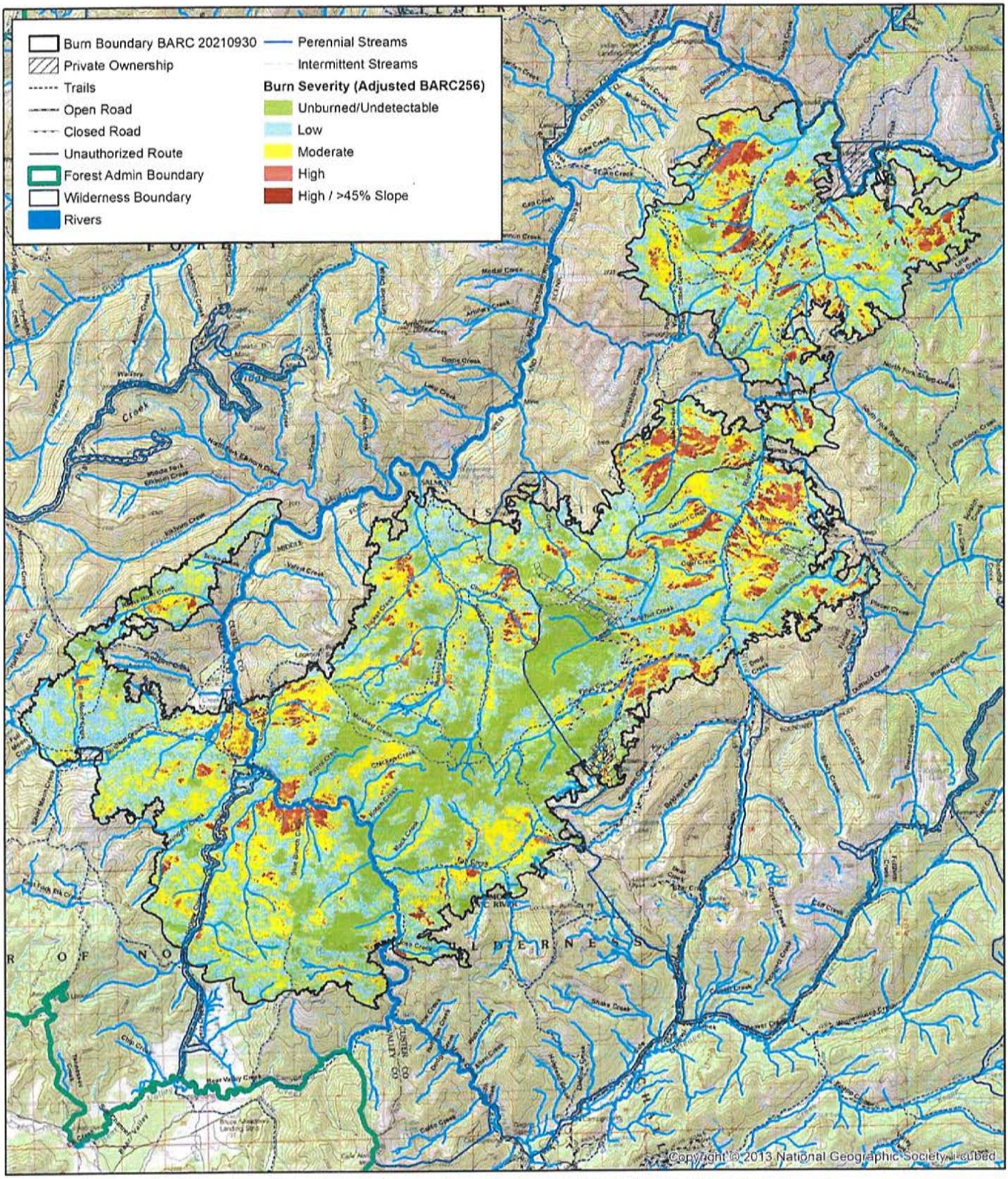
Adjusted Burn Intensity/Severity (10/26/2021) by WATERSHED	Watershed Area (ac)	Outside of Boundary	Unburned	Low severity	Moderate severity	High severity
Sulphur Creek at mouth (MFS)	32,687	81.6%	2.0%	8.6%	7.0%	0.8%
Soldier Creek at mouth (MFS)	13,480	3.7%	30.4%	32.7%	28.7%	4.4%
Little Soldier Creek at mouth (MFS)	4,993	12.2%	9.0%	28.3%	31.8%	18.7%
Float Creek at mouth (Rapid River)	7,327	13.4%	33.9%	26.2%	21.0%	5.5%
Rapid River at mouth (MFS)	78,244	64.8%	9.1%	11.5%	11.0%	3.7%
Boundary Creek at Culvert	4,173	50.1%	6.7%	22.4%	18.8%	2.1%
Unnamed Dagger Creek Tributary at Rd	374	0.0%	0.4%	28.7%	65.1%	5.7%
Blue Moon Creek at Ranch	1461	10.2%	10.5%	42.1%	33.4%	3.7%
Thomas Creek at mouth (MFS)	6,324	11.2%	8.6%	38.0%	34.7%	7.6%

A number of smaller drainages and tributaries that contain areas of moderate and high severity burn are likely to experience debris flow events on a smaller scale. Most of these are located in remote areas. Larger drainages within the burned area, such as the Rapid River and the Middle Fork Salmon River, will likely experience increased sediment loads and input of woody debris from flood events in some of the tributaries,

but are not likely to experience flood flows as a result of the fire because of the relatively small percentage of the watershed burned (eg., only 35% of the Rapid River watershed burned). Periodic pulses of sediment and woody debris into the Salmon River may cause localized short term changes to the river, but are within the range of what we would call normal geomorphic processes in this system, also providing material that is beneficial to spawning and rearing of resident and anadromous fish.



2021 Boundary Fire with Fire History polygons



Burn Severity Map for the Boundary Fire, Salmon-Challis National Forest

Map created 10/27/2021 by the Salmon-Challis National Forest Boundary Fire BAER Team. BARC Data and Fire Perimeter from analysis of Sentinel 2A satellite data, by USDA Forest Service, Geospatial Technology and Applications Center, BAER Imagery Support Program. Imagery date: 9/30/2021. BARC data adjusted based on 10/6/21 and 10/13/21 field verification and observations. Burn intensity and soil burn severity are roughly equivalent.

N

0 0.5 1 2 Miles

PART V - SUMMARY OF ANALYSIS

Introduction/Background

The Boundary Fire started on August 10, 2021 as a result of lightning, about 29 miles Northwest of Stanley, ID, within the Frank Church River of No Return Wilderness. The fire started just west of the Boundary Creek admin site/boat launch/campground along the Middle Fork Salmon River, on moderately steep topography between Boundary Creek and Sulphur Creek. As the fire progressed toward the Boundary Creek boat launch, firefighters were able to control its spread using fireline and backburns, while protecting values at risk including the campground, boat launch, guard station, the Dagger Falls bridge, the Middle Fork Salmon River corridor, the Sulphur Creek Ranch, and the Morgan Creek Ranch.

In late August, the fire made a run to the Northeast, dramatically increasing its size and becoming established in the Wilderness to the East of the Middle Fork Salmon River. With historically dry conditions and low humidity, the fire spread quickly to the Northeast in early September through the Soldier Creek drainage and into the Seafoam area and Rapid River watershed. On September 14, the Boundary Fire "officially" merged with the Scarface Fire, and after that point, the combined fire was managed as the Boundary Fire.

The Scarface Fire started on August 7, 2021 as a result of lightning, about 2.5 miles Southeast of the Middle Fork Lodge on the East side of the Middle Fork Salmon River in the Frank Church-River of No Return Wilderness. Similar to the Boundary Fire, the Scarface Fire spread dramatically in early September in the Thomas Creek drainage, and then into the Rapid River watershed before merging with the Boundary Fire. A point protection strategy was successful to protect the Middle Fork Lodge.

With dry conditions persisting into the Fall, the Boundary Fire continued to burn into October, when precipitation and higher humidities stopped the fire spread. The majority of the Boundary Fire burned in steep, inaccessible terrain within the Frank Church-River of No Return Wilderness. The western edge of the fire burned up to and around the burn scar from the 2018 Prospect Fire along the Middle Fork Salmon River, and up to the burn scars from the 2017 Honeymoon Fire and the 2006 Mountain Meadow-North Elk Fire in the Sulphur Creek Drainage. The Southeastern edge of the fire burned through the burn scar from the 2006 Boundary Fire, and then up to the burn scar from the 2012 Halstead Fire in the Seafoam area. The Northern portion of the fire (Scarface Fire) burned almost completely within the fire scars of the 1979 Mortar Fire and the 1988 Battleaxe Fire.

A. Describe Critical Values/Resources and Threats (narrative):

Table 5: Critical Value Matrix

Probability of Damage or Loss	Magnitude of Consequences		
	Major	Moderate	Minor
	RISK		
Very Likely	Very High	Very High	Low
Likely	Very High	High	Low
Possible	High	Intermediate	Low
Unlikely	Intermediate	Low	Very Low

1. Human Life and Safety (HLS):

BAER Value: Human life and safety on or in close proximity to burned NFS lands
What is at Risk: Human life and safety
Probability: Possible
Consequences: Major
Risk: High
Comments: Increased risk of hillslope erosion, rockfall, hazard trees, high flows, and debris flows will likely be present for 3 to 5 years following the fire.

Wilderness Trails – With a network of 110.4 miles of mostly wilderness trails within the burned area, a high risk exists to trail users over the next 3 to 5 years from rockfall, hazard trees, and trail

degradation. Trail users include hikers, backpackers, and stock users, including commercial outfitters. Deadfall is common along these trails and will increase dramatically over the next 10+ years as a result of the fire.

River Camps – Within the permitted section of the Middle Fork Salmon River from Boundary Creek to the confluence with the Salmon River, the fire burned adjacent to the river over a total distance of about 9 miles. Several drainges that drain directly into the Middle Fork were also extensively burned. This results in increased hazards to river users including fallen trees in the river, rockfall, hazard trees, and debris flows. Hazards at river camps are a primary concern:

- Teepee Hole Camp – This little used camp on a flat river terrace was extensively burned. Hazard trees exist, but no risk of debris flow exists.
- Cable Hole Camp – This little used camp on a flat river terrace was partially burned. Hazard trees may exist, but not risk of debris flow exists.
- Joe Bump Camp – The camp was not burned, but it is directly across from the outlet of Soldier Creek. The Soldier Creek drainage burned extensively (96% of the watershed burned, with 4.4% of the watershed burned at high severity), and the potential for debris flow exists that could impact the camp.
- Rapid River Camp – this little used camp is on a terrace at the mouth of the Rapid River. Approximately 35% of the Rapid River drainage burned, with some tributaries burning at high severity. It is possible that a debris flows that could impact the camp, although impacts from the tributaries are likley to be attenuated by the time they reach the Middle Fork Salmon.
- Little Soldier Camp – This popular, heavily used camp is at the mouth of Little Soldier Creek. The Little Soldier Creek drainage burned extensively (88% of the watershed burned, with 12.7% of the watershed burned at high severity), and a moderate to high potential exists for a debris flow that could impact the camp.

Seafoam Area – Much of the remote Seafoam area is accessible by vehicle. Portions of this area burned at high severity, creating hazards including rockfall, hazard trees, and debris flows. The potential exists for post-fire flood events to damage roads or make them impassible. Egress from popular camping areas could be an issue.

Rapid River Bridge – The Rapid River Bridge at the Rapid River Trailhead is a log stringer bridge that burned in the fire. Metal rods in the remains of the bridge logs may be a hazard, particularly if those logs are transported by high flows downstream into the Middle Fork Salmon River (*photo- right*).

2. Property (P):

BAER Value: Buildings, water systems, utility systems, road and trail prisms, dams, wells, or other significant investments on or in close proximity to burned NFS lands
What is at Risk: Open Forest Roads
Probability: Likely
Consequences: Major
Risk: Very High
Comments: Although only 23.1 miles of open road exist within the burned area, these heavily used roads serve as wilderness gateways and provide access to admin sites, boat launches, campgrounds, trails, and mines.

Boundary Creek Area – The Dagger-Boundary Road (FR 40568) is a very heavily used road to access the Boundary Creek admin site, the Boundary Creek boat launch, the Boundary Creek Campground, and the Dagger Falls Campground. Most of this road is within the burned area. The areas along the road burned at mostly low and moderate severity. The following concerns exist along this road:

- Dagger Creek Culvert: The fire burned adjacent to this crossing, but no fire occurred upstream of the culvert. There is little risk that the fire will result in increased flows at this crossing. This culvert has sustained damage over recent years as a result of beaver damming and overtopping of the road, and the condition of this crossing is currently poor.
- Unnamed tributary to Dagger Creek: The road crosses a small, steep perennial tributary to Dagger Creek, the drainage of which burned entirely (5.7% high severity, 65.1% moderate severity) (*below, left*). Because this is a steep drainage, this site has a moderate to high risk of a debris flow causing a debris jam at the culvert and impacting the road (*below, right*). Approximately 150 feet of road (between the culvert and the topographic low point) are at risk from damage or loss in the event that flood flows overtop the road.

- Boundary Creek culvert: Just upstream of the Boundary Creek admin site, FR40568 crosses Boundary Creek at a culvert. Most of the low gradient valley floor burned at low severity, with moderate and high severity burn on portions of the hillslopes. However, much of the upper watershed draining into Boundary Creek did not burn. The risk of a debris flow in Boundary Creek at this location is low.

Seafoam Area Roads – The Beaver Creek Road (FR 40008) is a popular backcountry road that provides access to the Seafoam Area over Vanity Summit and up Float Creek to Josephus Lake and Campground.

- The area along a 2.5-mile section of FR40008 adjacent to Float Creek burned at moderate and high severity. This section of road is a narrow single lane, native surface road that traverses the lower hillslope above Float Creek. While the road is situated well above Float Creek in most places and the highest burn severity in the Float Creek drainage occurred on the other side of Float Creek from the road, portions of the road are at risk from increased hillslope runoff from steep, moderate severity burned areas on the slopes above the road. The road currently has poor drainage on decomposed granite, and increased runoff would likely route down the road and cause considerable damage to the road (*photo, right*). The risk to this road is high.

- The Float Creek bridge on FR40008 is a 30-foot long timber bridge with 6 feet of freeboard over the high water elevation. Although steep slopes in the drainage upstream of the bridge burned at high severity, the bridge is at low risk as a result of the fire because it has adequate clearance (*photo, right*).
- The Harlan Creek Road (FR 40009), providing access to the Seafoam Mine, crosses Float Creek at a ford within an area burned at moderate and high severity. This road is primarily an ATV route. The ford is likely to experience dynamic adjustments during post-fire flood events and as the channel adjusts in this low gradient section of stream. The ford may become impassible, but no major loss of road infrastructure is likely to occur. The risk at this site is low.
- The Greyhound Ridge Road (FR 40011) access Greyhound Mine. This road switchbacks up a steep hillslope, a portion of which burned at moderate severity. Low or moderate risk exists to this road from increased hillslope runoff and erosion.

BAER Value: Buildings, water systems, utility systems, road and trail prisms, dams, wells, or other significant investments on or in close proximity to burned NFS lands
What is at Risk: Wilderness Trails
Probability: Likely
Consequences: Moderate
Risk: High
Comments: A total of 110.4 miles of mostly non-motorized trails exist within the burned area. Most of these trails are located within the Frank Church River of No Return Wilderness as part of an extensive network of trails used for hiking, backpacking, and stock use, including commercial outfitting. Because of the steep topography and erodible granitic soils, many portions of these trails are at risk of erosion and potentially loss as a result of increased post-fire runoff, soil erosion, and/or debris flows. The highest risk to trails occurs where trails are situated within or below steep slopes burned at high and moderate severity. High risk may also occur to trails that are located adjacent to streams in drainages that burned at moderate and high severity. The following trail segments were determined to be at high risk (total of 7.9 miles), and are described in more detail in the Trails Assessment document:

- West Fork Thomas Creek Trail #4008 (1.5 miles)
- Sheep Creek Trail #4030 (0.68 miles)
- Rapid River Trail #4007 (2.69 miles)
- Lake Creek/Cabin Creek Trail #4207 (1.8 miles)
- Soldier Basin/Lincoln Patrol Ridge Trail #4013 (1.26 miles)

Deadfall is also a persistent problem along these trails, which is likely to increase considerably over the next 10+ years within the burned area, affecting trail passability. Considerable resources have been spent in recent years to keep these trails open.

BAER Value: Buildings, water systems, utility systems, road and trail prisms, dams, wells, or other significant investments on or in close proximity to burned NFS lands
What is at Risk: Administrative Sites, Campgrounds
Probability: Unlikely
Consequences: Major
Risk: Intermediate
Comments: The following Forest Service sites are located within or adjacent to the burned area. These sites are all at low risk from post-fire flooding or erosion because of low burn severity adjacent to and/or upstream of the sites. Hazard trees may exist as a result of the fire at some of these locations.

- Boundary Creek Admin Site/Campground/Boat Launch
- Dagger Creek Campground
- Josephus Lake Campground
- Little Creek Guard Station

BAER Value: Buildings, water systems, utility systems, road and trail prisms, dams, wells, or other significant investments on or in close proximity to burned NFS lands
What is at Risk: Diversions on National Forest System lands
Probability: Likely
Consequences: Moderate
Risk: High
Comments: Several diversions exist on Forest Service land within the burned area. Most of these diversions are maintained and operated by private users under special use permits for use on private lands.

- Thomas Creek diversions – serving Middle Fork Lodge, hydropower and other uses. 89% of the Thomas Creek watershed burned, with 7.6% of the watershed burned at high severity. The debris flow risk at these diversions is high.
- Blue Moon Creek diversion – serving Sulphur Creek Ranch. 90% of the Blue Moon Creek watershed burned, with 3.7% of the watershed burned at high severity. The debris flow risk at this diversion is moderate.
- Little Creek diversions – serving Little Creek Guard Station (USFS). Only a small portion of the Little Creek drainage burned, and the debris flow risk at these diversions is low.

BAER Value: Buildings, water systems, utility systems, road and trail prisms, dams, wells, or other significant investments on or in close proximity to burned NFS lands
What is at Risk: Private Property within the National Forest boundary
Probability: Likely
Consequences: Moderate
Risk: High
Comments: Several parcels of private property exist within or adjacent to the burned area, within the National Forest boundary, including Middle Fork Lodge (at the mouth of Thomas Creek), Seafoam Mine, Greyhound Mine, Mountain King Mine, Sulphur Creek Ranch (at the mouth of Blue Moon Creek), and Morgan Creek Ranch (at the mouth of Sulphur Creek). The BAER program cannot directly address post-fire risks on private property.

3. Natural Resources (NR):

BAER Value: Soil productivity and hydrologic function on burned NFS lands
What is at Risk: Soil erosion and stream channel function
Probability: Likely
Consequences: Minor
Risk: Low
Comments: Increased soil erosion will likely occur, particularly in areas of high burn severity and steep slopes. Ground cover will likely recover quickly (1-3 years) in low and moderate severity burned area, and over a period of 3 to 5 years in high severity burned areas. Post-fire flooding and/or debris flows may occur in 3 tributaries of the MF Salmon River and numerous small tributaries of the Rapid River and other drainages. Debris flows have the potential to transport large amounts of mud, gravel, rocks, and trees into the Middle Fork Salmon River and its larger tributaries. Some

of these effects could propagate downstream. Because debris flows are part of the natural balance in this system and have created many of the morphologic features in the river canyon, this will not alter the overall balance of this high fire frequency system in terms of hydrologic function. Deadfall in stream valleys burned at high severity will be the primary influence on channel morphology for decades.

BAER Value: Critical habitat or suitable occupied habitat for federally listed threatened or endangered terrestrial, aquatic animal or plant species on or in close proximity to buned NFS lands
What is at Risk: Chinook, Steelhead, and Bull Trout Habitat
Probability: Likely
Consequences: Minor
Risk: Low
Comments: The Middle Fork Salmon River is designated critical habitat and supports ESA listed Chinook Salmon, steelhead and Bull Trout. Tributaries of the Middle Fork Salmon River that were affected by the fire also support populations of Chinook, Steelhead, or Bull Trout, and some are designated as critical habitat for these species. The fire appeared to mimic natural fire patterns that would have historically occurred in this area and are critical to developing and maintaining quality fish habitat and fish populations by introducing woody debris and spawning gravel to the river system through increased erosion and debris flow events. Although debris flows are likely to occur in some locations and may impact localized fish populations in the short term, the fire did not generate any large scale risks to critical fish values.

BAER Value: Native or naturalized communities on NFS lands where invasive species or noxious weeds are absent or present only in minor amounts
What is at Risk: Spread of invasive species
Probability: Likely
Consequences: Moderate to High
Risk: High
Comments: The burned area is susceptible to colonization by invasive species. The species known to be present in the area have the potential to disrupt native plant community reestablishment in areas otherwise uninfested by noxious weeds.

Known Infestations: The Boundary Fire burned primarily within the Frank Church River of No Return Wilderness, but also within the Boundary Creek "Cherry Stem" and the "Seafoam Bubble" (FS lands surrounded by Wilderness), as well as on FS lands adjacent to three private in-holdings. Known infestations of noxious weeds that are within the burned area are limited to small infestations of rush skeletonweed, hoary alyssum and Canada thistle, which are generally associated with the private inholdings and small trail side populations, as well as larger infestations of rush skeletonweed on the Northeast edge of the fire associated with the Middle Fork Salmon River Corridor. A total of 14 known infestations exist within the burned area, encompassing 310 acres. About 90% of these (280 acres) are in just 3 infestations adjacent to the Middle Fork Lodge and the Middle Fork Salmon River Corridor. The fire also burned adjacent to large populations of cheatgrass (*Bromus tectorum*) associated with the Middle Fork Salmon River corridor. While most of the fire occurred on the South side of the river on slopes generally not dominated by cheatgrass, many of the south-facing slopes just across the river are dominated by cheatgrass and in some cases rush skeletonweed as well.

Risk of Spread: Due to the proximity to known infestations, the ability of existing invasive plants populations to spread and become established, relatively high use spread vectors, and the removal of canopy, it is likely that invasive plants will have a negative effect on the post fire native plant vegetation community. The effects of spread and establishment of noxious and/or invasive plants would be long term and potentially irreversible to the values associated with critical habitat and Wilderness resources. The risk of invasive plant spread is associated with the spread of existing infestations into areas burned at moderate or high severity, as well as ground disturbing activities that occurred during fire suppression. Because most of the fire occurred in Wilderness, fire suppression impacts are associated with the cherry stems, facilities (FS infrastructure), and point

protection activities. Some suppression activities were performed on FS lands adjacent to private and/or state lands to minimize the impact to those lands and/or values at risk. Areas impacted by fire suppression activities include (but are not limited to) the following:

- Boundary Creek Complex
- Josephus Lake Campground
- Greyhound Mine
- Camptender Trailhead
- FS lands adjacent to the Middle Fork Lodge
- Little Creek Guard Station
- Morehead Lookout
- Sulfur Creek Ranch
- Morgan Ranch

4. Cultural and Heritage Resources:

BAER Value: Cultural resources on NFS lands which are listed on or potentially eligible for the National Register of Historic Places
What is at Risk: Historic Properties
Probability: Unlikely
Consequences: Moderate
Risk: Low
Comments: Numerous cultural resources are located within and adjacent to the burned area. Some of these cultural resources are eligible for listing on the National Register of Historic Places (NRHP). Impacts by fire-induced erosion or looting may damage or destroy the archaeological record and the depositional contexts important to the site's significance and information potential. While most historic properties located within the burned area are considered at low risk from post-fire erosion or flood events due to their location outside of drainages that burned at a high intensity, additional assessment may be needed in early summer 2022 to evaluate the risk to some sites.

B. Emergency Treatment Objectives:

- Reduce the risk of loss of Forest road and trail infrastructure.
- Reduce the risk of new weed infestations in the burned area and promote the recovery of native plant populations.
- Decrease risk to public life and safety within the burned area.

C. Probability of Completing Treatment Prior to Damaging Storm or Event:

Land: 80%
Channel: N/A – No BAER Treatments Proposed
Roads/Trails: 70%
Protection/Safety: 80%

D. Probability of Treatment Success

Table 6: Probability of Treatment Success

	1 year after treatment	*3 years after treatment*	*5 years after treatment*
Land	90%	80%	70%
Channel	N/A	N/A	N/A
Roads/Trails	80%	70%	70%
Protection/Safety	75%	75%	75%

E. Cost of No-Action (Including Loss):

The cost of no action is estimated to be $429,500 (See VAR Worksheet):
Native Plant Communities: An estimated annual spread rate of 20% was applied to the existing 310 infested acres, resulting of a potential spread of 225 acres during the 3-year period of high susceptibility. Eradication of this expanded infestation at $370/acre, assuming at least 2 treatments would be required, is $166,500. The actual cost could be higher because of susceptibility of some areas to large scale cheatgrass and rush skeletonweed infestation.
Roads: Replacement cost of 2 miles of road at high risk (at $40,000 per mile) is $80,000.
Trails: Cost to repair/replace 7.9 miles of Wilderness trail at high risk (at $20,000/mile) is $158,000.
Loss of Use costs: Estimated at $25,000.

F. Cost of Selected Alternative (Including Loss):

The total cost of all proposed treatments is $153,660. The probability of experiencing loss if treatment occurs is 0.30. Implementing the proposed treatments would reduce the probability of experiencing loss by 0.50, and the expected benefit of treatment would be $214,750. Treatment is justified.

G. Skills Represented on Burned-Area Survey Team:

☒ Soils	☒ Hydrology	☒ Engineering	☒ GIS	☒ Archaeology
☒ Weeds	☒ Recreation	☒ Fisheries	☐ Wildlife	
☐ Other:				

Team Leader: David Deschaine
Email: david.deschaine@usda.gov **Phone(s):** (208)756-5171

Forest BAER Coordinator: David Deschaine
Email: david.deschaine@usda.gov **Phone(s):** (208)756-5171

Team Members: *Table 7: BAER Team Members by Skill*

Skill	Team Member Name
Team Lead(s)	Dave Deschaine
Soils	Dave Deschaine
Hydrology	Bill MacFarlane/Dave Deschaine
Engineering	Pete Schuldt
GIS	Bill MacFarlane
Archaeology	Audrey Westmoreland
Weeds	Tommy Gionet
Recreation	Nick Schade/Lisa Byers
Fisheries	Christine Stewart
Other	

H. Treatment Narrative:

Land Treatments:

EDRR Weed Treatments

Conduct Early Detection Rapid Response (EDRR) management activities on invasive plant species within and adjacent to the burned area. Areas around known infestations along existing roads and trails will be examined for potential expansion into previously uninfested areas. EDRR activities will begin at known weed infestations and then radiate out from these epicenters to detect, map and treat new infestations. Chemical treatment will be the primary method used, and all herbicides proposed for use (see spec sheet in project file) are covered under the Salmon-Challis National Forest Invasive Plant Treatment Final Environmental Impact Statement (November 2015).

The EDRR work, due to the size of the burn, would be limited to vectors including known infestations. The existing infestations are listed an "Contain" weeds on the state list and EDRR would be performed to reduce or eliminate any spread outside of existing boundaries. The work will focus on the 5 road corridors and portions of the nearly 100 miles of system trails that burned, with extra attention on high severity burned areas, as these areas are likely to be more susceptible to the establishment of invasive plants and noxious weeds, particularly where in close proximity to seed sources and spread vectors. The work will also concentrate on the areas impacted by suppression activities listed in Section A of this report. EDRR is a suitable approach to treat these areas as well, as these areas are not within known infestations, but may be at risk as a result of introduced seed sources.

Because of Forest Service staffing capacity limitations, the proposed EDRR work would primarily require the use of a partnership crew to accomplish these tasks. The following estimates and assumptions were used to develop the funding proposal for this work:

- Fund a 4-person invasive species management crew from a partner organization such as the Montana Conservation Corps (MCC) for 6 two-week hitches. This crew would perform an initial review of the area as well as the EDRR work. This represents a considerable workload considering the size of the burned area, the remote nature of the area, numerous vectors, high and low elevation sites, and the possibility of multiple visits to critical sites. The expectation with this workload is that there will likely be more time spent looking for weeds than treating weeds. The cost of the MCC invasive species management crew is approximately $9,000 per hitch, for a total of $54,000. If the SCNF is not able to implement a partnership agreement, these funds would be put into a task order against the forest existing IDIQ weed treatment contract.
- Fund a temporary Forest Service employee to manage the Partnership and/or Contract to meet the need. Tasks include entering into the agreement, managing the agreement, directing the work, required reporting, and monitoring. A total of $6,000 is requested to fund this work (approximately 37 days at the GS-6 level).
- Additional Forest program funds are likely to be needed as in-kind funding to complete the proposed work.

Channel Treatments:

No BAER Treatments proposed.

Roads and Trail Treatments:

FR40008 Stormproofing

Road drainage will be improved along a 2-mile section of the Beaver Creek Road (FR40008) upstream of the Float Creek Bridge. This section of road is a single-lane native surface road, much of which is bench cut into the slope. A dozer will be used to outslope the road where needed and construct a

series of drainage dips to route hillslope runoff off the road. The frequency of drainage dips will vary with the grade of the road, but will generally be constructed every 300 to 500 feet (fitting to the topography and grade for durability and effectiveness). This work would be completed as soon as possible after the area becomes accessible from snowmelt on Vanity Summit (mid-June in most years).

Implementation of this treatment will require 1 day of equipment mobilization, up to 3 days of road work utilizing a dozer, 1 day of demobilization, and a crew of 2 people. Personnel cost is estimated to be $3000 (5 days at $500/day plus vehicle expenses). Equipment cost is estimated to be $4200 for a D6 dozer, including time to mobilize equipment to the remote site ($140/hour for 30 hours). Additional mobilization costs include $1000 for a transport truck ($500 each way). Total cost for this project would be approximately $8,200.

Wilderness Trail Stabilization/Storm-proofing

Based on an analysis of the burn severity within the Boundary Fire burn area and slope data, the trails listed in the table below have been identified as being "at risk" from post-fire flooding, erosion, or debris flows, and the forest will have the capacity to work on these trails early in the 2022 season if funded through BAER. The segments identified for project work are those within or downslope from areas burned at moderate and/or high severity, particularly on steep slopes, based on the burn severity mapping.

TRAIL #	TRAIL NAME	MILES	# OF HITCHES	# OF DAYS	RATE FOR PARTNER
4008	WEST FORK THOMAS	1.5	2	16	$24,000
4030	SHEEP CREEK	0.68	1	8	$12,000
4007	RAPID RIVER	2.69	1	8	$12,000
4207	CABIN CREEK	1.8	1	8	$12,000
4013	LINCOLN PATROL RIDGE	1.26	2	16	$24,000
	TOTAL	**7.93**	**7**	**56**	**$84,000**

Drainage features will be constructed, and stabilization measures taken on trails that have a high risk of loss or damage due to increased runoff expected within the first year following fire. Previous fires on the Salmon-Challis NF have shown that moderate and high burn severity areas have a high potential to impact existing trail systems. Treatments are proposed to reduce unacceptable risks within high severity burned areas and steep slopes burned at moderate and high severity.

Trail stabilization project work identified within the Boundary Fire burn area is for approximately 7.9 miles of trail on 5 different trail segment and the proposal is to utilize a partnership agreement with a youth conservation corps for 7 hitches. A youth conservation corps costs approximately $12,000 per hitch and a hitch consists of 8 days. Total cost requested from BAER funding for Wilderness Trail Stabilization is approximately $84,000.

The trail work will be implemented on trails lacking adequate drainage features for anticipated increased runoff by field crews using appropriate equipment and will include construction of wood and rock water bars, dip-drains, and rolling dips, as well as armoring of stream/drainage crossings. The work will follow Forest Service trail specifications, and the proposed trail work will be the minimum required to prevent serious erosion and/or loss of the trail infrastructure. Treatments will follow design specifications in the Burned Area Emergency Response Treatments Catalog (USDA Forest Service, 2006). The number of structures to be constructed will depend on burn severity, soil type, trail slope, and topography. Drainage structures will not be required along the entire length of each of these trail segments, however we expect the need for a significant number of drainage structures due to the steep slopes and fire severity.

All of the trail work will be completed by the end of August 2022, with the expectation that the trails would be stabilized prior to the high magnitude thunderstorms that typically occur in the late summer.

BAER funds would be used only to complete the work described above to reduce unacceptable risk to trail infrastructure as a result of the fire. In conjunction with BAER funds, other sources of funding (salary for Forest trails personnel, other grants, etc) will be used to address ongoing trail maintenance, trail clearing, and oversight of the BAER work.

Protection/Safety Treatments:

Hazard Warning Signs

Hazard warning signs will be placed at the following locations to warn visitors of hazards associated with the burned area:

- FR40568 (Boundary Creek Road) at Ayers Meadow
- FR40008 (Beaver Creek Road) near Seafoam Creek
- Wilderness Trails entering the burned area – approximately 4-6 locations

The cost of signs and installation is shown below:

- Road signs: 2 @ $150 each
- Road sign installation (labor): 2 @ $150 each
- Trail signs: $100
- Trail sign installation (labor): $200
- Total estimated cost: $900

Burned Area Information for River Users

River checkers will provide information for river users on the Middle Fork Salmon River regarding burned area hazards along the river, particularly flood/debris flow hazards that may exist at the mouths of the following tributaries:

- Joe Bump Camp at the mouth of Soldier Creek
- Rapid River Camp at the mouth of Rapid River
- Little Solder Camp at the mouth of Little Soldier Creek

This will be integrated into existing protocols, and no additional funding will be required.

Rapid River Bridge cleanup

Metal rods will be removed from the remains of the Rapid River Bridge as soon as the area becomes accessible (generally mid-June). This will require 1 day of work for a crew of 2. Alternatively, the logs could be removed from the river channel using a dozer in conjunction with the FR40008 stormproofing work (4 hours of dozer time @ $140/hour). The total cost of this project would be approximately $560.

I. Monitoring Narrative:

Monitoring inherently occurs as a part of EDRR activities to prevent the spread of invasive plants into susceptible burned areas. No additional monitoring is proposed.

PART VI – EMERGENCY STABILIZATION TREATMENTS AND SOURCE OF FUNDS

			NFS Lands				Other Lands				All
		Unit	# of		Other		# of	Fed	# of	Non Fed	Total
Line Items	Units	Cost	Units	BAER $	$		units	$	Units	$	$
A. Land Treatments											
EDRR Partnership agreemer	Hitch	9,000	6	$54,000	$0			$0		$0	$54,000
EDRR Partnership oversight	Each	6,000	1	$6,000	$0			$0		$0	$6,000
Insert new items above this line!				$0	$0			$0		$0	$0
Subtotal Land Treatments				$60,000	$0			$0		$0	$60,000
B. Channel Treatments											
				$0	$0			$0		$0	$0
				$0	$0			$0		$0	$0
Insert new items above this line!				$0	$0			$0		$0	$0
Subtotal Channel Treatments				$0	$0			$0		$0	$0
C. Road and Trails											
FR40008 Stormproofing	Each	8,200	1	$8,200	$0			$0		$0	$8,200
Trail Stab./Stormproofing	Hitch	12,000	7	$84,000	$0			$0		$0	$84,000
Insert new items above this line!				$0	$0			$0		$0	$0
Subtotal Road and Trails				$92,200	$0			$0		$0	$92,200
D. Protection/Safety											
Hazard warning signs	Each	400	1	$400	$0			$0		$0	$400
Hazard sign installation	Each	500	1	$500	$0						
Rapid River Bridge Removal	Each	560	1	$560	$0			$0		$0	$560
Insert new items above this line!				$0	$0			$0		$0	$0
Subtotal Protection/Safety				$1,460	$0			$0		$0	$960
E. BAER Evaluation											
Initial Assessment	Report	$5,000	1	---	$0			$0		$0	$0
				$0	$0			$0		$0	$0
Insert new items above this line!				---	$0			$0		$0	$0
Subtotal Evaluation				$0	$0			$0		$0	$0
F. Monitoring											
				$0	$0			$0		$0	$0
				$0	$0			$0		$0	$0
Insert new items above this line!				$0	$0			$0		$0	$0
Subtotal Monitoring				$0	$0			$0		$0	$0
G. Totals				$153,660	$0			**$0**		**$0**	**$153,160**
Previously approved											
Total for this request				**$153,660**							

PART VII - APPROVALS

1. Charles A. Mark 12/7/21

Forest Supervisor Date