Date of Report: 8/2/2021

BURNED-AREA REPORT

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: Deep Creek Canyon

B. Fire Number: MT-HLF-000239

C. State: Montana

D. County: Broadwater/Meagher

E. Region: 1

F. Forest: Helena-Lewis and Clark

G. District: Townsend

H. Fire Incident Job Code: 0115 P1N2SY21

I. Date Fire Started: 6/13/2021

J. Date Fire Contained: 98% contained as of 7/17/2021

K. Suppression Cost: Estimated $5,769,000 (all agencies and resources)

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

1. **Fireline repaired (miles):** None completed to date. Estimated to be completed: 10.7 miles
2. **Other (identify):** None completed to date. Estimated to be completed: 5 helispots, 7 drop points, 1 staging area, 2 stream crossings, 1 gate, 1 bridge repair, 0.3 miles road repair

M. Watershed Numbers:

Table 1: Acres Burned by Watershed

HUC #	Watershed Name	Total Acres	Acres Burned	% of Watershed Burned
100301010802	Cabin Gulch	7643	109	1.4%
100301010804	Middle Deep Creek	18,743	1128	6.0%
100301010801	Upper Deep Creek	19,882	3427	17.2%

N. Total Acres Burned:

Table 2: Total Acres Burned by Ownership

OWNERSHIP	ACRES
NFS	1776
OTHER FEDERAL (LIST AGENCY AND ACRES)	0
STATE	313
PRIVATE	2575
TOTAL	4664

O. Vegetation Types: The fire burned predominantly in Douglas fir on steep, dry slopes, with some interspersed open grassy parks. The riparian vegetation along Deep Creek in the highway corridor also shows a large amount of overstory mortality. However, regrowth of riparian forbs was evident at the time of the assessment, with some riparian shrubs sending up new shoots as well.

P. Dominant Soils: Soils within the fire perimeter are characterized by Cryocrepts and Ustochrepts on steep slopes, Cryoborolls and Haplocryolls in meadows and grass-dominated areas, and Haplocryalfs and Cryoboralfs in areas with lower slopes. These soils are derived from metasedimentary rocks with typical soil textures of loam and silt loam and rock content varying from 30 to 70%. See Soil Report Table 1 for a list of map units within the fire perimeter.

Q. Geologic Types: Geology across the Deep Creek Canyon fire consists of argillites, siltites, and quartzites. Landforms are primarily mountain ridges and slopes. The majority of slopes are between 20 and 60%, with some steep rock outcrops along Deep Creek.

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	9.5
INTERMITTENT	13.1
EPHEMERAL	0*
OTHER (DEFINE)	0

*Stream miles are based on the National Hydrologic Dataset (NHD). This is an undercount of ephemeral streams, which do exist within the fire perimeter.

S. **Transportation System:**
Trails: *National Forest (miles):* 0.4 *Other (miles):* N/A
Roads: *National Forest (miles):* 2.9 *Other (miles):* State Highway 12: 3.4 miles
Private: 17.8 miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres):

Table 4: Burn Severity Acres by Ownership

Soil Burn Severity	NFS	Other Federal (List Agency)	State	Private	Total	% within the Fire Perimeter
Unburned	210	0	70	533	813	17%
Low	503	0	121	943	1568	34%
Moderate	502	0	88	686	1276	27%
High	560	0	34	413	1007	22%
Total	1776	0	313	2575	4664	100%

B. Water-Repellent Soil (acres): Hydrophobicity was detected on high severity soils, and in some of the moderate severity areas. Moderate plus high severity areas are a total of 2283 acres.

C. **Soil Erosion Hazard Rating:** Wildfire induced changes to soil properties have potential to alter erosion rates from the natural, unburned state. Areas with moderate or high burn severity have little to no canopy or ground cover to intercept rainfall and may have altered infiltration, both of which may lead to increased wind and water erosion. This erosion hazard generally persists through the first few years post-fire until hillslopes stabilize as vegetation recolonizes, infiltration capacity increases, and ground cover is recruited. Unburned areas and those with low severity have little to no erosion hazard in comparison.

Table 5. Soil erosion hazard rating for moderate and high burn severity

Erosion Hazard Rating	***Acres***
Slight	817
Moderate	1183
Severe	268

D. Erosion Potential: Soil erosion and sediment potential were quantified using WEPPCloud-Disturbed. Several small sub-watersheds within the fire perimeter were modeled to assess specific areas of concern as well as the larger Deep Creek watershed which encompasses the majority of the fire. Hillslope soil loss ranged from 8 to 146 lbs per acre per year. The risk of soil loss is greatest in several steep, ephemeral or intermittent drainages that burned extensively at high and moderate severity.

E. Sediment Potential: Potential total sediment discharge at the outlets, including hillslope erosion and additional channel soil loss, ranged from 0.8 to 420 tons per year. The downstream receiving waters for post-fire sediment are Deep Creek and its tributaries. Refer to soils report for values for specific drainages.

F. Estimated Vegetative Recovery Period (years): Grasses are expected to recover in one to three years, with some forbs already showing regrowth particularly in areas of lower burn severity and in riparian areas. Overstory mortality was very extensive in both uplands and riparian areas, although the root systems of riparian shrubs are likely to have survived. Riparian shrubs are expected to recover within three to five years, and sooner in the scattered areas where mortality was low. Upland shrubs and conifers are expected to recover in twenty to fifty years. In some areas where conifer encroachment was occurring, conifer stands may revert to shrubland, as happened after the nearby Maudlow-Toston fire of 2000.

G. Estimated Hydrologic Response (brief description): Driven by high winds and heavy fuel loading, the Deep Creek Canyon fire caused extensive moderate to high burn severity with hydrophobic conditions that will resist infiltration temporarily, as well as substantial overstory mortality. The area has steep slopes averaging around 35% with many instances of slopes ranging 70-90%. The type of soils has moderate to high propensity for runoff in its natural state.

Potential damaging events of concern in the future are summer thunderstorms and to a somewhat lesser extent spring runoff. The hazard is highest this year since July and August thunderstorms could occur that would produce runoff. The hazard may persist for the next several years as the fire area recovers. USGS debris flow modeling suggests that even moderately intense summer storms could initiate debris flows from multiple steep, severely and extensively burned catchments. These smaller catchments are also predicted to see large increases in post-fire runoff in curve number hydrologic modeling performed by the BAER team hydrologist, although model results were highly variable across drainages. Postfire runoff ranges from 1.5 up to 25 times pre-fire runoff for a 5-year storm rain event. Curve number modeling also suggests that Deep Creek downstream of the burn area is likely to see elevated flows, but the higher unburned percentage of the overall Deep Creek watershed should help to moderate that effect. Full hydrologic recovery is not expected for several decades due to the extensive moderate and severe soil burn, the stand-replacing nature of much of the fire, and the dry environment that limits regrowth rate.

PART V - SUMMARY OF ANALYSIS

Introduction/Background

The Deep Creek Canyon fire started on Sunday June 13th, 2021 at approximately 15:45, in Deep Creek Canyon 18 miles east of Townsend, Montana along Highway 12 in the Big Belt Mountains. Personnel located a downed tree on a powerline, but as of this report, the official cause was still under investigation. The fire started on the north side of U.S. Highway 12 but jumped to the south side with high winds on June 15th. It continued to spread to the south and northeast for several days until being slowed by containment efforts and more favorable weather and was 95% contained by June 24th.

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

Table 6: 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):**
   There is high risk to any members of the public or USFS employees accessing the burn area via trails due to extensive dead standing trees and snags. The probability of damage or loss is *possible* and the magnitude of consequences *major*, resulting in *high risk*. **The recommended treatment is hazard signage at the Carl Creek trailhead.**

   There is high risk to any members of the public or USFS employees at the Deep Creek picnic area, in the event of intense rainfall over the burn area causing flooding and debris transport. The probability of damage or loss is *possible* and the magnitude of consequences *major*, resulting in *high risk*. **The recommended treatment is hazard signage at the Deep Creek picnic area.**

   There is high risk to several dry crossings on FSR 4146 and 4146A, which are Maintenance Level 1 roads that cross steep, ephemeral draws. The probability of damage or loss is *likely* and the magnitude of consequences *moderate*, resulting in *high risk*. The BAER team considered crossings improvements or removals, but agreed that those treatments were unlikely to be successful at mitigating the risk. **The recommended treatment is a gated closure at the entrance to FSR 4146 and 4146A,** in order to preserve access to the power line corridor but prevent public access.

   The BAER program does not assign risk ratings to threats on non-USFS lands. However due to the proximity of US Highway 12 as well as private and state lands within or downstream of the burn perimeter, the team has shared its findings with external partners including the National Weather Service, the Natural Resource Conservation Service, the state of Montana, and Broadwater and Meagher County Disaster and Emergency Services.

2. **Property (P):**The Carl Creek trail crosses through primarily low or moderate burn severity, with only a short section at the start of the trail being more heavily impacted and at risk of rilling and erosion from the adjacent hillslope. No ephemeral draws or streams cross the trail in this section, and therefore probability of damage or loss is *unlikely* and the magnitude of consequences *minor*, resulting in *very low risk*. **No treatment is recommended.**

   There is intermediate risk to infrastructure at the Deep Creek picnic area, including a bridge and access road, vault toilet, and picnic tables. The site is downstream of the burn and may see elevated flows, although hydrologic and hydraulic capacity modeling suggests that the bridge is capable of withstanding predicted flows. The team also took into account the greater percentage of unburned area upstream of the site, and the presence of several non-USFS highway crossings between the burn area and the picnic area which would likely catch debris before reaching the

picnic area. The probability of damage or loss is *possible* and the consequences would be *moderate*, resulting in *intermediate* risk, with **no treatment recommended**.

At the next crossing downstream, hydrologic and hydraulic capacity modeling suggests that the Sulphur Bar bridge is also capable of withstanding predicted flows. Again, the team took into account the greater percentage of unburned area upstream of the site, and the presence of several non-USFS highway crossings between the burn area and the picnic area which would likely catch debris before reaching the picnic area. The probability of damage or loss is *unlikely* and the consequences would be *moderate*, resulting in *low* risk, with **no treatment recommended**.

The team also considered potential impacts to the Cabin Gulch road, which has seen roadfill erosion from high flows in Deep Creek in the recent past. The same considerations as for the previous two sites apply here, and recent armoring of the roadfill with riprap further reduces the risk of damage. The probability of damage or loss is *possible* and the consequences would be *moderate*, resulting in *intermediate* risk, with **no treatment recommended**.

3. **Natural Resources (NR):**Soils within the fire perimeter have the potential to experience short-term loss of soil productivity and reduced hydrologic function in areas where increased runoff and erosion occurs. Although some proportion of eroded soil will remain on the hillslope, there is potential for delivery of eroded soil to stream channels given the steep slopes and higher soil burn severity along drainages and the frequency of summer thunderstorms. The magnitude of consequence is *minor* given that any soil damage is expected to be recoverable and localized. Roughly a third of the fire area has moderate to high erosion risk immediately after fire with stabilization expected in 3-5 years. Considering these factors, the probability of damage or loss is *likely*, the magnitude of consequences are *minor*, and the risk to soil productivity and hydrologic function is *low*. **No treatment is recommended.**

   There is high risk to native plant communities from the threat of noxious weeds and invasive plant species, particularly along trail corridors and suppression disturbance. Known noxious weed and invasive plant populations exist within and immediately adjacent to the burn area. Due to the limited availability of weed wash stations during suppression, it is very likely that invasives were transported during suppression activities. The probability of damage or loss is *very likely* and the magnitude of consequences is *moderate*, resulting in *very high risk*. **The recommended treatment is weed detection monitoring and herbicide application.**

4. **Cultural and Heritage Resources:**Twelve heritage sites were assessed for BAER risk. Of these, nine are Unevaluated or Eligible for Listing on the National Register of Historic Places. Out of the nine Unevaluated and Eligible sites, only four are at risk but rate at either Low or Very Low. Therefore, **none of these sites require heritage erosion treatments.**

B. Emergency Treatment Objectives: Two unacceptable risks were identified, due to the threat of invasive weeds to native plant communities, and the threat of hazardous post-fire conditions to members of the public. Treatment objectives therefore include minimizing the expansion of invasive weeds within and adjacent to the burn area, and raising public awareness of hazardous conditions through warning signs and gating closed roads at high risk of debris flow and erosion.

C. Probability of Completing Treatment Prior to Damaging Storm or Event:
Land: 80%
Channel: N/A
Roads/Trails: N/A
Protection/Safety: 90%

D. Probability of Treatment Success

Table 7: Probability of Treatment Success

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

E. Cost of No-Action (Including Loss): The invasive plants no-action treatment cost is estimated at up to $111,510, based on backpack spraying cost for the 1062 acres with moderate and high burn severity on NFS lands ($105/ac). No cost estimate is placed on potential loss of life that would be mitigated by hazard signs or gate closures.

F. Cost of Selected Alternative (Including Loss): Invasives treatment ($29,831) + hazard warning signs ($800) + gate closure ($4500) = $35,131

G. Skills Represented on Burned-Area Survey Team:

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

Team Leader:
Email: katherine.condon@usda.gov **Phone(s):** 406-495-3724

Forest BAER Coordinator:
Email: scott.nagel@usda.gov **Phone(s):** 406-495-3723

Team Members: *Table 8: BAER Team Members by Skill*

Skill	**Team Member Name**
Team Lead(s)	Katherine Condon
Soils	Kelsey Martin
Hydrology	Anne Dunckel
Engineering	Gabriel Witham and Nick Childs (trainees)
GIS	Joan Louie
Archaeology	Mark Bodily
Weeds	Tracy Schilling
Recreation	
Other	

H. Treatment Narrative:

Land Treatments:

Weed detection monitoring and herbicide ground application are recommended in areas of suppression-related ground disturbance. Weeds documented within and adjacent to the fire area include: spotted knapweed, Canada thistle, musk thistle, houndstongue, giant pepperweed and leafy spurge. Detection monitoring will be prioritized in the fire area adjacent to known weed infestation and areas of heavy fire suppression activity.

P1a. Invasives EDRR: Early detection, rapid response (EDRR) needs to occur following the first precipitation event and continue throughout the subsequent growing season. Documentation of weed locations, by species, and other observations regarding density and spread will be recorded following the guidelines in NRM and GIS corporate databases. The estimated resources needed and costs

include: 185 acres where weeds could spread from documented infestations into the fire area at a cost of $105 per acre for a total estimated cost of $19,425 for invasives EDRR. Along dozer and handline, the risk is very high due to lack of weed washing stations during suppression. Buffering these firelines results in 92 acres of additional treatment area, for a cost of $9,660. **The total of invasives EDRR is $29,085.**

P1b. Invasives EDRR – Suppression Repair: Land-based herbicide application with truck and UTV would occur this growing season with follow-up treatments in the first year post-fire as needed on containment line disturbed during suppression. This includes 6 miles of dozer line (4 acres) and 9 miles of handline (6 acres), **for a total suppression repair cost of $746. The total of BAER EDRR plus suppression EDRR is $29,831.**

Treatment Type	Treatment Method	Acres	Cost/Acre	Total
P1a. Invasives EDRR – Near existing weeds	Backpack	185	105	$19,425
P1a. Invasives EDRR – Near firelines	Backpack	92	105	$9,660
P1a. Subtotal				*$29,085*
P1b. Invasives EDRR – Suppression Repair	Vehicle	4	29	$116
	Backpack	6	105	$630
P1b. Subtotal				*$746*
All Treatments Total				**$29,831**

Channel Treatments: None proposed

Roads and Trail Treatments: None proposed

Protection/Safety Treatments:

S2. Physical closure devices: One gate would be installed at the entrance to FSR 4146, to prevent public access across the steep, severely burned draws that the road intersects, at an **estimated cost of $4500 for gate purchase and installation**.

S1b. Trail/recreation hazard signs: Warning signage at the Carl Creek Trail is recommended at each entrance into the burn perimeter to warn of post-fire risks and help maintain public safety. Warning signage is also recommended at Deep Creek picnic area, to warn of risk of elevated post-fire streamflow. **A total of four signs are requested at an estimated cost of $200 each for $800 total.**

I. Monitoring Narrative:

Weeds treatment: Treatment sites will be evaluated annually for the next three years to ensure control methods are meeting resource objectives and to inventory for new invaders. Weed specialists will visit chemically treated sites after treatment; this is especially important for weed populations that are sprayed to ensure efficacy of herbicide application. Initiate follow-up treatments if additional non-native species or new infestations are discovered. Control will be considered successful upon determination that all noxious weeds have been controlled have not spread beyond their pre-fire locations. No BAER funds are requested for this monitoring.

Warning Signs: District and SO personnel will monitor or check signs after events to ensure that they are legible and will be effective for the future. No BAER funds are requested for this monitoring.

Hydrologic monitoring: A recently decommissioned streamflow monitoring site downstream of the burn perimeter on Deep Creek on USFS land will be re-instrumented, in coordination with Broadwater Conservation District. Tipping bucket rain gauges that previously were used to monitor rainfall following the 2015 Cabin Gulch fire will be re-installed in the Cabin Gulch subwatershed, which is adjacent to the

Deep Creek fire. Coordination with the National Weather Service on the possibility of additional weather station deployment is ongoing. No BAER funds are requested for this monitoring.

Cultural resource monitoring: BAER treatments proposed by other resource areas that are causing new ground disturbance should be reviewed and surveyed by the project archaeologist in previously un-surveyed high site probability areas prior to implementation. BAER treatments proposed by other resource areas should be designed to avoid ground disturbing activity within Unevaluated or Eligible heritage site boundaries. Those treatments that are in close proximity (within 300 meters) of Unevaluated or Eligible heritage site boundaries should be monitored by a person designated by the project archaeologist. No proposed treatments meet these criteria, and therefore no BAER funds are requested for cultural resource monitoring.

PART VI – EMERGENCY STABILIZATION TREATMENTS AND SOURCE OF FUNDS

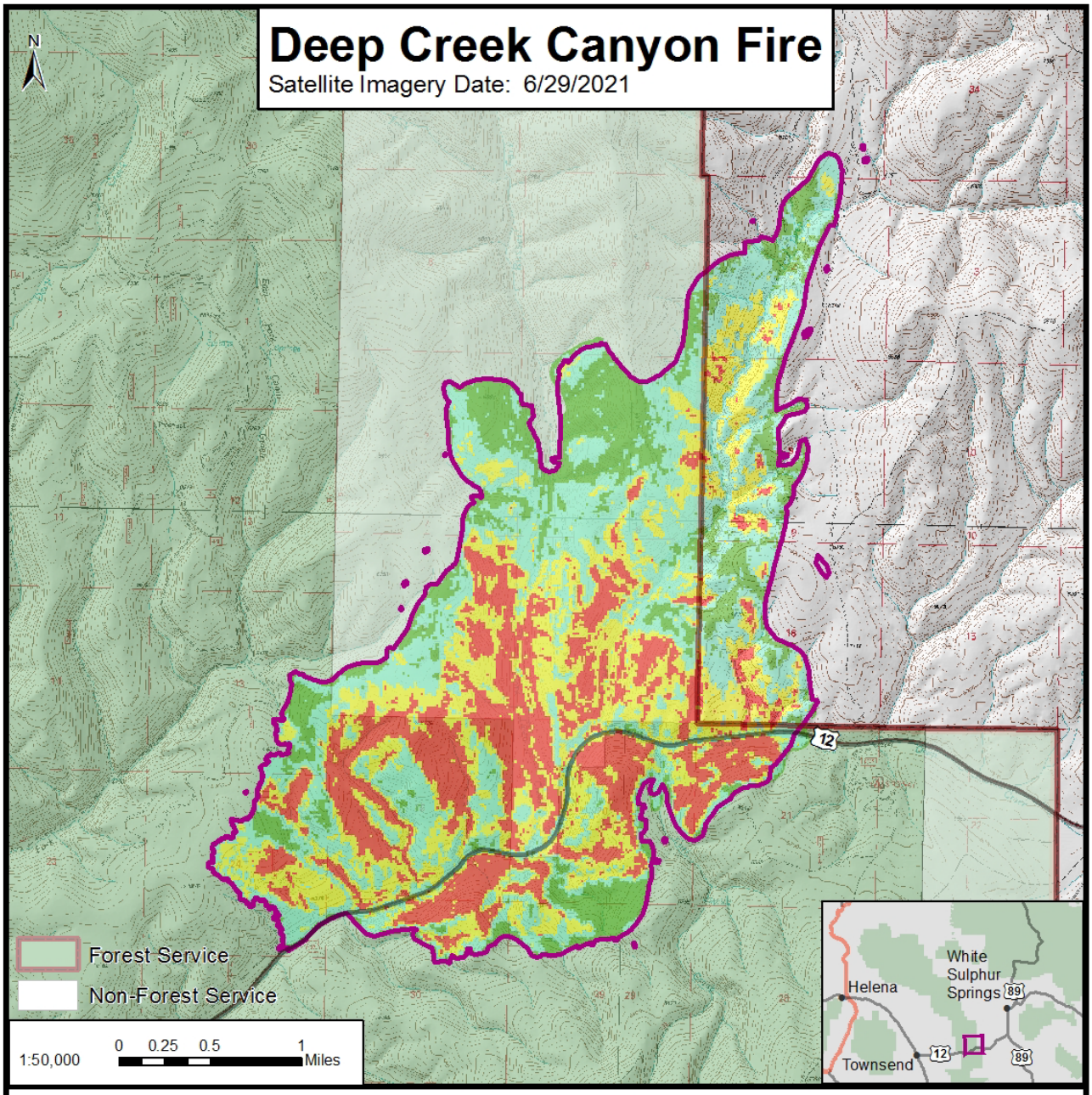
			NFS Lands				Other Lands				All
		Unit	# of		Other		Fed	# of	Non Fed		Total
Line Items	Units	Cost	Units	BAER $	$	# of units	$	Units	$		$
A. Land Treatments											
Invasives treatment	Backpack a	105	277	$29,085							$29,085
Invasives - suppression repair											$0
	Vehicle acre	29	4	$116	$0						$116
	Backpack a	105	6	$630	$0						$630
Subtotal Land Treatments				$29,831	$0		$0		$0		$29,831
B. Channel Treatments											
				$0	$0		$0		$0		$0
Subtotal Channel Treatments				$0	$0		$0		$0		$0
C. Road and Trails											
Subtotal Road and Trails				$0	$0		$0		$0		$0
D. Protection/Safety											
Hazard warning signs	Each	200	4	$800	$0		$0		$0		$800
Gate closure	Each	4,500	1	$4,500	$0						$4,500
Subtotal Protection/Safety				$5,300	$0		$0		$0		$5,300
E. BAER Evaluation											
Initial Assessment	Report			---	$19,254		$0		$0		$19,254
Subtotal Evaluation				$0	$19,254		$0		$0		$19,254
F. Monitoring											
Subtotal Monitoring				$0	$0		$0		$0		$0
G. Totals				$35,131	$19,254		**$0**		**$0**		**$54,385**
Previously approved											
Total for this request				**$35,131**							

PART VII - APPROVALS

1._____

Forest Supervisor Date

Appendix A: Map of soil burn severity for Deep Creek Canyon fire.



SOIL BURN SEVERITY

BURNED AREA EMERGENCY RESPONSE (BAER)
Helena-Lewis and Clark National Forest

SOIL BURN SEVERITY ACRES				
High	Moderate	Low	Unburned-Very Low	Total
1,007	1,276	1,568	813	4,664

This map is a product of a BAER rapid assessment. Further information concerning the accuracy and appropriate uses of this data may be obtained from the USDA Forest Service. The Forest Service makes no warranty, expressed or implied, including the warranties of merchantability and fitness for a particular purpose, nor assumes any legal liability or responsibility for the accuracy, reliability, completeness or utility of these geospatial data, or for the improper or incorrect use of these geospatial data. These geospatial data and related maps or graphics are not legal documents and are not intended to be used as such. The data and maps may not be used to determine title, ownership, legal descriptions or boundaries, legal jurisdiction, or restrictions that may be in place on either public or private land. Natural hazards may or may not be depicted on the data and maps, and land users should exercise due caution. The data are dynamic and may change over time. The user is responsible to verify the limitations of the geospatial data and to use the data accordingly.