

Date of Report: 07/07/2021**Interim #1 September 7, 2021 in blue****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 # 1
- ☐ Updating the initial funding request based on more accurate site data or design analysis

PART II - BURNED-AREA DESCRIPTION**A. Fire Name: Pack Creek****B. Fire Number: UT-MLF-000115****C. State: Utah****D. County: Grand and San Juan****E. Region: R4 Intermountain Region****F. Forest: Manti-La Sal****G. District: Moab RD****H. Fire Incident Job Code: P4 N2K5 (0410)****I. Date Fire Started: 06/09/2021****J. Date Fire Contained: 07/02/2021****K. Suppression Cost: \$10,000,000 on 7/3/2021****L. Fire Suppression Damages Repaired with Suppression Funds (estimates):**

1. Fireline repaired (miles): 2.7
2. Other (identify): N/A

M. Watershed Numbers:*Table 1: Acres Burned by Watershed*

HUC #	Watershed Name	Total Acres	Acres Burned	% of Watershed Burned
140300050401	Upper Pack Creek	19410	5728	30
140300050404	Mill Creek-Horse Creek	28052	3084	11
140300040202	Geyser Creek	13608	272	2

N. Total Acres Burned:*Table 2: Total Acres Burned by Ownership*

OWNERSHIP	ACRES
NFS	8942

OWNERSHIP	ACRES
OTHER FEDERAL (LIST AGENCY AND ACRES)	BLM: 140
STATE	0
PRIVATE	197
TOTAL	9279

- O. Vegetation Types:** Juniper, Gambel oak, quaking aspen and mixed conifer of Douglas-fir, subalpine fir, and Engelmann spruce.
- P. Dominant Soils:** The soil types most affected by the fire include in order from lower to higher elevation: the eroded Ustic Torriorthents (25%), the very dry Aridisols with shallow depth to bedrock Lithic Ustollic Haplargids (10%), Typic Argiborolls (9%) in the mid elevations with greater organic matter, Inceptisols in the higher elevations Dystric Cryochrepts (10%), along with Mollisols in the higher elevation Cryic Pachic Paleborolls (19%), Cryic Pachic Paleborolls (8%) and heavier textured Typic Cryoboralfs (14%) (see Table 1).

Table 3. Dominant soil types affected by high and moderate soil burn severity.

Soil Types	Acres	Percent
Ustic Torriorthents	965	25
Cryic Pachic Paleborolls	729	19
Typic Cryoboralfs	561	14
Dystric Cryochrepts	394	10
Lithic Ustollic Haplargids	389	10
Typic Argiborolls	343	9
Cryic Pachic Paleborolls	307	8
Ustic Torrifluvents	91	2
Typic Cryoborolls	33	1
Petrocalcic Calciustolls	33	1
Ustic Torrifluvents	25	1

- Q. Geologic Types:** Entrenched canyons of siltstone, mudstone, shale, sandstone and limestone layers typical of the Colorado Plateau. Landslide, glacial deposits mantle the canyons. Intrusive rocks form the La Sal peaks.

R. Miles of Stream Channels by Order or Class:

Table 4: Miles of Stream Channels by Order or Class

STREAM TYPE	MILES OF STREAM
PERENNIAL	8
INTERMITTENT	28
EPHEMERAL	
OTHER (DEFINE)	0.22 (artificial path)

S. Transportation System:

Trails: National Forest (miles): 13.92

Other (miles): N/A

Roads: National Forest (miles): 21.26

Other (miles): N/A

PART III - WATERSHED CONDITION

A. Burn Severity (acres):

Table 5: Burn Severity Acres by Ownership

Soil Burn Severity	NFS	Other Federal (BLM)	State	Private	Total	% within the Fire Perimeter
Unburned	773	23	0	24	820	9
Low	3513	94	0	115	3722	40
Moderate	4506	23	0	58	4586	49
High	151	0	0	0	151	2
Total	8943	140	0	197	9279	100

B. Water-Repellent Soil (acres): 4,738

C. Soil Erosion Hazard Rating: 390 acres with high EHR; 2,444 acres with moderate EHR; 3,602 with low EHR.

D. Erosion Potential: Estimates of channel and hillslope erosion from WEPPcloud modeling are reported below in Table 6. The values show despite erosion and deposition on the hillslopes, most of the sediment discharge will derive from drainage channels – roughly 80-90%.

Table 6: WEPPcloud modeled watersheds and outputs.

Watershed	Acres	High and Moderate Burn Severity (%)	Hillslope soil loss (tons/year)	Channel soil loss (tons/year)	Outlet sediment discharge (tons/yr)
Horse Creek	2432	17	44	310	360
Brumley/Dorry	7702	27	120	730	820
Pack Creek 1	1773	56	3	16	19
Pack Creek 2	7705	3	1	16	17
Oowah	2664	21	23	317	340

E. Sediment Potential: Estimates of sediment delivered to the modeled catchment outlets are reported above in Table 6. The additive effects of hillslope slopewash contributing to bared channels is modeled to produce from 17 to 820 tons sediment per year. Brumley/Dorry have the highest contribution given the relatively large area burned at high and moderate severity (2,079 acres).

F. Estimated Vegetative Recovery Period (years): 3-5 years for Gambel oak and quaking aspen; 3-5 years for mixed conifer with herbland stabilizing and 20-25 years for forest species to take hold.

G. Estimated Hydrologic Response (brief description):

Interim #1: Initially, the Pack Creek 2 analysis watershed did not warrant significant mitigation treatments. The hydrologic model results used in the evaluations of BAER critical values were underestimated, and debris flows capable of clogging and damaging the culvert occurred, and are expected to continue to occur for the next couple years. There is a high risk of damage to the Forest Service culvert and road at the intersection of Pack Creek 2.

The primary watershed responses of the Pack Creek fire are expected to include: 1) an initial flush of ash and debris, 2) rill and gully erosion on steep slopes within the burned area, and 3) potential flash floods and debris flows during summer monsoonal precipitation events (July – September). Due to the steepness of the topography in drainages with large areas now devoid of vegetation and groundcover after the fire, storms will likely create increased surface flow that could trigger floods or debris flows with high sediment

volumes. These responses are expected to be most pronounced during the first 1- 3 years after the fire and will become less evident as vegetation and soil-hydrologic function recover.

Post-fire runoff modeling was conducted on five analysis watersheds across the Pack Creek fire. Both the WEPPcloud and WILDCAT 5 models were used to predict post-fire flows for 2, 5, 10-year precipitation events of 30-minute duration. These increases in peak-flows are expected to occur in response to short duration, high intensity thunderstorms. Pack Creek 1 and Brumley/Dorry analysis watersheds have the most significant increases in magnitude. Pack Creek 1 is predicted to see increases in magnitude of approximately 5-8 times greater than pre-fire conditions for the 2-year event, while Brumley/Dorry is predicted to see increases in magnitude of approximately 3-10 times greater than pre-fire conditions for the 2-year event. In the remaining analysis watersheds, the magnitude of increase is predicted to be approximately 1-5 times greater than the pre-fire condition. Although this model predicts water runoff, some degree of flow bulking is likely to occur in the watersheds affected by the Pack Creek Fire over the next few years. These elevated post-fire flows and bulking could lead to plugged culverts, erosion of road infrastructure, decreased soil productivity and hydrologic function, as well as threats to human life and safety.

An analysis of post-fire debris flow threats in response to a range of rainfall intensities was conducted by the USGS. The probability of debris flows initiating in the burned areas within Pack Creek is 60-80%, 80-100% in Brumley/Dorry, and 40-60% in Horse Creek/Oowah drainages. A design storm with a peak 15-minute rainfall intensity of 40 millimeters per hour (mm/hr) was used in modeling debris flows, which is representative of a 2-year precipitation event in the La Sal Mountains.

PART V - SUMMARY OF ANALYSIS

Introduction/Background

The Pack Creek Fire was detected on June 9, 2021. Fire investigators determined that the point of origin was an abandoned campfire in the Pack Creek day use site on the Moab Ranger District of the Manti-La Sal National Forest. Fire activity increased significantly on June 10th when the fire made a 4,500 acre run to the NE as the fire became well established in high elevation terrain on the NW side of Mount Tukuñnikivats in the La Sal Mountains. Another period of significant growth (approximately 2,800 acres) occurred on June 13th as the fire progressed north to the Geyser Pass area in between Mt. Mellenthin and Haystack Mountain. The fire continued to experience minimal to modest daily growth until full containment was achieved on July 2, 2021.

The Forest Service BAER team arrived on scene on June 24th. Soil burn severity mapping of the burn scar was accomplished using a variety of methods. The initial map was produced using burned area reflectance classification (BARC) imagery acquired from the Landsat 8 satellite and processed by the Forest Service Geospatial Technology and Applications Center in Salt Lake City, Utah. A portion of the initial BARC map was obscured by clouds, which regularly build up over the higher terrain in the La Sal mountains. The BAER team was able to obtain additional video footage of the burn scar using an Unmanned Aircraft System that was assigned to the suppression incident. This footage was reviewed to identify burn patterns and digitize burn severity polygons within the area not covered by the BARC imagery. Field validation of the BARC map was conducted using the methods outlined in RMRS-GTR-24, resulting in a final field validated soil burn severity map.

Additional field review and identification of watershed response threats and hazards to human life and safety was conducted by the BAER field survey team which was staffed with hydrologists, a soil scientist, an engineer, and team leaders. The information gathered during the survey was shared with the remaining resource specialists assigned to the team, who helped identify threats, conduct risk assessments, and prescribe emergency stabilization treatments for all critical BAER values affected by the Pack Creek burnscar.

During the field survey, the BAER team identified numerous threats on NFS lands that have the potential impact downstream, off-forest assets. The primary concern is flash flood and debris flow initiation following

short duration, high intensity thunderstorms. The soil burn severity dataset has been shared with the Interagency Utah Post-Wildfire team. The USGS has completed a debris flow threat analysis. Technical and financial assistance under the USDA-NRCS Emergency Watershed Program has been requested by the two counties affected by the burnscar. An NRCS Damage Survey Report team will be mobilizing soon to assess risks to non-federal properties below the burnscar.

The remainder of this report will focus on threats to Critical BAER values identified in FSM 2523 – Emergency Stabilization – Burned Area Emergency Response.

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

Table 7: 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):

- a. Human life and safety of Forest visitors and employees traveling on NFS roads and trails, in the burn scar is threatened due to the potential for injury or loss of life from hazard tree strikes, falling rocks, flash floods, debris flows, and other burned area hazards. The probability of damage or loss is **likely** as the NFS transportation system contains many motorized and non-motorized routes adjacent to and through the burned area. The magnitude of consequence is **major** since an overhead hazard strike, entrapment in a flood or debris flow, or motorized vehicle collision with downed trees or fallen rocks could result in serious injury or loss of life. The risk level is **very high**. Administrative closures and treatments are recommended. See treatments P1a, P1b, P2.
- b. Human life and safety of Forest visitors and employees traveling cross-country on foot, skis, or horseback through the burned area (not on system roads or trails) is threatened due to the potential for injury or loss of life from hazard tree strikes, falling rocks, flash floods, debris flows, and other burned area hazards. The probability of damage or loss is **possible** as cross-country travel through the burned area is to be expected, however not with the frequency of travel that occurs on the transportation system. The magnitude of consequence is **major** since an overhead hazard strike, entrapment in a flood, or debris flow could result in serious injury or loss of life. The risk level is **high**. Administrative closures and treatments are recommended. See treatment P1a, P1b, P2.

2. **Property (P):** The dam on Oowah Lake is a NFS asset that is threatened by the loss of control of water during flash flood events and accumulation of floating debris on the lake surface. Accumulation of floatable debris could result in blockage of the trash rack on the inlet to the outlet structure. The probability of damage or loss is **likely** as floatable debris originated from fire damaged trees is expected to accumulate on the water surface following high flow events. The magnitude of consequence is **major** since blockage of the outlet works could result in overtopping of the earthen dam which lacks a hardened emergency spillway. If this were to occur the entire structure could fail. The risk level is **very high**. Structural modification on the dam was considered by the BAER team engineer, however construction of an emergency spillway on the existing structure is cost efficient when compared to other BAER treatments. Storm inspection and response of the outlet works is recommended. See treatment RT2.

- b. NFS road infrastructure on the Pack Creek Road is threatened by increased runoff from upstream areas of moderate and high SBS following short duration high intensity rainfall events. The probability of damage or loss is **likely** because many of the existing drainage structures are not sized to pass the increased post-fire runoff and portions of the road are adjacent to steep stream banks which are expected to erode significantly during post-fire flash flood events. The magnitude of consequence is **major** since this route is a ML3 road with significant drainage, fill, and surfacing investments. In addition to the property value of this NFS asset, the road is utilized to access residences that are located on a private in-holding. The risk level is **very high**. Treatments are recommended. RT1a, RT2, RT8, RT12.
 - c. NFS road infrastructure on the Geyser Pass, Haystack, Gold Basin, Boren Mesa, and Dark Canyon Lake roads is threatened by increased runoff from upstream areas of moderate and high SBS following short duration high intensity rainfall events. The probability of damage or loss is **possible** because many of the existing drainage structures are not sized to pass the increased post-fire runoff. The magnitude of consequence is **major** since these routes are ML3 and ML2 roads with significant drainage, fill, and surfacing investments. The risk level is **high**. Treatments are recommended. See treatments RT1a, RT2.
 - d. The remaining roads within or below the burn scar are threatened from increase post-fire runoff. The probability of damage or loss is **unlikely** due to the lack of large contiguous patches of moderate and high SBS above the routes. The magnitude of consequence is **moderate** as loss of control of water in the drainage structures would cause moderate levels of property damage to the routes. The risk level is **low**. Treatments are not recommended.
 - e. Some NFS trails (Dorrey Canyon Motorized, Dorrey Canyon Connect, Trans La Sal, Clark Lake, Clark Lake Loop, Gold Basin) have segments that are within or downslope of the burnscar and are threatened due to increased post-fire runoff that may result in accelerated erosion of trail prisms that are downstream or downslope of areas of moderate and high SBS. Many of the trails affected by the fire are located on steep slopes or in the drainage bottoms and have the potential to intercept overland flow from upslope burned areas. The probability of damage or loss is **very likely** because many of the threatened trails have steep grades and inadequate drainage features to withstand the expected increases in post-fire runoff. The magnitude of consequence is **moderate** because erosion of the threatened trail segments would result in moderate property damage and loss of the NFS investment in the trail system. The risk level is **very high**. Treatments are recommended. See treatment RT13.
 - f. The remaining NFS trails within or downslope of the are threatened by expected increases in post-fire runoff, however the probability of damage or loss is **unlikely** given the lack of moderate and high SBS areas above these trails. The magnitude of consequence is **minor** as any damage to the trails would not be localized and of low economic consequence. The risk rating for these trails is **very low**. Treatments are not recommended.
3. **Natural Resources (NR):** Soil productivity and hydrologic function within the Pack Creek Fire burned area are threatened by increased runoff and erosion. While a proportion of eroded soil will remain on the hillslope, delivery of eroded soil to stream channels could occur. The probability of damage is **possible** due to the consumption of ground cover by the fire in moderate and high severity burn areas. However, the magnitude of consequence is **minor** because any soil damage is expected to be recoverable and localized. Because of this, the risk is **low**, and no treatments are recommended.
- b. There is an increased risk to native or naturalized plant communities on NFS lands from invasive species and other weeds. Specialists have identified musk thistle, bindweed, Russian olive, kochia, Russian thistle, phragmites, and knapweed as possible weed species that will likely take root in newly disturbed areas within or adjacent the burned area. The

probability of damage to native or naturalized plant communities is **likely** due to multiple factors: 1) newly disturbed areas are highly prone to weed invasion; 2) there were no weed mitigation tactics in place during fire suppression; and 3) there is moderate or high SBS adjacent to road corridors that experience high use. The magnitude of consequence from this damage is **moderate** because there will be long-term effects of weed invasion to existing intact native plant communities. The risk is **high**. Treatments are recommended. See treatments L1a and L1b.

- 4. Cultural and Heritage Resources:** Cultural resources within the burned area are threatened by increased post-fire runoff. There are at nine sites that are eligible for listing in the National Registry of Historic Places (NRHP) that were burned over in the Pack Creek Fire. After field review, specialists noted that the probability of damage was **possible** given the newly exposed ground and access to these sites, but that the magnitude of consequence was **minor** because it would likely be a very localized issue with minor loss of cultural deposits. The risk level is **low**, and no treatments are recommended.

- B. Emergency Treatment Objectives:** Raise awareness of post-fire hazards throughout the burned area, minimize post-fire damage to NFS trails and NFS road infrastructure, restrict access to NFS roads with untreated threats that pose unacceptable risks to human life and safety, minimize the spread of noxious weeds in areas disturbed by fire suppression activities; minimize the spread of noxious weeds in burned areas.

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

Land: 80%

Channel: N/A

Roads/Trails: 75%

Protection/Safety: 95%

D. Probability of Treatment Success

Table 8: Probability of Treatment Success

	1 year after treatment	3 years after treatment	5 years after treatment
Land	85%	90%	90%
Channel	N/A	N/A	N/A
Roads/Trails	80%	90%	90%
Protection/Safety	90%	80%	70%

- E. Cost of No-Action (Including Loss):** \$1,719,000 (assumes 80% chance of loss of threatened market value resources and ongoing noxious weeds/invasive treatments costs with non-BAER funds).

- F. Cost of Selected Alternative (Including Loss):** \$689,017 (assumes costs of treatments to protect threatened market value resources with a 20% chance of loss of, costs of BAER EDRR, and ongoing noxious weeds and invasive species to be funded with non-BAER funds).

G. Skills Represented on Burned-Area Survey Team:

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

Team Leader: Brendan Waterman (Qualified), Jess Clark (Trainee)

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Forest BAER Coordinator: Matt Meccariello

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Team Members: *Table 9: BAER Team Members by Skill*

Skill	Team Member Name
<i>Team Lead(s)</i>	Brendan Waterman, Jess Clark
<i>Soils</i>	Vince Archer
<i>Hydrology</i>	Mark Muir, Daniel Lay
<i>Engineering</i>	Daniel Luke
<i>GIS</i>	Brock Fausett
<i>Archaeology</i>	Don Irwin, Alison Aakre
<i>Weeds</i>	Barb Smith
<i>Recreation</i>	Brian Murdock
<i>Other</i>	

- H. Treatment Narrative:** The following narratives summarize the response actions recommended to decrease risks to BAER Critical Values. Detailed specifications, cost estimates, and maps identifying the spatial location for the treatments are located in the Pack Creek BAER Assessment project record. The documents can be obtained by contacting the Manti-La Sal National Forest BAER Coordinator

Land Treatments:

L1a. Early Detection Rapid Response (EDRR) BAER: Surveys for new or expanding invasive plant/noxious weed infestations associated with the Pack Creek wildfire and eradication treatments will be conducted during summer 2021 and spring 2022 in areas of native plant communities with little to no noxious/invasive plant species present prior to the fire. Survey efforts may be coordinated with other federal, state, or local agencies/partners. Surveys will be completed within one year of fire containment. Survey, monitoring or treatment activities that extend beyond the first year will be accomplished through non-BAER funding sources.

Detection surveys and eradication treatments will be conducted on NFS lands that have moderate to severe fire effects, and are susceptible to infestation by invasive plant species. These areas were identified from Soil Burn Severity maps, site visits and proximity to other weed populations and vector sources such roads and motorized trails. Burned areas with a moderate or high SBS on NFS lands that are adjacent to known weed populations and/or motorized travel corridors have been prioritized for EDRR treatment. There is a potential for weed infestation to occur in other areas of moderate and high SBS throughout the burnscar, however the overall risk is lower given the distance from known vectors such as existing infestations and designated motorized travel corridors.

EDRR activities will be conducted at identified locations at an intensity/frequency necessary to identify the occurrence/spread of weed infestations, with a focus on species that are listed under the Utah Noxious Weed Act. Surveys will be conducted on foot, horseback, or vehicle (UTV/truck), as appropriate. Specific information (e.g. species, location, size, photos) regarding identified infestations will be collected and added to the appropriate database of record.

Timely surveys will allow for new or expanding weed infestations to be identified, and proper measures implemented for eradication/control to protect native plant communities where invasive plants are currently absent or present in minor amounts. The lower elevation pinyon/juniper habitats which burned at moderate to high severity and the burned riparian corridor adjacent to private land are most at-risk from the introduction and spread of noxious/invasive plants.

Implementation personnel will survey and treat any newly detected invasive plants or noxious weeds immediately upon detection. The estimated cost per acre is based on the assumption that much of the targeted acreage will only require a brief survey and not an eradication treatment.

Item	UOM	Unit Cost	# of Units	Total Cost
L1a EDRR – BAER	acre	\$18.73	263	\$4,925

L1b. Early Detection Rapid Response (EDRR) Suppression: Surveys and treatment for new or expanding invasive plant and noxious weed infestations associated with fire suppression activities will be conducted by during Summer 2021 and Spring 2022. EDRR activities that extend beyond the first year will be accomplished through non-BAER funding sources. EDRR Suppression efforts will only occur along areas that were disturbed by unmitigated suppression activities and suppression rehab, including areas of handline construction, heli-spots, safety zones, spike camps. These areas were delineated by the BAER Weeds Specialist using suppression disturbance lines and points provided by the IMT. If an effort to accurately capture the actual size of the on the ground disturbance, the points and lines were buffered into polygons that most accurately represent the actual disturbed area. The buffer assigned to the GIS line and point features varied by feature type. For example, the rehabilitated handlines are assumed to have a 5' total disturbance width.

Item	UOM	Unit Cost	# of Units	Total Cost
L1b EDRR – Suppression	acre	\$152	20	\$3,040

Channel Treatments: None recommended.

Roads and Trail Treatments:

RT1a Road Drainage – Storm Proofing existing features: Increased post-fire runoff and erosion from burned watersheds above NFS roads within and below the burnscar is expected to overwhelm the existing road drainage features and result in culvert plugging, culvert overtopping, loss of surfacing material, erosion of fill slopes, and deposition of debris on the NFS roads. These roads are critical for USFS administrative access, forest recreation, private property access, and numerous permitted outfitter and guide special uses that are a vital component of Moab's tourism economy. These routes represent a significant financial investment of NFS funds.

Implementation of the recommended treatments will decrease the risk to human life and safety and protect the NFS road infrastructure investments. The potential monetary cost to repair roads that would be damaged by post-fire events if left untreated significantly exceeds the cost of the treatments as the ML 2 roads are valued at \$75,000 per mile and the ML3 roads are valued at \$170,000 per mile.

The items to be implemented include culvert cleaning, ditch cleaning, armored water bar installation, rolling dip installation, and fill slope armoring along the sections of the roads that are downstream or downslope of areas of moderate and/or high SBS. Under the pre-fire runoff regime, the current condition and previous maintenance for the drainage structures on these roads was adequate to accommodate pre-fire runoff. Ongoing maintenance has not been deferred. An emergency funding authorization is needed to support the immediate mobilization of equipment and operators who will prepare the drainage structures for the increased runoff that is a direct result of the burned watershed conditions and the increased runoff response to precipitation events. Emergency storm proofing of high-value drainage features in combination with post-storm inspection and response (Treatment RT2) are appropriate BAER treatments in lieu of more costly structural modification to the NFS road system.

RT1a Road Drainage	Units	Unit Cost	# of Units	Total Cost
Road drainage/storm proofing	mile	\$3,681	14.73	\$54,210

Pack Creek 2 culvert (replacing large culvert)	Each	\$18,000	1	\$18,000
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RT2 Storm Inspection and Response: Storm inspection and response keeps drainage features treated under RT01 functional by removing accumulated sediment and debris between or during storm events. Following heavy rains and significant spring snowmelt the inspection will involve identification of drainage hazards such as accumulated debris, sediment, and plugged culverts that are limiting functionality of the road drainage features. The response will use equipment to remove obstructions from culvert inlets, catch basins, dips, lead-off ditches, riprap armor, and other drainage features. Excess material and debris removed from the drainage features will be placed where it cannot re-enter the stream. Problems will be corrected before they worsen or jeopardize the road drainage features. This treatment is used in lieu of more costly structural upgrades, such as culvert upsizing.

As noted above in the critical values discussion, the Oowah Lake outlet has a trash rack on the inlet that maintains the water surface elevation. Increased post-fire runoff and flood events will have the potential to transport fallen fire weakened trees and woody debris into the lake. An accumulation of floatable debris around the trash rack may block the inlet to the outlet structure resulting in a loss of control of water. Storm inspection and response of the outlet works is needed to ensure ongoing functionality of the impoundment.

RT2 Storm Inspection and Response	Units	Unit Cost	# of Units	Total Cost
Road Storm Inspection and Response – ML3	mile	\$2,194	14.2	\$31,150

RT8 Debris Rack Installation: A debris rack is needed at the one perennial stream crossing on the Pack Creek Road. The riparian forest directly above the crossing burned at moderate severity and contains numerous fire damaged and fire killed Cottonwoods that are expected to contribute increased floatable debris to the perennial stream course. A debris rack is needed on the inlet to the existing 60" culvert to prevent plugging, overtopping, loss of fill, and loss of access to the private homes above the crossing. The debris rack will also facilitate efficient cleaning that will be accomplished during implementation of treatment RT2 Storm Inspection and Response.

RT8 Debris Rack	Units	Unit Cost	# of Units	Total Cost
Debris Rack Installation	Site	\$800	1	\$800

RT12 Fill Slope Stabilization: Placement of riprap is needed to protect the Pack Creek streambank at four locations in between the Forest Boundary and the Pack Creek day use site. The road is located adjacent to the stream channel and is threatened from increased watershed response to high intensity precipitation. Damage to the streambank will lead to the loss of the road fill slope, resulting in significant road prism damage and increasing the risk of delivering road fill to the stream. Armoring of the stream bank/fill slope interface is needed to protect ML3 Pack Creek road from the flash flooding and excessive lateral channel erosion that is expected to occur following the design thunderstorm modeled by the BAER hydrologists (a 2-year return interval, 15-minute duration thunderstorm delivering approximately 0.4" of precipitation to the burned watersheds above the Pack Creek road.). In addition to the loss of the NFS asset, damage to the road would eliminate emergency vehicular access to two private residences that utilize Pack Creek road as the only access to their properties.

RT12 Fill Slope Stabilization:	Units	Unit Cost	# of Units	Total Cost
Fill slope/Stream Bank Armoring	job	\$36,789	4	

RT13 Trail Drainage/Tread Stabilization: The existing trail system drainage features are insufficient to handle the anticipated increase in post-fire runoff from areas burned at moderate to high severity on approximately 9.52 miles of trails in the BAER analysis area. Predicted increased runoff due to water repellant soils and lack of effective ground cover will be intercepted and captured by trails, leading to severe trail tread erosion that will render the trails unusable and/or dangerous to use. Additional hazards caused by the fire such as hazard trees and rockfall will create unsafe conditions at trail access points and worksites along the trails to workers. Accelerated erosion that is channelized downslope and into streams may impair water quality.

Implementing this treatment will decrease the risk of unacceptable loss of trail prism, while providing for continued recreation opportunities with reduced risk to human life and safety. Proper and adequate drainage for post-fire runoff will reduce and prevent the trail prism and tread from eroding. Preventing the loss of trail prism is much more cost effective than rebuilding trail prisms following a damaging runoff event.

The managed use for these systems is both motorized and non-motorized. Priority trails to be worked on include those that are within or below moderate to high soil burn severity slopes, have sustained steep grades, and lack inadequate drainage to effectively maintain control of the post-fire runoff originating from areas of moderate and high SBS.

The system trails are valuable resources for visitors and recreationists in the area. The trails in the Clark Lake area are heavily used for mountain biking and other non-motorized recreation and are also used by many of the permitted outfitters in the La Sals. The Dorry Canyon motorized trails are an important link in the large loop used by OHVs around the central portion of the La Sals. Large storm events will deteriorate and compromise the trail system integrity, eventually destroying large sections if no actions are taken. The fire has most likely burned through root and stumps underlying the trail tread creating hazardous voids beneath the trail. When trail users travel over these voids, they can break through the thin overlying crust potentially causing a significant accident and injury.

This treatment will improve surface drainage on the trail tread to limit erosion and to ensure safe use and travel on the trail for BAER treatment crews. Clearing and improving undamaged drainage structures will ensure capacity to accommodate increased runoff (water bars, rolling dips). Trails will also be outsloped where appropriate and feasible. Work will include cutting hazard trees as appropriate for worker safety during BAER implementation.

If the trails affected by the fire deteriorate or are destroyed by increased runoff and erosion the costs to reconstruct or relocate trails would be significant and costly as rebuild cost is estimated at \$25,000 per mile for Class 2 trails. The emergency response drainage construction would mitigate the risk of catastrophic failure and the potential for high replacement costs. It is anticipated that 80% of the affected trails would experience significant damage if no emergency stabilization is completed and 20% would have some level of damage if the work is completed prior to a damaging event.

The USFS Trail Class Matrix Trail (FSH 2353 Section 14.2 Exhibit 01) was utilized to develop emergency stabilization treatment specification needs for constructed features on the threatened trail segments.

Along significant segments of trails in the burned area, existing erosion control features such as water bars and rolling dips are sufficient only for pre-fire conditions. Precipitation and runoff that would have been absorbed by the soil and vegetative cover may now run over the surface. Ensuring full functionality of existing water bars and drain dips, and adding new drainage

structures on steeper trail sections in close proximity to streams will be necessary to protect the trails from the anticipated higher volume of runoff.

The trails in the burned area intersect numerous slope and small drainage terrain features which have the potential to focus increased runoff and debris flows. Should the trail become the watercourse for these increased flows, the likelihood of catastrophic failure would increase. Reinforcing sections of the trail tread where the underlying support of the trail has been removed by the fire is necessary. If these locations are not repaired a significant hazard exists for trail users.

If the trails affected by the fire deteriorate or are destroyed by increased runoff and erosion the costs to reconstruct or relocate trails would be significant. The emergency response drainage construction would reduce the risk of catastrophic failure and the potential for high replacement costs.

RT13 Trail Treatments	Units	Unit Cost	# of Units	Total Cost
Trail drainage/storm proofing – Class 2	mile	\$1,388	9.5	\$13,185

Protection/Safety Treatments:

P1a and P1b Burned Area Warning Signs: The purpose of the Burned Area Warning signs is to reduce risks to human life and safety and to inform forest visitors of potential dangers and/or hazards when entering burned areas on NFS lands. Entering burned areas presents a high risk to human and life and safety, with increased threats from post-fire effects such as falling trees, rolling rocks, flash floods, and debris flows. It is necessary to inform the public of burned-area hazards that are a direct result of wildfire; hazards which are substantially different compared to unburned forest setting and with which many forest visitors may be unfamiliar. Burned area warning signs will be installed to inform the public of the possible dangers associated with a burned area on major entry points into the burned area.

P1 Warning Signs	Units	Unit Cost	# of Units	Total Cost
P1a Road Warning Signs (materials and labor)	sign	\$828	7	\$5,798
P1b Trail Warning Signs (materials and labor)	sign	\$264.25	16	\$4,228

P2 Road Closure Devices: The purpose of the road closure devices is to reduce risks to human life and safety by restricting access to the La Sal Pass road. This route contains numerous unmitigated overhead hazards such as fire killed or weakened trees. The route also crosses multiple drainages that have the potential to significantly damage the road prism during flash flood or debris flow events. If this were to occur while forest visitors are driving the route, there is a potential for entrapment as the crossings could become impassable. Closure devices are needed at each end of the route to restrict motorized access.

P2 Road Closure Devices	Units	Unit Cost	# of Units	Total Cost
P2 Road Closure Devices	gate	\$2,950	2	\$5,900

I. Monitoring Narrative: Road drainage treatment effectiveness monitoring will be completed through implementation of storm inspections and response activities in the first year following containment of the fire. Road storm inspection and response will be monitored by assessing the response time to ensure objectives are being met. Trail drainage treatment effectiveness will be monitored by Forest personnel who will patrol trails after spring run-off and precipitation events to ensure existing drainage structures are effective and ready to handle the next precipitation event. EDRR treatments will be monitored by reviewing the size and density of

infestations following EDRR treatments. Warning sign treatments will be monitored by Forest personal to ensure that the signs are not being vandalized, damaged, or stolen. Road Closure devices will be inspected regularly to ensure that the gates have not been vandalized or damaged.

PART VI – EMERGENCY STABILIZATION TREATMENTS AND SOURCE OF FUNDS

Line Items	Units	Cost	Units	BAER \$	\$	units	\$	Units	\$	\$
A. Land Treatments										
L1a EDRR BAER	acre	19	263	\$4,926	\$0		\$0		\$0	\$4,926
L1a EDRR Suppression	acre	152	20	\$3,040	\$0		\$0		\$0	\$3,040
<i>Insert new items above this line!</i>				\$0	\$0		\$0		\$0	\$0
<i>Subtotal Land Treatments</i>				\$7,966	\$0		\$0		\$0	\$7,966
B. Channel Treatments										
None				\$0	\$0		\$0		\$0	\$0
<i>Insert new items above this line!</i>				\$0	\$0		\$0		\$0	\$0
<i>Subtotal Channel Treatments</i>				\$0	\$0		\$0		\$0	\$0
C. Road and Trails										
Pack Creek 2 Culvert Repl	each	18,000	1	\$18,000	0		0		0	\$18,000
RT1a Road Drainage	mile	3,681	15	\$54,221	\$0		\$0		\$0	\$54,221
RT2 Storm Inspection and Re	mile	2,194	14	\$31,155	\$0		\$0		\$0	\$31,155
RT8 Debris Rack	job	800	1	\$800	\$0		\$0		\$0	\$800
RT12 Fill Slope Protection	job	36,789	4	\$147,156	\$0		\$0		\$0	\$147,156
RT13 Trail Drainage	mile	1,388	10	\$13,186	\$0		\$0		\$0	\$13,186
<i>Insert new items above this line!</i>				\$0	\$0		\$0		\$0	\$0
<i>Subtotal Road and Trails</i>				\$264,518	\$0		\$0		\$0	\$246,518
D. Protection/Safety										
P1a Road Warning Signs		828	7	\$5,798	\$0		\$0		\$0	\$5,798
P1b Trail Warning Signs		264	16	\$4,228	\$0					\$4,228
P2 Road Closure Device	gate	2,950	2	\$5,900	\$0		\$0		\$0	\$5,900
<i>Insert new items above this line!</i>				\$0	\$0		\$0		\$0	\$0
<i>Subtotal Protection/Safety</i>				\$15,926	\$0		\$0		\$0	\$15,926
E. BAER Evaluation										
Initial Assessment	Report	\$55,000	1	---	\$0		\$0		\$0	\$0
				\$0	\$0		\$0		\$0	\$0
<i>Insert new items above this line!</i>				---	\$0		\$0		\$0	\$0
<i>Subtotal Evaluation</i>				\$0	\$0		\$0		\$0	\$0
F. Monitoring										
				\$0	\$0		\$0		\$0	\$0
<i>Insert new items above this line!</i>				\$0	\$0		\$0		\$0	\$0
<i>Subtotal Monitoring</i>				\$0	\$0		\$0		\$0	\$0
G. Totals				\$288,410	\$0		\$0		\$0	\$270,410
Previously approved				\$270,410						
Total for this request				\$18,000						\$18,000

PART VII - APPROVALS

1. _____
 Forest Supervisor Date

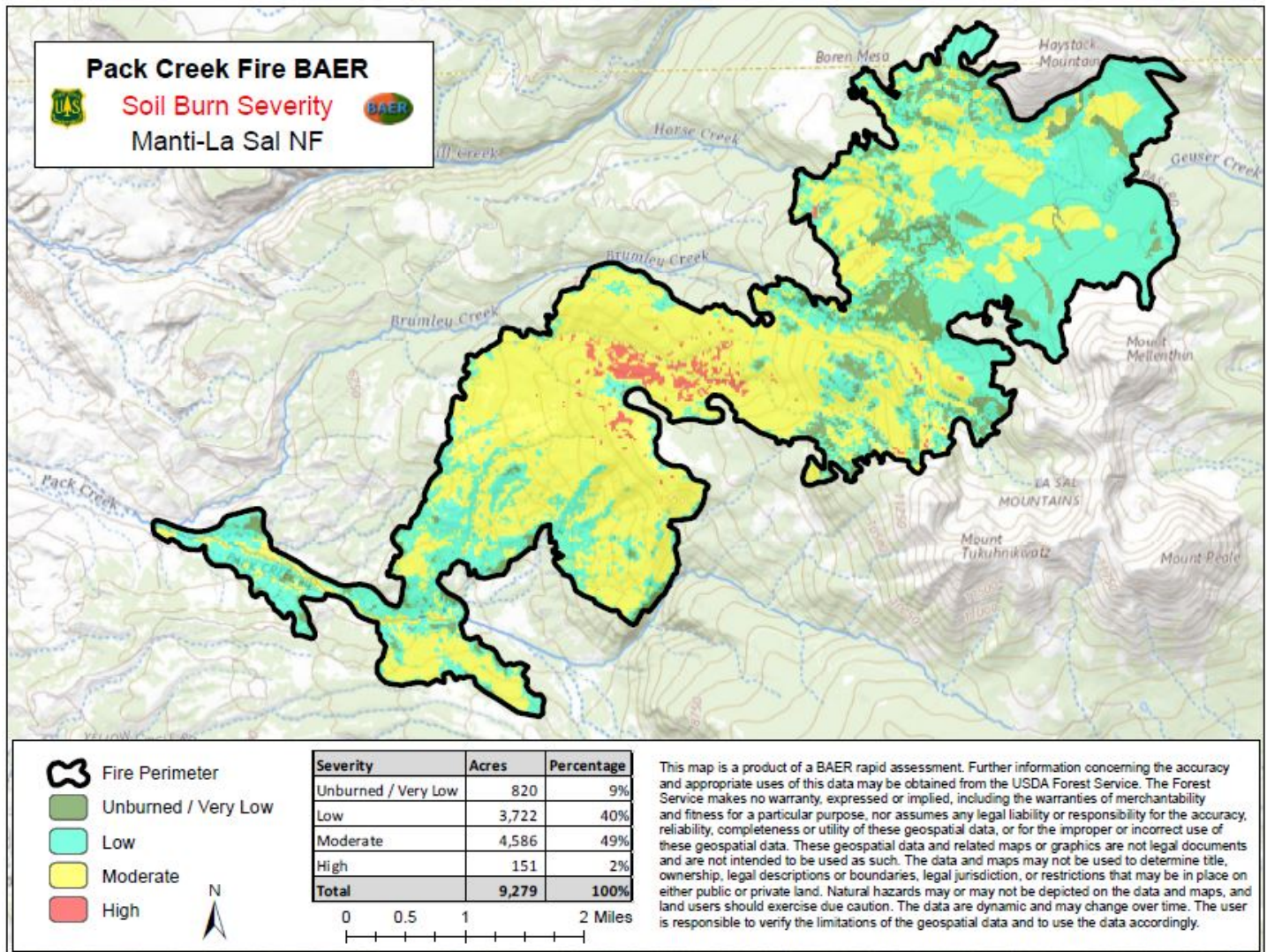


Figure 1 Pack Creek BAER Soil Burn Severity

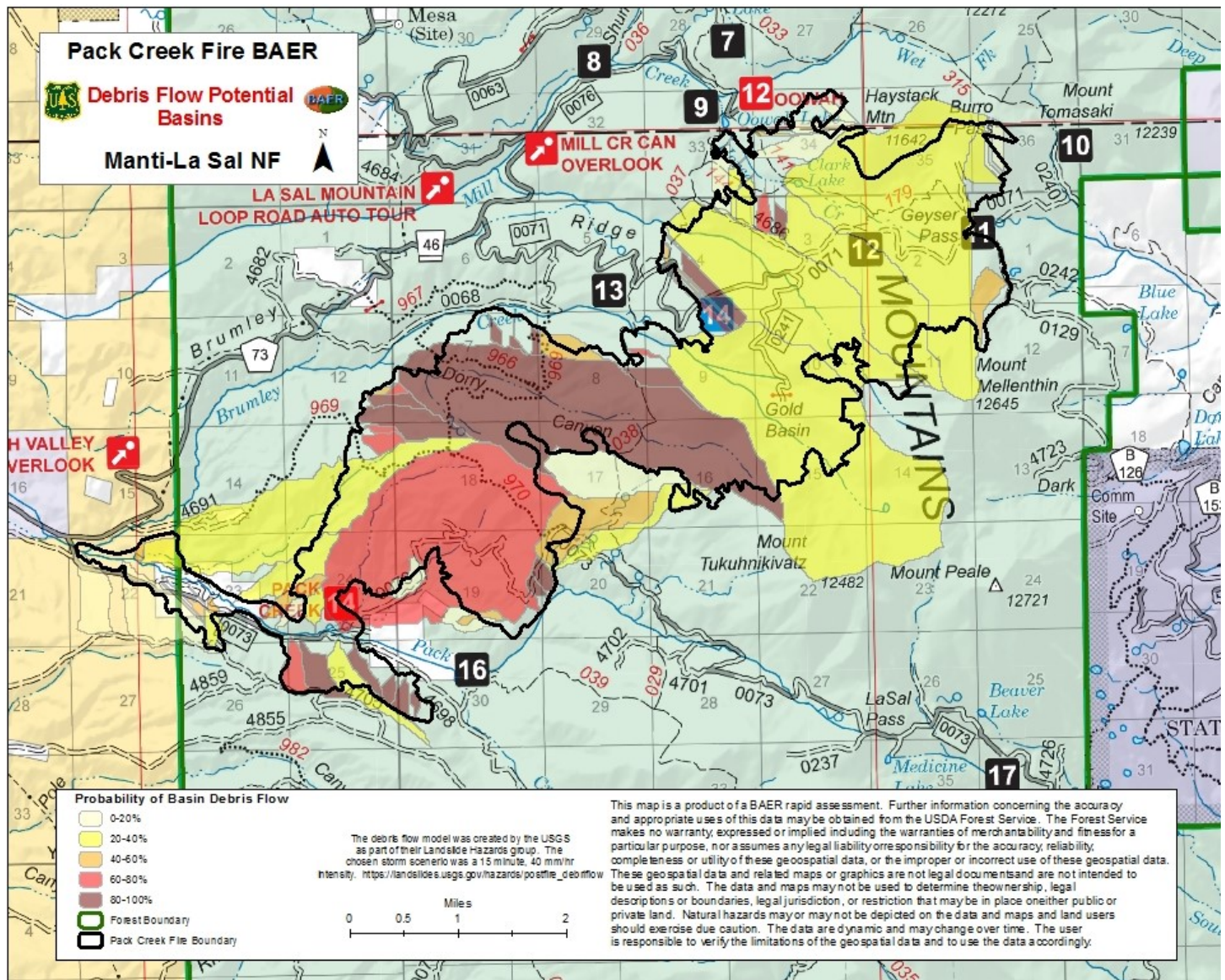


Figure 2 Debris Flow Probability in response to 15-minute peak intensity of 40 mm/h precipitation event. This is equivalent to approximately .4" of rainfall in 15 minutes and has a 50% probability of occurring over the burned area in a given year.