BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

A. Type of Report

[**X**] 1. Funding request for estimated emergency stabilization funds
[ ] 2. Accomplishment Report
[ ] 3. No Treatment Recommendation

B. Type of Action

[**X**] 1. Initial Request (estimate of funds needed to complete eligible stabilization measures)
[ ] 2. Interim Report ()
[ ] Updating the initial funding request based on more accurate site data or design analysis.
[ ] Status of accomplishments to date
[ ] 3. Final Report (following completion of work)

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Lolo Peak

B. Fire Number: MT-LNF-001288

C. State: Montana

D. County: Missoula, Ravalii

E. Region: 01 - Northern

F. Forest: 01-16 Lolo, 01-03 Bitterroot

G. Districts: Missoula & Stevensville

H. Fire Incident Job Code: P1K5ZH (0116)

I. Date Fire Started: July 15, 2017

J. Date Fire Contained: Est. 10/31/2017

K. Suppression Cost: $48M (as of 09/27/2017)

L. Fire Suppression Damages Repaired with Suppression Funds:

Reference the Lolo Peak Fire suppression rehabilitation plan for more information.

1. Fireline water barred (miles): Approximately 32.9 miles of dozer line, and 12.5 miles of hand line. An estimated 64.1miles of existing roads were used as fireline. Equipment lines were repaired using excavators and handcrews. Water bars are being constructed and slash applied, where appropriate on any firelines.
2. Fireline seeded (miles): Seeding on dozer line is ongoing and planned to be completed by the end of October. Specific competing seeded acres was not available on 9/28/17.
3. Other (identify): Incident base camps, spike camps, staging areas, drop points, and helispots (roughly 78 locations) are identified for suppression repair activities, including seeding, planting, ripping or scarification, and blocking motorized vehicle access where needed.

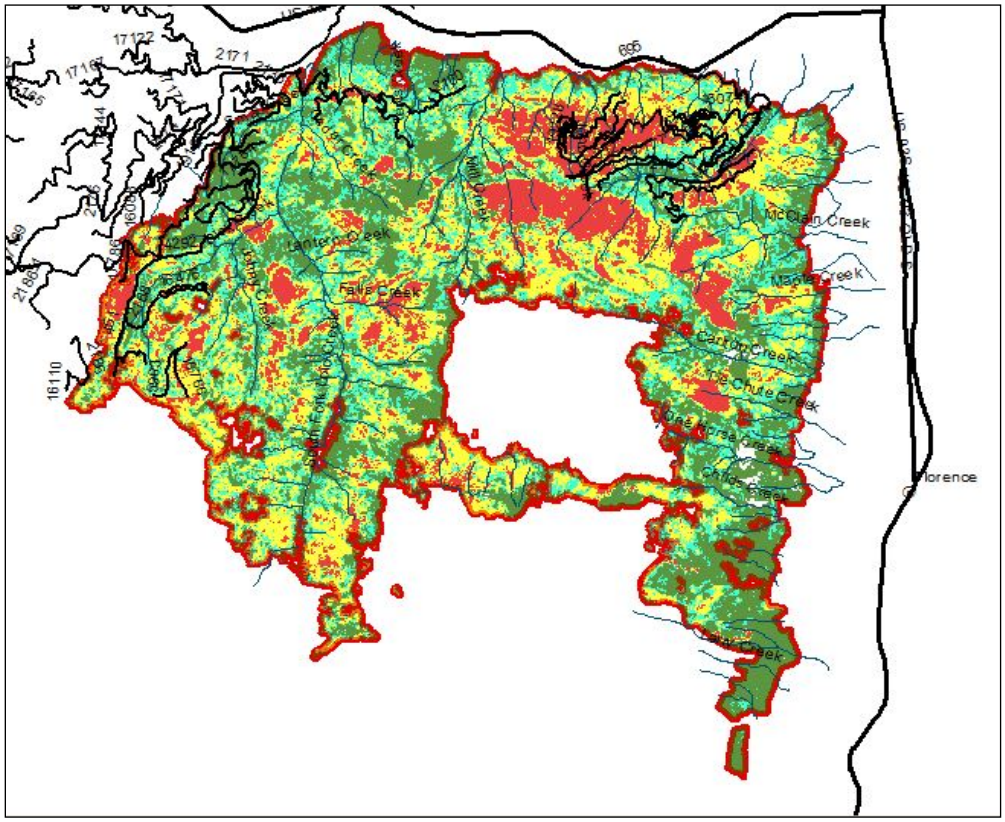
M. Watershed Numbers:

HUC 12 Name	HUC 12 Number
East Fork Lolo Creek	170102051402
West Fork Butte Creek	170102051406
South Fork Lolo Creek	170102051407
Lower Lolo Creek	170102051409
Bass Creek	170102051501
Sweeney Creek	170102051504
Upper Brushy Fork	170603030101
Larry Creek-Bitterroot River	170102051506
One Horse Creek-Sin-tin-tin-em-ska Creek	170102051507
North Woodchuck Creek-Bitterroot River	170102051508

N. Total Acres Burned: 53,902 acres (analysis boundary as of 09/28/2017)
NFS (43,096) Other Federal (0) State (845) Private (9,522)

Bitterroot National Forest 11,562 acres
Lolo National Forest 30,939 acres
Nez Perce-Clearwater National Forest 594 acres

Area of moderate and high burn severity in the Mormon Creek drainage.



Soil Burn Severity for the Lolo Peak Fire, Lolo National Forest. red = high burn severity, yellow = moderate burn severity, light green = moderate burn severity, dark green = unburned

O. Vegetation Types: The Lolo Peak fire includes a variety of vegetation types that are aspect, elevation, and slope dependent. The dominant vegetation types within the fire area are dry, mixed coniferous forests (lodgepole, western larch, Douglas fir, and ponderosa pine) and cool moist coniferous forests (subalpine fir). At lower elevations and on south facing slopes, open grown Ponderosa Pine forests are common. All forest types within the Lolo Peak fire are fire-adapted ecosystems that have fire return intervals that vary from 25 to 100 years.

P. Dominant Soils: Soils on the Lolo and Bitterroot National Forests are derived from a variety of parent materials, primarily granitic rock types and mica schists. These soils have a silt loam to sandy loam texture driven by parent material and are moderately-well to well-drained. The Lolo Peak fire area has inherently high soil profile rock content, with an average of 50% or higher profile rock observed within the most surveyed areas of the fire. Soil development within the fire area is generally weak, with little to no horizonation development and a thin organic layer. In this fire, dominant landforms included moderate relief mountain slopes, steep mountain slopes, and glacial cirque headwalls and alpine ridges.

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Q. Geologic Types: The Lolo Peak Fire occurred on the northern end of the north-south trending, glaciated, Bitterroot Mountain Range, south of highway 12 and west of highway 93. This end of the Bitterroot National Forest is composed of Precambrian basement rocks intruded by granite of the Idaho Batholith resulting in a complex assemblage of granite, gneiss, schist and other rocks, including quartzite. The geology on the Lolo National Forest is predominantly composed of schist, gneiss, and quartzite with lesser outcrops of granite. There are east-west trending normal faults in the Lolo Creek area, and north-south trending normal faults along the eastern flank. On the Bitterroot National Forest the burned area surface geology is composed of Quaternary alluvium, schist, gneiss, and mylonite. The topography of the area is rugged with many east-west trending, steeply sloped valleys.

R. Miles of Stream Channels by Class:

Perennial: 38 miles* Intermittent: 123 miles*

* *Miles calculated from NHD layer*

S. Transportation System (miles) NFS Roads: 74.4 miles of system roads, 23.9 miles of non-system roads
NFS Trails: 39.5 miles

Approximately 74.4 miles of system roads occur within the perimeter of the Lolo Peak fire, and 23.9 miles of non-system road. The table below summarizes these roads by maintenance level and system status.

Lolo Peak Fire	
Maintenance Level	**Miles**
ML1	15.59
ML2	47.76
ML3	7.48
ML4	3.58
Non-system	23.93

PART III. WATERSHED CONDITION

A. Burn Severity:

	Unburned	Low	Moderate	High	Total*
Bitterroot NF SBS	4198	1721	2017	432	8367
Lolo NF SBS	9716	8416	11470	6075	35675
Total	13914	10137	13487	6507	44427

*Acreage calculations are for Lolo & Bitterroot NF lands only and do not include water bodies within the burn perimeter

B. Water-Repellent Soil (acres): 6507 acres

Soils were tested for hydrophobicity throughout the Lolo Peak burned area to assess the level of water repellency. Under unburned conditions, soils within the fire perimeter are prone to showing some hydrophobicity, especially where soil drying is common during hot, dry summer months. Within the burned area, all high severity burned areas showed moderate to strong water repellency, approximating 6507 acres that show hydrophobic conditions. Over time, hydrophobic conditions diminish associated with soil burning as soils undergo freeze-thaw cycling and post-fire revegetation.

Soil Erosion Hazard Rating (acres):

Soil Erosion Hazard Acres	Low	Moderate	High
Pre-Fire	5,123	30,151	626
Post-Fire	5,123	24,731	6,047

Soils on the Lolo and Bitterroot National Forests were assigned erosion hazard potential based on surface erodibility potential under unburned conditions and in burned areas based on the impacts of moderate and high soil burn severity, which exacerbate soil erosion potential through loss of vegetative cover and consumption of surface organic materials. Elevated soil erosion hazard is only applicable for the first few years following the Lolo Peak fire until revegetation occurs to stabilize slopes.

C. Erosion Potential: 3.0 tons/acre, (range 1 to 6 tons/acre) averaged over the first two years post-fire

Soil erosion potential is higher in the Lolo Peak fire area than many other areas of the Lolo and Bitterroot National Forests based on slope steepness, limited effective ground cover, and underlying

soil parent material. In this area, granite, gneiss, and mica schists are the underlying parent materials which result in more fine soil movement associated with preferential flow around coarse rock fragments. On north facing slopes where thick canopy cover existed pre-fire, soils are now more prone to high rates of erosion due to limited root mass and understory vegetative cover. As vegetation re-establishes within the fire area, erosion potential is expected to diminish.

The Stevensville, Montana weather station data was adjusted to climatic conditions of the Lolo Peak fire perimeter with the climate interpolation program within ERMiT. The adjusted climate was determined based on the relatively higher elevation and precipitation of the Lolo Peak wildfire.

- Annual precipitation of 22 inches at 5080 feet
- A typical hillslope length of 1000 feet with 50% coarse fragments
- Hillslope Gradients of 25% slope at the top and 70% slopes midway down through the toe slope.
- Textures of Sandy Loam, Loam and Silt Loam.
- 20% exceedance probability which means that there is an 80% chance the erosion estimates will not be exceeded in a given year.

D. Sediment Potential: 1416 yds^3/mi^2 (averaged over first 2 years)
Sediment potential was based on a probability of 60% of the eroded soil reaching streams within the burned areas. This estimate of sediment potential is conservative based on the high burn severity and likelihood of sediment reaching the stream within the Mormon Creek drainage on the Lolo Peak fire. In areas with less burn severity, significantly less sediment is anticipated to reach stream channels.

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years): 1-3 years grass (achieve % effective ground cover), 10-15 years shrubs, 20-50 years conifers

B. Design Chance of Success, (percent): 50-90%, depending on site and treatment

C. Equivalent Design Recurrence Interval, (years): 25-year post-fire

D. Design Storm Duration, (hours): 24-hour

E. Design Storm Magnitude, (inches): 3.0 inches

F. Design Flow, (cubic feet/second/square mile): varies by drainage—see hydro report

G. Estimated Reduction in Infiltration, (percent): 45%

H. Adjusted Design Flow, (cfs per square mile): varies by drainage—see hydro report

PART V - SUMMARY OF ANALYSIS

Background: The Lolo Peak Fire started on July 17, 2017. As of this assessment and according to the most recent Incident Command Report the fire had burned approximately 53,902 acres. This report utilizes acreage of 53,252 acres including 42,984 acres on National Forest System (NFS) land administered by the Lolo National Forest, Bitterroot National Forest, Nez Pierce-Clearwater National Forest, 845 acres of state lands, and 9,522 of private lands.

The Lolo Peak Fire occurred on the northern end of the north-south trending, glaciated, Bitterroot Mountain Range, south of highway 12 and west of highway 93. Bedrock is composed of Precambrian basement rocks intruded by granite of the Idaho Batholith resulting in a complex assemblage of granite, gneiss, schist and other rocks, including quartzite. The topography of the fire area is rugged with many east-west trending, steeply sloped valleys. Several perennial streams flow through or adjacent to the burned area, including Lolo Creek, South Fork Lolo Creek, One Horse Creek, West Fork Butte Creek, Sweeney Creek, South Fork Sweeney Creek, North Fork Sweeney Creek, Bass Creek, Camp Creek, Carlton Creek, Cedar Creek, Dick Creek, Johnny Creek, Larry Creek, McClain Creek, Mill Creek, Mormon Creek, South, and Tevis Creek; all of which flows to the Bitterroot River upstream of Lolo, Montana.

The primary values at risk from post-fire effects due to the Lolo Peak Fire are: human life and safety, transportation infrastructure (roads and trails), soil productivity, water quality, bull trout habitat, and native vegetation communities. The primary threats caused by the fire include increased runoff, which is expected to intensify the first 2-3 years following the fire until the burned watersheds recover and accelerated hillslope erosion as a result of amplified runoff and decreased infiltration rates. High intensity, short duration rainfall may result in valley bottom flooding and localized debris flows, primarily in Mormon and John creeks. Additional threats originating from the destabilized hillslopes throughout the burned area include falling trees and rolling rocks.

A. Describe Critical Values/Resources and Threats (narrative):
(Formatted to incorporate “Critical Values and Risk Assessment” from WO ID 2520-2015-1)

1. Human Life and Safety:

Potential threats to visitors/recreating public, residents of private lands, & Forest Service employees include flooding with a potential for localized debris flows, hazard trees and rock fall, and loss of ingress and egress. These threats exist along roads, trails, trailheads, and other recreation areas, and to permitted uses downstream or downslope of burned slopes, particularly in areas with a high or moderate soil burn severity. Risk is increased with higher probability in places having greater access and more frequent concentrations of people, particularly if traveling on roads during significant flood and washouts occur. Locations with increased risk include: road systems within the upper Mormon Creek drainage, Mill Creek trail, and along the South Fork of Lolo Creek drainage. Warning signs and access barriers treatments are proposed to help manage these risks. Increased threats may also occur in recreation areas such as trails and dispersed camp sites where floods, debris, and falling trees can occur.

Increased risk to private residents within and adjacent to the fire perimeter including residents in Mormon and John Creeks and on benches within and near the fire perimeter in the east side of the fire. The potential for flash flooding, debris flows, falling rocks, and trees poses a threat as well as loss of ingress and egress to landowners if road systems are impacted. Several private residences exist within and downstream from the fire area. Coordination with NRCS and information sharing with landowners and emergency services is ongoing.

2. Property:

Approximately 74.4 miles of National Forest System Roads (NFSR) and 23.9 miles of non-system roads occur within the fire area. Roads and associated infrastructure represent an investment made by the Forest Service and safe passage is necessary for long term administrative use, emergency access, recreational opportunities, timber and salvage sales, permittee access, and private in-holder accessibility during and after the fire recovery period. Threats to the road infrastructure from post-wildfire conditions include flooding, slope failure, debris flows, and erosion. If drainage features become overwhelmed by these threats there will be a loss of control of water, resulting in damage to the road prism as well as downstream values. Roads were assessed on a case by case basis by both the probability of damage or loss and the magnitude of consequences. Regularly used roads in highly impacted drainages with inadequate ability to handle projected flows rank High or Very High. Less traveled roads in more secure locations with acceptable drainage features rank either Intermediate or Low.

The Mormon Peak road (NFSR 612), Mormon Creek road (NFSR 2155) and associated spurs (17146 & 17145), and the John Creek road (NFSR 2157) are at **Very High** risk. Tevis Creek road (NFSR 2160), roads within the Mormon Peak area (NFSR 16074, 16106, & 16107), Elk Meadows road (NFSR 451) and the surrounding roads (NFSR 4292 & 37), McClain Creek (NFSR 1311), roads within the McClain Creek area (NFSR 1313, 62191), and Johnny Creek (NFSR 2168) are all at **High** risk.

Non-system roads within the Mormon Peak and John Creek drainages are also at **Very High** risk. These roads have been historically used for timber access and will be affected by post-fire flows and debris similarly to system roads.

3. Natural Resources

Bull Trout

Mormon and S.Fk. Lolo are the primary stream of interest due to the fire coverage within those watersheds and the presence of ESA-listed species bull trout (*Salvelinus confluentus*) and bull trout Critical Habitat. Bull trout populations are low in Mormon Creek due to habitat conditions, stream size, and isolated conditions. S.Fk. Lolo bull trout populations are better and relatively stable due to minimally road watershed conditions and cold water conditions. The primary concern in the S.Fk. Lolo is temperature and the associated upward expansion of non-native species (brown and brook trout). It is quite likely that bull trout within the S.Fk Lolo will respond positively within a couple of years. Mormon Creek bull trout population, with the presence fire and road/watershed effects, could go extinct within the next bull trout generation (5-yrs). BAER road treatments on the south side of Mormon Creek will minimize the synergistic effects of the fire and road network upon bull trout and potentially extend their persistence within the watershed.

Native Plant Communities

Over 1,500 acres of known noxious weed infestations occur within the Lolo Peak Fire on both the Lolo (886 acres) and Bitterroot (667 acres) forests. Species include thistles, St. Johnswort, cheatgrass, common tansy, Dalmatian toadflax, houndstongue, leafy spurge, oxeye daisy, spotted knapweed, sulphur cinquefoil, tall buttercup, and tumble mustard. Infestations are mostly limited to roadside, trails, trailheads, and open winter range sites. There are no known aquatic invasive species within the perimeter of the fire. If aquatic invaders were established in the lakes within the Lolo Peak Fire perimeter from fire suppression activities, the creeks fed by the lakes would also be at risk, including creeks that are occupied Bull Trout habitat (One Horse, Sweeney, and Bass creeks) as well as the Bitterroot River (critical) and, eventually, the Clark Fork River

The Lolo Peak fire dramatically changed plant community condition in some areas where moderate to high intensity fire occurred. Crown canopy was highly reduced to eliminated (moderate to high intensity burned areas); as was shrub and forb cover in the understory. These disturbed areas are now highly vulnerable to noxious weed invasion or noxious weed spread from existing infestations or adjacent sources. Areas considered burned at low intensities are also susceptible to noxious weed invasions because native vegetation was reduced. In noxious weed ecology, any reduction in competition for available nutrients, space, or light is considered an advantage to noxious weeds growth and establishment.

Overall, if left untreated the noxious weeds in the Lolo Peak burned area could spread and establish causing new infestations throughout the fire perimeter. The spread and establishment of noxious weed directly impacts native plant and wildlife communities in terms of habitat for both and forage. Soil productivity and hydraulic function may also be impacted if left untreated. Noxious weeds' root systems do not secure soils to prevent erosion as well as native plants (Hickenbottom 2000). Additionally, there are some noxious weed that release phytotoxins to ward off native competitors. These phytotoxins also change the soil productivity by altering mycorrhizal interactions (Carey et al. 2002). Therefore, there is a "very likely" probability of loss for soils, hydrology, and native plant and wildlife communities (90 – 100%). Once noxious weeds are establish, complete eradication is nearly impossible and requires monitoring for several years in order to ensure the infestation does not re-establish. Damage to soils and native plant communities is irreversible in most cases and the loss of native plant communities (without treatment) is irretrievable as the native plant communities will

not return on their own. This would be considered a “major loss” to native plant and wildlife communities directly and indirectly impact recreational opportunities in the area.

Soil Productivity and Hydrologic Function

The Lolo Peak fire poses a high risk (likely, moderate) to soil productivity and hydrologic function associated with known post-fire watershed threats including accelerated hillslope and sheet erosion, slope failure, rilling, gullying, and increased overland flows in moderate and high burn severity areas of the Lolo Peak fire. Post-burn environments result in a deterioration of soil productivity, with impacts to organic matter, soil development, and biogeochemical processes. Analysis of existing soil conditions and land-types within the burned area suggests that while these areas have an elevated erosion hazard, the potential for erosion events will likely be localized and will not result in widespread long-term degradation of soils. While these impacts are significant in the short term, natural soil recovery is considered the best treatment, and the risk the soil productivity as a BAER critical value is moderate. It is anticipated that soil productivity will be influenced by burned acres in the short term (< 10 years) and as forest floor recovery occurs, the risks to soil productivity and hydrologic function will diminish. Treatments recommended to protect the BAER critical values of soil productivity and hydrologic function have been carefully coordinated with the engineering, fishery and recreation BAER team members in the development of road and trail treatments.

A low risk (likely, moderate) is anticipated to critical Cultural and Heritage Resources within the Lolo Peak burn perimeter. No BAER funds are being requested at this time but a post-fire assessment will be completed as soon as possible to determine current status. No other previously recorded cultural resources occur within the Lolo Peak Fire perimeter. Therefore, the Lolo NF Heritage Program will not be seeking BAER treatments in this initial 2500 – 8.

5. Other non-BAER Values:

Numerous NFS values that are not BAER Critical Values in addition to non-NFS values are potentially at risk from post-fire threats originating primarily on NFS lands. Treatments for these other values were not been identified by the BAER team. Evaluation for non-BAER Critical Values on NFS lands could be considered for appropriate program funding.

B. Emergency Treatment Objectives:

Mitigate and protect, to the extent possible, threats to personal injury or human life of forest visitors and Forest Service employees by raising awareness through posting hazard warning signs on roads, improving stream crossings, and communicate hazard of flooding, debris flows, and rock fall. Provide safe access to the burned area for personnel implementing authorized BAER response actions and communicate threats to cooperating agencies and community groups. Consider temporary closures to protect public users of NFS lands and recreation facilities.

Protect or minimize damage to NFS investments in roads infrastructure by installing drainage features capable of withstanding potential increased stream flows, debris flows, and a slope failure. Minimize damage to key NFS travel routes.

Protect or mitigate potential post-fire impacts to critical natural resources within the burned area including soil productivity and hydrologic function on NFS lands and critical habitat for bull trout, water for domestic and agricultural use, Implement treatments that minimize threats to naturalized ecosystems by minimizing the potential for expansion of non-native invasive species (NNIS) into the burned area; minimize expected invasion of NNIS within and adjacent to the area where soils and vegetation was disturbed as a result of fire suppression activities.

Evaluate authorized BAER weed treatments and existing infrastructure to determine effectiveness in post-fire flow conditions.

Assist cooperators, other local, State, and Federal agencies with the interpretation of the assessment findings to identify and address potential post-fire impacts to communities and residences, domestic water supplies, public utilities (including power lines, roads, and other infrastructure).

C. Probability of Completing Treatment Prior to Damaging Storm or Event:
Land - 80% Channel - NA Roads/Trails - 70% Protection/Safety - 90%

D. Probability of Treatment Success

Treatment	Years after Treatment		
	1	3	5
Land	80	80	90
Channel	NA	NA	NA
Roads/Trails	80	90	90
Protection/Safety	90	80	70

G. Skills Represented on Burned-Area Survey Team:

[X] Hydrology	[X] Soils	[x] Geology	[ ] Range	[x] Recreation
[X] Forestry	[ ] Wildlife	[X] Fire Mgmt.	[X] Engineering	[ ] Minerals/HazMat
[ ] Contracting	[ ] Ecology	[X] Botany	[X] Archaeology	[X] Vegetation
[x] Fisheries	[ ] Research	[X] GIS	[ ] Landscape Arch	

Team Leader: Mark Story / Ed Snook
Ann Hadlow, Lolo BAER coordinator
Dave Callery, hydrology
Dustin Walters, hydrology
Chad Yocum, hydrology
Claire Campbell, soils
Robert Bergstrom, soils
Dave Marr, soils
Scott Gerke, geology
Brian Story, engineering
Catlin Woods, engineering
Matt McCabe, engineering
Teresa Morales, geotechnical engineering
Chad Lundgreen, geotechnical engineering
Tim Wallace, GIS
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Shane Hendrickson, fisheries
Karen Stockman, botany/weeds
Gil Gale, invasives
Al Hishey, recreation
Carl Anderson, recreation
Mark Smith, recreation
Sydney Bacon, heritage
Matt Werle, heritage
Megan Oswalt, administration

H. Treatment Narrative:

Land Treatments:

L-01 EDRR (Early Detection and Rapid Response): EDRR is necessary to prevent the establishment and spread of noxious weeds into the unique native plant communities burned in the Lolo Peak Fire. EDRR will be used to minimize the potential for new noxious weed infestations and ensure the natural recovery of native perennial grasses and forbs. This treatment will also ensure the ecological indicators (soil stability, hydrologic function, and biotic integrity) are functioning properly during the natural recovery period on lands administered by the FS. Chemical treatment of new and existing noxious weed infestations will reduce the likelihood of spread to disturbed areas and help re-establish high quality wildlife habitat within the burn.

Ground treatments (truck/UTV mounted sprayer) would also occur for spotted knapweed and other weeds along the road sides within the burned area and areas where road improvements occur for BAER improvements. Treatments will be prescribed at 7 ounces/acre of aminopyralid with a surfactant for 675 acres (135 miles) that access the burned area perimeter

Ground treatments would include road and spot treatments (EDRR) along trails and sensitive areas. Early Detection and Rapid Response (EDRR) will be used to prevent new invaders from establishing and spreading into noxious weed free areas. Initial efforts would include spot treatments with herbicide along handlines, dozer, and contingency lines as well as known weed-free areas within the burned area. The purposes of these treatments are 1) to prevent known noxious weed infestations from spreading and/or increasing in density, 2) to detect and rapidly respond (spot treat) to known and new infestations associated with fire suppression/fire effects, 3) to prevent potential new infestations resulting from BAER actions, and 4) preserve native plant communities; wildlife habitat, soil and hydrological resources. These efforts would occur along road sides used as contingency lines, trails, open grasslands, and the interior of the fire where the canopy no longer exists.

Mormon Peak Winter Range with John's Creek in the background

Native plant community aerial treatments would occur on approximately 265 acres of known noxious weed locations burned winter range near Mormon Peak. The intent of the aerial application of herbicide is to interrupt the invasion of non-native grasses and spotted knapweed which can contribute to the continuity of fuels for future wildfires and decrease the fire return interval significantly.

Early detection would also be applied to surveying backcountry lakes for aquatic invasive species such as zebra mussels, New Zealand mud snails, Eurasian watermilfoil, and curly leaf pond weed. All of these species are present in Montana's waterways. Aquatic invasive species can have a devastating economic impact (Lovell and Stone 2006) therefore the decontamination process is strictly adhered to by firefighters for engines and aerial firefighting techniques. Early detection is limited to surveying for actual viable species. Backcountry lakes would be surveyed in the summer of 2018. Current conditions, cold and snowy, are not conducive to early detection, especially this close to the season ending event. If AIS are discovered the District will work with local agencies on an eradication plan. Sample collection (early detection) would be completed by forest service employees or partners.

Signs at trailheads would be installed to reduce noxious weed spread and encourage users to stay on trails. Each sign would also have a boot brush to clean footwear prior to entering vulnerable areas. Signs would be placed at the following trailheads on the Bitterroot NF: Lappi Lake (TR324), Bass Creek (TR4), Holloway Lake (TR393) and One Horse Lake (TR326). Signs would be placed at the following trailheads on the Lolo NF: South Fork of Lolo Creek (TR311), Lantern Ridge (TR309), Mill Creek (TR1310), and Lolo Peak (TR1311).

Example of Trailhead Prevention and Awareness sign (with bootbrush) and the severely burned Lolo Peak TH.

Channel Treatments: none proposed

Road and Trail Treatments:

Due to the limited time and resources for reconnaissance and the quantity and condition of system road segments within the fire perimeter, reconnaissance was prioritized by focusing on the roads that appeared to be at highest risk according to the burn severity mapping. A total of approximately 58.5 miles within the fire perimeter were examined in detail by BAER team members.

The following sections described evaluated roads within the burned area on which an emergency situation has been designated. See appendices for treatment specifications, risk evaluation details for all roads assessed, map showing treatment locations, and table breaking out treatments by road and mile post.

- NFSR 612 [Mormon Peak Road] – Lolo NF: Main arterial cost-share road providing access to private property and a popular trail head (Lolo Peak Trailhead). The roadway is in fair condition with ditch-line, partially plugged cross-drains, larger pipes at major drainage crossings, and rolling dips. The road is along the northern perimeter of the fire, eventually switching back into the burn and running mid-slope through a mixture of low, intermediate, and high burn severity.
  - In three draws which experienced intermediate and high burn severity, a potential exists for existing culverts with large fills to be overwhelmed during storm events, directing run-off onto the road prism.
  - Many ditch-lines and cross drains are partially or completely full of sediment, negatively impacting hydrologic function. These drainage features may be overwhelmed due to increased flows, causing water to channel down to the road, damaging the road prism and causing erosion.
  - Due to the Very High risk to NFSR 612 (Property) the following treatments are proposed:
    - Roadway storm inspection and response
    - Roadway storm-proofing (ditch pulling, culvert cleaning, road-way reshaping)
    - Culvert upsizing at major drainage crossings

- Installation of armored critical dips

Typical burned condition on Mormon Creek Road NFSR 612

- NFSR 2155 [Mormon Creek] – Lolo NF: Maintenance level 2 out-sloped road, currently closed year-round to public access dropping off the main Mormon Peak road, descending to Mormon Creek, crossing the creek, and heading back up the other side of the valley through high and moderate burn severity.
  - Post-fire hydrologic modelling (25 year recurrence interval) indicates that the culvert at the Mormon Creek crossing will experience a 900% increase in flow, overwhelming the existing pipe and causing substantial road fill failure and sediment delivery to Mormon Creek, which is critical Bull Trout habitat. A breach in the pipe fill could cause a discharge surge in Mormon Creek. A few private homes are at risk from flooding on Mormon Creek below the Forest Boundary.
  - Increased flows due to high burn severity are likely to overwhelm existing pipes and channel water down the roadway, damaging the road prism, and contributing sediment to Mormon Creek.
  - Due to Very High risk to NFSR 2155 (Property) and Very High risk to critical Bull Trout habitat (Natural Resources) the following treatments are proposed:
    - Remove culverts. Lay back road fill slopes in draws to leave the road passable to high clearance vehicles for administrative access
    - Install drivable water bars and outslope the road to facilitate drainage and minimize erosion

- NFSR 17145 & 17146: Maintenance Level 1 roads running mid-slope through intermediate and high burn severity with drainages leading directly into Mormon Creek.
  - Increased flows due to high burn severity will most likely overwhelm existing pipes and channel water down the roadway, damaging the road prism and contributing sediment to Mormon Creek.
  - Due to Very High risk to NFSR 17145 & 17146 (Property) and Very High risk to critical Bull Trout habitat (Natural Resources) the following treatments are proposed:
    - Remove culverts. Lay back road fill slopes in draws to leave the road passable to high clearance vehicles for administrative access
      Install drivable water bars and outslope the road to facilitate drainage and minimize erosion

- NFSR 2157 [John Creek]: Maintenance level 2 road accessible from the west through private property or from the east from the Mormon Peak Road (NFSR 612). The eastern section of the road was originally impassible due to fallen trees, however it has become passable post-fire as all trees were burned. The western portion of the road leading up from private property was opened during the fire for suppression access. The road has intermittent ditch-line with cross drains and pipes in the major drainages. Road runs almost entirely through intermediate and high burn severity, with multiple perennial and intermittent stream crossings. In multiple sections, the road was built on geologically unstable slopes, and has experienced slumping and slope failure.
  - Two 18” culverts were burned, and are no longer structurally sound.
  - There is the potential for culverts in draws which experienced intermediate and high burn severity to be overwhelmed during storm events, directing run-off onto the road prism in sections with large fills.
  - Due to the Very High risk to NFSR 2157 (Property) and Very High risk to human life and safety the following treatments are proposed:
    - Replace burned 18” culverts

        - Install armored critical dips at major draws
        - Remove culverts and lay back slopes in segments where the road is not needed
        - Outslope roadway in specific geologically unstable areas
        - Install temporary barrier to prevent unauthorized access from Mormon Peak Road
    - Slope stabilization of an unstable switchback of John Creek road 2157. This consists of installation of a micro-pile system to stabilize the toe of a road shoulder/toe of slope against potential failure due to an increase in overland flow and saturated soil conditions. See geotechnical report for design features.

- NFSR 16074, 16106, & 16107: Maintenance Level 2 out-sloped roads running mid-slope through predominately intermediate and high burn severity.
    - There is the potential for culverts in draws which experienced intermediate and high burn severity to be overwhelmed during storm events, directing run-off onto the road prism in sections with large fills.
    - Due to High risk to NFSR 16074, 16106, & 16107 (Property) the following treatments are proposed:
        - Roadway storm-proofing (ditch pulling, culvert cleaning, road-way reshaping)
        - Install armored critical dips at major drainage crossings
        - Storm inspection and response

- NFSR 2160 [Tevis Creek]: Maintenance level 2 road in good condition with ditch-lines, cross-drains, and larger pipes at major drainages. Road runs through a mixture of low, intermediate, and high burn severity and crosses the South Fork Lolo Creek via a road bridge (approx. 35' long).
    - Two 18" culverts were burned, and are no longer structurally sound
    - Many ditch-lines and cross drains are partially full of sediment, negatively impacting capacity. These drainage features may be overwhelmed due to increased flows, causing water to channel down to the road damaging the road prism and causing erosion.
    - Due to the High risk to NFSR 2160 (Property) and Very High risk to human life and safety the following treatments are proposed:
        - Replace burned 18" culverts
        - Roadway storm inspection and response
        - Roadway storm-proofing (ditch pulling, culvert cleaning, road-way reshaping)

- NFSR 451 [Elk Meadows]: Maintenance level 4 arterial road in good condition with ditch-lines, cross-drains, larger pipes at major drainage crossings, and aggregate surfacing. Road runs along the western perimeter of the fire, entering the burn for a segment and running immediately below an area of high burn intensity.
    - Cross drains are generally clean, but ditch lines are partially or completely full of sediment and vegetation, negatively impacting hydrologic function. These drainage features may be overwhelmed from post-fire flows and debris, causing water to channel down to the road damaging the road prism and causing erosion.
    - Due to High risk to NFSR 451 (Property) the following treatments are recommended:
        - Roadway storm inspection and response
        - Roadway storm-proofing (ditch pulling, culvert cleaning, road-way reshaping)

- NFSR 4292 & 37: Roads were not surveyed due to time constraints, but both run mid-slope through intermediate and high burn intensity.
    - Many ditch-lines and cross drains are most likely partially or completely full of sediment, negatively impacting hydrologic function. These drainage features may be overwhelmed due to increased flows, causing water to channel down to the road damaging the road prism and causing erosion.
    - Due to High risk to NFSR 4292 and 37 (Property) the following treatments are recommended:
        - Roadway storm inspection and response
        - Roadway storm-proofing (ditch pulling, culvert cleaning, road-way reshaping)

- NFSR 1311, 1313, & 62191 [McClain Creek area]: Maintenance level 2 roads with culverts at main drainage crossings on the Bitterroot National Forest. Roads provide public access. Roads provide administrative access to Bitterroot National forest lands, and the upper portion of the Mormon Creek

watershed on the Lolo National Forest. Road pass through a mixture of low, intermediate, and high burn severity.
  - There is the potential for culverts in draws which experienced intermediate and high burn severity to be overwhelmed during storm events, directing run-off onto the road prism in sections with large fills.
  - There is the potential for post fire debris and storm flow to exacerbate ongoing erosion on the road surface, leading to partial or total road failure.
  - Due to High risk to NFSR 1311, 1313, & 62191 (Property) the following treatments are proposed:
    - Roadway storm inspection and response
    - Roadway storm-proofing (*drain dip construction*, ditch pulling, culvert cleaning, road-way reshaping)
    - Installation of armored critical dips
    - Installation of riser pipes (only on NFSR 1311)

- NFSR 2168 [Johnny Creek]: Maintenance level 2 road running through a mixture of low, intermediate, and high burn severity. Road crosses Dick Creek, and a tributary to Dick Creek which are both perennial streams tributary to critical Bull Trout habitat.
  - There is the potential for culverts in draws which experienced intermediate and high burn severity to be overwhelmed during storm events, directing run-off onto the road prism and causing delivery of sediment to stream channels.
  - Due to High risk to NFSR 2168 (Property) the following treatments are recommended:
    - Install armored critical dips at stream crossings

- Nonsystem roads: These roads were built for past timber harvest, and vary in condition from full-size roads with culverts at major drainage crossings to roads that resemble full-size trails due to erosion and sluffing. Non-system roads run through a mixture of low, intermediate, and high burn severity. There are a significant number of non-system road miles within high burn severity in the Mormon Creek and John Creek drainages. This treatment focuses in on a few critical crossings.
  - Increased post-fire flows may overwhelm road prisms and drainage features exist, causing erosion of the road template, and delivering large amounts of sediment to streams.
  - Due to Very High risk to critical Bull Trout habitat and hydrologic function (Natural Resources) the following treatments are recommended:
    - Remove culverts and large road fills at critical draw crossings. This includes 5 culverts in Mormon Creek and 9 culverts in Johns Creek.

- Trails: 39.5 miles of trails occur within the Lolo Peak fire burn perimeter. 12 miles are located within or downslope moderate or high severity area and subject to damage from stormflow runoff and/or sloughing. Proposed treatments include clearing hazard trees necessary to protect BAER implementation trail work crews, constructing waterbars to direct water off trails, and re-establish flat treated in a few heavily burned sections.

Protection/Safety

Considerable risks occur when entering the burned area that merit public awareness. These include potential flooding, rolling rock and debris, falling trees, etc. Six warning signs are proposed at each major road entry point to the burned area including fire entry points @ NFSRs 451 [Elk Meadows], 2160 [Tevis Creek], 1311 [McClain], 612 [Mormon Peak], & 37 [West Fork Butte].