USDA-FOREST SERVICE FS-2500-8 (6/06)

Date of Report: 2/5/19

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

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

[X] 2. Interim Report # 1
[X] 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: Crescent Mountain

B. Fire Number: WA-OWF-000428

C. State: Washington

D. County: Okanogan

E. Region: PNW (R6)

F. Forest: Okanogan-Wenatchee

G. District: Methow Valley RD

H. Fire Incident Job Code: P6L2CW

I. Date Fire Started: 07/26/2018

J. Date Fire Contained: Est. 10/22/2018

K. Suppression Cost: $40.7 million as of 09/27/2018

L. Fire Suppression Damages Repaired with Suppression Funds
1. Fireline waterbarred (miles):
2. Fireline seeded (miles):
3. Other (identify): Approx. 50 miles restored to N. Zone suppression repair standards.

M. Watershed Number: Twisp River (1702000805);

Subwatershed Name	Subwatershed (HUC12)	Total subwatershed acres (% in fire perimeter)	Soil Burn Severity					
			Unburned or very low acres	Low		Mod		High	
				Acres	%	Acres	%	Acres	%
Buttermilk Creek	170200080506	23,710 (36%)	18,989	3,514	15%	1,176	5%	31	<1%
Eagle Creek	170200080505	8,578 (48%)	5,223	2,314	27%	955	11 %	86	1%
Fish Creek	170200090202	17,373 (1%)	17,280	93	1%				
Headwaters Twisp River	170200080501	12,866 (26%)	9,898	1,719	13%	1,130	9%	119	1%
Middle Twisp River	170200080507	21,865 (34%)	14,652	2,698	12%	4,034	18 %	481	2%
South Creek	170200080502	10,051 (35%)	7,521	1,700	17%	777	8%	53	1%
Upper Twisp River	170200080503	18,574 (71%)	5,993	6,882	37%	5,132	28 %	567	3%
War Creek	170200080504	17,363 (69%)	5,989	5,191	30%	5,262	30 %	921	5%
Grand Total			**85,545**	**24,125**		**18,465**		**2,258**	

N. Total Acres Burned: 52,610 total acres (as of 9/23/2018)

NFS Acres (52,500) NPS (22) Private (89)

O. Vegetation Types:

Pre-fire vegetation consisted of two primary zones, each covering roughly half the fire perimter: a lower elevation Douglas-fir zone and a higher elevation Subalpine-fir zone. The lower elevation zone was dominated by Douglas-fir and Ponderosa cover-types, while the higher elevation zone was dominated by Lodgepole Pine, Subalpine Fir, and some Englemann Spruce. The highest elevations were larger rock scree and high elevation herbs and shrubs. Understories were dominated by alder, ceanothus, and huckleberry.

P. Dominant Soils**:**

The dominant soil orders within the Crescent Mountain fire perimeter include Andisols and Inceptisols, with medial, ashy and/or lithic modifiers. Volcanic ash exists in large concentrations within the upper profile of all mapped andic soils. Dominant soil textures are moderately coarse to fine sandy loams, most of which are located on steep backslope down to toeslope positions. Soils within the burned area generally have extremely high rock content throughout the entire upper profile, ranging from 35% to 90%. Unconsolidated materials dominate the upper 1/3 backslopes of most landforms within the perimeter, with these being highly fragmental (>90% rock fragments). Shallow soils with very stony to extremely stony surface phases comprise over 50% of the fire perimeter.

Q. Geologic Types:

Eastern facing slopes in the Twisp River drainage is dominant by sedimentary rocks (Kps) and volcanic rocks (Kpv). The sedimentary rocks (Kps) are mostly sandstone, shale and pebble conglomerate. As the ancient Methow Ocean filled with marine sediments, streams and rivers deposited sand, gravel, and mud on top of them. In a few areas, ocean deposits are interlayered with the stream deposits. The volcanic rocks (Kpv) are predominantly andesitic breccia and tuff; locally fluviatile maroon siltstone, sandstone, and conglomerate. About 90 million years ago, volcanoes erupted on the flood plains of rivers that flowed over sediments of the former Methow Ocean, burying both the river deposits and the underlying Methow

Ocean sediments under volcanic rocks. The headwaters of the Twisp River is dominant by Tonalitic Plutons (Kt) intrusions. Western slopes in the Twisp River drainage is dominated by Napeequa Schist (TKns) and Tonalitic orthogneiss (TKto). Most of these rocks were derived from deep ocean sediments and ocean-floor basalt.

R. Miles of Stream Channels by Order or Class**:**

Stream Type	Miles
46003 (Intermittent)	112.0
46006 (Perennial)	58.3
55800 (Artificial Path)	0.2
Grand Total	170.5

S. Transportation System

Trails: 71 miles (~8 miles in designated wilderness)

Roads:

Maintenance Level	Miles
1 - BASIC CUSTODIAL CARE (CLOSED)	27.0
2 - HIGH CLEARANCE VEHICLES	4.6
3 - SUITABLE FOR PASSENGER CARS	18.6
4 - MODERATE DEGREE OF USER COMFORT	0.7
(blank)	5.4
Grand Total	56.3

PART III - WATERSHED CONDITION

A. Burn Severity (acres):

Soil Burn Severity by Ownership Acres					
Ownership	**Unburned**	**Low**	**Moderate**	**High**	**Total**
National Park Service	10	12			22
Private	37	40	12	0	89
U.S. Forest Service	7,715 (15%)	24,073 (46%)	18,454 (35%)	2,258 (4%)	52,500
Grand Total	7,762	24,125	18,465	2,258	52,610

B. Water-Repellent Soil (acres):

~ 22% of soils (100% of severely burned soil and 50% of moderately burned soil), or around 11,491 acres.

C. Soil Erosion Hazard Rating (acres):

738 (low) 10,427 (moderate) 33,737 (high) 6,992 acres not rated, or are rock/water

D. Erosion Potential: In this area, rates of soil erosion in undisturbed closed canopy forests are generally extremely low (less than 0.5 ton/acre/year). Post fire erosion rates in the Cresent Mountain Burned Area are modelled to be significantly higher (3.84 tons/acre)

E. Sediment Potential: up to 1,534 cubic yards/square mile

	Erosion Potential (tons/acre)	Sediment Potential (yd^3/mi^2)
West Fork Buttermilk	2.31	1063
Scaffold Creek	2.14	1268
Eagle Creek	2.14	1272
South Fork of War	2.10	1309
Main stem War	3.84	831
Williams Creek	1.98	1260
Reynolds Creek	3.24	1534
South Creek	1.98	1067
Roads End CG	1.98	1230
North Creek	1.74	1079
Scatter Creek	2.31	1462

F. Debris Flow Potential:

The USGS Geologic Hazards Division provided estimates of debris-flow likelihood, volume, and combined hazard for several design storms with a range of peak 15-minute intensities. Estimates are calculated at two scales: the stream segment and for drainage basins. The USGS model results, summarized below, can also be accessed on the USGS web page at http://landslides.usgs.gov/hazards/postfire_debrisflow/.

Debris flows are eminent in the Crescent Mountain Fire Area. Debris flows and flooding have occurred in the past under non-fire conditions. Within the burned area, some watersheds show a great deal of past debris slide/debris flow activity and it appears likely these areas could experience future debris flows. The following summary of probability of debris flow occurrence in burned area stream channels is based on a 15 minute rainstorm at a peak intensity of 24 mm/hour.

Summary of USGS Model Results and Field Observations

- Based on review of the USGS model results and associated data tables, the probability of debris flows is likely (above 60%) to very likely (above 80%) for numerous steep side channels within the Scaffold Camp Creek, Oval Creek, War Creek and North Creek sub watersheds and numerous steep drainages directly tributary to the twisp river. To a lesser extent, debris flows are also likely to very likely in steep side channels within the Williams Creek and South Creek sub watersheds.

- The USGS Combined Risk Rating is based on both probabilty and volume. As shown in the embedded map (above), much of the burned are has a combined risk rationg of moderate or high. Large areas within the Scaffold Creek, War Creek and North Creek sub watersheds are rated high for combined risk.

- As refelected by the “Watch stream” layer provided by the USGS and the hydrologic response model results sumamrized in this report, elevated debris laden and sediment bulked flows are likely to occur in main stem stream channels within the burned area. In these lower gradient reaches, it is likely suspended, dissolved and or floatable materials will be carried significantly further downstream.

- It is likely the increased probability of debris flow activity will subside within 3-5 years following the burn

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period	3 to 5 years
B. Design Chance of Success	80%
C. Equivalent Design Resource Interval	5 years
D. Design Storm Duration	1 hour and 24 hour
E. Design Storm Magnitude	5-yr, 1-hr: 0.6 inches 5-yr, 24-hr: 2.4 inches
F. Design Flow	5-yr, 1-hr: 0 cfs/mi^2 5-yr, 24-hr: 202 cfs/mi^2
G. Estimated Reduction in Infiltration	40%
H. Adjusted Design Flow	5-yr, 1-hr: 131 cfs/mi^2 5-yr, 24-hr: 647 cfs/mi^2

Hydrologic Response

The Crescent Mountain Fire burned 33% of the Twisp River watershed. As a result of the altered hydrologic function associated with burned soils and vegetation the primary critical values at risk for hydrology are associated with flooding, debris flows, and sedimentation. Watershed response is dependent on the occurrence and magnitude of storm events and should be greatest with initial storm events. The disturbances will become less evident as vegetation is reestablished, providing ground cover and increasing surface roughness.

The Wildcat Rainfall-Runoff Hydrograph Model (Hawkins and Greenburg 2013) was used to predict increases in peak flow resulting from the fire. Two different design storms were used in this analysis: the 5-year, 1-hour and 24-hour storms with magnitudes of 0.6 inches and 2.4 inches respectively. This model uses curve numbers to predict runoff. The curve numbers used are shown in the table below.

The results of the pre and post-fire hydrologic modeling are shown in the table below. The Scaffold, War, Reynolds, and Williams drainages stand out as those with the highest magnitude of change from pre-fire to post-fire conditions.

Sub-Watershed	5-year, 1-hour event		5-year, 24-hour event		
	Pre-fire estimated discharge (cfs)	Post-fire estimated discharge (cfs)	Pre-fire estimated discharge (cfs)	Post-fire estimated discharge (cfs)	Magnitude increase from pre to post fire flows
Eagle	0	26	174	323	2
North	0	23	176	291	2
Reynolds	0	60	151	472	3
Roads End CG	0	7	276	307	1
Scaffold	0	355	30	821	27
Scatter	0	23	88	194	2
South	0	24	359	491	1
War	0	133	326	1068	3
West Fork Buttermilk	0	28	134	295	2
Williams	0	36	34	200	6

PART V - SUMMARY OF ANALYSIS

Describe Critical Values/Resources and Threats (narrative):

As of September 23, 2018 the Crescent Mountain Fire burned approximately 52,610 acres along the southern side and headwaters of the Twisp River 10 miles west of Twisp, WA. The BAER team assessment identified the overall soil burn severity for the Crescent Mountain Fire as 15% unburned, 46% low, 35% moderate, and 4% high.

The BAER Team reviewed the burned area to inventory and conduct risk assesments for Critical Values to be Considered During Burned-Area Emergency Response.

HUMAN LIFE AND SAFETY
Human life and safety on National Forest System (NFS) lands.
PROPERTY
Buildings, water systems, utility systems, road and trail prisms, dams, wells or other significant investments on NFS lands.
NATURAL RESOURCES
Water used for municipal, domestic, hydropower, or agricultural supply or waters with special Federal or State designations on NFS lands.
Soil productivity and hydrologic function on NFS lands.
Critical habitat or suitable occupied habitat for federally listed threatened or endangered terrestrial, aquatic animal, or plant species on NFS lands.
Native or naturalized communities on NFS lands where invasive species or noxious weeds are absent or present in only minor amounts.
CULTURAL AND HERITAGE RESOURCES
Cultural resources which are listed on or potentially eligible for the National Register of Historic Places, Traditional Cultural Properties, or Indian Sacred Sites on NFS lands.

Human Life and Safety - Overview

There is high risk to human life and safety on Forest Service and private land downstream of the burned area. Risk to forest personnel and forest users is elevated based on potential imapcts from flooding, debris flows, hazard trees, and rockfall along trails and roads in the Twisp River drainage. Individuals who may find themselves in portions of the burn area along any of the drainages or roads affected by fire are at risk during storm events. Areas that have the highest potential for increased flows resulting from the fires include drainages with large amounts of high and moderate burn severity, especially Scaffold Creek, War Creek, Williams Creek and Reynolds Creek. Debris flows in these areas are a risk to life and safety for forest visitors and workers, and to property including roads, trails, and campgrounds. The FS Road may be impacted by flooding and debris where flood waters cross the road. These hazards are possible anywhere the road crosses a fan, and are more likely where channels currently exist along the fans. Many of these channel networks can be observed in lidar data.

Treatments to mitigate hazards on NFS lands include: safety signs; road, trail and campsite closures; road drainage improvements; trail storm-proofing; and road and trail storm inspection and response.

Property and Life/Safety

National Forest System Roads (Property):
Within the burned area, there are approximately 14 miles of maintenance level 3 roads that will likely be impacted by erosion, flooding or debris flows. Impacts include deposition of eroded material on the road surface, erosion of the road surface and/or impacts to road drainage features and function. These areas of concern include sections of FSR 4440 road, FSR 4430, FSR 4435, FSR 4420, FSR 4440465, FSR 4440460, FSR 4430100, FSR 4420080, FSR 4435080, FSR 4435015, FSR 4430220 and FSR 4440395. Treatments to lower potential impacts on NFS roads include:

- Improving existing drainage features that are not adequate for the projected flow increases
- Armored rolling dip/rolling dip to minimize damage to the road surface and divert water off the road
- Storm inspection and response
- Logjam removal/relocation at Eagle Creek
- Removal of sediment deposit at Reynolds Creek
- Bridge and culvert inspection

Due to various reasons such as fire suppression activity, blow down and time constraints, some Maintenance Level 3 and all Maintenance Level 1 and 2 Roads within the burned area were not field reviewed as part of this BAER assesment. Further assessment is required to determine potential impacts on these roads, life/safety of road users and downstream impacts on fisheries resources.

Road Bridges (Property): There are 6 bridges that could potentially be impacted by post wildfire high flows and associated scouring or debris deposition. These bridges are labelled as Mystery Camp, War Creek, East Fork Buttermilk, West Fork Buttermilk CRAB, Reynolds Creek CRAB, War Creek Bridge Camp. All bridges, with the exception of the East Fork Buttermilk Bridge, are not Bridge not on 2019 inspection schedule, therefore storm inspection and response treatments are required to monitor for scour and debris buildup. Further treatments such as debris clearing may be required if monitoring indicates that is necessary.

Road Users (Life and Safety) on Maintenanace Level 3 Roads and Bridges: Road users could be impacted by flooding, debris flows and rockfall within the burned area. Unsafe road conditions and/or loss of ingress or egress could also potentially cause impacts to life or safety. Based on a high risk rating, a temporary closure is proposed on FSR 100 to protect public safety. Warning signs are are proposed to lower the risk for users of other roads within the burned area (listed above).

Trails: (Property): There are approximately 71 miles of trail within the Crescent Fire on the Methow Valley Ranger District. Of those miles, 2 were in high severity burns, 30 miles of moderate severity burn, and 39 miles of low severity or unburned conditions. There are approximately 32 miles of trails that will likely be impacted by erosion, flooding or debris flows. Impacts include deposition of eroded materials on the trail, erosion of the trail and/or impacts to trail drainage features and function. BAER team members conducted “on the ground” surveys for first 0.5 miles of War Creek trail, Oval/Eagle Creek trail, Scatter trail, and Twisp Pass trail. Multiple burned snags and stump holes exist and War Creek trail itself is a high risk of flooding and failure. The ground based surveys found that soil burn severity levels and relative steepness were reasonable predictors of erosion potential. Fire burn severity is used to determine trail stabilization treatments, described later in this report.

Trail Users (Life and Safety): As described above, trails and trail users could be impacted by flooding, debris flows and rockfall within the burned area. Based on a high risk rating, a temporary closure is proposed for the War Creek Trail to protect public safety. Warning signs are are proposed to lower the risk for users of other trails within the burned area (listed above). A trail bridge over the Eagle Creek Fire was partially burned and needs to be assessed before the trail is opened for public use.

Trails Summary Table

TRAIL NAME	TRAIL #	MILES IN MOD OR HIGH SBS
CRESCENT MINE	422	0.7
DUFFY LAKE	410.3	0.3
EAGLE CREEK	410	1.0
LOUIS LAKE	428	0.3
NORTH CREEK	413	1.4
OVAL CREEK	410A	1.3
OVAL PEAK	436	2.9
REYNOLDS CREEK	402	3.7
SCATTER CREEK	427	2.4
SOUTH CREEK	401	1.2
SOUTH FORK WAR CREEK	409	1.5
SPLAWN	435	1.4
TONI BASIN	408B	0.8
TWISP PASS	432	0.9
TWISP RIVER	440	2.0
WAR CREEK	408	4.0
WAR CREEK RIDGE	439	3.0
WEST FORK BUTTERMILK	411	0.2
WILLIAMS CREEK	407	3.0
Grand Total		32.1

Developed Campgrounds and Dispersed Campsites (Life and Safety): Based on high risk ratings, temporary closures are proposed for 2 campsites at the the Roads End campground and Horse Camp (along the main stem of the Twisp River) to protect public safety. Warning signs are proposed to lower the risk for users of dispersed campsites near the Gilbert Ghost Town adjacent to North Creek. A comprehensive inventory of dispersed campsites throughtout the burned area was not conducted.

Private Property: Privately owned land and structures exist adjacent to the burned area and downstream from the Scaffold Camp Creek and Buttermilk Creek watersheds. Detailed ground based inventory of these areas was not conducted by BAER personnel. Ongoing coordination and information sharing with the personnel from the county, NRCS, NWS and DNR is being conducted to address concerns for potential threats to private property and/or life/safety in these areas.

Natural Resources

Soil Productivity and Hydrologic Function: Loss of ash cap and surface soil through erosion and debris flows is very likely to occur on steep burned slopes throughout the burned area. Loss of ash cap soils and other surface soils is not recoverable but effects to soil hydrologic function likely to be short term as fire induced water repellency recovers naturally. No erosion control treatments (mulching, seeding, etc) are recommended to manage increased risk for soil erosion but roads and trail treatments will reduce overall sedimenation of stream channels with and downstream from the burned area.

Critical Habitat for Upper Columbia ESU Endangered Spring Chinook and Threatened Steelhead and Bull Trout: Soil erosion and debris flows are likely to cause loss of critical habitat due to excessive sedimentation and increased turbidity. The impacts on population size and habitat quality are moderate while the impacts on spawning habitat are high. No erosion control treatments (mulching, seeding, etc) are

recommended to manage these impacts but roads and trail treatments will reduce overall sedimenation of stream channels with and downstream from the burned area.

Native Plant and R6 Sensitive Plant Communities: Invasive plant spread and establishment is very likely to occur following the fire. Suppression activities such as construction of dozer lines, staging areas exacerbate this threat significantly. Within the burned area, there are 30 acres (13 miles) of dozer line, staging areas and roads used as contingency lines on which significant ground disturbance (blading) has occurred. The probablity that noxious weeds could become established or spread in these areas is high to very high. EDRR treatments are recommended to manage establishment and/or spread of noxious weeds in these areas. These areas are described in the Botany/Invasive Plants Specialist Report and outlined on the treatments map, below.

Cultural-Heritage Resources:

There are 10 previously recorded cultural resource sites potentially affected by the Crescent Mountain Fire. Of these sites 1 is eligible for the NRHP, 4 are not eliblible and 5 are unevaluated. As outlined in the Cultural Resources Report, risk ratings for post fire impacts on the eligible and unevaluated sites are are low and no treatments are recommended. The risk for potential data loss in the Twisp Pass area due to post fire erosion and/or looting is high. Emergency data collection was proposed to address this risk but it is outside the scope of BAER. Other BAER treatments were not considered feasible or practical to address potential data loss in the Twisp Pass area.

Cultural resources could potentially be impacted by proposed road and trail treatments. The Forest Archaeologist will be notified of proposed mitigation treatments and will conduct field review, documentation and consultation with the THPOs and the SHPO if/where needed.

Emergency Determination/Value Assessment:

The table below is Exhibit 02 from FSM 2523.1. This matrix was used to evaluate the risk level for each value identified during this BAER assessment. See FSM 2523.1 for additional information.

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**

The embedded table on the following six pages is a summary of the values within and adjacent to the Crescent Mountain fire area, the threats to those values, the probability of damage or loss, magnitude of consequences and the resulting level of risk. In summary, the burned area includes a road and trail network, trailhead parking areas, campgrounds, critical habitat for ESA-listed bull trout and chinook salmon and steelhead habitat, as well sensitive plant communities and heritage/cultural resources.

Summary Table of Critical Values

Life/ Property/ Resources	Critical Value	Threat to Value	Probability of Damage or Loss	Magnitude of Consequence	Risk	Treatment	Notes
HLS (Road Users)	Roads intersecting fire boundary.	Potential of snags, felling of trees, or other unforeseen timing of hazards	**Likely:** Roads within moderate/high burn severity	**Major:** concern for safety including potential travel delays	Very High	8 Warning Signs	Signs will be placed at road and fire boundary intersections.
HLS (Trails)	War Creek Trail	Threat to life/safety of trail users from flooding, debris flows or unsafe trail conditions	**Possible**: Trail alignment in valley bottom	**Major:** Potential impacts on HLS are considered major	High	Temporary Closure	
HLS (Campgrounds)	Roads End and Horse Camp Campgrounds	Flooding	**Possible**: flooding risk is associated with the main stem of the Twisp River	**Major**: Potential impact on HLS	High	Closure	
HLS (Campgrounds)	Twisp River Trail-bridge over Eagle Creek	Bridge was burned in fire. Unsafe to use.	**Possible:**	**Major:** Potential impact on HLS	High	Bridge should remain closed until repaired or replaced	
HLS (Trails)	All NFS trails except War Creek Trail Summarized in Trail Summary Table (above)	Threat to life/safety of trail users from flooding, debris flows or unsafe trail conditions	**Unlikely:**	**Major**: Potential impacts on HLS are considered major	Intermediate	Warning Signs	
Property (Roads)	FSR 4440 road prism (ML3, 3.901 miles in or below high/moderate burn area)	elevated runoff and dry ravel from moderate-high SBS burned hillslopes	**Very Likely:** increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Storm Proof (3.721 miles) and Construct 5 Dips & 4 Armored Dips	Sole access to multiple trailheads (Twisp, Copper, Gilbert) and campgrounds (Roads End, Gilbert)
Property (Roads)	FSR 4430 road prism (ML3, 3.017 miles in or below high/moderate burn area)	elevated runoff and dry ravel from moderate-high SBS burned hillslopes	**Very Likely**: increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Storm Proof (2.957 miles) and Construct 5 Armored Dips	Primary access to Williams and War Creek trailheads. Post burn predicted flow is extremely high (see Hydro report).

Life/ Property/ Resources	Critical Value	Threat to Value	Probability of Damage or Loss	Magnitude of Consequence	Risk	Treatment	Notes
Property (Roads)	FSR 4435 road prism (ML3, 3.509 miles in or below high/moderate burn area)	elevated runoff and dry ravel from moderate-high SBS burned hillslopes	**Likely:** increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Storm Proof (3.409 miles) and Construct 5 Armored Dips, Sediment Wedge Fill removal from bottomless arch inlet (50 CY)	Primary access to Twisp River Horse Camp and three trailheads. Post burn predicted flow is extremely high (see Hydro report).
Property (Roads)	FSR 4420 road prism (ML3, 1.702 miles in or below high/moderate burn area)	elevated runoff and dry ravel from moderate-high SBS burned hillslopes	**Very Likely**: increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Storm Proof (1.682 miles), Construct 2 Armored dips, Remove Log jam at Outlet Eagle Creek Crossing	Access to Oval/Eagle Trailhead with multiple trails.
Property (Roads)	FSR 4440465 road prism (ML 3, 0.572 miles in moderate burn area)	elevated runoff and dry ravel from moderate-high SBS burned hillslopes	**Very Likely**: increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Storm Proof (0.572 miles)	Primary access to road Ends CG and two Trailhead.
Property (Roads)	FSR 4435015 road prism (ML 3, 0.384 miles in moderate burn area)	Elevated runoff and dry ravel from moderate SBS burned hillslopes	**Likely**: increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Storm Proof (0.384 miles)	Access to Reynolds Trailhead
Property (Bridge)	Reynolds Creek CRAB	Potential scour in high flows and potential impact damage from mobilized debris.	**Very Likely**: increased flow and associated debris	**Major:** Loss of bridge investment	Very High	Monitor and Remove 50 CY of Sediment edge at inlet	Bridge not on 2019 inspection schedule, therefore inspection is required to monitor for scour and debris buildup. Further treatment may be required if monitoring warrants additional countermeasures

Life/ Property/ Resources	Critical Value	Threat to Value	Probability of Damage or Loss	Magnitude of Consequence	Risk	Treatment	Notes
Property (Roads)	FSR 4430100 road prism (ML 3, 1.60 miles in moderate burn area)	elevated runoff and dry ravel from moderate SBS burned hillslopes	**Very Likely**: increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Construct 2 Armored Dips (property protection) and gate road for closure per Soils Specialists recommendations (HLS)	Access to War Creek Trailhead with multiple trails.
Property (Roads)	FSR 4420080 road prism (ML 3, 0.971 miles in moderate burn area)	elevated runoff and dry ravel from moderate SBS burned hillslopes	**Likely**: increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Very High	Storm Proof (0.971 miles)	Access to Oval/Eagle Trailhead with multiple trails.
Property (Roads)	FSR 4435080 road prism (ML 3, 0.514 miles below moderate burn area)	Elevated runoff and dry ravel from moderate SBS burned hillslopes	**Possible:** increased flow and associated debris	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	High	No Treatment	Access to Twisp River Horse Camp
Property (Roads)	FSR 4440460 road prism (ML 2, 0.4 miles in moderate burn area)	elevated runoff and dry ravel from moderate SBS burned hillslopes	**Likely**: increased flow and large woody debris in draws and culverts could erode roadway at point of flow	**Moderate:** Loss of road prism and increased sedimentation into Mad River drainage that affects fish critical habitat	High	No Treatment	Access the town of Gilbert historical site.
Property (Roads)	FSR 4430220 road prism (ML 3, 0.2 miles in moderate burn area)	Elevated runoff and dry ravel from moderate SBS burned hillslopes	**Possible**: increased flow and large woody debris in draws and culverts will overtop roadway	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	High	No Treatment	Access to Williams Trailhead

Life/ Property/ Resources	Critical Value	Threat to Value	Probability of Damage or Loss	Magnitude of Consequence	Risk	Treatment	Notes
Property (Roads)	FSR 4440395 road prism (ML3, 0.2 miles in or below high/moderate burn area)	Elevated runoff and dry ravel from moderate-high SBS burned hillslopes	**Possible**: increased flow and large woody debris in draws and culverts will overtop roadway	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	High	No Treatment	No Treatment
Property (Bridge)	Mystery Camp Bridge	Potential scour in high flows and potential impact damage from mobilized debris.	**Possible**: increased flow and associated debris	**Major:** Loss of bridge investment	High	Monitor during storm inspection and response	Bridge not on 2019 inspection schedule, therefore inspection is required to monitor for scour and debris buildup. Further treatment may be required if monitoring warrants additional countermeasures
Property (Bridge)	War Creek Bridge	Potential scour in high flows and potential impact damage from mobilized debris.	**Possible**: increased flow and associated debris	**Major:** Loss of bridge investment	High	Monitor during storm inspection and response	Bridge not on 2019 inspection schedule, therefore inspection is required to monitor for scour and debris buildup. Further treatment may be required if monitoring warrants additional countermeasures
Property (Bridge)	East Fork Buttermilk Bridge	Potential scour in high flows and potential impact damage from mobilized debris.	**Possible**: increased flow and associated debris	**Major:** Loss of bridge investment	High	Monitor as part of regular program of work	Bridge due to be inspected in 2019 as regular program of work. Inspection is required to monitor for scour and debris buildup. Further treatment may be required if monitoring warrants additional countermeasures
Property (Bridge)	West Fork Buttermilk CRAB	Potential scour in high flows and potential impact damage from mobilized debris.	**Possible**: increased flow and associated debris	**Major:** Loss of bridge investment	High	Monitor during storm inspection and response	Bridge not on 2019 inspection schedule, therefore inspection is required to monitor for scour and debris buildup. Further treatment may be required if monitoring warrants additional countermeasures
Property (Bridge)	War Creek Bridge Camp	Potential scour in high flows and potential impact damage from mobilized debris.	**Possible**: increased flow and associated debris	**Major:** Loss of bridge investment	High	Monitor during storm inspection and response	Bridge not on 2019 inspection schedule, therefore inspection is required to monitor for scour and debris buildup. Further treatment may be required if monitoring warrants additional countermeasures

Life/ Property/ Resources	Critical Value	Threat to Value	Probability of Damage or Loss	Magnitude of Consequence	Risk	Treatment	Notes
Property (Roads)	ML 3 Roads not surveyed, Further assessment required.	Potential scour in high flows	**Likely**: increased flow and large woody debris in draws and culverts will overtop roadway	**Major:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	High	No treatments identified	Roads were not assessed due to various reasons such as fire suppression activity, blow down and time constraints. Further evaluation necessary.
Property (Trails)	NFS Trails. Sections of 19 trails, 32 miles total. Summarized in Trail Summary Table (above)	Potential erosion of trail and/or deposition of eroded material on trail	**Likely**: Moderate and High Soil Burn Severity	**Moderate:** Loss of trail tread	High	Trail storm proofing	
Property (Roads)	ML 2 Roads not surveyed, Further assessment required.	Potential scour in high flows	**Likely**: increased flow and large woody debris in draws and culverts will overtop roadway	**Moderate:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Intermediate	No treatment	Roads were not assessed due to various reasons such as fire suppression activity, blow down and time constraints. Further evaluation necessary.
Property (Roads)	ML 1 Roads not surveyed, Further assessment required.	Potential scour in high flows	**Possible:** Roads with minimal burn severity.	**Minor:** Loss of road prism and increased sedimentation into Twisp River drainage that affects fish critical habitat	Low	No treatment	Roads were not assessed due to various reasons such as fire suppression activity, blow down and time constraints. Further evaluation necessary.
Natural Resources	Native Plant Communities	Invasive plant spread and establishment.	**Very Likely:**	**Major:**	High to Very High	30 acres (13 miles) of dozer line, staging areas and roads used as contingency lines on which significant ground disturbance (blading) has occurred.	

Life/ Property/ Resources	Critical Value	Threat to Value	Probability of Damage or Loss	Magnitude of Consequence	Risk	Treatment	Notes
Natural Resources	Soil productivity and hydrologic function	Loss of ash cap and surface soil through erosion and debris flows, decreased infiltration, damming and sedimentation of waterways	**Very Likely**: steep slopes, highly erodible soils, loss of canopy and ground cover	**Moderate:** loss of ash cap is not recoverable, short-term recoverable effects to hydrologic function	Very High	No treatment recommended--no cost-effective treatment available	
Natural Resources	Critical habitat for upper Columbia ESU endangered spring chinook and threatened steelhead and threatened bull trout	Loss of critical habitat due to excess sedimentation and debris flow, increased turbidity, and duration and magnitude of sediment load	**Likely:** increased flow and highly erodible soils and steep slopes	**Moderate:** genetics, population size and poor habitat quality, spawning habitat	High	Treat roads and trails to minimize post-fire erosion and sedimentation of aquatic habitat where multiple values benefit from such treatment	
Heritage Resources	Twisp Pass cultural resource areas	Loss of cultural resource scientific data due to increased looting and erosion	**Very Likely:** increased ground visibility and highly erodible soils and steep slopes	**Very High:** loss of scientific data	High	No treatment recommended	Emergency data recovery recommended – Outside scope of BAER. Update forest Archeologist.
Heritage Resources	FS02209, the Eagle Creek Trail (Eligible)	Increased erosion and sedimentation from burned slopes, channelized water from upslope	**Unlikely** - This resource receives regular maintenance under Forest Program of Work.	**Minor** - would not impact qualifications for National Register of Historic Places	Very Low	No treatment recommended except for proposed trail storm proofing.	

B. Emergency Treatment Objectives:

The objectives of the emergency treatments proposed in this document are to manage identified unacceptable risks from "imminent post-wildfire threats to human life and safety, property, and critical natural resources on National Forest System lands" (FSM 2523.02). The timely application of the proposed treatments is expected to substantially reduce the probability of damage to the BAER critical values identified in the section A, above. Recommended emergency treatment objectives include the following:

Land Treatments

1. Foster the recovery of native plant communities, including sensitive species, in the burned area by minimizing the proliferation of noxious weed populations

Channel Treatments

1. No channel treatments proposed

Road and Trail Treatments

1. Reduce risk of road and trail infrastructure damage from elevated post-fire hillslope runoff and flood flows
2. Reduce erosion and transport of fine sediment into area streams, and thus reduce impacts of road and trail network to water quality and aquatic habitat for ESA-listed species.

Protection and Safety Treatments

1. Protect human life and safety of forest visitors through raising awareness of the risks present in a post-fire forested mountain setting by installing informational and warning signs at trail and road portals in and adacent to the burned area.
2. Protect human life and safety from post-fire hazards at selected trails and campgrounds through closure treatments

Monitoring and Coordination

1. Facilitate partner agency efforts to install temporary systems on NFS land to provide early warning for precipitation and runoff events that could threaten off-NFS values.
2. Monitor the effectiveness of road and trail treatments and facilitate any needed maintenance of treatments during the first year following the fire.

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

Land 95 % Channel -- % Roads/Trails 75 % Protection/Safety 90 %

D. Probability of Treatment Success

	Years after Treatment		
	1	3	5
Land	80	75	70
Channel	NA	NA	NA
Roads/Trails	70	80	90
Protection/Safety	85	90	95

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

VARTool Model Outputs

	Treatment Cost	Expected Benefit of Treatment
Roads Treatments	$125,650	$1,130,220
Trails Treatments	$33,000	$122,500

G. Skills Represented on Burned-Area Survey Team:

- Soils: Justin Urresti, Mary Young, Ryan Schmitt (T)
- Hydrology: Jamie Krezelok, Tom Matthews
- Engineering. Lori McAllister, Ken Bigelow, Brett Yaw (T), Fredrick (Shaun) Oliver (T)
- Archeology: Jennifer Ryan
- Recreation: Methow Trail Staff
- Fisheries: Gene Shull
- Botany, Weeds: Kelly Baraibar, Lowell McFetridge
- GIS: Tim Downing
- PIO/Liason: Carly Reed

Team Leaders: Eric Schroder, Luke Cerise

Email: eschroder@fs.fed.us (303 541 2538), lukemcerise@fs,fed.us (509) 486-5108

H. **Treatment Narrative:**

(Describe the emergency treatments, where and how they will be applied, and what they are intended to do. This information helps to determine qualifying treatments for the appropriate funding authorities. For seeding treatments, include species, application rates and species selection rationale.)

See Appendix A for Treatment Map

Land Treatments

Noxious Invasive Weed Early Detection Rapid Response (EDRR) – Early detection and treatment of invasive plants is critical to prevent them from becoming established in fire-affected areas. Treatment is most effective when infestations are small and isolated. Timing of treatments is important in order to address the weeds before they can produce seed and proliferate. EDRR is covered under the Okanogan-Wenatchee Forest-wide Site-specific Invasive Plant Management FEIS and ROD (2016) with a range of treatment options including use of nine herbicides. Proposed treatments fall under two categories: Noxious weed mitigation of dozer lines that passed through noxious weed-infested areas on private land and into uninfested national forest system and land protection of sensitive native plant communities.

Following the 2018 update of national weed treatment guidance, BAER is the preferred mechanism to treat suppression-related potential spread of invasive weeds along equipment-installed fire line where equipment is known to have passed through weed-infested areas and into uninfested areas, in the first year following the fire. Dozer lines below 4000' elevation and roads and trails through the burned areas were judged to be at greatest risk for spreading whitetop, dalmation toadflax, difuse knapweed, sulphur cinquefoil and other aggressive invasive weeds. EDRR in these settings in the first year following the fire should enable OWNF personnel to minimize the spread of these weeds onto previously undisturbed Forest lands.

Item	Unit	Unit Cost	# Units	Total
EDRR - Suppression	Lump Sum	$6,835	1	$6,865
EDRR	Lump Sum	$3,635	1	$3,635
	Total Land Treatment Cost			**$10,500**

Channel Treatments

No channel treatments are prescribed.

Roads Treatments

Within the fire perimeter, there are approxiately 51 miles of Forest Service system roads. Approximately 22 miles of road are located on or below moderate and high soil burn severity areas, and were determined to be at elevated levels of risk of damage in the post-fire environment. Road treatments are designed to improve drainage in order to remove higher levels of runoff from roads before extensive damage or loss of infrastructure can occur.

Roads proposed for treatment are vital for public and administrative access in addition to resource protection. Efforts were made to prescribe the least-cost alternative to accomplish the desired mitigation. Treatments were prescribed on 14 out of the 50 miles of maintenance level 3 roads. Treatments to protect property and natural resources include:

- Improving existing drainage features that are not adequate for the projected flow increases
- Armored rolling dip/rolling dip to minimize damage to the road surface and divert water off the road
- Logjam removal/relocation at Eagle Creek
- Removal of sediment deposit at Reynolds Creek
- Bridge and culvert inspection
- Temporary road closure at War Creek accomplished by means of gates and signing

Treatment Item	Estimated Quantity	Unit	Unit Price	Cost
Stormproofing	13.7	Mile	$ 3,200.00	$ 43840
Armored Dip	18	Each	$ 3,600.00	$ 64,800
Rolling Dip	5	Each	$ 1,650	$ 8250
Sediment Wedge Removal	1	Lump Sum	$ 2,760.00	$ 2,760
Removal or Relocation of Logjam	1	Days	$ 1,000.00	$ 1,000
Storm Inspection and Response	5	Each	$ 1,000.00	$ 5,000
				$ 125650*

***Estimated costs shown here, actual costs are adjusted in Part VI to show low bid costs requested in Interim 1**

Trail Treatments

There is approximately 71 miles of system trail within the Crescent Mountain Fire. Two miles are within high soil burn severity and 30 are within moderate soil burn severity areas.

Many of the trails in the burned area are at high to very high risk due to the burning of stabilizing brush, roots and logs. Current trail drainage features are not adequate to address the anticipated increased runoff. Treatments are needed to provide sustainability of the trails and to prevent off-site impacts, should the trails erode or fail.

Trail Stabilization: Features will be constructed to standard as defined by USFS Trails Handbook 2309.18. Installation should be designed to last no more than three years. Permanent structures are not part of this treatment. Hazard tree mitigation is requested to address imminent safety risks for work crews installing trail drainage structures. Drainage feature installation will will be implemented on trail segments passing through and/or immediately below areas of moderate or high soil burn severity. The focus will be on sections of trail that have continuous gradient for a length of greater than roughly 50 feet (depending on trail gradient) and are either insloped (cupped) or show evidence of routing water (rills, gullies). Hazards within or along the trail route that restrict efficient and safe access to work sites will be mitigated (rocks, trees). This treatment is designed to stabilize trails for anticipated increases in runoff. The stabilization methods may vary by site but are designed to reduce trail erosion or damage.

Treatment prescriptions for trail drainage maintenance include:

- Clean existing drainage features
- Installation of rolling grade dips and non-structure water bars
- Berm removal, bank stabilization and the installation of non-structure stream crossing

Hazard Warning Signs: Working, traveling, and recreating in burned areas poses an elevated risk to Human Life and Safety. The purpose of this treatment is to acknowledge and alert forest employees and visitors to the existing threats associated with traveling trails within and downstream of burned areas.

"Entering Burned Area" signs are needed to alert the public to possible threats to life and safety. These signs should contain language addressing risks that warrant heightened awareness such as falling trees, rolling rocks, and flash floods. These warning signs should be posted in key locations to alert travelers to upcoming dangers such as falling rocks, "Flood Risk – No Parking or Standing", etc. The OWNF has existing templates for these signs. Specifications and cost information are described in the engineering and recreation reports.

Item	Unit	Unit Cost	# of Units	Cost
Installation of Drainage Features	each	$50	660	$33,000
	Total Trail Treatment Cost			**$33,000**

Protection and Safety Treatments

Road Users (Life and Safety) on Maintenanace Level 3 Roads and Bridges: Road users could be impacted by flooding, debris flows and rockfall within the burned area. Unsafe road conditions and/or loss of ingress or egress could also potentially cause impacts to life or safety. Based on a high risk rating, a temporary closure is proposed on FSR 100 to protect public safety. Warning signs are are proposed to lower the risk for users of other roads within the burned area (listed above in the critical values/threats section of this report).

Trail Users (Life and Safety): As described above, trails and trail users could be impacted by flooding, debris flows and rockfall within the burned area. Based on a high risk rating, a temporary closure is proposed for the War Creek Trail to protect public safety. Warning signs are are proposed to lower the risk for users of other trails within the burned area (listed above in the critical values/threats section of this report). A trail bridge over the Eagle Creek Fire was partially burned and needs to be assessed before the trail is opened for public use.

Developed Campgrounds and Dispersed Campsites (Life and Safety): Based on high risk ratings, temporary closures are proposed for 2 campsites at the the Roads End campground and Horse Camp (along the main stem of the Twisp River) to protect public safety. Warning signs are proposed to lower the risk for users of dispersed campsites near the Gilbert Ghost Town adjacent to North Creek. A comprehensive inventory of dispersed campsites throughtout the burned area was not conducted.

Private Property: Privately owned land and structures exist adjacent to the burned area and downstream from the Scaffold Camp Creek and Buttermilk Creek watersheds. Detailed ground based inventory of these areas was not conducted by BAER personnel. Ongoing coordination and information sharing with the personnel from the county, NRCS, NWS and DNR is being conducted to address concerns for potential threats to private property and/or life/safety in these areas.

Road warning and closure signs	each	$ 750.00	14	$10,500
Gate (closure)	each	$ 8,000.00	1	$8,000
Trail warning signs	each	$ 30.00	30	$900
Trailhead and CG - hazard trees	site	$ 650.00	4	$2,600
Subtotal Protection/Safety				**$22,000**

Monitoring Narrative:

(Describe the monitoring needs, what treatments will be monitored, how they will be monitored, and when monitoring will occur. A detailed monitoring plan must be submitted as a separate document to the Regional BAER coordinator.)

Field monitoring to determine the effectiveness of the protection and safety treatments and trail storm proofing treatments is recommended. Post storm monitoring trips to collect information on treatment effectiveness and watershed responses would be used to adjust warning or closure treatments as needed to protect the safety of forest personnel and the public. The effectiveness of the protection and safety treatments is highly dependent on monitoring and adaptive management. Funding not requested at this time. The Forest may pursue the development of Forest-lwide BAER monitoring plan.

Part VI – Emergency Stabilization Treatments and Source of Funds Interim # 1

			NFS Lands				Other Lands				All
		Unit	# of		Other	# of	Fed	# of	Non Fed	Total
Line Items	**Units**	**Cost**	**Units**	**BAER $**	**$**	**units**	**$**	**Units**	**$**	**$**
A. Land Treatments										
EDRR - Suppr.	Lump Sum	$6,835	1	$6,865						$6,865
EDRR	Lump Sum	$3,635	1	$3,635						$3,635
Subtotal Land Treatments				$10,500	$0					$10,500
B. Channel Treatments										
Subtotal Channel Treat.				$0	$0					
C. Road and Trails										
Stormproofing	mile	$ 3,200.00	13.7	$43,840	$0		$0		$0	$43,840
Armored Dip	each		18	$0	$0		$0		$0	$0
Adjusted Armored Dip	each	$ 2,900.00	18	$52,200						
Rolling Dip	each		5	$0	$0		$0		$0	$0
Adjusted Rolling Dip	each	$ 3,500.00	5	$17,500						
Sediment Wedge Removal	lump sum		1	$0			$0		$0	$0
Adjusted Sediment Wedge Removal	lump sum	$ 6,500.00	1	$6,500						
Removal or Relocation of Logjam	days		1	$0			$0		$0	$0
Adjusted Logjam removal	each	$ 9,200.00	1	$9,200						
Adjusted mobilization contract	each	$ 8,500.00	1	$8,500						
Storm Inspection and Response	each	$ 1,000.00	5	$5,000			$0		$0	$5,000
Trail drainage improvement	structure	$ 50.00	660	$33,000	$0		$0		$0	$33,000
Subtotal Road & Trails				$175,740	$0		$0		$0	$81,840
D. Protection/Safety										
Road warning signs	each	$ 750.00	14	$10,500	$0		$0		$0	$10,500
gate	each	$ 8,000.00	1	$8,000						$8,000
Trail warning signs	each	$ 30.00	30	$900	$0		$0		$0	$900
TH and CG hazard trees	site	$ 650.00	4	$2,600	$0		$0		$0	$2,600
Subtotal Protection_Safety				$22,000	$0		$0		$0	$22,000
E. BAER Evaluation										
assessment costs				$50,800			$0		$0	$50,800
trainee costs							$0		$0	$0
Subtotal Evaluation							$0		$0	$0
F. Monitoring										
										$0
Subtotal Monitoring				$0	$0		$0		$0	$0
G. Totals				**$208,240**	$0		**$0**		**$0**	**$165,140**
Previously approved				$191,150						
Total for this request				**$17,090**						

PART VII - APPROVALS

1. _____ 2/8/2019
Forest Supervisor (signature) Date

2. _____ 3/6/2019
Regional Forester (signature) Date

Appendix A: Crescent Mountain BAER Treatment Map