DRAFT SPRING CREEK BURNED AREA REPORT

(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

Interim 1

The Spring Creek Fire of 2018 looking towards Sangre de Cristo drainage.

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 (Best estimate of funds needed to complete eligible stabilization measures)

[x] 2. Interim Report # Items are in Green Font
[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)

The US Forest Service Burned Area Emergency Response (BAER) team's purpose is to assess the threats to life, property, and cultural and natural resources from fire induced changes to the watershed that can cause erosion, sedimentation, rockfall, flooding, and debris flows. The BAER team has analyzed the entire Spring Creek Fire for post-fire conditions and this predictive assessment of changed soil conditions is shared with all entities affected by the fire. This report is a synopsis of BAER findings and the Forest Service's internal request for implementation funding to treat values at risk **on Forest Service lands only**. It includes a summary of the technical reports generated by the BAER team and potential pre-rain mitigations for values managed by the Forest Service. Complete technical reports will be made available through the Costilla and Huerfano Offices of Emergency Management. Information generated by the BAER team is crucial for further analysis by other agencies affected by the fire to examine their values at risk occurring off-Forest. Pre-rain mitigation treatments on non-Forest lands are the responsibility of the managers/owners of those values, but the Forest Service will cooperate with other agencies to implement treatments if they must occur on lands managed by the Forest Service.

Forest Service lands that burned are very steep and remote with many values at risk both on FS land and immediately downstream such as the La Veta, Walsenburg, and Forbes Ranch subdivisions, drinking water for the town of La Veta and Walsenburg, storage capacity of Daigre and Wahatoya Reservoirs, the road leading to FS trailheads, hiking trails, native plants, fish, wildlife, and numerous cultural resources. Work to prepare these values at risk on Forest represents a small portion of the implementation work that will need to be done on the lands surrounding the National Forest; that is being addressed by the BLM and NRCS teams. Natural Resource Conservation Service, Bureau of Land Management along with many land owners who will use the information that the **Interagency BAER Team** generates across the total burn area to focus their work. Reports from these agencies will be posted when they are completed.

During the second week of July of 2018 the BAER team initiated a cooperative effort with the BLM and NRCS Watershed Emergency Response Teams and other agencies to facilitate and participate in an assessment of all values at risk. The Spring Creek Fire started in Forbes Park June 27 and by July 16th had burned 108,046 acres with 9,837 acres on the San Isabel National Forest in the Culebra Ranges on the San Carlos Ranger District, 12,266 acres Burau of Land Management public lands on the Royal Gorge Field Office, 3,867 acres of state land and 82,076 acres of private land. Downburst winds from a thunderstorm quickly moved the fire to the east into Ponderosa Pine and mixed conifer stands. The mixed conifer stands had a large component of white fir impacted by decades' long spruce budworm infestations, resulting in a heavy dead and down surface fuels which allowed the fire to transition into the crowns and promoting long range spotting. The San Isabel Forest Service BAER coordinator and BAER team liaison established a watershed assessment group of cooperating agencies to co-ordinate assessment, information transfer, and to update communities at risk.

Agencies in this group include:

- USFS/BLM/NRCS Interagency BAER team
- Department of Homeland Security Emergency Management
- Huerfano County and Costilla Office of Emergency Management
- Huerfano County and Costilla Water Resources Divisions
- Huerfano County and Costilla Office of Emergency Management
- La Veta, Walsenburg, and Ft Garland Watershed Protection
- NOAA Weather Service
- US Geological Survey
- Colorado Geological Survey

- Colorado Water Conservation
- Huerfano and Costilla County Commissioners
- Congressional Staffers

The BAER team finalized their reports for this assessment on July 25th and will share those with Costilla and Huerfano OEM offices. The BAER liaison will continue to participate in flood preparedness information sharing from the BAER assessment of flood conditions.

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Spring Creek Fire

B. Fire Number: CO-CTX-001266

C. State: CO

D. Counties: Costilla /Huerfano

E. Region: 2

F. Forest: Pike-San Isabel

G. Districts: San Carlos Management Unit

H. Fire Incident Job Code: PNLW8H

I. Date Fire Started: June 27, 2018

J. Date Fire Contained: pending

K. Suppression Cost: $20+ million

L. Fire Suppression Damages Repaired with Suppression Funds
   1. Dozerline repaired / waterbarred: 103 out of 137 miles as of 07/5/2018
   2. Hand line repaired: 8 out of 14 miles as of 07/15/2018

M. Watershed Number and Name:

TABLE 1: Soil Burn Severity by Modified 6th-Field Sub watersheds affected by the Spring Creek Fire.

HUC 6 12 digit ID	HUC 6 Watershed Name	Acres	Unburned	Low	Moderate	High	Percent of watershed Burned at Moderate and High
110200060302	Badito Cone-Huerfano River	30,318	30,247	71	0	0	0%
110200060408	Chavez Arroyo	12,622	12,079	257	239	47	2%
110200060301	Dog Springs Arroyo	30,571	24,616	2,841	2,279	835	10%
130100020502	Headwaters Sangre de Cristo Creek	35,393	33,346	1,376	458	213	2%
110200060401	Headwaters Cucharas River	20,848	19,475	569	632	172	4%
110200060404	Headwaters Middle Creek	20,107	5,776	1,779	6,563	5,989	62%

110200060403	Indian Creek	11,196	1,877	1,945	3,535	3,839	66%
110200060108	Manzanares Creek-Huerfano River	34,667	34,507	6	154	0	0%
110200060406	Middle Creek-Cucharas River	34,039	28,072	1,205	2,610	2,152	14%
110200060407	North Abeyta Creek	19,091	12,904	1,460	3,362	1,365	25%
110200060207	Oak Creek-Huerfano River	19,098	18,167	243	580	108	4%
110200060103	Pass Creek	16,688	10,611	715	3,477	1,885	32%
110200060402	South Abeyta Creek	11,708	5,890	1,272	2,687	1,859	39%
110200060206	South Oak Creek	23,278	8,964	3,927	7,188	3,199	45%
130100020501	Wagon Creek	23,942	7,335	4,578	8,337	3,692	50%
130100020503	West Indian Creek	29,537	25,092	2,284	1,887	274	7%

N. Total Acres Burned: Spring Creek Fire Assessment Area: 108,046 acres
(NFS Acres 9,837; BLM 12,266; State 3,867; Private 82,076)

O. Vegetation Types: The dominant vegetation communities within the fire perimeter include:

Vegetation has been mapped on National Forest System lands as warm mixed conifer, cool mixed conifer, lodgepole pine, aspen, bristlecone or limber pine, and Gambel oak. These types extend onto BLM and private lands on the east slope of the burn area. On the western slope are large areas of grasslands, big sagebrush, and pinyon-juniper stands.

P. Dominant Soils:

- Leadville fine sandy loam, range on average 25 to 55 percent slopes. They consist of fine sandy loam soil texture and covers about 10,271 acres within the fire perimeter.

- Goemmer cobbly clay loam, range on 20 to 50 percent slopes. They consist of Cobbly clay loamsoil texture and covers about 9,385 acres within the fire perimeter.

- Tolman-Rock outcrop complex, range on 25 to 65 percent slopes. They consist of Stony sandy loam soil texture and covers about 7,596 acres within the fire perimeter.

- Tolvar-Laveta-Rock outcrop complex, range on 9 to 65 percent slopes. They consist of moderately decomposed plant material and covers about 7, 590 acres within the fire perimeter.

Q. Geologic Types: The Spring Creek wildfire area Geologic Types: The Sangre De Cristo Mountains form a nearly continuous mountain ridge extending from the Arkansas River canyon near Salida, Colorado, on the north to Sante Fe, New Mexico, on the south. The La Veta Pass area is a historic route from the eastern plains across the mountains to the San Luis Valley. This area is part of the Southern Rocky Mountain system (Vine, J.D., 1974). The Spring Creek Fire occurred on the eastern slope of the Sangre De Cristo Mountain Range north west of the Spanish Peaks in southern Colorado.

This region is characterized by steep ridge lines and drainages. Elevations in the burned area range from about 7, 037 feet above sea level by the town of La Veta to 11,411 feet above sea level at Iron

Mountain. Bedrock within the boundaries of the Spring Creek Fire consist of three primary rocks units: The Sangre De Cristo Formation (PIPsc), The Upper Minturn Formation (IPmu), and the Cuchara Formation (Tc). All of these rock units are sedimentary ranging in age from Middle Pennsylvanian to the Lower Eocene. Intrusive igneous rocks deposited during the Tertiary age can be seen in the areas of Silver, Iron, and Rough Mountain and extending outward from the peaks in the form of dikes and sills. Surface rock units include Quaternary deposits of Alluvium and Colluvium. These unconsolidated sediments are available for transport during flood flows, and can add tremendous bulk and erosive power to moving water.

The physiography of the burned area is primarily gentle to moderate slopes (0-40%) with steeper slopes of 40+ percent surrounding the areas of Mount Mestas, Silver Mountain, Rough Mountain, Iron Mountain, Raspberry Mountain, and Kruger Mountain. Slope in-stability features such as recent pre and post fire debris slides, rock-falls and surface erosion features frequent some steep slopes in the burned area (Photo 1), while fluvial erosion processes have shaped the gentler valleys and ridges. Some areas show a great deal of slope dissection and slope instability, while other areas are relatively smooth, un-dissected and devoid of instability features. The area is underlain entirely by alternating sedimentary Sandstone and Shale rock formations, ranging in age from Cretaceous (83-65 million years ago) to Pliocene (5.3-2.5 million years ago) Epochs, and overlain by Quaternary alluvial and surficial sediments and slide deposits to present age. Invariably, rock formations mapped as sandstone have thinner inter-beds of shale, and formations mapped as shale have relatively thinner inter-beds of sandstone (Dibblee, 1966).

R. **TABLE 2: Miles of Stream Channels by Order or Class**

Type of Stream	Perennial	Intermittent	Ephemeral
Stream Miles	60	336	153

S. Transportation System:

- Roads: 294 (7.7 FS, 285 private and 1 BLM) miles
- Trails: 4.9 miles

TABLE 3: Summary of Transportation System

San Isabel NF	Length
Unauthorized Routes	0.0
Level 1 - Administrative Use	0.0
Level 2 - High Clearance Vehicle	6.9
Level 3 - Passenger Vehicles	0.8
TOTAL	**7.7**

A. Burn Severity (acres):

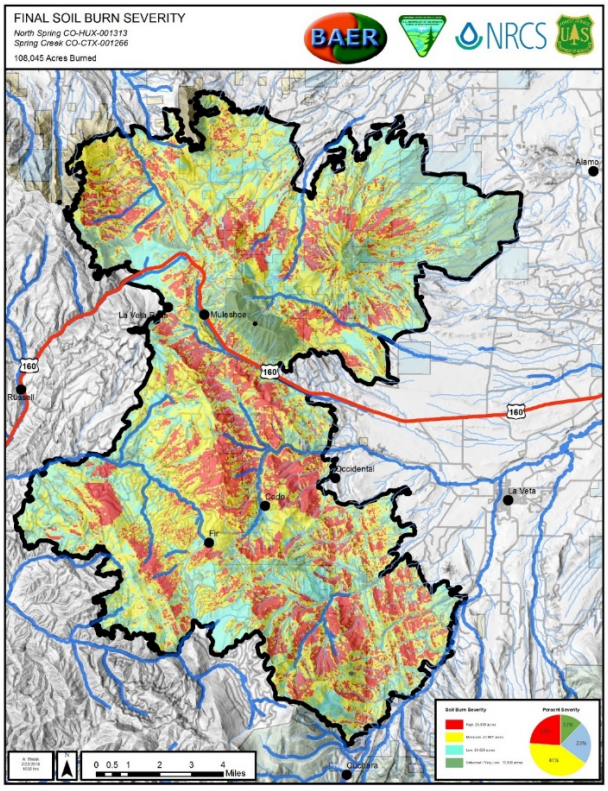
Acres: 13,693 (unb/v.low) 43,990 (low) 24,529 (moderate) 25,632 (high)

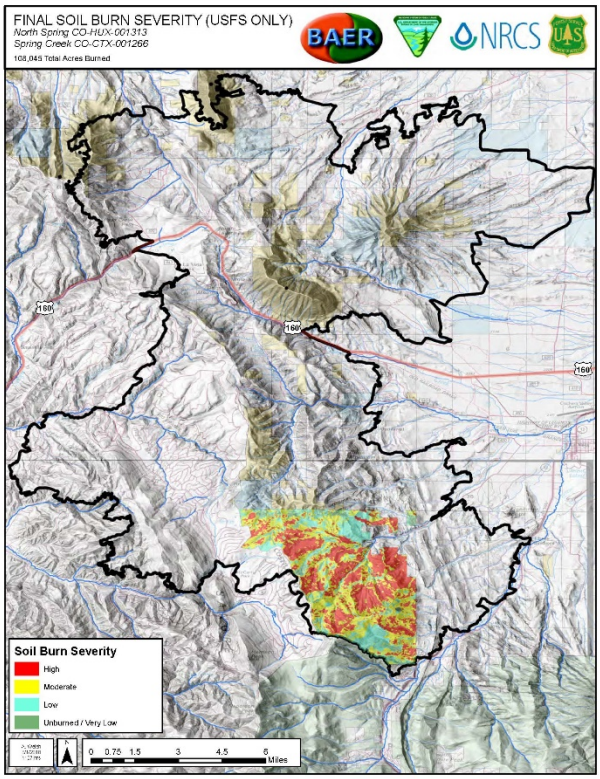
Percent: 13% (unb/v.low) 40.5% (low) 23% (moderate) 23.5% (high)

TABLE 4: Acres of Soil Burn Severity

Acres of Soil Burn Severity by Ownership					
	Unburned / Very Low	Low	Moderate	High	Grand Total
FEDERAL	3,386	8,426	3,568	6,560	21,940
STATE	754	1,575	932	671	3,932
PRIVATE	9,556	33,989	20,029	18,401	81,975
Grand Total	13,696	43,990	24,529	25,632	108,045
Percent	13%	40.5%	23%	23.5%	100%

Map 1: Soil Burn Severity (entire perimeter)





Map 1.1: Soil Burn Severity (Forest only)

Interpreting the Soil Burn Severity Map: Fire Intensity vs Soil Burn Severity

Parameters commonly used to define fire intensity or burn severity on vegetation are flame height, rate of spread, fuel loading, thermal potential, canopy consumption or tree mortality. Soil burn

severity for BAER analysis considers additional surface and below-ground factors that relate to soil hydrologic function, runoff and erosion potential, and vegetative recovery. Indicators of soil burn severity include degradation of surface structure, loss of soil organic matter, and consumption of fine roots and formation of water repellent layers. Spring Creek BAER soil scientists followed standard soil burn severity mapping methods fully described in the Field Guide for Mapping Soil Burn Severity (http://www.fs.fed.us/rm/pubs/rmrs_gtr243.pdf).

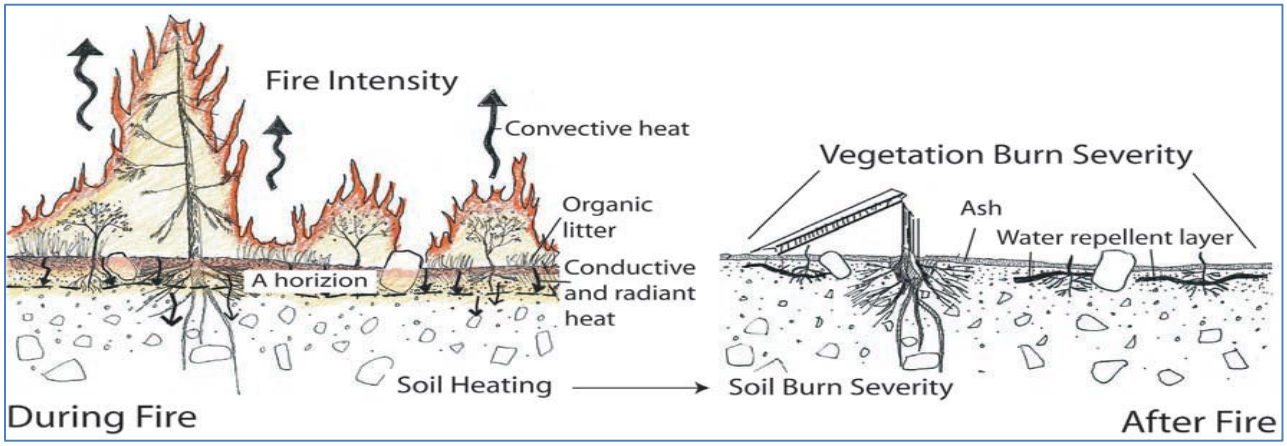


Figure 1: Effect of Fire Intensity on Above-ground Vegetation and Below-ground Soil Properties (Graphics by Mike Hankinson, National Park Service)

The Map 1: Soil Burn Severity illustrates the general soil burn severity pattern on the landscape. The soil burn severity is overwhelmingly moderate to high (65%) with the rest being low to very low soil burn severity. There is 23% low soil burn severity because of the high pre-fire ground cover, and partly because the fire was heavily wind-driven.

The following pictures (Figures 2 & 3) are companion pictures to show typical soil burn severity and landscapes with mixed mortality due to differing vegetation types, slopes, aspect, and location.

Figure 2 – Fire Soil Burn Severity Examples

		
High soil burn severity effects are degradation of surface structure, consumption of soil organic material and formation of water repellent layers	**Moderate soil burn** severity with fire effects of litter and duff removal and char and water repellency to 1 inch below the surface	**Low soil burn severity** due to minimal fire effects on this soil with a clay-loam surface texture

Figure 3 – Landscape examples for soil burn severity

High soil burn severity landscape

Moderate soil burn severity landscape

Low soil burn severity landscape

General Soil Burn Severity Patterns, Selected Influencing Factors and Recovery Interpretations (based on field observations)

Selected Factor Influencing Soil Burn Severity: Weather
Weather conditions which influenced fire behavior. For example the fire progression was extreme due to strong winds and heavy brush and flashy fuels and moved east from the Forbes Ranch subdivision over to La Veta within a few days of ignition. The fire then moved in a southerly to northwardly direction, burning over Hwy 170 north to Silver Mountain.

Selected Factor Influencing Soil Burn Severity: Terrain
Steep terrain and chimney canyons played a role in fire behavior along with wind patterns. South and southwest slopes have lower humidity, higher fuel temperatures and are more exposed to summer thunderstorm winds. These areas had more brush and flashy fuels creating rapid fire spread. With these conditions strong downdraft winds increased burn intensity.

Selected Factor Influencing Soil Burn Severity: General Vegetation, Density, and Fire History
Vegetation cover type, density and fuel loading also influenced the soil burn severity patterns especially areas that have burned in the past. Areas inland are not influenced by coastal fog and humidity experienced moderate to high burning on north-facing slopes and on south-facing slopes influenced by more flasher fuels experience low to moderate burning.

Selected Factor Influencing Soil Burn Severity: Soil Type/Surface Layer Texture
Soil type also influenced soil burn severity patterns. Fire effects on soils such as degradation of structure, changes in soil color, consumption of fine roots and depth of water repellent layers were strongly influenced by soil surface texture. In soils with clay loam surface textures, fire effects on soil were commonly minimal soil destruction and water repellency generally occurred at the surface. In soils with sandy loam and fine-gravelly loam surface textures, fire effects on soil were common

soil charring and aggregate destruction to depths of 1 inch up to 4 inches and water repellency was observed at depths of up to 4 inches.

Initial Interpretation for Recovery of Hillslope Stability: Ground Cover
Low rates of leaf litter were observed in forested areas due to full consumption of canopy but with low and moderate soil burn severity some cover was present. Thin layers of scorched needles and leaves do provide effective erosion control in these areas. In forested areas that experienced high soil burn severity or areas where shrub cover was consumed, ground cover recovery will be slow. Recovery of low lying vegetation will heavily influence recovery of hill-slope stability in these areas.

B. Soil Resource Condition Assessment Sections:

The Spring Creek Fire burned approximately 108,045 acres within Huerfano and Costilla counties, CO. The assessment includes mapping of soil burn severity (SBS) on approximately 108,045 acres of the fire, and Values at Risk (VAR) assessment and erosion modeling on Forest Service, BLM, Private, and other lands. The BAER Team found the overall soil burn severity to be 12.9% unburned & very low, 22.7% low, 40.7% moderate, and 23.7% high for the entire fire area perimeter. Severe soil heating was dominated on dense forest ecotypes and high elevation areas, presumably with pre-heating of fuels from fire progression patterns. Vegetation is predominantly a mix of oak brush, pinyon/juniper, hardwood forest ecotypes, and grasslands.

The fire area was dominated by Moderate and High SBS. Soils with High SBS within the fire is characterized by the soil surface being detrimentally altered to depths up to 5cm. Soil cover was extensively consumed. Because of recent rains, the surface of the High SBS soils were compressed and eroded. Because the surface had little cover, High SBS soils are expected to have high runoff potential. The Moderate SBS has fairly intact soil structure with presence of most fine roots, though charred in the surface 1-3 cm, and the natural seedbank should be only modestly affected boding well for natural recovery in the future. However, soil water repellency was very common within moderate and high SBS, estimated in 40-60% of these areas, and present but spotty in low soil burn severity areas. Soils with Moderate SBS retained approximately 30-50% soil cover, although charred and less effective as protection against runoff. Low SBS areas still have good surface structure, contain intact fine roots and organic matter, and should recover in the short-term once revegetation begins and the soil surface regains more cover for erosion protection.

Identified Values at Risk (VAR) upon National Forest Service (NFS) and Bureau of Land Management (BLM) lands are invariably linked to drainages with high and moderate SBS soils; identified VARs are mainly road and trail infrastructures, boundary fences, and a few archaeology sites. There are NO land treatments for conservation of soil productivity proposed on NFS and BLM lands; we do have high modeled erosion rates within the assessment areas. However, the depth of erosion is limited by dense living roots below the heat affected surface. These roots provide resistance to erosion, and although soil productivity is likely reduced as a result of the fire, these deep soils will not change site potential. No emergency was declared for soil productivity so no treatment is warranted as an emergency. Off-site hazards of erosion source areas are present and serious, possibly posing high risks to life and property; ability to manage these downstream VARS is limited by the scope of BAER treatment responsibilities.

There are effective areas that would be beneficial to incorporate ground based treatments such as mastication of burned trees to increase soil cover. Those decisions would have to be considered by those affected by downstream effects. A map of potential treatment areas are included as map E-1

Treatment Map - Spring Creek Fire in Appendix E. The GIS data is included in the project record and from the author of this report.

The area experienced storms during the assessment that produced erosion, debris flows, and minor flooding. This allowed the team to quickly identify areas at risk prior to the completion of the assessment. Erosional processes were observed that indicated that roots and water repellency is protecting all but the upper 3-4 inches. Although the amount of sediment may decrease as available sediment becomes depleted, runoff which contributes to peak flows and flooding will not be reduced until vegetation noticeably recovers in the next 3-5 years. Though soil productivity is likely to be reduced in the short term, the forest will be re-established and return soil productivity. In a very large runoff event, the roots may not protect the soil from deeper erosional features.

Post fire storm related hazards in the form of debris-flow and sediment transport/deposition have already occurred and continue to damage roads/trails, streams and other waterbodies in Indian, Pass, Middle Creek, and Abeyta Creek drainage and Silver Mountain area. Until natural revegetation, soil-cover recovery, and natural diminishment of soil water repellency occur, the risk of damaging events is not over. This risk is expected during the occurrence of severe storm events for the next several years.
Areas likely to be hardest hit by erosional processes are Indian Creek, Pass Creek, Middle Creek, Abeyta Creek, and portions of Silver Mountain.

C. Water Repellent Soils:

Hydrophobic strength was observed in approximately 65% of the observed fire area. Soils that burned with moderate and high soil burn severity on south aspect slopes resulted in near complete vegetation canopy and organic horizon removal, leaving surface rock as the only effective ground cover. The other moderate soil burn severity class occurred.

D. Erosion Potential:

Soil texture, climate, slope, rock content and burn severity dictate soil erosion hazard rating (EHR). These ratings are consistent with field observations made during the BAER soil assessment. These observations were calculated from the 2 year and 10-year storms on the burned sediment severity Erosion Risk Management Tool (ERMiT) map.

Post-fire summary erosion rates are shown in table 5. More detailed information is available and on file with the authors.

Table 5. Hillslope Sediment Production Rates by 6th field watershed.

HUC-12 Watershed (Spring Creek Fire perimeter)	Area (Acres)	2-year Runoff Event Erosion Rate (tons/acre)	10-year Runoff Event Erosion Rate (tons/acre)
Chavez Arroyo	12,622	0.094	0.662
Dog Springs Arroyo	30,572	0.290	1.609
Headwaters Sangre de Cristo Creek	53,295	0.034	0.243
Headwaters Cucharas River	50,499	0.037	0.274
Headwaters Middle Creek	20,107	1.157	6.137

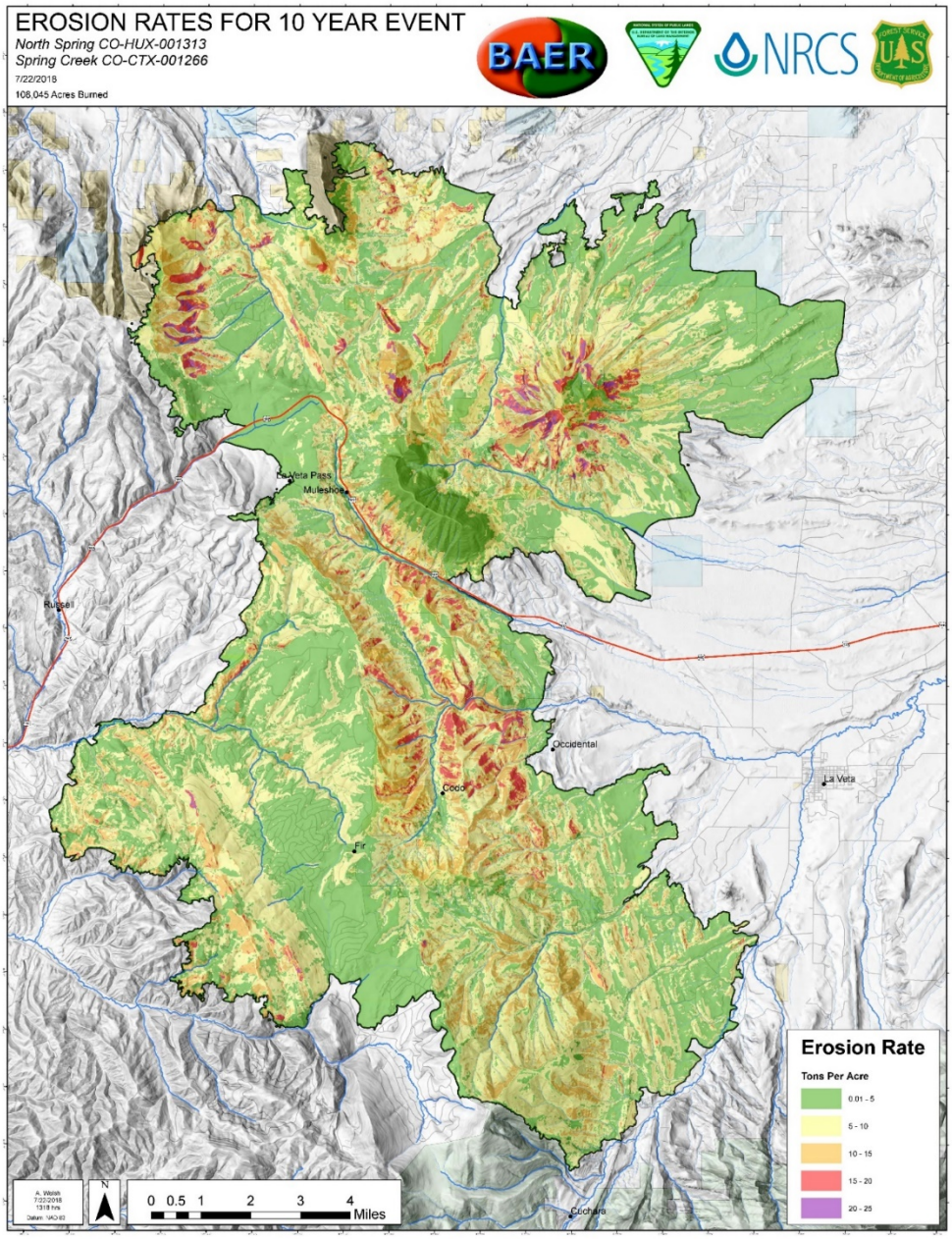
HUC-12 Watershed (Spring Creek Fire perimeter)	Area (Acres)	2-year Runoff Event Erosion Rate (tons/acre)	10-year Runoff Event Erosion Rate (tons/acre)
Indian Creek	11,196	1.462	6.061
Manzanares Creek-Huerfano River	64,784	0.010	0.148
Middle Creek-Cucharas River	44,498	0.163	1.125
North Abeyta Creek	19,092	0.634	2.611
Oak Creek-Huerfano River	19,101	0.127	0.523
Pass Creek	18,628	0.794	3.096
South Abeyta Creek	11,709	0.811	4.295
South Oak Creek	25,383	0.999	4.121
Wagon Creek	23,944	0.825	3.668
West Indian Creek	30,408	0.251	1.040
Total	**435,836**	**0.351**	**1.668**

Regardless of the accuracy of absolute numbers, the model is used here for relative ratings of different areas within the fire for relative potential as sediment source areas. The headwaters of Indian Creek and Middle Creek have the highest erosion rates, exceeding 6 tons/acre for a 10 year event. These watersheds have a large portion of the area having burned as high. It must be noted that using erosion rates for a watershed should not be used to evaluate the risk at specific areas of a watershed. For instance, Pass Creek watershed had a moderate amount of erosion but also contained the area of greatest risk to flooding and debris flows due to the severely burned steep slopes immediately above

Most watersheds have erosion rates less than 1 ton/acre for a 2-year runoff event. This rate is acceptable with respect to natural recovery versus slope treatments to stabilize soils. This, however, is the average rate for all the watersheds and include unburned areas. Locally, we observed rates much higher following the storms during the assessment. Areas where this occurs shows up (Map E-1 Treatment Map, Appendix E) on very steep slopes where stabilization treatments would not be very effective, and thus not cost effective. Treating lower gradient slopes with lower erosion rates does not reduce total sediment production effectively at watershed scale either and thus is not generally cost effective. Substantial areas in 20-60% slope gradients and high erosion rates are the most cost effective to treat and make a significant difference at watershed scale (see map below).

.

Map 2: Erosion Rates



F. Hydrology

Fire Impacts on Hydrologic Function:

Functioning of hydrologic processes is connected to vegetation (type, density, litter and organic matter accumulation) and soil types. Fire causes impacts to several hydrologic processes including reduction in interception, transpiration, and infiltration, and increases in the rate of runoff (due to lack of litter and decreased surface roughness) and soil moisture. Removal of vegetation and changes to soil such as increases in hydrophobicity, changes in soil structure, and removal of duff and organic matter alters these processes and ultimately lead to increases in runoff, peak flows and erosion. Changes in hydrologic processes can also lead to slope instability and result in post-fire debris flows, mudflows, and other mass wasting (as described in the geology report)

Wildfires primarily affect water quality through increased sedimentation. As a result, the primary water quality constituents or characteristics affected by this fire include color, sediment, settle able material, suspended material, and turbidity. Floods and debris flows can entrain large material, which can physically damage infrastructure associated with the beneficial utilization of water (e.g., water conveyance structures; hydropower structures; transportation networks). The loss of riparian shading and the sedimentation of channels by floods and debris flows may increase stream temperature. Fire-induced increases in mass wasting along with extensive tree mortality can result in increases in floating material – primarily in the form of large woody debris. Post-fire delivery of organic debris to stream channels can potentially decrease dissolved oxygen concentrations in streams. Fire-derived ash inputs can increase pH, alkalinity, conductivity, and nutrient flux (e.g. ammonium, nitrate, phosphate, and potassium), although these changes are generally short lived. Post-fire increases in runoff and sedimentation within the urban interface, and burned structures and equipment within the fire perimeter may also lead to increases in chemical constituents, oil/grease, and pesticides.

The most noticeable effects on water quality will be increases in sediment and ash from the burned area into waterbodies in and downstream of the fire area. Flash flooding and debris flows are natural watershed response for this area. The risk of flash flooding and erosional events will increase as a result of the fire, creating hazardous conditions within and downstream of the burned area.

Flooding Potential and Modeling

Soil burn severity has a very strong influence on flooding potential. High severity to moderate severity burned soils tend to have more water repellency post fire; however, a certain amount of water repellency is natural in pre-fire conditions as well. The increase in fire-related water repellency diminishes with lower burn severity. Field observations indicated that about 65% of the soils within the burn area exhibited hydrophobicity. Flood potential will decrease as vegetation reestablishes, providing ground cover, increasing surface roughness, and stabilizing and improving the infiltration capacity of soils.

Hydrologic Modeling

In general 6th level subwatersheds were used as the modeled drainages in the analysis on private lands (Map 3). Within the Indian Creek watershed one smaller drainage was modelled to evaluate the potential values at risk on NFS land. The streams are bedrock, cobble, and gravel dominated stream systems. Many of the riparian areas in the upper reaches are timbered with a small riparian gallery adjacent to the stream system. As the streams flow down into the valleys they become wider and shallower with more defined floodplains. There are areas where the streams are downcut due to degraded conditions, which may be exacerbated with the high flows from the burned area. Streams with stable riparian vegetation are more likely to remain functional through the high flow events. There are approximately 60 miles of perennial stream, 36 miles of intermittent stream, and 153 miles of ephemeral channels within the fire perimeter.

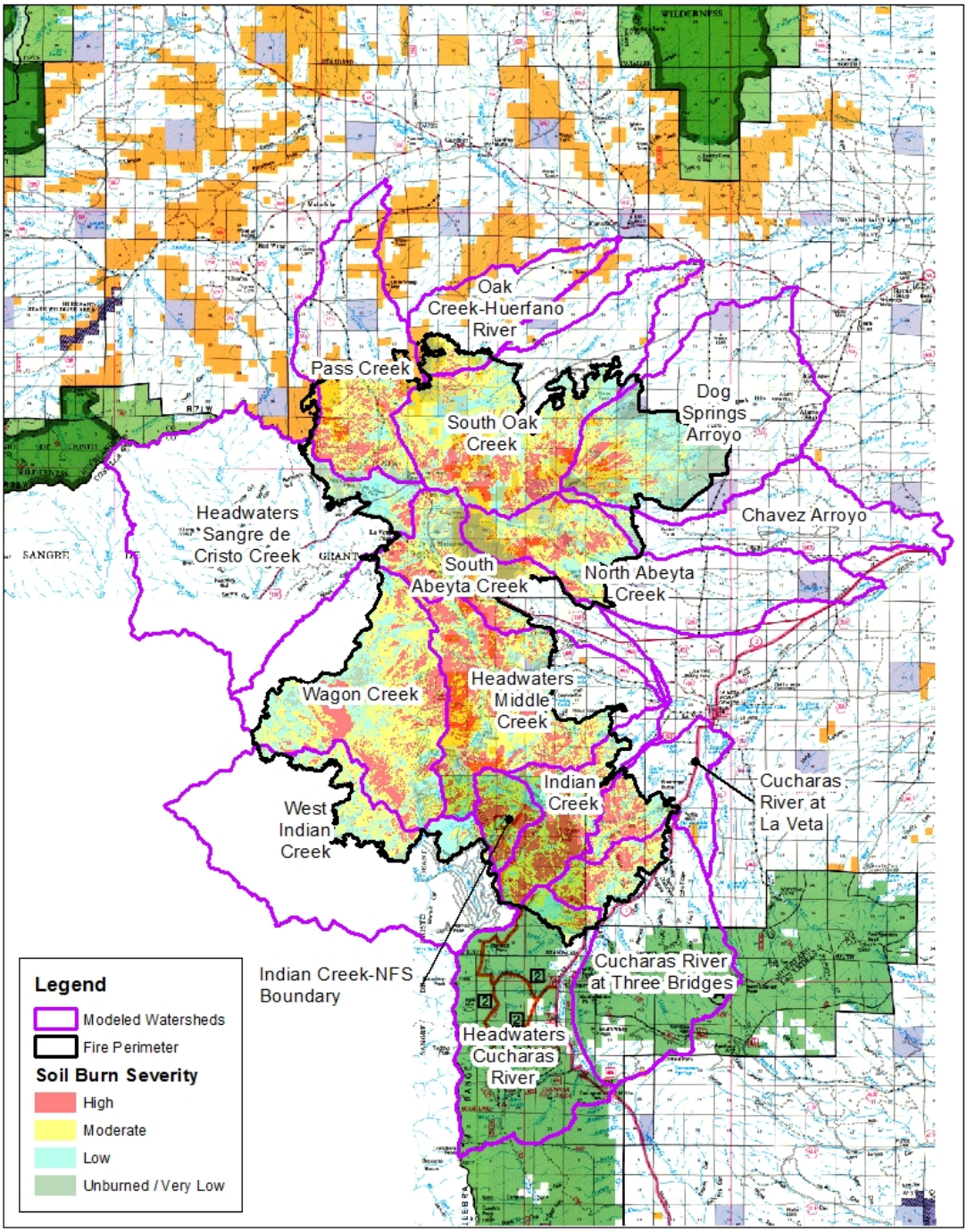
The Indian Creek-NFS Boundary watershed is included in the Indian Creek watershed. The Cucharas River at La Veta watershed includes the Headwaters Cucharas River, and the Cucharas River at Three Bridges watersheds. The Bandito Cone and Manzanares River watersheds were not included in the analysis due to the small amount of burned area within the watershed boundary. The Oak Creek-Huerfano River and Dog Springs Arroyo watersheds were both analyzed upstream of the original watershed boundaries at the Highway 69 crossings.

Table 6: 6th Field Watersheds for the Spring Fire.

6th field sub-watershed	HUC	Named streams in the fire perimeter	Total acres	Acres in fire perimeter	Percent burned
Badito Cone-Huerfano River	110200060302	NA	30,318	71	0.2%
Chavez Arroyo	110200060408	Chavez Arroyo	12,622	543	2%
Dog Springs Arroyo	110200060301	Dog Springs Arroyo	30,571	5,955	20%
Headwaters Sangre de Cristo Creek	130100020502	Sangre de Cristo Creek	35,393	2,047	7%
Headwaters Cucharas River	110200060401	Big Branch	20,848	1,373	5%
Headwaters Middle Creek	110200060404	North Middle Creek, South Middle Creek, Middle Creek, Idlewild Creek, Oak Creek	20,107	14,331	47%
Indian Creek	110200060403	Indian Creek, Price Creek, Copper King Canyon	11,196	9,319	31%
Manzanares Creek-Huerfano Creek	110200060108	Palo Duro Creek	34,667	160	1%
Middle Creek-Cucharas River	110200060406	Rilling Creek, Vories Canyon, Cucharas River	34,039	5,967	20%
North Abeyta Creek	110200060407	North Abeyta Creek	19,091	6,187	20%
Oak Creek-Huerfano River	110200060207	Oak Creek	19,098	931	3%
Pass Creek	110200060103	Pass Creek, Spring Branch	16,688	6,077	20%
South Abeyta Creek	110200060402	South Abeyta Creek	11,708	5,818	19%
South Oak Creek	110200060206	South Oak Creek, Yellowstone Creek	23,278	14,314	47%
Wagon Creek	130100020501	Vega Creek, Wagon Creek	23,942	16,607	55%
West Indian Creek	130100020503	Bear Creek, North Fork	29,537	4,445	15%

Elevation within the burned area perimeter ranges from approximately 11,138 feet at Rough Mountain to approximately 7,300 feet along Oak Creek on the southeastern side of the fire. Annual precipitation ranges from approximately 15 to 20 inches throughout the fire perimeter and is comprised of snowfall during the winter and high intensity thunderstorms in the late summer or early fall. The geology of the Spring Creek Fire is dominated by sandstone and shale.

Map 3: Modeled Hydrologic Units for the Spring Fire.



Post-fire conditions have been evaluated to determine how changes to soil conditions as well as hillslope and channel hydrology are expected to impact Values at Risk. Estimation of pre- and post-fire peak flows was completed using USGS Regression Method (Parrett et al. 2004). The regression

method is a widely used and efficient method for determining the difference between the pre- and post-fire runoff based on a modifier. This analysis used the StreamStats (USGS 2017) to calculate the 2-year, 5-year, and 10-year pre-fire peak flows for the watersheds. The Rio Grande runoff equation was used for the majority of the watersheds. A few watersheds used the Foothills Region equation for prediction of pre-fire flows.

The USGS regression method uses a modifier to calculate post fire runoff. This modifier is defined as a ratio of post-fire to pre-fire runoff and is calculated as follows:

Modifier = 1 + Percent Runoff Increase x $(A_H + A_M)/A_T$

where
A_H = high burn severity area within the watershed (acre or mi^2);
A_M = moderate burn severity area within the watershed (acre or mi^2); and,
A_T = total watershed area (acre or mi^2).

The Percent Runoff Increase was determined by observing peak stream flow volumes at 5 different stream locations that resulted from a two-year rainfall event, that occurred on July 16th , measuring estimated average width and depth of high water marks and estimating flow velocity. These calculated streamflow values were then compared to the 2-year pre-fire flow calculated by StreamStats at those locations. The observed post-fire flow resulting from the July 16th, 2-year rain event discharge of cubic feet per second (cfs) value was divided by the StreamStats predicted pre-fire 2-year cfs value to determine percent increase at the 5 locations: Indian Creek, Vories Creek, Wagon Creek, Middle Creek, and Cucharas River at Three Bridges. For watersheds where stream flow measurements were not taken from the peak flows of the July 16th rain event, the percent increase was estimated based on soil burn severity mapping, topography, vegetation, geology, and soils of the watershed.

The July 16th rain event was determined to be distributed over the burn area with officially recorded precipitation amounts ranging from 0.3 in. – 0.8 in., as reported by the National Weather Service gage data, radar data, and the Cuchara National Interagency Fire Center Remote Automated Weather Station (RAWS). The estimated duration of this storm was 30 min. – 60 min.

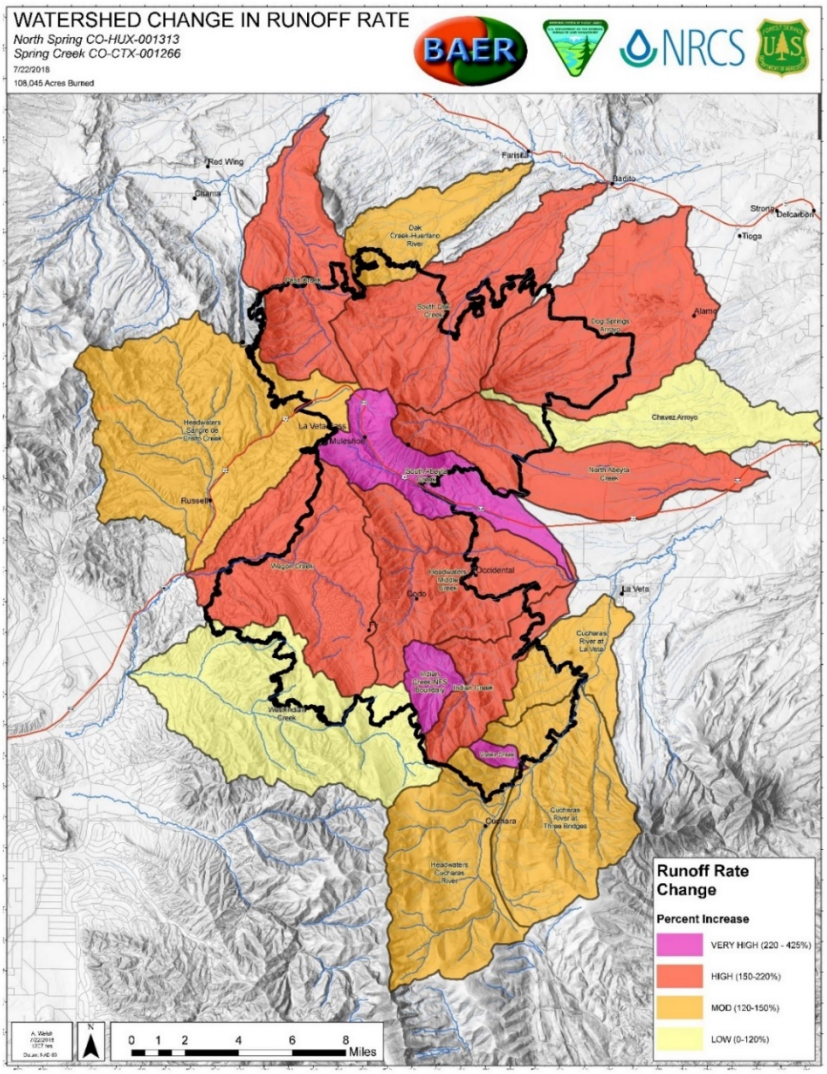
The results of the pre and post-fire hydrologic modeling are shown in Table 7 and on Map 4. Large increases in flow are expected within the modeled drainages as a result of the simulated design storm. While absolute flow magnitudes may contain considerable uncertainty, relative increases in peak flow provide a more useful guide for understanding the general extent of alteration of a drainages soil hydrologic function. The post-fire peak flows do not include a large debris bulking factor; therefore, the actual post-fire peak flows are expected to be higher than predicted. It is expected that flash floods and debris flows are likely to occur with sufficient rainfall and intensity. A general rule of thumb, based on anecdotal information from previous fires, is that greater than a half inch of rain in less than 1-hour is sufficient to initiate debris flows within burned areas. Debris flows are not a component of this peak stream flow modeling, and are addressed in the Geology Report of this assessment.

Table 7: Pre and Post-fire Peak Flow Predictions using The USGS Regression Model

Modeled Watershed	Factor of Increase
Chavez Arroyo	1.1
Cucharas River La Veta	1.2
Cucharas River at Three Bridges	1.4
Dog Springs Arroyo	1.8

Modeled Watershed	Factor of Increase
Headwaters Sangre de Cristo Creek	1.2
Headwaters Cucharas River	1.5
Headwaters Middle Creek	1.8
Indian Creek	1.9
Indian Creek-NFS Boundary	3.7
North Abeyta Creek	1.5
Oak Creek-Huerfano River	1.3
Pass Creek	2.0
South Abeyta Creek	2.2
South Oak Creek	2.0
Vories Creek	4.25
Wagon Creek	1.5
West Indian Creek	1.1

Map 4: Magnitude of Post-fire Runoff Within the Modeled Watersheds.



Independent post fire flood modeling has been completed by Coalition and Collaborative, Inc (COCO), and Natural Resources Conservation Service. These post initial BAER 2500-8 studies have determined that the Forest Service Office and Work Center in the town of La Veta have direct threats from debris and flood flows from the adjacent Cucharas River.

COCO's Cucharas River's Post-Fire Flood Analysis showed 5 and 10 year floods approaching (within 300 feet) but not reaching both Forest properties. However, of more interest were the estimated post fire discharges at the town of La Veta:

River	Discharge (cfs)	
	5-year	10-year
Indian Creek	5798	7493
Middle Creek	4484	6145
Cucharas River	4500	6690
Total	14782	20328

In 1890, the Cucharas River was straightened out slightly and relocated to accommodate the railroad and 1889 flood. The old channel appears to runs from SW to N through town with an old oxbow located approximately 1 city block from the Forest Service Office. Additionally, an abandoned or unmaintained storm water ditch has been found immediately adjacent to the work center. If the Cucharas River has a 5 or 10 year discharge as listed in the table above, it is likely going to return to part or all of its historical location and storm water ditches. It is common for rivers to return to previously used channels during flood events. In this event, both Forest Service facilities in La Veta will likely be in or on the new (old) floodplain and portions of the facilities could be flooded.

The NRCS modeled mse4 (typical thunderstorm) in a 24 hour period. Results from that model show probability of flooding for the NFS facilities:

Probability of Exceedance	Inches of Rainfall	In Flood Prone Area?	
		FS Office	Work Center
1%	4.4	Yes	Yes
10%	2.6	Yes	Yes
50%	1.8	No (1/2 block away)	No
100%	1.5	No (1/2 block away)	No

Since the fire debris and flood flows coming from Vories Canyon and other Cucharas tributaries have been observed along Hwy 12 from 1/2 inch rain storms.

The Forest Service did not previously propose treatments for protection of it facilities in the town of La Veta because it was not aware of the threats to Forest facilities.

G. Geologic Considerations:

Within the burned area of the Spring Creek Fire, some drainages and slopes present evidence of past mass wasting as debris slide and debris flows that will be increased during future storms, while other drainages and slopes have little evidence of recent past slope instability. **As conditions change due to the fire, erosion and mass wasting might be initiated.**

In watersheds that experienced moderate to high soil burn severity, as a result of the removal of vegetation by the fire, soils are exposed and have become weakened, and rocks on slopes have lost their supporting vegetation. Due to these post-fire new conditions, some sections above Hwy 160 and Hwy 12, in addition to some other State, private and FS roads are at risk from rolling rock, plugged culverts, debris slides and in some cases, debris flows. Risks to human life, roads, trails and natural resources is moderate to high in some areas of the Spring Creek Fire.

Base on the USGS debris flow modeling some drainages above Hwy 12, County Road 421, County Road 572 and the community of Paradise Acres have a high probability to produce debris flows. This is confirmed by field and aerial observations which show that some steep drainages above these VAR's are loaded with loose rock and unsorted, unconsolidated materials. At present a few of these drainages have already experienced post-fire debris flows as a result of monsoon rainstorms.

Recommended treatments for debris flow, mass wasting and rock fall hazards include coordination with NOAA, OEM, and NRCS to develop an early alert system to notify the public of these hazards before any significant storm. In addition, warning signs and road closures are recommended in some locations in the burn area; clearing and improvement of catch basins and ditches along the road; maintenance and up-grade of drainage structures.

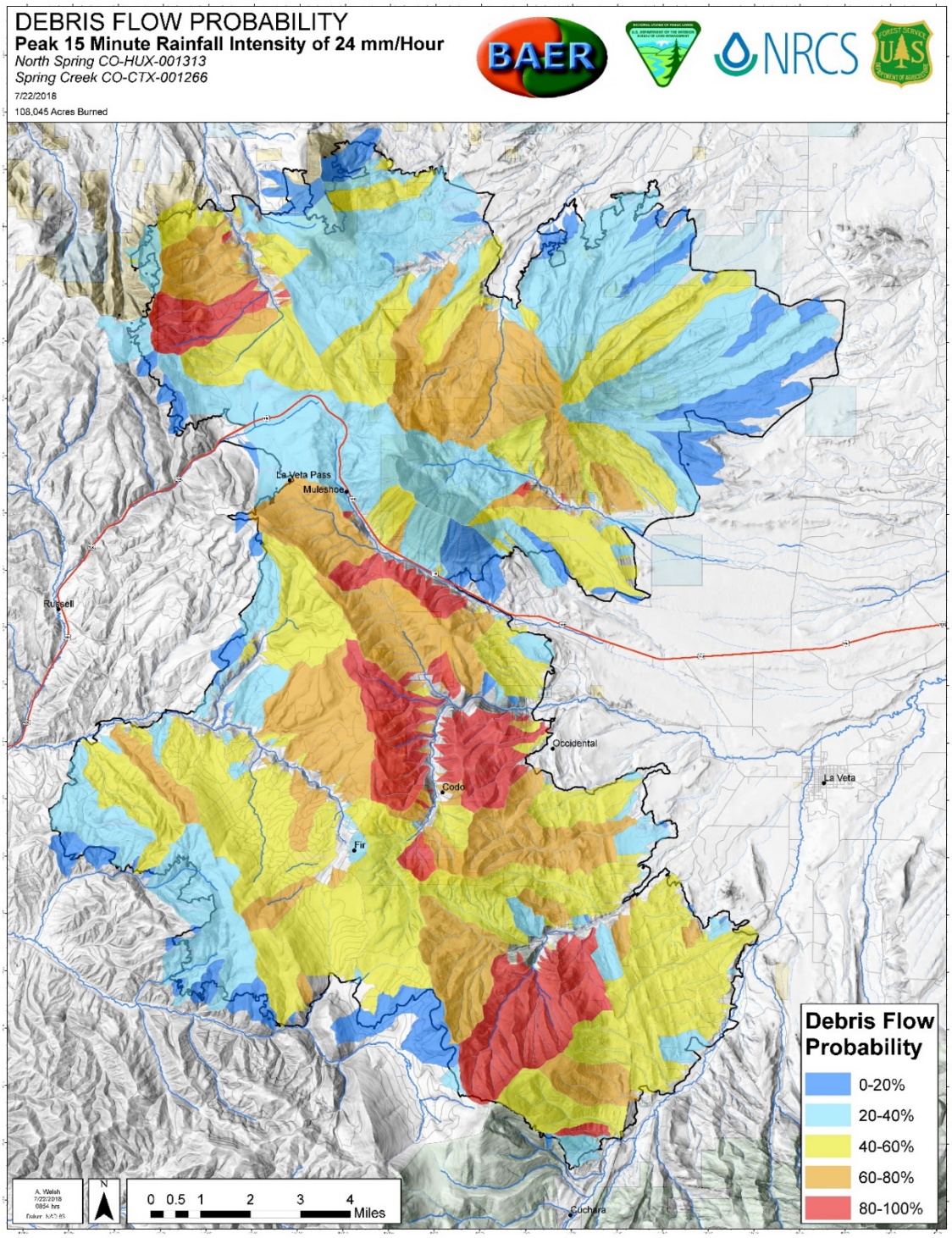
Debris Flow Potential:

The US Geological Survey (USGS) - Landslide Hazards Program, has developed empirical models for forecasting the probability and the likely volume of post-fire debris flow events. To run their models, the USGS uses geospatial data related to basin morphometry, burn severity, soil properties, and rainfall characteristics to estimate the probability and volume of debris flows that may occur in response to a design storm (Staley, 2016). Estimates of probability, volume, and combined hazard are based upon a design storm with a peak 15-minute rainfall intensity of 12 – 40 millimeters per hour (mm/h) rate. We selected a design storm of a peak 15-minute rainfall intensity of 24 millimeters per hour (0.94 inches/hr.) rate to evaluate debris flow potential and volumes since this magnitude of storm seems likely to occur in any given year.

Based on USGS debris flow modeling it appears that under conditions of a peak 15-minute rainfall intensity storm of 24 millimeters per hour (0.94 inch/hr.), the probability of debris flows occurring is 80-100% in some channel/creeks above Hwy 12, County Road 421, County Road 572 and the community of Paradise Acres. Under these same conditions, predicted volumes of these debris flows are expected to range from 1,000-100,000 m^3 in other channels.

Within the Spring Creek Fire burned area, slope failures such as rock fall, debris slides, debris flows, dry ravel, surface erosion and gullying have shaped the landscape in the past. Those processes will now be exacerbated, relative to the degree of fire burn severity, and the intensity, frequency and duration of future storms. In watersheds that experienced moderate to high soil burn severity which caused the removal of vegetation by the fire, soils are exposed and have become weakened and rocks on slopes have lost their supporting vegetation. Due to these post-fire new conditions, threats are elevated from rockfall, debris slides, flooding and sediment deposition, and in some cases, debris flows. Risks to living beings, property and infrastructure, roads, trails, campgrounds, reservoirs and natural resources is moderate to high in some areas of the Spring Creek Fire (see Map 5 below).

Map 5: Debris Flow Probability



Conclusion:

Modeling for soils, hydrology, and geology show 4 areas are at extreme risk for flooding, hyper-concentrated flows, and/or debris flows. Paradise Acres which is located on an old debris fan has already experienced one debris flow; Sulfur Springs along Indian creek which is in a floodplain that will likely be

flooded; Vories creek that intersects Hwy 12 has a debris fan above the highway; and Pass Creek SR 572 that is located on the stream terrace that is likely to flood and wash the road away. These all warrant careful monitoring and closure when storms greater than .5in/hr are expected to hit.

PART IV - HYDROLOGIC DESIGN FACTORS

Table 8. Hydrologic design factors

Estimated Vegetative Recovery Period	3 to 5 years
Design Chance of Success	80%
Equivalent Design Resource Interval	2 years
Design Storm Duration	1 hour
Design Storm Magnitude	1 inch
Design Flow	67 cfs/mi^2
Estimated Reduction in Infiltration	62%
Adjusted Design Flow	140 cfs/mi^2

PART V - SUMMARY OF ANALYSIS

A. Describe Critical Values/Resources and Threats:

Background:
The Spring Creek Fire started in early June and by July 16th had burned 108,046 acres with 9,837 acres on the San Isabel National Forest in the Culebra Ranges on the San Carlos Ranger District. The fire was detected on June 27th, 2018 in the Forbes Park subdivision in grass in sagebrush. Downbust winds from a thunderstorm quickly moved the fire to the east into Ponderosa Pine and mixed conifer stands. The mixed conifer stands had a large component of white fir impacted by decades' long spruce budworm infestations, resulting in a heavy dead and down surface fuels which allowed the fire to transition into the crowns and promoting long range spotting. The fire destroyed 216 homes and damaged 119 homes and caused thousands to evacuate.

Summary of Spring Creek Fire BAER Values at Risk
Based on field observations and assessment of burned watershed conditions and expected responses the BAER team identified potential for post wildfire impacts on the following values at risk:

Human Life and Safety
- Increased risk for the general public to be impacted by rolling rocks, flooding, landslides, debris flows and hazardous trees along road and trails

Property
- USFS system roads
- USFS trails
- Water diversion and conveyance infrastructure
- Cadastral markers
- **Administration buildings (work center) in the town of La Veta**

Natural Resources

- Water for domestic and agricultural uses
- Native or naturalized plant communities
- Soil productivity and hydrologic function
- Fisheries and aquatics
- Wildlife

Cultural Resources

- Prehistoric sites
- Historic sites
- **Forest Service Office in the town of La Veta**

Risk Assessment Process:

The risk matrix below, Exhibit 2 of Interim Directive No.: **2520-2010-1** was used to evaluate the Risk Level for each value identified during Assessment:

Table 9: Risk Level

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

Values at Risk Matrix:

The values at risk (VAR) matrix displayed in Appendix C below summarizes values at risk, post wildfire threats and risk ratings for forest service lands. Other lands that are not forest service (State, County, and Private) were noted but not evaluated for risk. Values with high or very high risk ratings are addressed, where possible, with BAER response actions (treatments). Generally, response actions are not recommended for values with low and intermediate risk ratings (except in the case for life).

Life and Safety Values at Risk - Forest Users and Personnel: The BAER team identified increased risk for potential impacts to life and/or safety of Forest visitors and personnel entering the burned area. Potential threats include rolling rocks, flooding, debris flows and/or landslides, sediment or debris delivery to hazardous trees, loss of road or trail tread, and loss of ingress/egress. Generally, increased risk occurs within or directly down-slope from high and moderate burn severity areas. The proposed installation of warning signs and outreach efforts to share key information from the BAER report will also lower the probability that life and/or safety could be impacted by post wildfire processes.

Private Property (Property and Life Safety) - Private Homes and Structures: The BAER team did identify some private residences and structures at increased risk from post wildfire processes. However, extensive inventory of structures and other values on private land was not conducted. Information sharing and outreach efforts with NRCS and Huerfano and Costilla County departments of transportation and

emergency services focusing on potentially affected communities are proposed to increase awareness of burned area conditions and potential impacts to private values.

Property Values at Risk - Forest Service Roads

The following values as related to National Forest roads were identified during the Spring Creek Fire BAER assessment.

Human Life and Safety:

Threats to human life and safety exist throughout the burned area. Fire killed trees in the burned area pose an immediate threat to the public. Many trees have already fallen and it is likely that many more will continue to fall, especially during storm events.

There is an immediate and continuing future threat to travel along roads within the burned area due to the increased potential for falling rocks and trees from burned slopes adjacent to roads and increased potential for debris flows. With the loss of vegetation and change of soil infiltration, normal storm frequencies and magnitudes can more easily initiate erosion on slopes and initiate swamping of roads or cause washouts at drainage features or stream crossings. These events make for hazardous travel on forest roads and put the safety of users at risk

The probability of damage or loss of human life and safety is measured to be *Possible* and the magnitude of consequence *Major*, therefore the risk is estimated to be *High*.

Property:

Waterbars and drainage dips are regular features along the alignment of both Level 2 (high clearance) and 3 (passenger car) roads affected by the fire and such features which are draining slopes of moderate and high burn severity are inadequate and subject to overtopping and diverting flow down the road prism and substantially eroding the roadbed. Ditches are likewise consistent along in-sloped roads but are often too shallow to handle sediment from flows in impacted areas.

Stream/road interaction points (culvert crossings) with significantly impacted drainages above are likewise susceptible to these increased flows and debris plugging. Overtopping in these locations would be more extreme, with sudden failures of the road prism and mass wasting whether the crossing is on a slope or in a floodplain. Even in scenarios where the prism fill does not collapse, excessive erosion and damage to the prism will occur around the inlet of the culvert and on the fill slope across the road. Structure loss may occur in both these situations.

The probability of damage to these features is deemed *Likely* in the majority of identified locations and consequences either *Moderate* or *Major* depending on site. A risk rating of either *High* or *Very High* has been thus attached.

Property Values at Risk - Forest Service Trails

Potential values at risk identified and addressed in this report include: Forest Service system trails, trailheads, and dispersed recreation sites. Risks include threat to life and safety of forest visitors, agency staff, BAER team and threat to trails.

Human life and safety

Potential threats to human life and safety within and downstream of the burned area exist for forest visitors and workers on NFS trails and dispersed recreation sites.

Property

Potential threats to property and infrastructure on NFS lands within and downstream of the burned area exist primarily along the trail.

The property values at risk are segments of Forest Service system trails. In areas of high soil burn severity mid-slope trails are likely to become covered by dry ravel and debris. It is also likely that there will be moderate trail damage caused by the loss of water control. In addition, fire-damaged trees will fall across the trail. This added material will also obscure trail definition, causing users to wander off the established trail, especially at switchbacks. Repeated off-trail travel may eventually create a new path that is hazardous to users and subject to enhanced erosion.

Some system trail segments have been found to be at high risk of damage and/or loss. These findings are based on proximity to moderate and high burn severity areas, side hill slope, soil characteristics, and results of aerial and on-the-ground surveys.

Probability of Damage or Loss: Likely
Magnitude of Consequence: Moderate
Risk Level: High

Water Quality:
The following BAER critical values (Forest Service Manual 2523.1 Exhibit 01) were considered as potential values at risk from post-fire flows and debris.

- Hydrologic function on National Forest System (NFS) lands.
- Water Quality on NFS lands.
- Human life and safety on NFS lands

Impacts to Domestic water users
Numerous small water systems are scattered throughout the Spring Creek Fire area. The majority of these water systems are associated with private property and are located on mid to lower slope drainages. Burn severity mapping indicates that these systems may have been impacted by the high severity fire. Systems that take water from streams in burned watershed will likely experience issues with turbidity and potential damage to system infrastructure during fall and winter storms. Systems that take water from springs will have a higher potential for impacts.

Treatments: Share assessment information with water users and NRCS. Municipal Water district possible actions: Increase maintenance at water intake facilities. Monitor system during storm events. Consider adding storage to ensure a clean water source is available during high turbidity events.

Natural Resource Values at Risk – Water Quality
Surface waters in the fire area will be bulked by ash, debris, and other floatable and transportable material during storm events. It is likely that stream flows from the first post-fire runoff producing rain events will see high concentrations of ash and fine sediment that will cause considerable turbidity and degradation of water quality and the beneficial uses of water. Beneficial uses of water are identified and protected by the Colorado State Water Quality Control Board by regulation. Beneficial uses are: municipal water supply, contact and non-contact recreation, wildlife habitat, warm and cold water aquatic habitat, rare species habitat, fresh water replenishment, and spawning.

It was recognized that there are values potentially at risk to flooding and/or debris flows on other jurisdictional lands within and adjacent to the burned NFS lands. The authority to assess and mitigate emergencies for these other jurisdictional lands lies with the National Resource Conservation Service

(NRCS). Coordination between the US Forest Service and other jurisdictional entities (primarily NRCS) will be essential to continue risk assessment to these other properties.

- Magnitude of Consequences: Moderate
- Probability of Damage or Loss: Likely
- Risk: Intermediate

- Storm patrols should be conducted by all relevant parties to ensure that blockage of crossing structures do not occur during the first runoff producing storms. Roads should be storm-proofed as necessary.
- Share assessment information with local communities, landowners, water users, permit holders, NRCS, and NOAA/NWS to facilitate preparation for fall and winter storm.

Natural Resource Values at Risk - Soil Productivity

Soil productivity on steeper slopes could be compromised in the areas that have burned at high and moderate soil burn severity. Portions of Indian, Abeyta, Pass, and Sangre de Cristo creek headwaters are at risk based on a lack of soil cover, deep soil charring, and steep slopes that could erode productive topsoil. For complete details see soils report.

Natural Resource Values at Risk - Threatened and Endangered, Sensitive, and Invasive Plants

Threatened and Endangered Plants

The USDI Fish and Wildlife Service has identified two federally listed species as having part of their range on the Pike and San Isabel National Forests. These species are the threatened Penland's Mosquito Range Mustard (*Eutrema penlandii*) and the threatened Ute Lady's-tresses (*Spiranthes diluvialis*). Western Prairie Fringed Orchid (*Platanthera praeclara*) does not occur in Colorado, but may be affected by water depletions in the South Platte River basin.

There are no documented occurrences of, nor habitat for, Penland's Mosquito Range Mustard or Ute Lady's-tresses within the fire. As a result, consultation with US Fish and Wildlife Service was not required.

There are no known occurrences of federally listed threatened, endangered, or proposed plant species in the fire area. There is also no known habitat, including proposed or designated critical habitat, for any of these species in the fire area. For these reasons, there will be no effect to any federally listed threatened, endangered, or proposed species. The potential values at risk, in relation to invasive noxious weeds are the ecological stability of native plant communities and the degradation of Region 5 Sensitive plant habitat.

In forested communities, fire can change vegetation species composition and structure, creating early seral conditions, even under low to moderate burning intensities. Sites may remain in younger successional stages until trees become re-established and the potential natural community has developed.

The burn severity within the fire boundary varies greatly depending upon topography, location, and community type. Most herbaceous plant species are able to survive during the fire within these areas. These areas become important refugia for species as well as important reservoirs of seed sources for re-colonization. The fire may have benefited these areas by creating a mosaic of effects on the landscape, increasing nutrient cycling, and reducing ground fuels.

In many areas of the fire, including those with high to moderate fire severity, the root systems of grasses and shrubs are viable and will re-sprout. Seed banks of native plants also occur in these areas. Although early seral ecosystems maintained by fire, such as grass and shrub communities, it will take many years to re-establish trees on these sites.

Ecosystems maintained by surface fires contain persistent successional tree species that are generally shade intolerant, and have developed adaptations to survive fire. In these fire-regulated ecosystems, fires are frequent but are normally less intense in fire behavior and effects.

Most perennial herbaceous plants and shrubs present in burned landscapes survive burns because the effects of the fire rarely reach below the surface of the soil. Although portions of these plants above the ground are eliminated, their combined root mass is very effective in holding soil in place. This reduces the necessity of seeding and mulching burned sites.

Many species of herbs, grasses and shrubs are healthier and more abundant following a fire because of reduced competition, canopy reduction, and nutrient release. Seeds of many plants remain in the soil and germinate following fires. Mulching of seeded areas may interfere with the growth of plants in the seedbank. Mulch can prevent infiltration of rain into the soil. Layers of mulch may make it impossible for germinating plants to reach the soil for roots to take hold, or for leaves to penetrate the mulch to obtain access to sunlight.

Invasive Weeds

Invasive weed species are often a major concern to native and naturalized plant communities following wildfire. Removal of competitive vegetation by fire, areas with moderate to high burn severity and disturbances from suppression efforts such as bulldozer lines and staging areas can create openings for noxious weeds to invade, and impede or prevent recovery of desirable vegetation. (See appendix for list of dominant vegetation communities within the fire perimeter). Fire perimeter and middle interior is very accessible to public consequently creating a transmission vector for the introduction of noxious and invasive species.

On NFS lands species include: Scotch thistle (*Onopordum acanthium, O. tauricum*), Hoary cress (*Cardaria draba*), Canada thistle (*Cirsium arvense*), and Houndstongue (*Cynoglossum officinale*). Scotch thistle, Houndstongue, Hoary cress and Canada thistle have been found on the Indian Creek Road (FSR 421) and Indian Creek motorized trail (FST 1300) and along CO Hwy. 12 adjacent to the Forest boundary (see map).

Emergency Determination

There is an emergency situation for the recovery of native vegetation due to significant threats from noxious weed establishment and/or spread affecting natural plant community integrity, wildlife habitats, and watershed values. **It is likely** that existing weed infestations will increase, particularly in moderate to high soil burn severity areas, due to conditions favorable to accelerated growth and reproduction, and release from competition with native plant communities. In addition, the unknowing introduction and dispersal of invasive weeds into areas disturbed by fire suppression and rehabilitation has the potential to establish persistent weed populations. It is expected that most native vegetation will recover if weed invasions are minimized.

Natural Resource Values at Risk - Threatened and Endangered, Sensitive Wildlife

This assessment evaluates the effects of the Spring Creek Fire and the potential effects of the burned area emergency response (BAER) treatments on the following potential candidate of the Canada Lynx critical habitat.

The Spring Creek Fire burned a total of 50,426 acres of potential Lynx habitat as mapped by Colorado Parks and Wildlife. This potential habitat overlaps 7,753 acres or 19% of the Trinchera Lynx Analysis Unit, and falls between the Trinchera, Huerfano and Greenhorn Lynx Analysis Units. The potential habitat mapped by CPW has been further refined by the USFS and BLM respectively into Primary and Secondary Habitat. Within the burn perimeter 4,712 acres of Primary and Secondary habitat burned on USFS lands, and 7,450 acres of Primary and Secondary habitat burned on BLM lands. The primary and secondary habitat within the burn perimeter was higher density forest stands that received a higher burn severity than the average for the burn overall.

Lynx habitat was negatively impacted by the fire. The probability of loss from post fire effects is ***possible*** because of possible debris flow and sedimentation. The magnitude of the consequence is ***minor*** due to the relatively low use of this area by Canada Lynx (one observation 25 years ago) and the expected recovery rate for Lynx habitat post-fire regardless of treatment. The risk matrix determination is ***low*** because post-fire flooding and sedimentation threats will not exacerbate any impacts already caused by the fire. No treatments have been recommended for Canada Lynx.

Natural Resource Values at Risk - Threatened and Endangered Fisheries

No T&E fisheries fall in the forest service lands within the Spring Creek fire. However the 2013 Rio Grande Cutthroat Trout Conservation Strategy lists the Rio Grande Cutthroat trout, a Forest Service and BLM sensitive species, were impacted by the fire and are expected to be impacted by sedimentation and debris flow after the fire. The Forest Service lands involved in the fire were on the north side of La Veta Pass and do not drain into Rio Grande Cutthroat trout habitat. The BLM is recommending treatments for this species through their Burned Area Recovery program.

Soil Productivity Values at Risk

Threats to Soil Productivity**:**

Probability of Damage or Loss: Likely
Magnitude of Consequences: Moderate
Risk Level: High

An elevated level of erosion can be expected in the aftermath of the fire based on modeling of erosion and sedimentation and erosion risk analysis. However, this is a fire-adapted ecosystem that has evolved in the presence of fire, and many of the slopes with the highest predicted erosion are too steep to effectively treat with mulch. Of the ground that is treatable, not enough acres were present on the forest to make any significant reduction in erosion.

The Spring Creek Fire BAER team assessed the landscape for the effectiveness of potential land treatments; specifically soil cover additions by methods such as straw mulching, wood straw, mastication, or hydro-mulching. To consider the maximum benefit of treatments, both private and public land were considered. Our analysis showed the percentage of each pour point watershed that could be treated

following the feasibility analysis. Mulching is generally considered to treat watersheds if at least 50% of the watershed can be treated. Throughout the fire many areas on private and BLM would qualify.

Property Values at Risk - Heritage Sites

The objective of this report is to identify cultural resource sites considered threatened by deteriorated post-fire conditions, and make treatment recommendations that will reduce damage to site integrity and significance caused by increased runoff, erosion, and debris flows resulting from effects of damaging events (i.e., storms) on the deteriorated watershed.

This cultural resources assessment centers on post-fire conditions that could directly or indirectly result in adverse effects to known cultural resource sites. Adverse effects may include the potential to bury surface and subsurface cultural resources to prohibit discovery; the possibility of soil movement that would change the context of the remains which are Vetal to any scientific analysis or interpretation value; and increasing the visibility of site locations that would make them more susceptible to looting or vandalism.

Though large portions of the burn area have not been adequately surveyed there are no known cultural resources within the burn perimeter on FS lands.

In addition to the risk of post-burn environs, proposed treatments by other BAER specialists (hydrologists, soil scientists, geologists, recreation) may have the potential to affect cultural resources and are subject to the provisions of 36 CFR 800**.** Prior to BAER implementation, an archaeologist should be assigned to the implementation team to ensure that inventory and compliance requirements per National Historic Preservation Act are satisfied.

Threats to Heritage Sites
For efficiency purposes, both the work center and historical Forest Service office will be discussed from this point on together. The Forest Service Office and Work Center in the town of La Veta have direct threats from debris and flood flows from the Cucharas River. The Town of La Veta is directly downstream of the Spring Creek Fire burn scar. Approximately 6,585 acres of the Cucharas River watershed is within the fire perimeter with 2,147 of these acres on NFS lands. On NFS lands there is approximately 1,443 *acres of* moderate and high soil burn severity, which is 22% of the total burned area in this watershed. The office is officially listed as eligible on the National Historic Register (Site ID: SHF 1175). Indirectly the facilities may not be usable if the town of La Veta water and sewer facilities shut down from debris and flood flows due to the fire.

Probability of Damage or Loss: Likely
Magnitude of Consequences: High
Risk Level: High

Emergency Determination

- **If flood flows return to the old channel the office and work center would likely be within the 50% and 100% probability of exceedance area for being within the flood prone areas. Flooding and debris flow at these sites could be catastrophic to the structures.**

Property Values at Risk – Cadastral- Historical Original Monuments

Objectives: Protect original monuments established in the 1880's in addition to associated accessories to witness the corners at risk based on the burn severity of the Spring Creek Fire.

Concerns (based on your resource/specialty): The corners at risk based on the burn severity of the Spring Creek Fire, private land survey monuments that control the public land boundaries are at risk of being lost due to the Spring Creek Fire and the residual effects from the fire. These residual effects include flash flooding, landslides, debris flow, and falling hazard trees which may be a result from the fire. Several of these are located in floodplains and need immediate attention.

Resource Condition Assessment

Resource Setting – Land survey monuments have been set to control the boundaries between public and private land as part of the Public Land Survey System. These are original stone monuments set in the 1880s. The monuments that have been identified as Values at Risk all control the public land boundary, are within drainages that will be prone to flooding due to the fire, or are on slopes within high intensity burn areas and are at risk of flash flooding, landslides, debris flow, and falling hazard trees.

Burned Area Reconnaissance – Based on existing survey records relative to maps of the burned area and site visits to specific locations, there land survey monuments need to be located, protected, and re-monumented as necessary.

Findings of the On-The-Ground Survey - Public land boundaries and the physical ground locations of private land and public land have been identified as being at risk of being lost. The associated values consist of the location of fences, structures, roads, and property rights as well as the correct location of the public land boundaries for future treatment projects.

The existing land survey monuments in question have been used since the 1880s to determine land boundaries for public and private land. Since the 1880s many land surveys have been conducted to identify the associated boundaries. If the monuments in question were lost, it would cost the tax payers and adjacent land owners a considerable amount of funding to reestablish the boundaries based on controlling land survey monuments in areas that have not been effected by the residual effects from the fire.

Emergency Determination

Risk Assessment – Certain land survey monuments have been listed using the BAER Risk Assessment Matrix. The certain monuments that have been identified as having a very likely probability of damage or loss based on the fire and residual effects of the fire. The magnitude of consequences would be moderate due to the substantial property damage of the monuments and the irreversible damage to this critical resource. These risks cannot be managed via administrative means because the monuments need to be protected in the field. There is a proven treatment to manage these risks, as proposed below. The proposed treatment will substantially reduce the risk of losing the monument within the first year after the fire. This action is the most economical method to manage this risk and the cost is minimal and justifiable. This treatment proposal can be completed before damage is expected within the next year.

Protection/Safety

Human Life and Resource protection the Forest will ensure safety for Forest visitors and protection to Forest resources during the recovery period by road closure and information along with BAER warning signs that will be installed around the fire perimeter at main entry points, trailheads and other strategic locations. One road will be gated and signed as closed.

B. Emergency Treatment Objectives:

To allow safe passage of water to protect infrastructures, watersheds, cultural sites, and fish habitat from accelerated sheet and rill erosion. Also, to protect watersheds from the spread of noxious weeds. Risk determination is dependent on the design storm selected and downstream values at risk. By using a set of average storms (2, 5, and 10-year events) emergency planning measures can be designed to mitigate and minumize anticipated risks. Using a 2-year design storm the values at risk can be evaluated to see how sensitive the watershed is and to determine if an emergency exists for a typical winter storm.

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

Land 80 % Channel **n/a** % Roads/Trails **95** % **Protection/Safety 90 %**

D. Table 10: Probability of Treatment Success

	Years after Treatment		
	1	3	5
Land	90%	85%	80%
Channel	n/a	n/a	n/a
Roads/Trails	95%	90%	85%
Protection/Safety	95%	90%	85%

E. Summary of Cost Risk Analysis (see Appendix D):

- Market Resource Values (direct losses and loss of use): $7,000,000
- Spring Creek 2 Fire Treatment Cost: $222,000
- Expected benefit of treatment $1,970,000
- Benefit/cost ratio = 4.5

As described in this report, threats to life/safety and non-market cultural and ecological values exist throughout the burned area. These values were described in the abbreviated VAR Tool Assessment spreadsheet considered in the benefit/cost ratio. Although not represented in the calculations, all proposed treatments reduced risk for multiple market and non-market values at risk. These important indirect benefits are not represented in the calculations.

G. Table 11: Skills Represented on Burned-Area Survey Team (complete list In Appendix A)

Hydrology	Soils	Geology	Engineering
Archeology	Recreation	Botany	Wildlife
GIS	Weeds	Range	Aquatics

Team Leader: Brad Rust	Email: brust@fs.fed.us	Phone: 530-226-2427
Paul Crespin	District Ranger	pcrespin@fs.fed.us
Wesley Burton	Detailed District Ranger	wesleyburton@fs.fed.us
Kalem Lenard	Assistant Field Manager	jlenard@blm.gov
Steve Sanchez	BAER Team Coordinator	ssanchez@fs.fed.us

H. Treatment Narrative for Forest Service:

Land Treatments

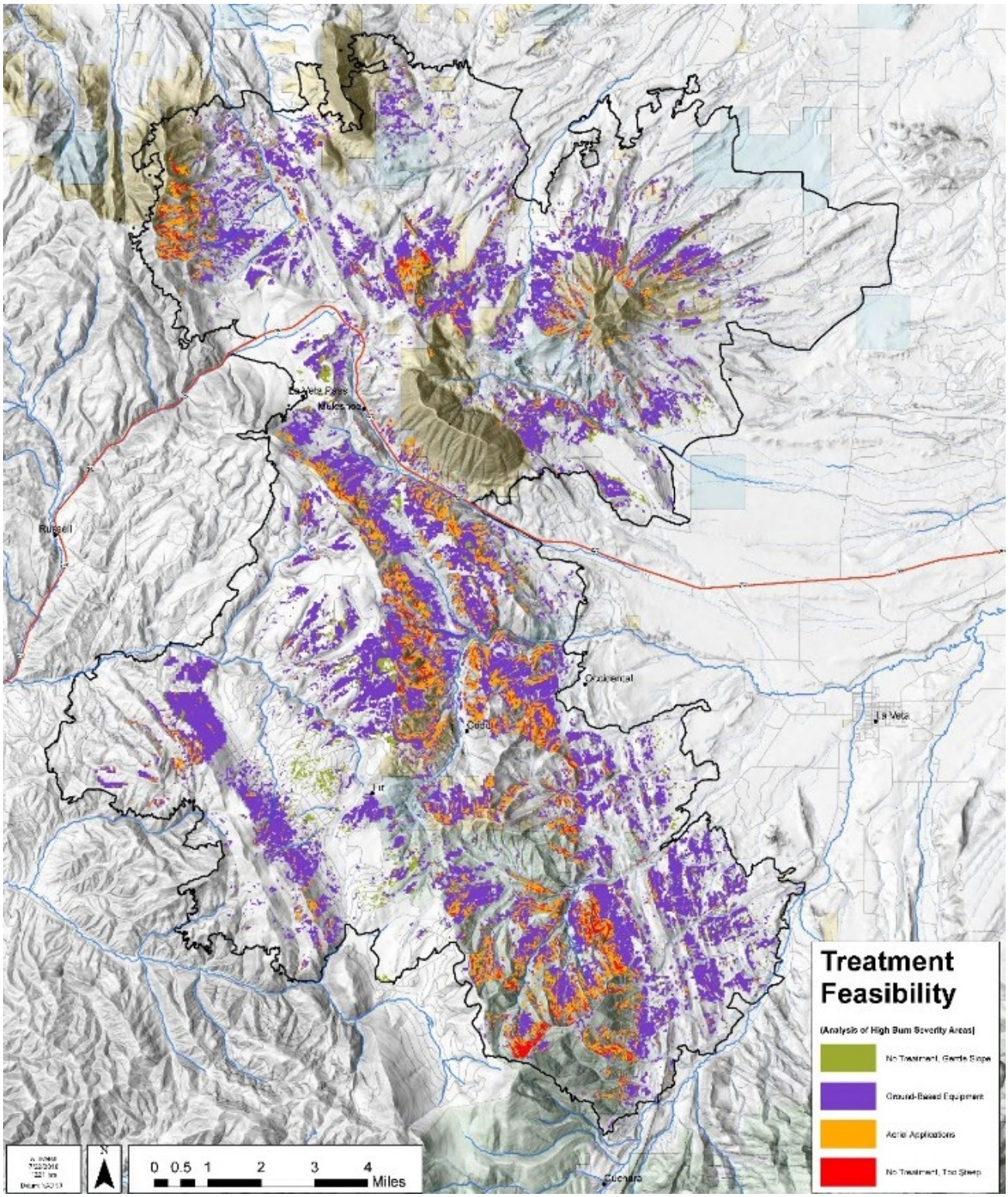
The initial assement concluded there was no threat to Forest values other than roads and trails from damage to soil productivity, debris flow and potential flooding. The hydrologic modeling done during the BAER effort is a quick rainfall-runoff simulation. With the results of the more time consuming and extensive modeling done by the NRCS and COCO the risk to the Forest Service facilities in the Town of La Veta became apparent.

A Spring Creek Fire Stakeholder group was formed by Christe Coleman with Colorado Department of Homeland Security and Emergency Management and is referred to as the "RMAC Team" (Recovery Multi-Agency Coordination Team). BAER assessment data was shared with Natural Resources Conservation Service and the RMAC team who in turn conducted studies and modeling into surrounding landscapes. The RMAC Study titled Cucharas River's Post-Fire Flood Analysis, as well as the NRCS modeling indicates there is a threat to the Town of La Veta from flooding and debris flows. The Forest Service has two facilities in the town of La Veta.

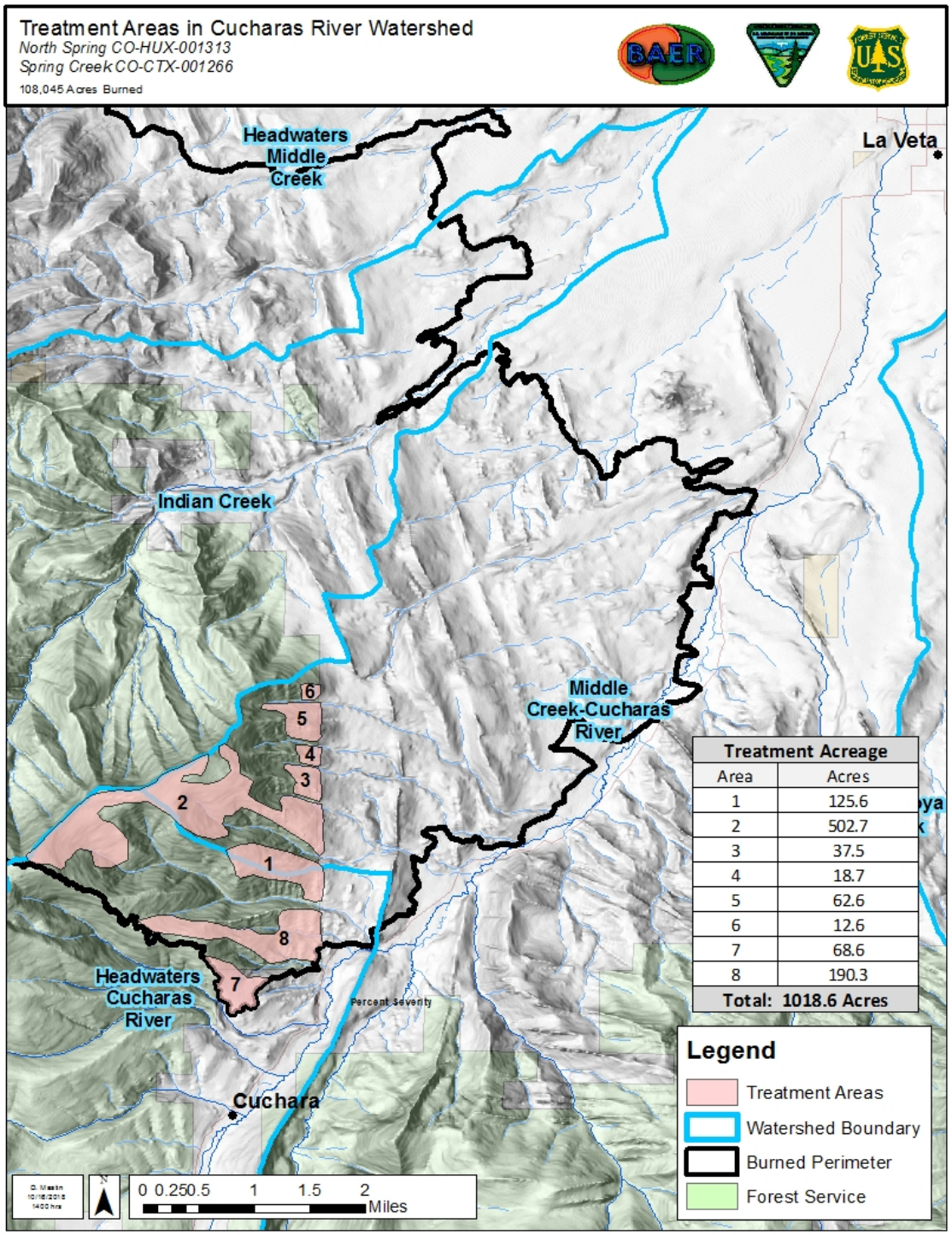
Additional analysis by the soils specialist determined that up 1,118 acres of the 1,443 acres of moderate to high burn severity acres on NFS lands could be treated in the Cucharas River watershed upstream of the town of La Veta to reduce impact from debris flow and eventually flood flows. The Forest evaluated a land treatment proposal for protection of its facilities and it is listed below.

- **Treatment Type on 1,118 acres:**
  - **Masticate fire-killed trees and spread shredded material on NFS and other lands in watersheds predicted to impact Forest infrastructure in the Town of La Veta.**
  - **Hand rake seed and install erosion protection matting at key hillslope road intersections to prevent soil loss and encourage revegetation.**

Intial proposed treatment areas provided in the map below was shared with RMAC. Treatment evaluation is futher discussed under Heritage Treatments below. Full Land Treatment costs are estimated at $1544 per acres and $3000 per day for implementation team (approx 1.8 million). In summary it does not appear to be land treatments are cost affective and within the interstest of the BAER directives to conduct for the protection of these facitlites.


Treatment Feasibility
(Analysis of High Burn Severity Areas)
No Treatment, Gentle Slope
Ground-Based Equipment
Aerial Applications
No Treatment, Too Steep
0 0.5 1 2 3 4
Miles
N
Russell
Cedd
La Veta

In the event funding outside of the BAER becomes available, a closer look at proposed treatment polygons in the Cucharas River watershed directly related to downstream Forest Service facilites is provided below:



Treatments to Mitigate the Emergency from Invasive Weeds

- Treatment Type:
  - Treat known weed infestations
  - Conduct weed detection surveys
  - Treat newly found infestations from detection surveys

- Treatment Objective:
  - Decreased noxious weed establishment/dispersal
  - Early Detection/Rapid Response (EDRR) of new infestations or new invading species
  - Reestablish desirable plants and a healthy plant community.

- Treatment Description:
  - Treat known weed infestations**.** Treat existing known populations, newly found infestations and conduct weed detection surveys using the EDRR strategy on NFS lands. On NFS lands including the Indian Creek Rd (FSR 421), Indian Creek motorized trail (FST 1300), intersections of completed dozer lines (8.9 miles) and FS roads/trails, County Roads, Colorado Highway 12 particularly at these intersections where there is public ingress/egress and other known forest roads and trail infestations.

  - Conduct weed detection surveys. Determine the need for present and future treatments, noxious weed monitoring assessments will be conducted to document if increased noxious weed invasion is occurring within the burn area perimeter on NFS, however concentrate in Cuchara roadless areas on NFS lands. Individuals conducting the monitoring will be trained to recognize and treat noxious weeds and will treat any infestations encountered. Monitor all roads within the fire area for new infestations, as well as areas of moderate to high soil burn severity, and areas impacted by suppression and rehabilitation activities, such as bulldozer lines, helispots, drop points, and staging areas, particularly at the intersection of dozers lines and roads/trails. Prioritize areas proximal to known infestations. Begin treatment, survey and monitoring spring/summer 2019 and continue efforts throughout the subsequent growing seasons. All other BAER treatments will be coordinated with noxious weed treatment to minimized spread and establishment of noxious and invasive species.

  - Treat newly found infestations from detection surveys. Focus on priority species: Cypress Spurge (*Euphorbia cyparissias*), leafy spurge (*Euphorbia esula*), myrtle spurge (*Euphorbia myrsinites*) and any new high priority species brought in from suppression and rehabilitation activities.

Table 12: BAER Treatment Cost on NFS lands

Line Items	Units	Unit Cost	# of Units	BAER $
Noxious Weeds				
Treatment (existing): Labor/equipment/supplies (2 person crew)	days	407.90	20	$8,158
Detection: Labor/equipment (1 person crew)	days	150.88	120	$18,105
Treatment (new): equipment/supplies/PPE	unit	1,000.00	10	$10,000

Fleet for Seasonal	months	6	1	$2,247
Subtotal Land Treatments				**$38,510**

Natural Recovery

Vegetation in the mixed conifer will recover slowly. Even in areas of moderate soil burn severity, the canopy was mostly killed and the seed source removed. Stands with an element of Ponderosa Pine and Douglas Fir will likely recover more quickly, since at least a few mature trees are likely to have survived to produce seed into newly exposed mineral soil. The montane chaparral shrubs were mostly killed by the fire, but fire stimulates manzanita seeds stored in the soil to germinate along with other re-sprouting species. Redwoods in the stream bottoms for the most part survived. The ones that succumbed to having their cambium burned due to deep litter and duff around the base of the tree will resprout at the base and will create a new tree.

Road and Safety Treatments:

Treatment Objective: Minimize the risk of road failure in the burn area through the placement and maintenance of effective water control measures. Prevent the channeling of water on roads. Ensure the diversion of runoff in controlled intervals to reduce erosion and further watershed degradation. Road treatments along with Storm Inspection and Response monitors and maintains the function of drainage features, and ensure road access for FS administration, permitees, and private in-holders.

Human Life and Safety Treatments:

Definitions:

1) Gate Closure: Temporary admin closure that prevents road access while retaining administrative access for maintaining treatments and resource monitoring. Accomplished with a gate and appropriate signs such as Burned Area Warning, No Parking and Road Closure postings.

2) Burned Area Hazard Sign**:** Warning sign that outlines hazards present in burned areas which can persist for many years. Hazards vary by location and include rock fall, hazard trees, flooding potential and road/trail routes blocked by trees or storm debris.

Table 13: Human Life and Safety Treatments

San Isabel NF Emergency Road Closures with Signage			
Road	**Length**	**Maintenance Level**	**Recommended Closure location**
NFSR 421	0.8	3 – PASSENGER VEHICLES	Beginning of the road
NFSR 421	5.0	2 - HIGH CLEARANCE VEHICLES	At field above Forbes Park (after 421.E)

San Isabel NF Burned Area Warning Signs		
Road	**Location**	**Sign Type**
NFSR 421	Gate @ end of CR 421	Entering Burned Area Fallen Rocks And Debris
NFSR 421	Gate @ closure by Forbes Park	Entering Burned Area Fallen Rocks And Debris

Table 14: Property Treatments

SPRING CREEK FIRE - TREATMENT SCHEDULE					
ROAD	**TREATMENT**	**UNIT**	**QUANTITY**	**COST**	**TOTAL**
NFSR	Waterbar Installation	EA	9	$ 650.00	$ 5,850.00
420	Drainage Reinforcement	MILE	1.4	$ 1,430.00	$ 2,002.00
	Storm Inspection and Response	DAY	2	$ 1,450.00	$ 2,900.00
				TOTAL	$ 10,752.00
NFSR	Install Gate with Signage	EA	2	$ 6,250.00	$ 12,500.00
421	Cattleguard Cleaning	EA	1	$ 600.00	$ 600.00
	Drain Dip Installation	EA	18	$ 950.00	$ 17,100.00
	Drainage Reinforcement	MILE	5.8	$ 1,430.00	$ 8,294.00
	Culvert Removal (above 24")	EA	5	$ 960.00	$ 4,800.00
	Storm Inspection and Response	DAY	6	$ 1,450.00	$ 8,700.00
				TOTAL	$ 51,994.00
NFSR	Waterbar Installation	EA	8	$ 650.00	$ 5,200.00
421 Spurs	(A, B, C, D, E, F, G, H)			**TOTAL**	$ 5,200.00
		TREATMENT TOTAL			$ 67,946.00
SPRING CREEK FIRE - OVERHEAD SCHEDULE					
	Mobilization and Bonding for contract	JOB	1	14%	$ 9,512.44
	GS-9 - Storm Inspection	DAY	8	$ 320.00	$ 2,560.00
	GS-11 - Contract Admin	DAY	10	$ 390.00	$ 3,900.00
		OVERHEAD TOTAL			$ 15,972.44
		IMPLEMENTATION TOTAL			**$ 83,918.44**

Definitions:

3) Drainage Dip: Provides relief flow path for flooded roadway or overwhelmed stream culvert crossings to minimize diversion potential and associated erosion and damage of road prism. Optional armoring of the outlet limits erosion of the feature and fill slope as the concentrated flow moves downstream.

4) Drivable Waterbar: Provides relief flow path for overwhelmed cross drains or in-sloped roads with absent or inadequate cross drains to remove post-fire flows and sediment from the road prism, especially on steep road grades. Practice is reserved for Level 2 roads with lower traffic and design vehicles.

5) Drainage Reinforcement: Provides an intercept path for flows and associated debris off fire-impacted slopes without losing capacity and diverting flow onto the roadbed. Applicable to existing ditches, drainage dips and waterbars.

6) Culvert Removal: Removal of cross drains and stream crossing culverts which cannot be protected through relief dips or other methods. Stockpile culvert and back-slope the crossing to conform to general channel shape and provide unobstructed hydrological function.

7) Roadway Storm Inspection and Response**:** Monitors road drainage improvements and maintenance treatments as they respond to significant storm events and subsequently repairs damages that compromise the effectiveness of these efforts.

Trail Treatments

To mitigate threats to life and safety, close trails and recreation sites affected by the fire (as part of an area closure) for the first winter following the fire, and prior to lifting the closure, install warning signs at all trailheads within or leading to the burned area.

Trails and Trailheads

Indian Trail (National Forest System Trail 1300): The Indian Trail, is a moderately used ATV trail starting at the Indian Trailhead along NFSR 421 traveling south to Bear Lake Trailhead. This trail is open to vehicles 50" or less and is managed as trail class 3 and maintenance level 2. The trail is just over 14 miles in length. Indian Trailhead is a moderately used trailhead with a trailhead sign and space available for approximately 4 vehicles.

Dispersed Campsites

Indian Creek dispersed sites: These dispersed sites are along or at the end of the following roads: NFSR's 421 (Indian Creek Road), 421.A, 421.B, 421.C and 421.D; and NFSR 410 (Tracy Canyon Road). On the 421 road group there are twenty-five sites and along 410 there are twelve. These are undeveloped sites that usually occupied for tent camping.

Trail Treatments Description: An emergency determination was made that the following BAER treatments are required on trails (Indian Trail) in the Spring Creek Fire burned area to protect property and reduce life/safety hazards:

- Trail stabilization
- Storm proofing
- Treatment of hazard trees while working on the trail
- Temporary site and trail closure
- Warning Signs
- Storm inspection and response

Dispersed Recreation Site Treatments Description: An emergency determination was made that the following BAER treatments are required on dispersed recreation sites in the Spring Creek Fire burned area to protect and reduce life/safety hazards. Temporarily close the area to minimize risk to life. Areas that will be open will have warning signs installed at the Forest boundary about hazard tree dangers.

Closure: All trails and recreation sites affected by the fire should be closed for the first winter following the fire. Conditions following the first winter should be evaluated to judge if additional time is needed to provide for user safety or resource protection. If additional time is needed, it can be obtained through an extension of the original forest order mandating an area closure and leaving existing closure signage in place.

Prior to lifting the closure, warning signs should be installed at all trailheads within or leading to the burned area. This will make visitors aware of potential hazardous conditions that may remain. Trailheads at both ends of the Tequepis Trail (29W06) will requiring warning signs.

Note: storm proofing treatments include log outs necessary to make the work sites accessible and free of hazard trees and to allow for safe crew egress in case of emergency.

Monitoring: Periodic trail inspections will be needed to monitor the effectiveness of the treatments. The inspections should be conducted after significant weather events. The inspectors will correct minor problems and report significant issues on and along the trail. They should also check for public usage of the trail in order to monitor the effectiveness of the forest closure. Based on information gathered on treatment effectiveness monitoring, an interim request may be submitted to the region for consideration for additional funding to correct problems in response to unforeseen storm damage.

The treatments were chosen to minimize infrastructure loss due to impact from upslope burned areas and potential erosion and sediment transport to downslope resources. Below is a table summary of the trail and dispersed site treatment costs:

Table 15: Trail Treatment and Costs

Item	Unit	Unit Cost	# of Units	Cost
Trail Stabilization (total trail miles of high & moderate severity burn, cost includes contractor and USFS oversight)	Mile	$6000	4.7	$28,200
Trail Stabilization vehicle costs	Mile	$1	1000	$1000
Trail Closure Implementation	Each	$2500	1	$2500
Warning Signs	Each	$400	3	$1200
Storm Inspection and Response	Day	$690	10	$6900
			Total Cost	**$39,800**

Table 16: Recreation Sites Treatment and Costs

Item	Unit	Unit Cost	# of Units	Cost
Warning Signs (dispersed rec sites)	Each	$400	3	$1200
Warning Signs (dispersed rec sites)	Sites	$250	15	$3750
			Total Cost	**$4,950**

Protection/Safety Treatments

Burned Area Closure and Warning Signs

Posting of areas burned will alert the public to potential dangers of falling trees and rolling rocks. For roads, the recommended treatment is installation of seasonal closure and warning signs at major points of entry. The following locations were identified as a signage strategy for main entry points of the Spring Creek Fire perimeter. As soon as possible install road and area closure signs with associated information at the above existing and new closure gate locations. After the fire area administrative closure has been lifted replace road and area closure signs at these locations with typical BAER Warning signs, to warn potential road users that they are entering a burned watershed.

Table 17: Protection and Safety Cost

Item	Unit	# of Units	Unit Cost	Total
Install Road Closure and Information Signs	Each	2	400	800
Install BAER Warning and Information Signs	Each	4	500	2,000
Re-Sign existing Gates (Road Closed, object mark, reflect.)	Each	2	250	500
Install Locked Gate Ahead Signs	Each	2	125	250
Install Flash Flooding signs at 3 low water crossings	Each	3	125	750
Sub Total				**$4,300**
Mobilization Administration Implementation	%	1	25	**$1,075**
Total				**$5,375**

Heritage Treatments $52,000

Proposed treatments made by other specialists (hydrologists, soil scientists, geologists) that have the potential to affect cultural resources are subject to the provisions of 36 CFR 800**.** Prior to BAER implementation, an archaeologist should be assigned to the implementation team to ensure that inventory and compliance requirements per NHPA and the R5/SHPO Programmatic Agreement are satisfied.

Proposed treatment to protect Forest Service Office and Work Center (administration site added to this section to facilitate efficiency) include:

Building #3522, La Veta Office = $392,003 Capital Recovery Value (CRV)
Building# 9310, La Veta WC Garage/Barracks = $467,380 CRV

La Veta Forest Service Office:
Protection of the lowest openings in the building envelope, expedient protection utilizing sandbags (or similar means), and operation/maintenance of these systems for three years. Install triple pump system (battery and electric powered) to quickly remove any water that enters basement space before mold sets in or structural damage occurs.

La Veta Forest Service Work Center:
Install approximately 400 linear feet of 3 foot high retaining wall. Wall could be made from barrier bags filled with sand or Jersey Barriers. Place approximately 300 linear feet along the back property line that extends east and west to protect the bunkhouse, barn and tack shed.

Place approximately 100 linear feet on the property line that runs north and south. Tie the two retaining walls in at the corner. The walls are to be located on the high side of the property.

Cadastral

Treatments to Mitigate the Emergency

Treatment Type: Land survey monument location and protection. Locate, identify, and preserve the location of the original monument and witness assories.

Treatment Objective: Preserve existing land survey monuments that are at risk from the residual effects from the fire.

Treatment Description: The monuments will be located on the ground using survey grade GPS so that the monument and its location can be put to future use if necessary. Then we will set a new monument, if needed, in its place. We will then protect any remaining bearing trees and assessors. In some cases we will set steel fence post alongside the monument so that it can be easily located and identified by specialists after damaging storms. The post will also reinforce and help protect the monument from debris flow. In some cases, stone mounds will be built around the existing monuments in order to increase the durability and longevity of the monument. This rehabilitation will help protected against flooding and debris flow caused by the residual effects of the fire. These corners will then be described and recorded for future use. Once the monuments have been rehabilitated, trained sawyers will be employed to conduct the hazard tree removal in order to further ensure the stability of the monument and the safety of future users.

Table 18: Cadastral Treatment Cost: $13,500

Zone 2 - Pike and San Isabel and Comanche NG		**Spring Creek Fire**					
At Risk Monument Protection		**T. 30 S., Rs. 69 & 70 W., 6th P.M.**					
NOTE: This cost estimate could change based on additional record research or a change in the scope of work.							
Item No.	**Supplies/Service**	**Base Year Crew Configuration**		**Quantity**	**Unit**	**Unit Price**	**Total Amount**
1.1	**Record Research and Adjoiner Notification**	1/2 Day=$275 FED Rate$55/hr.		2	Job	$275	$550
1.2	**Corner Recovery and Positioning**						
	1.2.1-Difficult 4 Corners/ Day (Mineral Claim Corners)	1 Day	2 person Crew	15	Each	$200	$3,000
	1.2.2-Normal 6 Corners/ Day	1 Day	2 person Crew	0	Each	$80	$0
	1.2.3-Easy 10 Corners/ Day	1 Day	2 person Crew	0	Each	$80	$0
	1.2.4-Traverse add-on	1/2 Mile/ Day	2 person crew	0	Mile	$1,600	$0
1.5	**Corner Monumentation**						
	1.5.1 Difficult - Dig	6 Corners/ Day	2 person crew	11	Each	$134	$1,459
	1.5.2 Easy - Drive	12 Corners/ Day	2 person crew	0	Each	$67	$0
1.11	**Prepare Diagram and Report**			40	Hour	$55	$2,200
1.15	**Travel Per Diem**	$123/day/person		10	Day	$123	$3,690
				Total =			**$10,899**

			Supplies/ Vehicles/ Overhead =	**$2,601**
			Total Estimated Cost =	**$13,500**
Project Days =		10		
Crew Members on Travel =	X	3		-
Chargable Travel Days =		30		-
Daily Gov. Travel Rate $123/day	X	$123		
1.15 Travel Per Diem =		$3,690		

Wildlife

No treatments are being proposed to address Canada Lynx habitat due to the risk matrix determination of ***low*** because post-fire flooding and sedimentation threats will not exacerbate any impacts already caused by the fire.

Fisheries

No T&E fisheries fall in the forest service lands within the Spring Creek fire so no treatments are proposed.

Implementation Team Leadership and Coordination and Implementation Leader

Interagency Coordination:
Interagency coordination started during the fire and continued throughout the BAER Assessment. Continuing this coordination by providing the BAER Assessment Report, specialist reports and attending meetings is anticipated. In addition, letters detailing potential physical responses and impacts from the fire that may influence safety in and downstream of the fire area will need to be composed and sent to all public and private stakeholders at risk from increased sediment and flooding. Funding is requested for agency coordination, Implementation team lead, and for the Forest BAER Coordinator to ensure continued coordination with cooperating agencies, prompt implementation, tracking of BAER treatments, and installation of burn area warning signs. The facilitation may include: phone calls, meetings, and field trips to the affected areas.

A part time implementation leader will be needed to help organize and track the road work, trail work, signage, and to compile costs and update reports. There will be separate and additional trail and road implementation leaders who's cost is covered in those sections. The implementation leader costs and BAER coordinator costs are captured together as 10 total days of work at $500/day.

Table 19 – BAER Interagency Coordination

Item	Unit	Cost	Number	Total
Coordination with Public & Private	ea	$500	10	$5,000

I. 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). See Appendix B below for road, trail, and heritage monitoring.

Part VI – Table 20: Emergency Stabilization Treatments & Source of Funds, Pike Isabel NF Initial Request

Click red icons for notes.	NFS Lands					Other Lands				Money Left Total $
Line Items	**Units**	**Unit Cost**	**# of Units**	**BAER $**	**Spent $**	**# of Units**	**Fed (BLM) $**	**# of Units**	**Non Fed $**	
A. Land Treatments										
Invasive Weed Detection &Treatment	project	$38,510	1	$38,510	$0		**$40,000**		$0	$**38,510**
Seeding and mulch and application	*NA*						$5,687,000			
Treatment planning and implementation team	***NA***						**$36,000**			
Subtotal Land Treatments				**$38,510**	**$0**		**$5,763,000** **		**$0**	
B. Channel Treatments - none										
Subtotal Channel Treatments				$0	$0		$0		$0	$0
C. Road and Trails										
Road Stormproofing	project	$83,915	1	$83,915	$0		$0		$0	$83,915
Trail Stormproofing	project	$39,800	1	$39,800	$0		$0		$0	$39,800
Recreation Sites Stormproofing	project	$4,950	1	$4,950	$0		$0		$0	$**0**
Subtotal Road & Trails				$123,715	$0		**$2,256**		$0	**$123,715**
D. Protection/Safety										
BAER warning & closure signs	project	$5,375	1	$5,375	$223.94		$0		$0	$0
Cadastral	project	$13,500	1	$13,500	$0		$0		$0	$0
Coordination with Public & Private	days	$500	10	$5,000	$0		$0		$0	$0
Forest Facilities		***$12,000 office, $40,000 admin site***		**$52,000**	**$0**					$
Subtotal Protection				$23,875	$223.94		$0		$0	$

Click red icons for notes.	NFS Lands					Other Lands				Money Left Total $
Line Items	Units	Unit Cost	# of Units	BAER $	Spent $	# of Units	Fed (BLM) $	# of Units	Non Fed $	
E. BAER Evaluation										
Assessment Team	0231	H2BAER	---	---	$123,555	---	$63,588	---	$0	$0
	---	---	---	---	$0	---	$0	---	$0	$0
Subtotal Evaluation				---	$123,555	---	$0	---	$0	$0
F. Monitoring										
Trail Treatment Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Road Treatment Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Subtotal Monitoring				$2,000	$0		$0		$0	$0
G. Totals				$52,000	**$60,190.94**		**$0**		**$0**	**$188,100**
Previously approved				**$188,100**		Comments: other federal lands and private have the potential for treatments of helimulching and mastication				
Total for this request				$52,000						
Total Request				$240,100						

** While BLM EWP work is approved funding has not been appropriated as of yet

PART VII - APPROVALS

1. Carolyn Upton Acting — 11/29/18

Forest & Grassland Supervisor (signature) — Date

Pike/San Isabel NF's

Cimarron/Comanche NG's

2. _____ _____

Regional Forester (signature) — Date

APPENDICES: Supporting Information:

Appendix A: Spring Creek Fire Fire BAER Team

Appendix B: Monitoring for Roads and Trails

Appendix C: Spring Creek Values at Risk Matrix and Recommended Post-Fire Response

Appendix D: Summary of Cost-Risk Analysis

Appendix E: Treatment Map for the Spring Creek Fire

Appendix A: Spring Creek Fire BAER Team:

Steve Sanchez	BAER Coordinator	stevenasanchez@fs.fed.us	PSICC	719-849-1282	719-553-1518
Misty DeSalvo	PIO	mdesalvo@fs.fed.us	PSICC	719-429-4696	719-269-8525
Brad Rust	Team Leader	brust@fs.fed.us	SHF	530-917-0434	530 226-2427
Anne Poopatanapong	Team Leader (T)	apoopatanapong@fs.fed.us	R6 - RO	971-201-9489	503-808-2663
J. Yonnie Schwartz	Geologist	jonathanschwartz@fs.fed.us	LPF	805-698-9752	805-646-4348 x311
Aaron Lamp	Engineering	alamp@fs.fed.us	PSICC	719-252-2092	719-553-1494
Lisa Maestas	GIS	lisadmaestas@fs.fed.us	PSICC		719-553-1474
Amanda Sanchez	Archaelogist	asanchez@fs.fed.us	PSICC	575-770-3061	719-553-1505
Rebecca Biglow	Hydrologist	becbiglow@gmail.com	BLM (AD)	541-337-5582	719-239-9716
Andrew Breibart	Hydrologist	abreibart@blm.gov	BLM	760-920-0375	970-642-4944
Eric Nicita	Soil Scientist	enicita@fs.fed.us	ENF	530-748-5827	530-621-5290
Negussie Tedela	Soil Scientist Trainee	ntedela@blm.gov	BLM	719-480-0342	719-480-0342
Heidi Plank	Wildlife	hplank@blm.gov	BLM	970-485-0728	970-244-3012
Eduardo Duran	Botany/Range	eduran@blm.gov	BLM	719-850-0612	719-850-0610
John Baumchen	REC/Trails/OHV	jbaumchen@fs.fed.us	PSICC	575-303-3779	719-269-8702
Kathy Murphy	Plans/Logistics/Finance	kathymurphytahoe@gmail.com	TNF	530-414-1350	
Daniel S. Johnson	SOFR	dancolorado@hotmail.com	CO - RYEX	719-480-9764	
Patrick Moran	Geology	patrickjmoran@fs.fed.us	RGF	609-315-0889	719-852-6286
Diane Mastin	GIS (T)	dmastin@blm.gov	BLM	970-485-0728	970-244-3090
Andrew Welsh	GIS (T)	andrewwelsh@fs.fed.us	WMF	703-919-6596	603-536-6245

Appendix B: Monitoring Protocols:

Spring Creek Fire
Road Effectiveness Monitoring

The 2500-8 report requests funds to monitor the effectiveness of road treatments on Spring Creek Fire roads.

4. Monitoring Questions
- Is the road-tread stable?
- Is the road leading to concentrating runoff leading to unacceptable off-site consequences?

2. Measurable Indicators
- Rills and/or gullies forming of the road
- Loss of road bed.

3. Data Collection Techniques
- Photo documentation of site
- Inspection Checklist (attached)

4. Analysis, evaluation, and reporting techniques

- Monitoring will be conducted after storm events. If the monitoring shows the treatment to be ineffective at stabilizing road and there is extensive loss of road bed or infrastructure an interim report will be submitted. A several page report would be completed after the site visit. The report would include photographs and a recommendation on whether additional treatments are necessary.

Road Inspection Checklist

Date:_____ Inspector_____
Time:_____ Forest Road_____

Describe locations reviewed during inspection:_____

Was there road damage?

Was culvert plugged?_____.

GPS _____

Describe damage and cost to repair? (GPS)_____

Photo taken of road damage_____

Recommended actions to repair:_____

Spring Creek Fire
Trail Effectiveness Monitoring

The 2500-8 report requests funds to monitor the effectiveness of trail treatments on Forest Trails in the Spring Creek Fire.

1. Monitoring Questions
   - Is the trail tread stable?
   - Is the trail leading to concentrating runoff leading to unacceptable off-site consequences?

2. Measurable Indicators
   - Rills and/or gullies forming on the trail
   - Loss of trail bed

3. Data Collection Techniques
   - Photo documentation of site
   - Inspection Checklist (attached)

4. Analysis, evaluation, and reporting techniques

   - Monitoring will be conducted after storm events. If the monitoring shows the treatment to be ineffective at stabilizing trail and there is extensive loss of trail bed or infrastructure an interim report will be submitted. A several page report would be completed after the site visit. The report would include photographs and a recommendation on whether additional treatments are necessary.

Trail Inspection Checklist

Date:_____ Inspector_____
Time:_____ Forest Trail_____

Describe locations reviewed during inspection:_____

Was there trail damage?
Did the trail crossing fail?_____. GPS)_____

Describe damage and cost to repair? (GPS)_____

Photo taken of trail damage_____

Recommended actions to repair:_____

Appendix C: Spring Creek Values at Risk Matrix, Treatments and other recommended Post-Fire Response

1	Property	FS	Indian Creek OHV trail	trail tread, prism blow out,	VeryLikely	Major	Very High	Temp closure, improve drainage, storm protection features	eduran@blm.gov	-105.1338919	37.45125845
1a	HumanLifeSafety	FS	Indian Creek OHV trail	hazards trees along the 5 miles	Possible	Major	High	close; hazard tree removal; drainage; check crossings			
2	Property	FS	421 road	Rock and sediment transport closed the road. Tree hazards.	VeryLikely	Moderate	Very High	Road maintenance and road closure sign; recontour the area; gate; pulling culverts; rolling dips	ntedela_BLM	-105.1231357	37.45559811
2a	HumanLifeSaftey	FS	421 road	Rock and sediment transport closed the road. Tree hazards.	VeryLikely	Moderate	Very High	Road maintenance and road closure sign; recontour the area; gate; pulling culverts; rolling dips			
3	Natural Resource	FS	FS Boundary Fence	Burned fence; sediment flow risk; recovery of native vegetation; cattle drifting	Possible	Moderate	Intermediate	Replace or repair minor facilities. Exclude cattle for vegetative recovery.	eduran@blm.gov	-105.1671531	37.4625756
4	Property	FS	FS water rights	impacts to water develop from post fire flooding and erosion	unlikely	minor	Very Low	none			
5	Natural Resource	FS	Canada Lynx Critical Habitat	Type conversion as a result of soil loss. Loss of site potential.	Possible	minor	Low	none	hplank_BLM		
6	HumanLifeSafety	FS	Dispersed Camping Location	Hazard Trees damaging sites	Likely	Major	Very High	Warning signs for the recreationists.			
7	HumanLifeSafety	FS	Traffic on open roads	Fallen trees, snags, rocks, prism failure, culvert overtopping	Possible	Major	High	Install hazard signs, spot hazard tree falling, emergency roads closures	alamp_usfs		
8	Property	FS	NFSR 420 - Tracy Canyon	Culvert overtopping, prism failure, excessive roadbed erosion, fill slope loss next to stream	Likely	Moderate	High	Waterbar installation, reinforce drainage features	alamp_usfs		
9	Property	FS	NFSR 421 - East Indian Creek	Culvert overtopping, prism failure, excessive roadbed erosion, fill slope loss next to stream	Likely	Major	Very High	Gate closure, Culvert removal, Dip & Waterbar Installation, Reinforce drainage features, Prism outsloping	alamp_usfs		
10	Property	FS	NFSR 421 Spurs	Fill slope loss next to stream, facilitation of water concentration resulting in flows to the	Likely	Moderate	High	Waterbar installation, leadout ditches	alamp_usfs		
11	Natural Resources	FS	Watershed - Hydrologic function and Aquatic Habitats	Increased runoff and sediment deposit from roads and related drainage features in event of	Likely	Minor	Low	Road treatments and grade controls on steep drainages with road/water interactions	alamp_usfs		
12	Natural Resource	FS	Soil and Water Resources	Accelerated erosion of roads with hydrologic connectivity to streams, impacting water quality.	Likely	Moderate	High	Implement roads and trails treatments to stabilize roads that can impact water quality.	jkrezelok_FS		
13	Property	BLM	BLM Boundary Fence	Fence burned; cattle drifting onto lands; sediment flow; recovery of native vegetation; debris flow	Very Likely	Major	Very High	Replace or repair minor facilities. Exclude cattle for vegetative recovery.	eduran@blm.gov	-105.1880749	37.65303647
13a	Property	BLM	BLM Boundary Fence	cattle drifting onto lands; sediment flow; recovery of native vegetation; debris flow	Very Likely	Moderate	Very High	Replace or repair minor facilities. Exclude cattle for vegetative recovery.	eduran@blm.gov	-105.2380834	37.63927219
14	Natural Resource	BLM	BLM Sheep Mountain oil and gas lease	potential hazmat site if overtopped	unlikely	Major	Intermediate	no treatment			
15	HumanLifeSafety	BLM	Traffic on open roads	Fallen trees, snags, rocks, prism failure, culvert overtopping	Possible	Major	High	Install hazard signs, spot hazard tree falling, emergency roads closures	alamp_usfs		
16	Property	BLM	Road @ T27S, R69W, Sec 30, NE ¼, SW ¼	Increased roadbed erosion from moderately burned timber areas	Likely	Moderate	High	Install additional waterbar drainage	alamp_usfs		
17	Property	BLM	Road @ T28S, R69W, Sec 4, NW ¼, SE ¼	Increased erosion on road bed	Likely	Minor	Intermediate	Install additional waterbar drainage	alamp_usfs		
17a	Property	BLM	Road @ T28S, R69W, Sec 17, SE ¼, NW ¼	Increased erosion through treed area absent of drainage features.	Likely	Moderate	High	Install additional waterbar drainage, outslope road where feasible in the timber. Leave grassy 2-track segments undistrubed	alamp_usfs		
17b	Property	BLM	Road @ T28S, R69W, Sec 17, SE ¼, NW ¼	Mild erosion (2-track in grass)	Possible	Minor	Low	None, road is not entrenched and will likely weather increased sheet flows without treatment	alamp_usfs		
18	Natural Resources	BLM	Watershed - Hydrologic function and Aquatic Habitats	Increased runoff and sediment deposit from roads and related drainage features	Likely	Minor	Low	Road treatments and grade controls on steep drainages with road/water interactions	alamp_usfs		
19	Property	FS and BLM	FS and BLM survey monument marker	debris flow; sediment and landslides	Very Likely	Moderate	Very High	retreat with modern survey monument; visit and reaccessorize with new material			
20	Natural Resource	FS and BLM	noxious weed on FS and BLM lands	loss of native vegetation	Very Likely	Moderate	Very High	rapid response and treatment; Wyden admendment			
21	Property	PVT	Road 572	Creeks from Iron Mountain area drains this area. Loss of tread/use of the road from debris flow and loss of culvert. Loss of the road				dips, storm patrol, temp closure	enicita_usfs	-105.2123672	37.64734685
21a	HumanLIfeSafety	PVT	Road 572	Loss of human life				dips, storm patrol, temp closure			
22	Property	PVT	Paradise acres south road	Diversion of flow could damage road				Install critical dip and excavate throat	enicita_usfs	-105.2231055	37.63984478
23	Property	PVT	Abeyeta fiber optic	Cable conduit is at risk of large flow and moving organic debris; bulk flow with logs from uphill slope				Identify and notify admistrators of the cable.	enicita_usfs	-105.1620783	37.56988271
24	HumanLifeSafety	PVT	Abeyta power line access road	Bridge burned up and now 20-25 ft chasm. Road is accessible and only warning is pink flagging.				Determine ownership for low g term stabilization. Temporarily place boulder barricade on either side.	enicita_usfs	-105.1621847	37.56976081
25	HumanLifeSafety	PVT	440/421 connector Middle Creek	barbed wire fence collecting woody material. Likely will back up more and break causing culvert plugging. Outlet also has barbed wire increasing sediment t buildup. Thick sediment buildup upstream of inlet and in pipe.				clean inlet and outlet. Install pass through fence, install flood hazard signs.	enicita_usfs	-105.0405946	37.51071655
25a	Property	PVT	440/421 connector Middle Creek	barbed wire fence collecting woody material. Likely will back up more and break causing culvert plugging. Outlet also has barbed wire increasing sediment t buildup. Thick sediment buildup upstream of inlet and in pipe.				clean inlet and outlet. Install pass through fence, install flood hazard signs.			
26	HumanLifeSafety	PVT	Middle Creek Culvert	3 ft culvert plugged Road overtopped . Upstream side nearly filled. Drowning risk if crossed during high flow				Excavate inlet and upside culvert	enicita_usfs	-105.1703617	37.57247471
27	HumanLifeSafety	PVT	hwy12						abreibart_BLM	-105.0831749	37.40158
28	HumanLifeSafety	PVT	PVT land road	road could wash out flow from .2 inches of the					abreibart_BLM	-105.4563649	37.4311044

29	Property	PVT	Paradise Acres PVT						abreibart_BLM	-105.2319795	37.6431974
30	Property	PVT	County Road creek crossing	creek crossing County road				county redirect 160 highway runoff in box culvert drivable ford with low flow pipes clean flow paths of trough and debris PowerLine pole protection	abreibart_BLM	-105.1704357	37.5725996
31	Property	PVT	electrical line	electrical line can be taken out from flooding				information electric company	abreibart_BLM	-105.2514373	37.5247963
32	Property	PVT	buried electric line	runoff could expose line					abreibart_BLM	-105.2086175	37.4848243
33	HumanLifeSafety	PVT	PVT culvert	culvert filling from debris flow and sediment				recommend clean outlet of willow clean inlet during storms stabilize TRY FILL	abreibart_BLM	-105.2674039	37.5224934
34	Property	PVT							abreibart_BLM	-105.2116711	37.6485585
35	NaturalResources	PVT	Soil productivity	Soil erosion				None	brust_usfs	-105.1951455	37.58827189
36	Property	PVT	stream and culvert road crossing						hplank_BLM	-105.1978675	37.43394215
36a	Natural Resource	PVT	stream and culvert road crossing								
37	Property	PVT		stream and culvert road crossing					hplank_BLM	-105.2049984	37.4335713
38	Natural Resource	PVT		stream and culvert road crossing							
39	Property	PVT	culvert, indian creek	silt flow from burn impacting culvert, road and creek					hplank_BLM	-105.2368196	37.43779404
39a	Natural Resource	PVT	culvert, indian creek	silt flow from burn impacting culvert, road and creek							
40	NaturalResources	PVT	forbes park lake	potential silt into lake, unsure of potential risk					hplank_BLM	-105.1890731	37.4468276
40a	Property	PVT	forbes park lake	potential silt into lake, unsure of potential risk							
41	Property	PVT	culvert on road adjacent to blm, only	culvert likely to overtop and was out road				armored critical dip; storm patrol	hplank_BLM	-105.1307966	37.61317747
42	HumanLifeSafety	PVT							abreibart_BLM	-105.2157837	37.6344412
43	NaturalResources	PVT	Forbes Ranch	Potential for accelerated erosion due to lack of vegetative cover within burn.				Mastication of dead trees around area to return nutrients into the area. Reduce erosion by cutting down hazard trees. Wood shred and spread on burn area.			
44	Property	PVT	town diversion	unknown sedimentation				storm patrol replace concrete diversion	abreibart_BLM	-105.0318089	37.4580847
45	Property	PVT		water quality					abreibart_BLM	-104.8608479	37.5943459
46	HumanLifeSafety	PVT		water quality							
47	Property	PVT	CR520 north aveytacreek					fix fences sign flood hazard storm patrol clean inlets and outlet move LWD out of cottonwood zone	abreibart_BLM	-105.0167448	37.5745886
48	Property	PVT	Diversion channel and structure	silt and debris flow				NRCS would clean diversion North of Abeyta Cr	nick		
49	Property	PVT	Old Taos Trail	erosion from ephemeral channel coming from Sheep, Silver and Little Sheep Mtn							
50	Natural Resource	PVT	Salvagable timber along Forbes and Trinchera Ranch	sediment and debris flow along road that would access the timber making it inaccessible.							
51	Property	PVT	Water System to La Veta and Walsenburg	Damage to infrastructure from debris flow. Excessive sedimentation							
51a	HumanLifeSafety	PVT	Water System to La Veta and Walsenburg	Damage to fresh water supply. Could potentially become health hazard.							
52	HumanLifeSafety	PVT	Cuchara PVT Community	Debris flow, sediment, run off and flash flooding from burnt drainages above community.							
53	HumanLifeSafety	PVT	Hwy 160 along Abeyeta Creek	Debris flow, sediment, run off and flash flooding from burnt drainages around the highway.							
54	Natural Resource	PVT	Capp Cabin mudslide	debris flow NE side of Silver Mtn				Work with NRCS			
55	Property	PVT	Pass Creek structures	Structures in floodplain and at risk to flooding.							
56	Property	PVT	Forbes Park Railroad	Debris flow and potential loss of structures							
57	Property	PVT	Huerfano gauges and associate downstream structures	Stream gauges may be compromised from increased sedimentation upstream.							
58	Property	Unknown Jurisdiction	Road @ Sheep Mountain (T27S, R70W, Sec 27) (off of CR 562)	Culvert basin overtopping, excessive roadbed erosion due to low capacity ditchlines	Possible	Moderate	Intermediate	Re-establish ditchlines to restore capacity, maintain culvert inlet basins. Storm patrol.	alamp_usfs		
59	Property	Unknown Jurisdiction	Road @ Mount Mestas (T28S, R69W, Sec 19, SE ¼, SE ¼)	Increased erosion of roadbed from increased flows and sediment/debris from adjacent slopes	Likely	Moderate	High	None, road is not entrenched and will likely weather increased sheet flows without treatment. May be covered with sediment from adjacent burned slopes but cannot be prevented.	alamp_usfs		
60	Property	PVT	Vories Creek	Increased flooding and erosion and debris flow				Communicate with land owners and install early warning system.	bbiglow		
60a	HumanLifeSafety	PVT	Vories Creek	Increased flooding and erosion and debris flow				Communicate with land owners and install early warning system.	bbiglow		
61	Property	PVT	Sulphur Springs and neighborhood	Flooding, erosion and debris flow, and access by roads.				Communicate with land owners and install early warning system.	bbiglow		
61a	HumanLifeSafety	PVT	Sulphur Springs and neighborhood	Flooding, erosion and debris flow, and access by roads.				Communicate with land owners and install early warning system.	bbiglow		
62	Natural Resource	BLM	Rio Grande Cutthroat Trout	Potential sediment debris flow into occupied stream reaches. Local extirpation of population. Loss of site potential for recovery.	Very Likely	Major	Very High	Communicate findings to FWS, CPW and Trinchera Ranch	hplank_BLM		
63	**Heritage**	**FS**	**La Veta Office**	**Flooding and debris flow**	**Very likely**	**Major**	**Very High**	**Land treatments and structure protection**	**ssanchez**		
64	**Property**	**FS**	**La Veta Administrative Bldg.**	**Flooding and debris flow**	**Very likely**	**Major**	**Very High**	**Land treatments and structure protection**	**ssanchez**		

Appendix D: Summary of Cost-Risk Analysis

Spring Creek Fire Benefit Cost Analysis:

Total benefits of resources for whole fire FS lands:

All Resource	Value $	
Roads at risk	$120,000	
Trails	$60,000	
Water quality	$5,000,000	
Soil productivity	$400,000	
Threatened and Endangered Species (fish and wildlife)	$0	No T&E on FS lands
Native Plant Communities near invasives	$500,000	
Heritage Resources	$860,000	
Public safety	$1,000,000	Human life and/or safety is not a market value. Estimated cost of injury accident.
	$7,940,000	

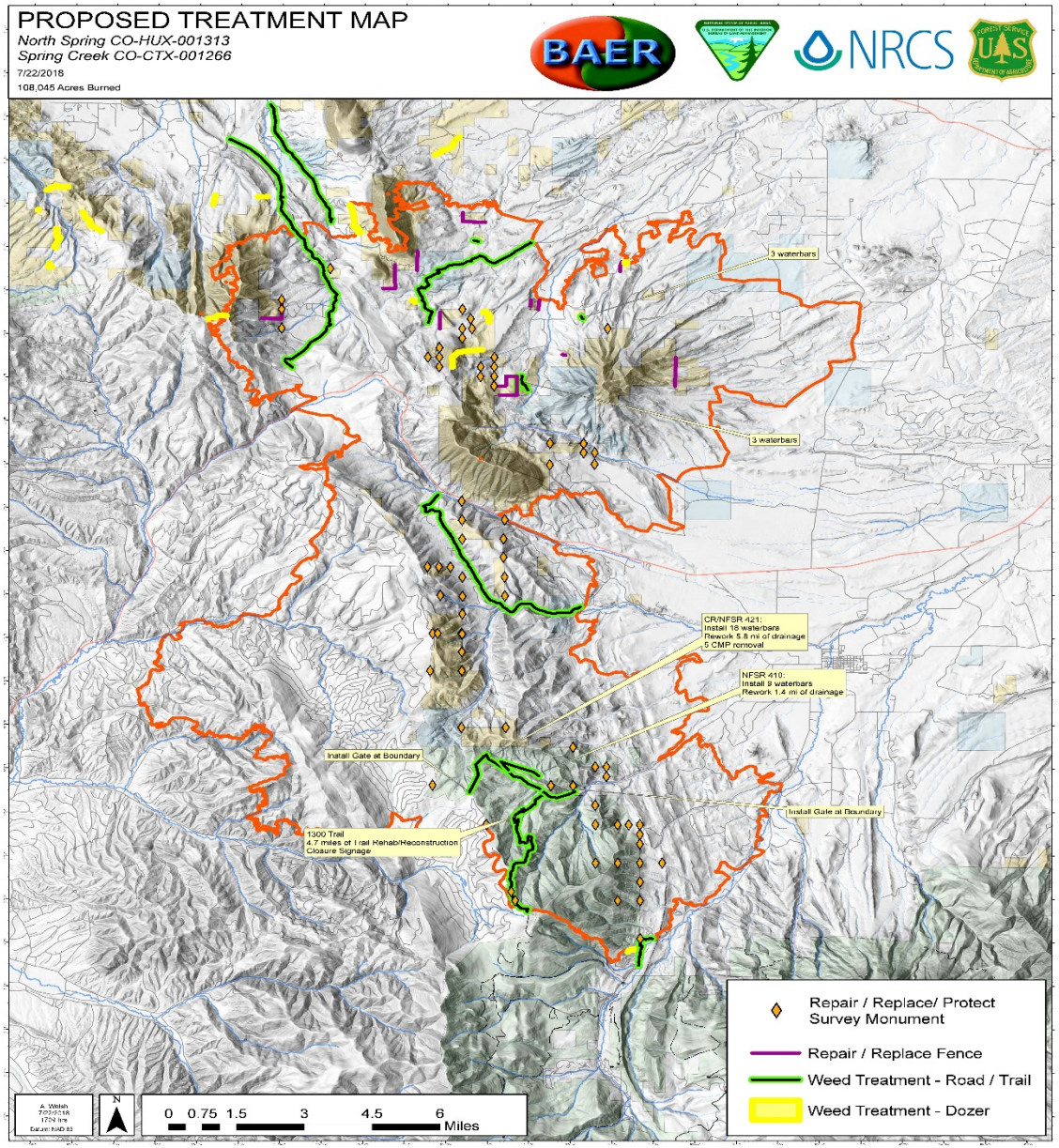
Proability of loss without and with treatments:

All Resource	Probability loss no treatments:	Probability loss w/ treatments:	Reduction in proability of loss
Roads at risk	90%	20%	70%
Trails	80%	20%	60%
Water quality	60%	40%	20%
Soil productivity	60%	35%	25%
Threatened and Endangered Species (fish and wildlife)	30%	30%	0%
Invasive Plants	50%	20%	30%
Heritage Resources	70%	5%	65%
Public safety	80%	20%	60%

Total cost of treatments on Forest Service:

Click red icons for notes.	NFS Lands				Other Lands					Money Left
Line Items		Unit	# of	BAER $	Spent	# of	Fed (BLM)	# of	Non Fed	
A. Land Treatments										
Invasive Weed Detection &Treatment	project	$38,510	1	$38,510	$0		$0		$0	$38,510
Seeding and mulch and application							$5,687,000			
Treatment planning and implementation team							$36,000			
Subtotal Land Treatments				**$38,510**						
B. Channel Treatments - none										
Subtotal Channel Treatments				$0	$0		$0		$0	$0
C. Road and Trails										
Road Stormproofing	project	$83,915	1	$83,915	$0		$0		$0	$83,915
Trail Stormproofing	project	$39,800	1	$39,800	$0		$0		$0	$39,800
Recreation Sites Stormproofing	project	$4,950	1	$4,950	$0		$0		$0	$4,950
Subtotal Road & Trails				$123,715	$0		$0		$0	$123,715
D. Protection/Safety										
BAER warning & closure signs	project	$5,375	1	$5,375	$0		$0		$0	$0
Cadastral	project	$13,500	1	$13,500	$0		$0		$0	$0
Coordination with Public & Private	days	$500	10	$5,000	$0		$0		$0	$0
Heritage	2 structures			$52,000						
Subtotal Protection				$75,875	$0		$0		$0	$75,875
E. BAER Evaluation										
Assessment Team	0231	H2BAER	---	---	$123,555	---	$0	---	$0	$0
	---	---	---	---	$0	---	$0	---	$0	$0
Subtotal Evaluation				---	$123,555	---	$0	---	$0	$0
F. Monitoring										
Trail Treatment Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Road Treatment Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Subtotal Monitoring				$2,000	$0		$0		$0	$2,000
G. Totals				**$240,100**					**$0**	
Previously approved				$188,100		Comment				
Total for this request				$52,000						

Appendix E: MAP E-1 Treatment Map - Spring Creek Fire


PROPOSED TREATMENT MAP
North Spring CO-HUX-001313
Spring Creek CO-CTX-001266
7/22/2018
108,045 Acres Burned
BAER
NRCS
3 waterbars
3 waterbars
CR/NFSR 421:
Install 16 waterbars
Rework 5.8 mi of drainage
5 CMP removal
NFSR 410:
Install 9 waterbars
Rework 1.4 mi of drainage
Install Gate at Boundary
Install Gate at Boundary
1300 Trail
4.7 miles of Trail Rehab/Reconstruction
Closure Signage
Repair / Replace/ Protect Survey Monument
Repair / Replace Fence
Weed Treatment - Road / Trail
Weed Treatment - Dozer
N
0 0.75 1.5 3 4.5 6
Miles