High Park Fire Burned Area Emergency Response (BAER) Report

July 17, 2012

DOT
DEPARTMENT OF TRANSPORTATION

LARIMER COUNTY
COMMITTED TO EXCELLENCE

NRCS
Natural Resources Conservation Service

FOREST SERVICE
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DEPARTMENT OF AGRICULTURE

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HIGH PARK EMERGENCY STABILIZATION BURNED AREA REPORT

SUMMARY

Starting on June 9, 2012 and until containment was achieved on July 1, 2012, the High Park Fire burned over 87,200 acres on multiple land jurisdictions. It is the largest and most destructive fire in the history of Larimer County, destroying 259 homes and cabins and disrupting the lives of hundreds of residents. Potential aftereffects include increased flooding, erosion and threats to human life and safety, property and natural and cultural resources.

Of the burned acres within the fire perimeter, 32,302 burned at a low severity; 35,399 at a moderate severity; and 5,714 at a high severity. More than 14,000 acres within the perimeter were unburned. An interagency Burned Area Emergency Response (BAER) team has identified possible treatments for the High Park Fire burn area. This report summarizes watershed information, areas of concern, values at risk and proposed treatment. Emergency treatments considered include land treatments, road and trail treatments, protection/safety treatments, and, for the U.S. Forest Service (USFS), cultural resources.

The team was comprised of resource specialists from the Natural Resources Conservation Service (NRCS), Larimer County, Colorado Department of Transportation (CDOT) and the U.S. Forest Service (USFS). BAER teams consider potential immediate post-fire impacts to critical values of: human life and safety, property, natural resources, and cultural and heritage resources (see Table S-1). Risk is assessed based on the magnitude of the consequences and probability of damage or loss to any of these critical values (see Table S-2).

The USFS is responsible for addressing concerns on National Forest System lands. The NRCS has an ability to help address concerns on non-Federal lands in partnership with willing private landowners and local sponsors who are able to provide funds to match federal funding through the Emergency Watershed Protection Program.

Aerial mulching is proposed to stabilize burned hillslope areas on both National Forest System (NFS) and private lands. Areas planned or proposed for aerial mulching to reduce erosion are in high and moderate soil burn severity and on slopes between 20% and 60%. They are also strategically located in areas where life, safety, or property is at risk or where there is high risk to public water supply.

Aerial mulching is planned for 5,597 acres on NFS lands. Other planned treatments/responses on NFS lands include road repairs or closures; temporary closures of areas, including USFS trails; warning signs; noxious weed detection and treatment; hazardous tree cutting (of immediate threats); and trail stabilization.

Possible treatments for private lands include aerial mulching and seeding of an additional 5,657 acres; barriers or other measures to reduce damage from sediment and other debris; clearing channels and drainageways; warning signs, and increasing the size of culverts on County roads and providing some protection from erosion to reduce the risk of flood flows overtopping and washing out portions of these roads.

In total, this BAER assessment has identified approximately $24 million in potential emergency stabilization treatments to address impacts of the High Park fire. Approximately $17 million in possible treatments is identified for public roads and private lands. Approximately $9.9 million

of these treatments may be eligible for 75% federal funding through the NRCS Emergency Watershed Protection (EWP) program. The cost for local sponsors and private landowners would be approximately $9.3 million. The extent of work on private lands is dependent upon the availability of both Federal and local funding.

Table S-1. Critical Values to be Considered During Burned-Area Emergency Response

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

Table S-2. BAER Risk Assessment

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**

Probability of Damage or Loss: The following descriptions provide a framework to estimate the relative probability that damage or loss would occur within one to three years (depending on the resource):

- Very likely - nearly certain occurrence (>90%)
- Likely - likely occurrence (>50% to < 90%)
- Possible - possible occurrence (>10% to <50%)
- Unlikely - unlikely occurrence (<10%)

Magnitude of Consequences:

- Major - Loss of life or injury to humans; substantial property damage; irreversible damage to critical natural or cultural resources.
- Moderate - Injury or illness to humans; moderate property damage; damage to critical natural or cultural resources resulting in considerable or long term effects.
- Minor - Property damage is limited in economic value and/or to few investments; damage to natural or cultural resources resulting in minimal, recoverable or localized effects.

Source: Forest Service Manual 2523 – Emergency Stabilization –Burned Area Emergency Response (BAER) - Interim Directive, 2012

PART I - TYPE OF REQUEST

A. Type of Report

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

B. Type of Action

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

[ ] 2. Interim Report #_____
[ ] Updating the initial funding request based on more accurate site data or design analysis
[ ] Status of accomplishments to date

[ ] 3. Final Report (Following completion of work)

PART II - BURNED-AREA DESCRIPTION

A. Fire Name and Number

Fire Name: High Park
Fire Number: CO LRX GW7N

B. Location

State: CO
County: Larimer
Region: 2
Forest: ARNF-PNG
District: Canyon Lakes
Fire Incident Job Code: PNGW79

C. Dates

Date Fire Started: 06/09/2012
Date Fire Contained: 07/01/2012

D. Costs and Damages Repaired

Suppression Cost: Approx. $39.2 million at time of BAER Report.

Fire Suppression Damages Repaired with Suppression Funds

1. Fire line (dozer line) water barred (miles): 30 (of 33 miles constructed)
2. Fire line seeded (miles): 0
3. Hand line: 13 miles of hand line constructed, 13 miles repaired (covered, scarified, and water barred
4. Chipping: 42 miles (approximately 30' on fire-side of road) of roadside hazard tree chipping was completed as part of suppression activities

E. Watershed Numbers

Watershed Number	Watershed Name	Acres
101900070805	City of Fort Collins – Cache La Poudre River	16,670
101900070303	Skin Gulch – Cache La Poudre River	13,310
101900070105	Pendergrass Creek – South Fork Cache La Poudre River	11,234
101900070302	Young's Gulch	9,217
101900070305	Hill Gulch - Cache La Poudre River	8,784
101900070303	Redstone Creek	8,460
101900070301	Upper Buckhorn Creek	7,643
101900070302	Middle Buckhorn Creek	4,466
101900070304	Gordon Creek	4,156
101900070209	Bennett Creek	1,611
101900070210	Seven mile Creek - Cache La Poudre River	1,163
101900070802	Horsetooth Reservoir	410
101900070704	Milton Seaman Reservoir – North Fork Cache La Poudre River	266
101900070104	Little Beaver Creek	96
	Total	**87,487**

At approximately 87,487 acres, the High Park Fire is the largest recorded fire in the northern foothills of the Front Range and/or Larimer County (USFS fire history layer).

The northern and northwestern part of the burned area is within 9 HUC6 Watersheds (Skin Gulch-Cache la Poudre, Pendergrass Creek-South Fork Cache La Poudre River, Young's Gulch, Hill Gulch-Cache la Poudre, Gordon Creek, Bennett Creek and small proportions of Seven mile Creek, Little Beaver Creek, and Milton Seamen Reservoir-North Fork Cache la Poudre River). These watersheds are tributary to the Cache la Poudre River and confluence at various locations within Poudre Canyon, northwest of the City of Fort Collins.

The eastern part of the burned area is within 2 HUC6 Watersheds (City of Fort Collins-Cache La Poudre River and a small part of Horsetooth Reservoir). These watersheds drain primarily east towards the City of Fort Collins. The natural drainage pattern is heavily modified by water conveyance and storage facilities just west of Fort Collins.

The southern part of the burned area is within of 3 HUC6 Watersheds (Upper Buckhorn, Middle Buckhorn and Redstone). These watersheds drain generally east and south to Buckhorn Creek and, ultimately, the Big Thompson River.

F. Total Acres Burned

Total Acres Burned:	87,487	
National Forest Service (NFS)	42,634	(48.7%)
Other Federal	261	(0.3%)
State	5,022	(5.7%)
Private	39,570	(45.2%)

A map of the burn perimeter and land ownership is included at the end of the report.

G. Vegetation Types

Predominantly mature lodge pole pine, relatively closed canopy. At lower elevations, mixed-conifer forests containing lodge pole pine, ponderosa pine, and Douglas-fir. Upper elevations consist of forests transitioning to Engelmann spruce and subalpine fir. Pockets of aspen exist throughout forested areas and in minor drainage-ways. Limber pine on some ridgelines.

Non-forested openings are primarily grass, grass-forb complexes, mountain mahogany, bitterbrush, sagebrush, and other upland shrubs. Major drainages with riparian areas are dominated by graminoids and willows, with alders, Rocky Mtn. maple, and other common riparian vegetation. Steep rocky south- or west-facing hillsides/canyons of lower elevations with open junipers, ponderosa pine, shrubs and bunchgrasses; steep rocky north- or east-facing hillsides/canyons with bunchgrasses, shrubs, and mixed-conifer forests dominated by Douglas-fir.

H. Dominant Soils

There are 56 soil units inside the High Park fire perimeter. Dominant soils inside the fire perimeter are divided into three map units which comprise 13% to 25% of the area. These map units are:

- Wetmore-Boyle-Rock outcrop complex, 5 to 60 percent slopes,
- Haploborolls-Rock outcrop complex, steep, and
- Redfeather sandy loam, 5 to 50 percent slopes.

These 3 units represent a total of 52% of the burned area. The Haploborolls-Rock outcrop complex is mostly in moderate to low burn severity areas and Redfeather sandy loam units are located mostly in moderate soil burn severity areas. The Wetmore-Boyle-Rock outcrop complex is the dominant soil unit inside high burn severity areas.

Rock fragments are abundant across the High Park Fire area. The three most common soil map units generally have between 10% and 60% by volume rock fragments in the surface horizons and between 35% and 80% fragments in the underlying subsoil. Surface textures are mostly sandy loam throughout the fire area. Rock outcrops are common throughout the burned area, especially on steep slopes with gradients greater than 60%.

I. Geologic Types

There are six main geologic formations in the burned area: two igneous, two metamorphic, and two sedimentary. The igneous formation of granitic rock material covers 19 percent of the area. The metamorphic formations are biotitic and felsic gneiss with schist, and cover approximately 79% of the area. The sedimentary formations are sandstones and limestones. The sedimentary formations cover approximately 1% of the burned area. Large granite inclusions occur in the south-central area of the burn. Metamorphic rocks (biotitic gneiss and felsic gneiss) occur as a continuous unit inside the perimeter with small inclusions of felsic gneiss formation.

J. Stream Channels by Order or Class:

Perennial	57 miles
Intermittent	271 miles
Ephemeral	316 miles

K. Transportation System

County Roads:	42.3 miles
CDOT Highways:	24.7 miles
Forest Service:	40.6 miles
Private Roads:	98.5 miles
Trails:	9 miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres)

Total Acres Burned:	87,487	
Unburned	14,072	(16.1%)
Low	32,302	(36.9%)
Moderate	35,399	(40.4%)
High	5,714	(6.5%)

A Burned Area Reflectance Classifications (BARC) image was obtained on 06/18/2012. Approximately 50,000 acres was covered by the 06/18 image. Additional BARC coverage was requested but, due to cloud cover, additional imagery was not available. The BAER Team mapped the remaining acreage on the west and north sides of the fire based on aerial and ground reconnaissance of the burned area. Soil burn severity observations and mapping were based on criteria outlined in the Field Guide for Mapping Post Fire Soil Burn Severity. An additional 7,685 acres (The Hewlett Fire) was recently burned in May, 2012. The High Park Fire burned to the western and southern flanks of the Hewlett Fire.

The cumulative effect of increased peak flows and sediment laden flows from both burned areas increases the risk for various downstream values at risk, particularly effects on human life and safety, property and natural resources, including drinking and irrigation water providers.

A soil burn severity map is included at the end of the report.

B. Water-Repellent Soil

Water Repellent Soil: 12,238 acres

Water repellency was observed in the field under moderate and high soil burn severity in shrub and forest vegetation types. It was estimated that 30% of the high and moderate severity burn is water repellent.

C. Soil Erosion Hazard Rating

Low	7,867 acres
Moderate	30,009 acres
High	48,798 acres

D. Soil Erosion Potential

The Erosion Risk Management Tool (ERMiT) model was used to determine the expected rates of erosion from burned and unburned hill-slopes within the burned area. ERMiT runs for a variety of slopes, vegetation types and burn severities within the burned area are outlined in the High Park BAER Soil Resources Report.

Eighteen scenarios were selected geographically by ownership (US Forest Service land, private, state and/or county), burn severity (high, moderate, low), and cover (forest, grassland, shrubland). Slope gradients and hill slope length were determined for each scenario using Geographic Information System (GIS). Rock content and surface texture was obtained from the soil survey. The data were then entered into ERMiT to obtain the amount of sediment delivery expected from unburned (pre-fire) and burned areas (post-fire).

Erosion potential within the burn ranged from less than 1 ton/acre pre-fire to 23 tons/acre post-fire. This estimate was based on soil burn severity, slopes and ERMiT modeling as shown below:

ERMiT inputs:

Soil Burn Severity/ Vegetation type	Scenario #	Hillslope Horizontal Length (ft)	Slope % top	Slope % middle	Slope % toe	Texture	Rock content %
High/forest	1	700	60	30	10	extremely cobbly loamy sand	35
High/rangeland	2	700	30	10	10	very gravelly coarse sandy loam	35
High/shrub land	3	500	30	20	10	very gravelly coarse sandy loam	35
Moderate/forest	4	1000	0	40	20	coarse sandy loam	35
Moderate/ rangeland	5	900	60	30	10	very gravelly coarse sandy loam	35
Moderate/ shrub land	6	400	40	20	10	sandy loam	35
Low/forest	7	400	40	20	10	very cobbly sandy loam	35
Low/rangeland	8	100	30	10	0	coarse sandy loam	5
Low/shrub land	9	600	40	20	10	extremely cobbly loamy sand	15

ERMiT outputs:

Soil Burn Severity/ Vegetation type	Scenario #	Sediment delivery (tons/acres) pre-fire	Sediment delivery (tons/acre) post-fire
High/ Forest	1	1.4	15.91
High /Rangeland	2	0.42	4.9
High/Shrub land	3	0.7	14.84
Moderate/Forest	4	2.19	19.69
Moderate/Rangeland	5	1.65	22.9
Moderate/Shrub land	6	0.65	10.95
Low/Forest	7	0.88	4.95
Low/Rangeland	8	0.14	0.63
Low/Shrub land	9	3.75	9.84

E. Sediment Potential

1,090 cubic yards / square mile

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period

3-5 years (for recovery of hill-slope stability)

B. Design Chance of Success

80% (assuming damaging storm does not occur before treatments are in place)

C. Design Storm Information

Design Recurrence Interval	10 years
Design Storm Duration	1 hour
Design Storm Magnitude	1.5 inches
Design Flow	70 cubic feet / second / square mile)

D. Reduction in Infiltration

Estimated Reduction in Infiltration: 55 percent

E. Adjusted Design Flow

Adjusted design flow 180 cfs per square mile

Watershed Number	Watershed Name	Percent USFS land	Pre-fire Estimated Discharge (cfs)	Post-fire Estimated Discharge (cfs)	% of pre-fire flow
101900070209	Bennett Creek	98	114	210	184%
10190006061602	Blackhurst Gulch	0	139	501	360%
10190007141012	Boyd Gulch	0	95	468	493%
10190007140610	Buck Gulch	100	51	206	404%
101900060614B4	Buckhorn D	0	197	495	252%
10190007140608	Cedar Gulch	82	92	402	437%
101900071812DG	Devil Gulch	0	134	385	287%
101900071812EG	Empire	0	73.7	183	249%
10190007141004	Falls Gulch	98	93	470	505%
101900070304	Hewlett Gulch	48	408	747	183%
10190007141008	Hill Gulch	18	226	1094	484%
101900071812AG	Labeau Gulch	0	148	383	259%

Watershed Number	Watershed Name	Percent USFS land	Pre-fire Estimated Discharge (cfs)	Post-fire Estimated Discharge (cfs)	% of pre-fire flow
101900071812OG	Long Brown Gulch	0	176	844	479%
10190006061606	Lower Laurence	0	85	213	251%
10190007180604	Lower Lewstone	0	214	1063	497%
10190007031006	Lower South Fork	100	45	135	301%
10190007180604	Middle Lewstone	0	49	154	314%
10190006060206	Monument Gulch	88	50.1	153	305%
10190006060224	Paradise Park	38	99.1	394	397%
10190006060210	Pendergrass A	92	33.3	85	255%
10190007031004	Pendergrass B	100	39	285	731%
10190007031004	Pendergrass C	100	26	1090	4194%
10190007031004	Pendergrass D	87	29	82	284%
10190007180602	Poudre 1A	0	137	730	533%
10190007180602	Poudre 1C	0	128	460	360%
10190007140602	Poverty Gulch	94	136	796	585%
10190006061604	Raspberry Gulch	0	181	494	273%
10190006061610	Redstone Creek A	0	101	562	556%
10190006061610	Redstone Creek B	0	80	501	626%
10190006061610	Redstone Creek C	0	74	257	348%
10190006061610	Redstone Creek D	0	47	58	124%
10190006061610	Redstone Creek E	0	95	127	133%
10190007180606	Rist A	.35	108	691	640%
10190007180606	Rist B	0	89	389	437%
10190007180606	Rist C	0	98	411	419%
10190007180606	Rist D	0	128	716	560%
10190007180606	Rist E	0	53	235	443%
101900071818H1	Santanka Gulch	0	41.5	56	135%
10190007140604	Skin Gulch	89	182	884	486%
101900071818H2	Soldier Canyon	0	92.2	171	185%
10190007140606	Stevens Gulch	50	81	269	332%
10190006060402	Stove Prairie A and B		241	829	344%
10190007031008	Trib to South Fork	80	49	717	1464%
10190007180602	Tunnel	0	139	442	318%
10190006060222	Twin Cabin Gulch	85	63.6	242	381%
101900071818H3	Unnamed 1	0	30	50	168%
10190007180602	Unnamed 2	0	72.5	389	536%
10190007141014	Unnamed 3	1	40	213	531%
10190007141014	Unnamed 4	0	32	86	270%
10190007141014	Unnamed 6	39	35	77	221%
10190007141002	Unnamed 9	85	96	380	396%
10190006061606	Upper Laurence	0	168	473	281%
10190007180604	Upper Lewstone	13	96	242	252%
10190007031006	Upper South Fork	89	226	1068	473%
101900071818H4	Well Gulch	0	68.6	80	116%

Watershed Number	Watershed Name	Percent USFS land	Pre-fire Estimated Discharge (cfs)	Post-fire Estimated Discharge (cfs)	% of pre-fire flow
10190006060216	White Pine A	96	30.6	69	226%
10190006060214	White Pine B	83	21.6	35	160%
101900070303	Young Gulch A	58	121	511	422%
101900070303	Young Gulch B	21	166	558	336%
101900070303	Young Gulch C	0	56	138	246%
101900070303	Young Gulch D	63	96	369	384%
101900070303	Young Gulch E	19	143	724	506%
101900070303	Young Gulch F	77	69	195	283%

A map of the percent flow increase by watershed is included at the end of the report.

PART V - SUMMARY OF ANALYSIS

A. Critical Values / Resources and Threats

Critical values, resources and threats are

HUMAN LIFE / SAFETY and PROPERTY

Threats to life and safety and property exist in valley bottom areas and in steep burned gulches throughout and downstream from the burned area. Residents and road users will be exposed to increased risk of flooding and debris flow. Houses and other structures, driveways, other private property, Forest Service recreation facilities, and roads and trails located in valley bottoms adjacent to or in the flood prone areas or near stream channels are at increased risk for flooding and debris flow.

The small unincorporated community of Poudre Park is located near the confluences of two large and heavily burned watersheds: Hill Gulch and Falls Gulch. Both watersheds have already experienced flood and debris flows from a relatively small rainfall event on July 6, 2012. Similarly, the Bellvue community is located on the Mill Gulch drainage which receives stormwater runoff from Long Brown Gulch, Labeau Gulch and Devil Gulch. There is the potential for significantly increased stormwater and flood flows from these watershed under post-fire conditions.

In several locations, structures and roads are located on alluvial and debris flow fans at the outlets of severely burned gulches and are at increased risk for debris flows.

Most of the major irrigation canals located east of the High Park fire burn area follow contours in a north-south orientation. There are many locations where tributary drainages flowing in a west to east direction are passed over or under the irrigation facilities. There is an increased risk for flood flows and sediment to enter irrigation canals and adversely impact the operation of these facilities. Water diversion infrastructure is at risk due to sediment and debris accumulation. Numerous ponds and small reservoirs within the burned area are at increased risk of filling with sediment and/or dam failure.

Roads

There are State, private, County and Forest Service roads within the burned area. The mainline County Roads and Colorado State Highway (SH) 14 form the transportation backbone in the foothills and mountainous areas affected by the High Park fire. SH 14 serves as a major east-west route for recreational users of the Poudre River and Forest Service Lands. There are numerous private homes and cabins, some clustered in small unincorporated communities such as Poudre Park, located immediately adjacent to the highway and river. SH 14 extends over Cameron Pass and provides year-round access to the North Park area.

Potential post-fire impacts include damage to the road system and/or loss of access due to increased runoff rates that overwhelm the capacity of bridges and culverts, plugging of hydraulic structures by debris and sediment, severe erosion of the road surface, or deposition of sediment or debris on road surfaces. Increased risk for temporary loss of access/egress exists on both SH 14 and mainline County Roads in the burn area.

There are approximately 42.3 miles of County maintained roads located within the boundaries of the High Park fire burn area. The County maintained road mileage is evenly split between paved (21.3 miles) and non-paved (21.0 miles) road surfaces. Major County roads impacted by the High Park fire and located directly within or adjacent to the burn area include:

- CR 25E (Redstone Canyon Road)
- CR 27 (Buckhorn Road changing to Stove Prairie Road north of CR 44H)
- CR 29C (Missile Silo Road)
- CR 44H (Buckhorn Road)
- CR 52E (Rist Canyon Road)
- CR 63E (Pingree Park Road)

There are also many miles of County roadway that run along the southern and western boundaries of the burn area that will likely receive concentrated water, sediment and debris runoff generated from hill slopes and drainages in the adjacent burned areas. These roads include:

- CR 23 in Bellvue
- CR 25E between CR 50 and CR 52E
- CR 27E north of CR 52E
- CR 50 CR 54E in the Bellvue area

Additionally, there are 98.5 miles of private roads in the fire area, virtually all of which are non-paved. These private roads serve subdivisions such as Whale Rock, Davis Ranch, Stratton Park, Paradise Park and Glacier View as well as a variety of 35+ acre parcels that did not go through any County subdivision approval process.

The County roads all functionally serve as collector roads on the County network. CR 27 (Buckhorn Road) functions as a major collector roadway and carries about 1,000 vehicle trips per day. The other county maintained roads in the burn area serve as minor collector roads but also carry significant traffic. For example, east of the Davis Ranch Road access point, CR 52E (Rist Canyon Road) has an average daily traffic load of more than 1,100 vehicles per day. Any damage to, or blocking of, the county road network, or private roads, could eliminate access to residents, emergency service providers or the general public using these routes to reach other areas of the County. County Roads such as CR 27 (Buckhorn/Stove Prairie) have also been used as detour routes for recent post-fire debris flow episodes that have affected and closed SH 14.

Private gravel roads within the burned area are also likely to exacerbate the risk of flooding and erosion by collecting surface water, concentrating it and delivering it to hill slopes or stream channels. Most of the private roads within the burn have inadequate cross-drainage culverts.

The County Roads and SH 14 routes were the only means of providing ground-based emergency response and deploying firefighting assets into the impacted area. Major roadway routes are generally constrained by topography and tend to be coincident with the paths of the larger stream channels such as Rist Creek, Redstone Creek, Stove Creek and Buckhorn Creek.

In addition to the County Roads, private roads and SH 14, there are seventeen total Forest Service roads that lie within the fire perimeter. Three of these roads travel through Low and Unburned severity burn and are unlikely to sustain damage. The remaining 14 roads travel through Moderate and High severity burn and impacts are likely. These roads will require additional cross drainage or improvement of existing drainage, including rolling dips, lead outs, and ditches. Culverts are undersized for the anticipated flow increases, and culverts size will need to be increased or culverts will need to be removed, and replaced after peak flows recover toward pre-burn conditions. Some roads may be closed until watershed conditions recover.

> ***An emergency for roads was determined for Human Life and Safety and Property. The probability of loss is Very likely and the magnitude of consequence is Major. Therefore, the risk is Very High.***

Recreation Resources

- Mountain Park Campground's location at the base of the steep, burned hillside create a high probability that 5 campsites closest to the burned area will be susceptible to debris flow and minor flooding. A minor flow (several inches in depth) did occur into one of these sites after a major rain event on 7/6/12.
- The culvert located under Highway 14 at Stove Prairie Campground creates a moderate likelihood that flooding/debris from high rain fall onto the burned hillside across from the campground will be deposited onto the campground's access road and have to be removed.
- Ansel Watrous Campground has been determined to be intermediate risk, since the wide and fairly deep creek bed can likely handle major rain runoff. This was evidenced during a heavy rain event since the fire's containment date.
- Similar to Stove Prairie Campground, the culvert at located under Highway 14 at Diamond Rock Picnic Area poses a moderate probability that flooding/debris from high rain fall onto the burned hillside across from the picnic area will flow through the culvert and splash directly onto picnickers sitting at a table in a direct path with the culvert. The picnic area predates the culvert.
- The looped Mount McConnel and Kreutzer Trails, Hewlett Trail, and Young Gulch Trail all sustained burn severity that has reduced tree and ground cover to the point that debris flows are already occurring along much of their lengths. The Young Gulch trail is at greatest risk. Hazard trees are also an issue on all these trails.
- There is a high probability that recreation residences that have been constructed over or near creeks at the mouths of drainages will be susceptible to life-threatening flooding and debris flows. These locations include cabins in the Lower Bennett, Narrows, and Poudre Park summer group residences. One structure at the Narrows has already been destroyed by a debris flow.
- The fire line created in the Narrows area has created an access point for unauthorized OHV use onto highly erodible soils. This may create an additional debris flow hazard for Highway 14 and increase vegetation destruction and run-off.

- Recreational fishing and scenic viewing along the South Fork Poudre River has been greatly impacted by the fire. Biologists have determined that sedimentation and run-off from the fire will stress the river environment for the next several years.

An emergency for recreation (trails, recreation sites, and recreation residences) was determined for Human Life and Safety and Property. The probability of loss is Very Likely and the magnitude of consequence is Major. Therefore, the risk is Very High.

Water Diversion Infrastructure

Three municipal water supply diversions lie within the burn perimeter. These diversions provide water for the City of Fort Collins, the City of Greeley, and the Tri-Districts. Each entity operates its WTP separately; however there is interconnectivity through water transfers. These facilities are at increased risk of damage due to debris and sediment accumulating at the intakes which are all located on the Poudre River.

The eastern perimeter of the fire is bounded by Horsetooth Reservoir, the largest east-slope reservoir of the Colorado-Big Thompson Project, and the Hansen Supply Canal, which delivers water from Horsetooth Reservoir to the City of Greeley WTP at Bellvue and water to the Cache La Poudre River. Horsetooth water is also delivered to agricultural users via the Poudre. These facilities are also at increased risk from post-fire runoff and sedimentation.

Additionally there are 18 irrigation diversion structures on the Poudre River that could be impacted by increased debris and sediment flows. These 18 structures provide irrigation water through 441 miles of canals which supports over 100,000 acres of irrigated cropland in Larimer and Weld County. Sediment deposition can be expected to occur in some irrigation canals.

An emergency for water diversion infrastructure for the facilities on the Cache La Poudre River was determined for Property. The probability of loss is Very likely and the magnitude of consequence is Moderate. Therefore, the risk is Very High.

NATURAL RESOURCES

Water Quality Degradation

Soil erosion and subsequent large sediment increases are predicted throughout and downstream of the burn area. An emergency for water quality degradation was determined for the following reasons:

- Large sediment increases are expected. These increases will be of short term duration, recovering to pre-fire conditions over time with the worst impacts occurring over the next three to five years. During this time there is high potential for degradation of source water quality for the city of Fort Collins, the City of Greeley, and the Tri-Districts (North Weld, East Larimer-Fort Collins) which all utilize water from the Poudre River. There will likely be significant impacts to public water supplies due to sediment increases and reduced water quality. All of these water providers also use Horsetooth Reservoir as an alternate water supply to the Poudre River. The fire has also affected a portion of the area in Lory State Park and private lands that drains directly into Horsetooth Reservoir.

An emergency was determined for water quality degradation. The probability of loss is Very likely and the magnitude of consequence is Major. Therefore, the risk is Very High.

Flood Hazard

The flood hazard is predicted to increase dramatically within and immediately downstream of the burn area. An emergency for flood hazard was determined for the following reasons:

- Runoff is predicted to increase significantly following the fire.
- There are a high number of residents and recreationists in the area resulting in high numbers of people exposed.
- High traffic roads with drainage structures including Colorado Highway 14 and County Roads 27, 52E, 25E, 44H and 63E.
- There is substantial risk to life and property resulting from the increased flood risk.

The probability of loss is Very likely and the magnitude of consequence is Major. Therefore, the risk is Very High.

Debris Flow Hazard

The debris flow hazard is expected to increase significantly in the years following the fire. An emergency for debris flows was determined for the following reasons:

- There are a high number residents and recreationists in the area resulting in high numbers of people exposed.
- The infrastructure in the area in not adequate to handle the increases in flow and sediment predicted.
- Debris across the roads in the area could result in large numbers of people being cut off from emergency services, possibly for long periods of time.
- There is substantial risk to life and property resulting from the increased debris flow risk.

The probability of loss is Very likely and the magnitude of consequence is Major. Therefore, the risk is Very High.

Road Washout Hazard

The road wash out hazard is expected to increase significantly in the near future. An emergency for roads washing out was determined for the following reasons:

- There is substantial risk to life and property resulting from the increased debris flow risk.
- The current transportation system is not expected to handle the predicted flood flow increases and sediment loads.
- Roads washing out in the area could result in large numbers of people being cut off from emergency services, possibly for long periods of time.

The probability of loss is Very likely and the magnitude of consequence is Major. Therefore, the risk is Very High.

Native or Naturalized Plant Communities

There are no known occurrences of Threatened or Endangered (TE) plants in or near the burn area, and no undetected occurrences are suspected. Overall, there are no anticipated threats to TE plant species due to possible erosion, sedimentation, or other fire- or fire-suppression related impacts. The canal-side site of Ute ladies-tresses on non-federal land is not expected to be impacted by any treatment options.

Multiple sites of several sensitive plants and species of local concern are known to occur in the burn area. Most sites occur in rocky areas or ridges, and some plants are anticipated to have burned during the fire or to be adversely impacted by habitat alteration in the short-term. It is probable that many plants survived, and that most sites would not experience long-term reduced viability with return to pre-burn conditions, including return of pollinators. None were impacted by fire suppression activities.

No Emergency was determined for Native or Naturalized Plant Communities.

Range and Weeds

Several areas with known weed infestations were noted in the field: Young Gulch Trail (several species including leafy spurge burned at moderate to high soil burn severities), the area at CR27 and Highway 14 (several species including leafy spurge burned at light soil burn severity), riparian meadows near Fish Creek trailhead (yellow toadflax burned at patchy light soil burn severity to no burn), campgrounds along Highway 14 (unburned). On the Hewlett Fire, the fire did not burn the west side of the Hewlett Gulch trail. The High Park Fire took care of this and the entire trail is burned mostly at light soil burn severity.

In the Swan Range Allotment, the burn was variable, but the West pasture appeared to be more moderately burned than the Middle pasture. The spring developments sustained light damage and the fences sustained moderate to heavy damage. In the Bennett Creek Allotment, the burned area east of Pingree Park Road occurs in steep and timbered terrain generally not grazed by livestock; therefore, most of the utilizable rangeland occurring on the rest of the allotment was unaffected. The Camman Spring survived. No emergency structural or management measures are needed on either allotment to protect recovering areas from grazing. Timing and intensity of grazing in 2013 will be monitored and addressed through the grazing permit administration process.

The fire burned approximately 6,000 acres of private rangeland with a potential loss of 1,600 Animal Unit Months of forage. Since the severity of the burn in these areas ranged from light to moderate they should recover fully within a year or two. However, seeding and mulching might be needed in those private rangeland areas as well as other areas, where noxious weeds have been identified or are a concern, as part of an overall integrated weed management plan to provide competition to keep the weeds from re-establishing and or expanding their range on private lands.

Many feet of private pasture fencing was lost in the fire requiring a great deal of labor and expense to replace. This fencing has to be replaced so that livestock can graze again and have their grazing controlled to maintain or improve the rangeland health, protect riparian areas and allow for the use of livestock as a biological control for some of the weed species. Animal hoof action will also play a key role in speeding up the process of reducing the hydrophobicity of the soil. Livestock watering facilities were lost and will also have to be rebuilt to provide dependable, clean water for both livestock and incidental use by wildlife.

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 unintentional 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.

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.

Wildlife: Critical Habitat or Suitable Occupied Habitat

The fire appears to have resulted in minor consequences to Preble's critical habitat and other suitable Preble's habitat. As described above, the majority of riparian vegetation within Preble's habitat appears to have been unburned or lightly burned by the fire. Additionally, where riparian herbaceous or shrub vegetation was moderately burned or killed, this vegetation should grow back within about 1 to 3 years approximately. This also should be the case for herbaceous and shrub vegetation in the adjacent upland Preble's habitat zone as well. Some riparian vegetation may be covered by ash and sediment during flood events, but this would be a fairly temporary condition not resulting in long-term impacts to Preble's habitat. On private lands any proposed treatments that could have an adverse effect on Preble's habitat will go through the proper federal and/or state review process before treatments are implemented.

For the mapped lynx habitat, the majority of this forest area was killed by crown fire. This forest habitat will take a few to several decades to grow back to a condition where it may provide suitable lynx habitat. However, as described in the wildlife report, it's questionable how much of this area actually provided suitable lynx habitat because it is likely that much of it was dry lodge pole pine or single-story lodge pole that lacked dense horizontal cover, which is a key component for lynx habitat. Also, the polygon of mapped lynx habitat was isolated by lower elevation unsuitable habitat from the main body of both the Poudre and Estes LAUs. Crown fire in this type of ecosystem is a natural disturbance process that ultimately provides different age classes of forest for lynx habitat.

Based on the discussion presented above, it is determined that there is no emergency for either Preble's or lynx habitat within the High Park Fire area.

Fisheries

The streams that will see potential adverse impacts from post fire run-off events associated with thunderstorm and overland flow events identified during the BAER process were: main stem Cache La Poudre River, South Fork Cache La Poudre River, Buckhorn Creek, Bennett Creek, and Young Gulch. We anticipate adverse post-fire effects to alter aquatic habitats and disrupt aquatic life for three to five years. Recovery of aquatic ecosystems will occur as erosion rates diminish and flushing flows route fire contrived fine sediment from main channels.

Because there are no fish that are threatened or endangered found in the area within the fire boundary or directly downstream that would experience adverse post fire effects, there is no emergency determination for fisheries. Similarly, as the Arapaho Snow fly is only a species under consideration for listing and not an officially listed species, there is not an emergency determination.

However, to limit impacts to aquatic habitat and organisms, it is strongly recommended that upland treatments in the watershed address overland flow erosion, that trail reconstruction to Young Gulch be completed in accordance with Region 2 Soil and Water Conservation Practices, and that all road reconstruction and maintenance be completed in accordance with Region 2 Soil and Water Conservation Practices and specifically address and limit stream sedimentation.

CULTURAL AND HERITAGE RESOURCES

Cultural resources have been assessed only on National Forest lands. On private lands any proposed treatments that could have an adverse effect on Cultural Resources will go through the proper federal and/or state review process before treatments are implemented to minimize impacts.

The High Park Fire is located in steep terrain with relatively few known cultural resources. Those that are known are clustered around the drainages on the perimeter of the fire area. Three values at risk (resources rated at high or very high risk) were identified: 5LR1381, a prehistoric plains woodland period open camp; 5LR13065, a WWII plane crash site; and 5LR11051, a historic recreation residence. 5LR1381 is at risk damage from debris flows and erosion events stabilization or data recovery are recommended. 5LR13065 is at risk or erosion and is in an area proposed by other resources for aerial mulching. 5LR11051 is at risk of for erosion that could cause damage to cultural resources, substantial property damage and possibly loss of life or injury to humans.

In addition, undiscovered NRHP-eligible cultural resources may exist in the area of potential effects associated with BAER-related activities such as construction of water bars, trail work, or other ground-disturbing activities. The National Historic Preservation Act requires a cultural resource inventory and consultation with the State Historic Preservation Office (SHPO) prior to implementation of these activities.

The probability that post wildfire runoff from typical high intensity/short duration summer thunderstorms could impact cultural and heritage resources is possible and, if impacted, the consequences would be major. The risk for impacts to these resources is considered to be high.

SUMMARY OF RISK ASSESSMENT

Threat Identification	Critical Value	Probability of Loss	Magnitude of Consequences	BAER Risk
Roads	Life and Safety / Property	Very Likely	Major	Very High
Trails and Recreation	Life and Safety / Property	Very Likely	Major	Very High
Water Diversion infrastructure	Property	Very Likely	Moderate	Very High
Water Quality Degradation	Natural Resources (Water Supply)	Very Likely	Major	Very High
Flood Hazard	Natural Resources	Very Likely	Major	Very High
Debris Flow Hazard	Natural Resources	Very Likely	Major	Very High
Invasive species	Natural Resources	Likely	Moderate	High
Cultural Resources	Cultural Resources	Possible	Moderate	Intermediate

B. Emergency Treatment Objectives

LAND TREATMENTS

The objective of aerial mulching is to provide temporary ground cover and help reduce rainfall-induced hill-slope erosion and associated flooding, sediment laden flows and/or debris flows within the burned area. This treatment is recommended to:

- Lower the risk of post wildfire impacts to life/safety of residents, road users and recreational users;
- Lower the risk of post wildfire impacts to private property, roads and water supply infrastructure; and
- Lower the risk of post wildfire impacts to public drinking water quality.

The objective of noxious weed detection surveys and treatments is to provide for recovery of native vegetation by preventing the establishment and spread of noxious weeds in the recently burned area.

ROAD AND TRAIL TREATMENTS

The purpose of road treatments is to reduce the risk of transportation system drainage failure which could compromise ingress/egress, damage the road surface, increase erosion, sedimentation, and cause downstream damage. Road treatments mitigate the fire's effect on the transportation infrastructure and protect life, safety, property, and critical natural or cultural resources. These treatments work in conjunction with land, channel, and protection/safety.

The objective of forest road and trail stabilization treatments on Forest Service lands is to lower the risk of damage to property (system trails) by lowering erosion of the trail surface in severely burned and steep areas within the burned area and to provide for public safety. The objective of temporary closure of roads is to reduce risk to human life and safety.

PROTECTION / SAFETY TREATMENTS

Flood Warning Systems: The Poudre River watershed provides public water supply to the City of Fort Collins, City of Greeley and the Tri-Districts which serves a range of unincorporated areas in the front-range Larimer and Weld Counties. Use of existing flood warning systems provided by the National Weather Service and the Larimer County Office of Emergency Services would notify water providers that sediment laden floodwaters may be approaching. They can then make an informed decision about whether to close intake head gates to avoid taking sediment laden water into their systems.

Road Warning Signs: Warning signs will inform the public of the risks associated with travel within the burn area that include excess stormwater runoff, possible high water or flash floods and debris that may create a hazard along public roads. Warning signs will be installed along major public roads at the edge of the burn area. Additional signs will be installed in high-risk areas. In these areas, access may be cut-off by high water, debris, or other hazards.

Hazardous Tree Removal: The objective of the hazardous tree removal treatment is to lower threat of hazardous trees to the life/safety of workers implementing BAER trail stabilization and storm patrol treatments on the Mount McConnel, Kreutzer, Hewlett, and Young Gulch Trails.

Trail Warning Signs: The objective of installing warning signs is to reduce threats to life/safety of recreational hikers by warning that they are entering a burned area and warning against access into hazardous areas adjacent to the trails. These signs also serve too accelerate natural recovery by preventing travel off trails. Additional signs to provide warning of increased potential for falling rock and debris are also recommended to lower threats to human life/safety at specific locations along trails within the burned area.

Temporary Trail Closure: The objective of temporary closure of trails is to reduce risk to human life and safety.

Communication and Emergency Response Planning: Another important objective of the BAER Team is to communicate the findings of this report to the National Weather Service, the Larimer County Office of Emergency Services and the local Fire Protection Districts. The purpose of this communication would be to inform these entities of anticipated post wildfire watershed response and associated threats to public safety. This information could be utilized in the development of early warning systems or emergency response plans.

CULTURAL RESOURCES

The objective of cultural resource treatments is to prevent irretrievable loss of archeological information, to prevent looting by informing recreational users of the importance of archaeology and federal laws that prohibit theft of artifacts and damage to historic or prehistoric sites, to prevent erosion on disturbance of archaeological materials, and to divert runoff that is adversely affecting the foundation of a recreation residence.

C. Market Resource Values (direct losses and loss of use)

Direct losses and loss of use associated with the resource values are associated with rainfall events that are likely to occur over the burn area in the future. Assigning a dollar value to these losses is extremely difficult because of the uncertainty about the location and severity of future rainfall events and resultant floods over an area this large.

At present and during the immediate future, providers of potable water and irrigation companies will be impacted by ash, sediment and debris transported by storm runoff into waterways, most notably the Poudre River and Horsetooth Reservoir, from the burn area. The cities of Greeley and Fort Collins have estimated that loss of direct flow rights on the Poudre River ranges from $500,000 to $1 million annually for each city. Fort Collins estimates additional treatment costs will be from $500,000 to $1.4 million annually, and Greeley estimates additional treatment costs will be from $500,000 to $1 million annually. The Tri-Districts estimates the additional treatment costs for their Soldier Canyon Filter Plant will be $650,000 to $1.3 million annually. These costs depend not only on the frequency and severity of future rainfall events, but also on the recovery time for the watershed—the number of years it takes the watershed to return to a pre-fire condition.

Unburned homes in several communities, particularly in Poudre Park and Bellvue, are at significantly increased risk for flood damage because of the much higher runoff and debris flows expected from even modest rainfall events. Initial hydrologic analyses suggest that the likelihood of very damaging runoff (runoff which had been considered a 100-year storm under pre-fire conditions) may be twenty time greater in post-fire conditions. That is, the likelihood of potentially very damaging runoff which had a 3 to 5 percent chance of occurring during the next 3 to 5 years under pre-fire conditions now has a 60 to 100 percent chance of occurring during the next 3 to 5 years. Homes scattered throughout the burn area located in or near drainageways are now exposed to similarly higher levels of risk from flooding and debris flows. Because it is more likely that intense precipitation will occur over areas smaller than the entire burn area, it is virtually impossible to estimate a specific dollar amount for direct losses from flooding and debris flows.

The risk of damage to public roads, including State Highway 14 in Poudre Canyon, is similarly difficult to estimate. Flooding and debris flows in the burn area have already occurred, necessitating cleanup effort to remove accumulated debris from roadways. Additional flooding and debris deposition will certainly occur over at least the next 3 to 5 years. More severe flooding which will overtop and potentially wash out roadways is highly likely, and again significantly more likely than under pre-fire conditions. But the location and severity of damage to roads depends on the location and intensity of

future rainfall events, which is extremely difficult if not impossible to predict with any reasonable degree of certainty over an area the size of the burn area without further, extensive analysis.

Damage to private roads from flooding and debris flows will almost certainly occur, but again, the location, extent and cost of this damage cannot be calculated with a reasonable degree of certainty at this time.

D. Skills Represented on Burned-Area Survey Team

[x] Hydrology	[x] Soils	[ ] Geology	[x] Range
[ ] Forestry	[x] Wildlife	[ ] Fire Mgmt.	[x] Engineering
[ ] Contracting	[ ] Ecology	[x] Botany	[x] Archaeology
[x] Fisheries	[ ] Research	[ ] Landscape Arch	[x] GIS

Because the fire burned both NFS and non-federal lands, a multi-agency team was assembled to conduct the burned area assessment. Personnel from the Forest Service, the Natural Resources Conservation Service, Larimer County, and the Colorado Department of Transportation were represented on the team. The BAER process of evaluating burned area conditions, critical values at risk, threats, risk and treatments was employed. Inter-disciplinary and inter-agency coordination occurred throughout the process.

Forest Service BAER Team Members

Forest Service Team Lead	Eric Schroder
Soils	Lizandra Nieves-Rivera
Hydrology	Deb Entwistle/Liz Schnackenberg/ Jamie Krezloc
Hydrology/Affected Interest Liaison	Carl Chambers
Noxious Weeds/Botany	Kim Obele/Steve Popovich
Engineering	Kipp Klein/Judy Kittson/Steve Wood
Recreation	Kristi Wumkes
Wildlife	Dale Oberlag
Fisheries	Chris Carroll
Cultural Resources	Larry Fullencamp
GIS	Janice Naylor/Amy Coe
Public Information	Tammy Williams/Reghan Cloudman

NRCS Team Members

NRCS Team Lead	Todd Boldt
Soil Scientist	John Norman
Soil Scientist	Chris Fabian
Range	John Fusaro
Public Information	Petra Barnes-Walker
Engineering	Andy Piszkin
Hydrology	Steve Yochum

Larimer County Team Members

Larimer County Team Lead/Engineering	Mark Peterson
Engineering	Todd Juergens
GIS	Jeff Rulli
Weeds	Tim D'Amato
Public Information	Deni LaRue

CDOT Team Members

CDOT Engineering	Scott Ellis

External Partners and Contacts

City of Fort Collins	Lisa Voytko
City of Greeley	Eric Reckentine
Tri-District/Soldier Canyon Filter Plant	Rodney Hansen
Northern Water	Roger Sinden
Boulder County Plant Ecologist	Claire DeLeo
CO State Forest Service	Greg Sundstrom

E. Treatment Narrative

LAND TREATMENTS

Aerial Mulching and Seeding

Public Lands
Aerial application of 5,597 acres of mulch on NFS lands to provide groundcover replacement is recommended. Approximately 90% of the treatment acres (5,037ac.) would be mulched with weed-free agricultural straw. The remaining 10% of the area (560 ac.) would be mulched with wood shreds. Wood shreds would be used in locations such as ridge tops, where winds would likely blow away straw. Mulching treatments are located to address threats to values at risk such as human life and safety, property (primarily homes and roads) and public water supply.

Private Lands
The NRCS is recommending mulching and seeding on 5,657 acres of private land through the Emergency Watershed Protection (EWP) program to address the significant values at risk caused by the High Park Fire. The acres to be treated have high erosion and sediment delivery rates which will be reduced by the recommended treatments. The treatment areas meet the criteria for treatment listed below. Erosion control materials that will meet treatment objectives are certified weed free agricultural straw. The recommended application rate for straw mulch is 1.5 tons/acre. Seeding will be done with a sterile hybrid cover alone or in combination with a locally adapted native seed mix. Potentially, other USDA programs could be used by individual private land owners to address specific fire related issues that occur on their properties. However due to the Very High Risk associated with human life and safety, the public water supply and property including homes and the non federal road network, the EWP program will provide the most efficient and effective method for addressing the values at risk through a local sponsoring entity. Federal resources for fire rehabilitation on ***private*** lands should be targeted to high priority watersheds that reduce erosion, sedimentation, debris flows and will reduce the impacts of noxious weeds.

Criteria for treatment polygon locations include one or more of the following:

- High and moderate soil burn severity, on slopes between 20% and 60%

- Watersheds tributary to the Cache la Poudre River and from which increased hill-slope erosion and sediment delivery to the Cache la Poudre River is highly probable in the first year following the fire (based on soil erosion modeling, hydrologic modeling, map review and field review); or where life and safety or property are at risk.

- Watershed not tributary to the Cache la Poudre where local life and safety or property are at risk .

Generally, these treatment polygons are located where dense to moderately dense stands of conifers were burned and where soil burn severity was mapped as high or moderate due to consumption of most, if not all, of the litter/duff forest floor. Due to removal of ground cover and heat impacts on the soil, these once stable hill-slopes are now highly susceptible to erosion. Generally, the precipitation events of highest concern are high intensity summer thundershowers. Erosion control materials that would meet treatment objectives include certified weed free agricultural straw and/or other effective erosion control materials such as wood shreds. The recommended application rate for straw mulch is 1 ton/acre. The recommended application rate for wood shreds is 6 tons/acre. Based on recent monitoring of aerial application of mulch on another local fire (Fourmile Fire in Boulder County), treatments are likely to be effective in this geographic location. As shown in the Soil Scientist's Specialist Report, ERMiT runs for typical treatment areas show significant reduction in probability of hill-slope erosion if mulching treatments are applied.

A map of potential mulching zones is included at the end of the report.

Noxious Weed Detection and Treatment

Treatment Description: (to be implemented partially with Forest Service personnel and partially with Larimer County crews through a Participating Agreement on NFS lands)

- Conduct weed detection surveys. Prioritize areas where heavy fire suppression activity occurred, such as bulldozer lines, helispots/heliports, spike camps, equipment cleaning sites, and staging areas. Also, areas of moderate to high soil burn severity, particularly those areas proximal to known infestations and heavy suppression activity. The entire burn area should be monitored for possible introduction of invasive species inadvertently brought in on fire suppression equipment and vehicles from outside Larimer County. Despite the awareness and active efforts to prevent weed spread by introduction of seed or vegetative propagules, the problem is often documented in areas following wildfire. Monitoring needs to occur following the first precipitation event, and continue throughout the subsequent growing season.

- Treat newly found infestations from detection surveys. Focus on three priority species: leafy spurge (Euphorbia esula), diffuse knapweed (Centaurea diffusa), and spotted knapweed (Centaurea maculosa); and any new high priority species brought in from outside of Larimer County.

CHANNEL TREATMENTS

Public Lands
No channel treatments are proposed on USFS lands.

Private Lands

Purpose

The purpose of channel treatments is to help convey runoff through the drainage system and remove debris that may plug channels and culverts resulting in water being diverted and causing damage outside of the stream channel itself. Implementation along the areas proximate to the mainline County roads will be conducted by either County crews or contractors. On private lands, the County will conduct public outreach, asking residents to remove debris and keep drainage ways clear.

Channel Debris Clearing

Channel-debris clearing removes debris from the channel and flood prone areas that could dislodge and plug culverts or damage downstream property. High priority areas for treatment would include areas in close proximity to houses and directly upstream from culverts. Debris may include burned wood from trees and debris from burned structures. Generally, this treatment would be done manually with a focus on small debris considered likely to be transported downstream.

Sediment Basins and Debris Racks

Sediment basins and debris racks will be pursued at locations that lend themselves to such measures. This would be at locations where there is an opportunity to trap and settle out suspended sediments before they reach a main channel or where large amounts of woody debris are likely to be generated (e.g., Fall, Hill or Watha watersheds) and may adversely impact downstream structures or infrastructure. Periodic cleaning of such facilities would be necessary to regain retention capacities.

Floodwater Detention or Diversion Facilities

Although more detailed hydrologic analyses are currently being conducted by the NRCS, field observation suggests that the Bellvue community may be at significantly increased risk for flooding from the upstream burned watersheds. Most of the community and CR 23 are located in the historic drainage way for Mill Canyon. Once more detailed hydrographs are developed; it may be appropriate to determine if there is any flood storage or channel diversion alternatives that would help mitigate for this increased flood risk.

ROAD TREATMENTS

Storm Inspection and Response

Storm inspection and response keeps culvert and drainage structures functional by cleaning sediment and debris from the inlet between storm events on public roads where access is required. Typically, crews drive the roads during or immediately after storms, checking sediment and debris accumulations and performing thorough, rapid inspection of road drainage features, culverts, and other structures. The crew is responsible for maintaining culvert function by opening culvert inlets and removing debris. Within the regular duties of County road maintenance crews, routine road, culvert and infrastructure inspections are performed.

Additional inspections within the burn area will be added to regularly scheduled inspections. Crews will inspect culverts and ditches for debris prior to storm event runoff, and remove any accumulated debris or sedimentation from those locations. Crews will also monitor high risk areas during storm events to immediately identify areas at risk of flooding or debris sedimentation. Following a storm event, crews will identify areas that have been impacted and respond by initiating a cleanup effort to remove accumulated sediment and debris from roadways, or repair damaged infrastructure

Increase culvert diameters at drainage crossings, add drainage, and armor drainage outlets

Minor Structures (having a span of from 4’ to 20’) and culverts that are used for roadway drainage (ditch relief culverts) and channel crossings contribute to the watershed emergency when they are damaged in a fire or when their hydraulic capacity is marginal. Post-fire sediment and debris flow in channels may plug structures or culverts and increase the diversion-potential risk.

Increased storm runoff due to the fire's effects can cause the failure of undersized culverts and lead to erosion of the road fill, thereby deteriorating water quality. Stream diversion potential may exist along insloped roads with a continuous road grade.

Larimer County will upgrade or replace culverts located within high-risk areas, or add features to alleviate sediment deposition on the county road, within the culverts, or downstream. Larger culverts, headwall and endwall treatments, or riprap aprons will be installed to increase the efficiency of flow through the culverts, prevent overtopping, or reduce erosion and sedimentation at the culvert locations. Larimer County has prioritized the reach of Rist Creek/Rist Canyon Road extending from the mouth upstream to Davis Ranch Road for consideration of structure upgrades. There are a number of driveway crossings of Rist Creek that must also be analyzed to determine their effects on flow capacity and risk of overtopping during post-fire flood events. Stream channel crossings along CR 27 (Buckhorn Creek) and CR 25E (Redstone Creek) are also areas of high risk and will be analyzed and potentially upgraded to increase hydraulic capacity and create conditions where the roadways can withstand overtopping flows.

On Forest Service lands, a determination was made that BAER treatments are needed on nearly all system and non-system roads within the burned area. The following treatments were identified as BAER road treatments for the High Park Fire burned area:

- Temporary road closures are recommended for NFSR 100 and NFSR 152 to protect public safety.
- Road stabilization with Rolling Dips, Lead Outs and Ditches
- Treatment of hazard Trees and Unstable Rocks to protect workers implementing BAER treatments
- Erosion control on steep side slopes above or adjacent to roads by aerial mulching, aerial mulching is addressed above.
- Removal of culverts on all roads and replaced with hardened low water crossings
- Replacement of culverts when drainage/vegetation has been restored
- Storm Inspection and Response on roads to remain open

TRAILS AND RECREATION FACILITIES

The following recommendations are made for trails and recreation facilities:

- Mountain Park Campground: Restrict use of host site and sites 1-5, 17, 20, 23 until slope stabilizes, by removing them from the reservation website. Inform campers that non-life threatening debris flows may occur around site 32. Have hosts monitor rain events and debris flows. Post signs at campground: In case of flash flood climb to safety.
- Culverts at Stove Prairie Campground and Diamond Rock Picnic Area: Remove hazard trees above culvert at Diamond Rock to provide for crew safety, and install large diameter rock riprap in area below outlet of culvert to dissipate water flow energy. Install caution sign at picnic table below culvert.
- Trails: Keep all trails closed to ensure public safety until trail stabilization can be implemented or conditions stabilize. Remove hazard trees to ensure crew safety during construction of trail stabilization features. Post "entering burn area/stay on trail" and flood

warning signs at trailheads. Provide out sloping where possible. Provide additional cross-drainage on trails. Where feasible, utilize volunteer community crews to assist with trail stabilization and rehabilitation.

- Close the Young Gulch Trail for the year due to slope instability/high flooding potential in this large watershed. Install a gate at the trailhead to keep vehicles out of the parking area. Install closure signs. Monitor trail for conditions after major rain events, and after the spring thaw.

- Close the east side of the Mount McConnel Trail until trail stabilization features can mitigate safety concerns.

- Stabilize the eroded portion of the Kreutzer Trail to prevent continued incision on the eastern portion of the trail before allowing public use.

- All recreation residence owners have been notified of the conditions and risks associated with the locations of their summer-use cabins. Engineering inspections for building stability will be recommended to residence owners after facility assessments by the Forest Service.

- Install protective barriers along the Narrows fire line section to prevent OHV trespass and increasing erosion.

Implement closure order to prohibit recreational use along the Wild River portions of the South Fork of the Poudre, to allow this specially-designated corridor time for natural restoration. Provide monitoring and enforcement of the closure order.

CULTURAL RESOURCES

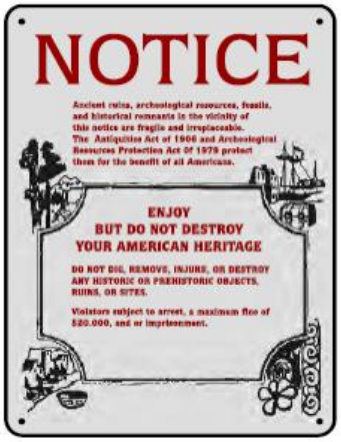
Treatment Types

5LR11051 – Installation of Log Deflectors
5LR13049 – Sign Installation
5LR13065 – Aerial Mulching (coordinated treatment)
5LR1382.1 – Trail Stabilization (coordinated treatment)

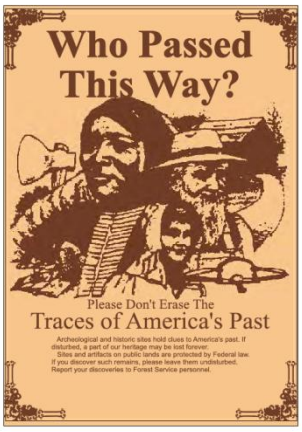
Treatment Descriptions

5LR11051 – Log Deflector Installation: the proposed treatment for protection of site the Lower Bennett Creek Recreation residence would utilize the BAER catalog Log deflector treatment (Napper 2006:77). The treatment would place log deflectors around site 5LR11051 to change the runoff's direction without erosion by simulating a new channel area. The treatment would place 6 to 9 inch diameter logs at a 120 degree angle from the diversion point and construct a shallow trench to divert runoff.

5LR13049 – Sign Installation: the proposed treatment for the prevention of looting at the Cyril and Mayme Spaulding Homestead consists of installation of education signs on posts near the site. The proposal would use Forest Service signs that educate recreational users about cultural resource laws and the value of cultural resources as shown on the following page:



Reddish brown on light gray, (27-7). 11" x 14"



P2346
Brown on tan.
12" x 16"

(Unicor 2011)

In addition to the specific treatments that are being proposed for cultural resources aerial mulching treatments that have been proposed for other resource areas would benefit the cultural resources at risk as well by reducing the probability and severity of flooding or debris flows.

PART VI – SUMMARY OF EMERGENCY STABILIZATION TREATMENTS AND SOURCE OF FUNDS

The table on the following page is a tabulation of estimated costs to address emergency stabilization measures identified through this BAER assessment process. The USFS is responsible for addressing concerns on National Forest System lands. The NRCS has an ability to help address concerns on non-Federal lands in partnership with willing private landowners and local sponsors who are able to provide funds to match federal funding through the Emergency Watershed Protection (EWP) program.

Possible treatments for private lands include aerial mulching and seeding of an additional 5,657 acres; barriers or other measures to reduce damage from sediment and other debris; clearing channels and drainageways; warning signs, and increasing the size of culverts on County roads and providing some protection from erosion to reduce the risk of flood flows overtopping and washing out portions of these roads.

In total, the BAER assessment identified approximately $24 million in potential emergency stabilization treatments to address impacts of the High Park fire. Nearly $7.3 million is identified for treatments to USFS lands. Approximately $17 million in possible treatments is identified for public roads and private lands. Approximately $9.9 million of these treatments might be eligible for 75% federal funding through the NRCS Emergency Watershed Protection (EWP) program. To meet the 25% local match would require about $2.5 million. The extent of work on private lands is dependent upon the availability of both Federal and local funding.

In addition to the local match required for any EWP funds that may be available, Larimer County faces a potential cost of nearly $7 million to address needs on the County road system that are not eligible for EWP funding. CDOT costs to address needs on State Highway 14 are still being determined.

Consequently, the total cost for Larimer County, other local sponsors and private landowners is estimated to be approximately $9.3 million. No source of these local funds has yet been identified.

Treatment	USFS Costs	NRCS/ EWP Sponsor Costs	Larimer County Costs	State Costs	Total
Mulching	$6,912,550	$5,657,000			$12,569,550
Weeds	$36,600	$0			$36,600
Seeding for weeds	$0	$1,697,100			1,697,100
Channel Debris Clearing	$0	$126,000			$126,000
Sediment Basin & Debris Racks	$0	$702,000			$702,000
Floodwater Detention or Diversion Facilities	$0	$1,440,000			$1,440,000
Storm Inspection & Response	$0	$0	$159,500	*	$159,500
Increase Culvert Sizing	$0	$0	$6,665,000	*	$6,665,000
Road and Trail	$297,549	$0			$297,549
Protection and Safety (Closures, signs, etc)	$5,750	$276,000		*	$281,750
Treatment Monitoring	$6,750				
Agency Total	**$7,259,199**	**$9,898,100**	**$6,824,500**		**$23,975,049**

* State costs to be determined.