USDA-FOREST SERVICE

FS-2500-8 (7/08)
Date of Report: 10/4/18
Date of Report: 10/19/18

HIRZ-DELTA FIRE BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

The Delta Fire looking down I5 towards Slate Creek on September 2018.

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 #_1___
[x] Updating the initial funding request based on more accurate site data or design analysis
[ ] Status of accomplishments to date

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

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: HIRZ-DELTA

B. Fire Numbers: CA-SHF-001223; CA-SHF-001444

C. State: CA

D. County: Shasta and Trinity

E. Region: 5

F. Forest: Shasta-Trinity

G. Districts: TRMU, NRA, SMMU

H. Fire Incident Job Code: P5L2ZM, P5L4L8

I. Date Fire Started: Hirz - Aug. 9, 2018; Delta - September 5, 2018

J. Date Fire Contained: Hirz - Sept. 30th, 2018; Delta - projected containment of 10/05/18

K. Suppression Cost: $106 million Current $59 Million for the Delta $47 Million for the Hirz

L. Fire Suppression Damages Repaired with Suppression Funds

Dozerlines:
Dozerline repaired: 81 Miles / waterbarred: 9 miles

Handlines:
Handline repaired 17 Miles / waterbarred: 2 miles

M. Watershed Numbers and Names (affected on FS lands):

HUC 5 & 6-7ish	**NAME** Watershed	**Acres**
1802000405	**McCloud River Abv Shasta Lake**	**310,282**
1802000405XX	Chiquito Cr	1,182
1802000405XX	Dutch Cr	1,755
1802000405XX	Hirz Cr	3,312
1802000405XX	Kabyai Cr	1,177
1802000405XX	Nawtawakit Cr	2,851
1802000405XX	NE Hirz Bay Trib	1,576
1802000405XX	Oak Cr	2,458
1802000405XX	Tom Dow Cr	3,018
1802000405XX	Tuna Cr	2,402
1802000405XX	Willtawaket Cr	988
1802000403	Squaw Valley Creek	66,761
1802000504	**Sacramento River Abv**	**311,637**

	Shasta Lake	
1802000504XX	Boulder Cr	4,110
1802000504XX	Campbell Cr	2,805
1802000504XX	Dog Cr	12,312
1802000504XX	Hazel Cr	14,036
1802000504XX	Mosquito Cr	2,826
1802000504XX	North Salt Cr	15,498
1802000504XX	Middle Salt Cr	11,027
1802000504XX	Salt Cr	10,375
1802000504XX	Shotgun Cr	7,538
1802000504XX	Slate Cr	20,284
1802000504XX	Whitlow Cr	1,596
1802015101	**Clear Creek (Delta)**	**159,195**
1802015101XX	Upper Clear Cr	7,346
1801021103	**East Fork Trinity River**	**73,882**
1801021103XX	China Cr	194
1801021103XX	Halls Gulch	8,321
1801021103XX	Big Watson Cr	8,278

N. Total Acres Burned 109,506 (Hirz = 46,425 ac; Delta = 60,705 ac; Delta-Spot = 2,376 ac)

HIRZ DELTA Soil Burn Severity Acres by Fire				
Incident Name	SBS	Acres	Overall Percent	By Fire Percent
Delta	High	3677.66	3.43	6.06
	Low	21034.15	19.63	34.65
	Moderate	33251.86	31.04	54.78
	Very Low	2741.70	2.56	4.52
Delta Total		60705.36	56.66	100
Hirz	High	781.20	0.73	1.68
	Low	30087.35	28.08	64.81
	Moderate	13835.44	12.91	29.80
	Very Low	1721.24	1.61	3.71
Hirz Total		46425.23	43.34	100
Grand Total		107130.6	100	

O. Vegetation Types

Black oak, Oregon white oak, Pacific Douglas fir, white fir, mixed conifer, canyon live oak, lower montane mixed chaparral, gray pine, Ponderosa pine, annual grasses and forbs, upper montane mixed

chaparral, huckleberry oak, and California whitethorn.
P. Dominant soils:

Specific dominant soils found in the fire are Holland, Marpa, Neuns, Ishi Pishi, and Olete . The Holland series consists of very deep, well drained soils that formed in material weathered from granitic rock and has a fine-loamy texture. The Marpa series consists of moderately deep, well drained soils that formed in material weathered from shale, sandstone, schist and other metavolcanic or metasedimentary rocks. It is a gravelly Loam-skeletal and is typically found on a north facing slope. The Neuns series consists of moderately deep, well drained soils that formed in slope alluvium and colluvium from metamorphosed igneous and sedimentary rocks. Neuns soils are on mountains and lava plateaus. Slopes range from 15 to 80 percent and they are gravelly loams. The Ishi Pishi series consists of deep, well drained, soils that formed in material weathered from serpentinitic metamorphosed ultramafic rocks. Ishi Pishi is a gravelly clay loam soil. Typically, Olete soils have dark reddish brown and dusky red very gravelly silt loam B horizons, weak red very stony silt loam C horizons, and basalt bedrock at depth of about 24 inches Olete very gravelly silt loam and are found in a forested environment.

Q. Geology and Geomorphology:

Geology: The Hirz and Delta fires lie within the Klamath Mountains Physiographic Province, and are underlain predominantly by Paleozoic and Mesozoic metavolcanic and metasedimentary rock as well as the Ordovician Trinity Ultramafic Complex and minor amounts of Quaternary sediments in the valleys. Tectonic processes accreted numerous terranes to the western margin of North America and two of these occur within the fire area: the Eastern Klamath and Trinity Terranes.

Geomorphology: Most of the geologic terranes of the Klamath Mountains are weak and prone to landslides. Rapid uplift, high precipitation, and seismic activity to the west have created a landscape with abundant deep seated landslides, many of which occupy several square miles. Most of these larger complexes are dormant under present climatic and seismic conditions though some from tens to hundreds of acres in size are known to be active. Both the dormant and active landslides are very important parts of the landscape because they are often the source of debris slides during wet winters, which in turn provide materials to be mobilized by debris flows.

R. Miles of Stream Channels by Order or Class:

HIRZ-DELTA = **188** Miles Perennial, **239** Miles Intermittent, **516** Miles Ephemeral

S. Transportation System:

HIRZ-DELTA – Trails all ownership **24** miles Roads all ownership: **270 MVUM**

PART III - WATERSHED CONDITION

A. Soil Burn Severity by total and ownership (acres): FS is 30,149 ac (30% high and moderate).

Ownership:

Hirz Delta Soil Burn Severity Acres by Ownership						
Ownership		Soil Burn Severity				
Ownership Level	Agency	High	Low	Moderate	Very Low	Grand Total
Federal	Bureau of Land Management		11.05	0.62	0.91	12.59
	Unknown Federal		0.47	1.77	0.00	2.24
	USDA Forest Service	2820.95	28526.87	27561.01	2362.34	61271.17
Federal Total		2820.95	28538.39	27563.40	2363.26	61286.01
Non Profit	The Nature Conservancy	0.10	505.25	49.20	7.02	561.58
Non Profit Total		0.10	505.25	49.20	7.02	561.58
State	California State Lands Commission	105.76	553.74	490.07	5.18	1154.77
State Total		105.76	553.74	490.07	5.18	1154.77
PVT	PVT	1532.04	21524.10	18984.61	2087.48	44128.24
PVT Total		1532.04	21524.10	18984.61	2087.48	44128.24
Grand Total		4458.85	51121.50	47087.29	4462.95	107130.58

B. Water-Repellent Soil by total and FS (acres): Water repellency is a primary element of the soils effects in this fire: severe repellency is widespread and throughout the fire area, occurring in all soil burn severity classes from the bottom of the surface-charred layer (generally 0.5 - 1 inch deep), and varying in thickness from 0.5 - 1 inches in clay loam soils to 2 to 4 inches in sandy loams in high SBS. Repellency will be largely responsible for moderate soil burn severity expected to have a watershed runoff response similar to high. Repellency also occurred naturally in unburned areas, usually beginning at about 0.5 inches depth and 1 inch thick; but repellency was greatly exacerbated by the fire in coarse-sandy soils. Without repellency, these soils have rapid infiltration rates and surface runoff and erosion would normally be localized to shallow soil areas and/or steep slopes. It is estimated that about 40% of the fire area has water repellency elevated by the fire.

C. Soil Erosion Hazard (see ERMit below)

D. Erosion Potential: ERMiT erosion values are used in lieu of Erosion Hazard Rating.

Post-fire Batch ERMiT model predictions for the 5-year storm recurrence interval runoff event shows that surface erosion rates are estimated to exceed 100 tons per acre depending on the area in the fire. The

rainfall erosivity over the fire area happens to be the highest in the state of California. That, coupled with a predominantly loamy texture that is has a high erosion texture, means the erosion rates on the fire are expected to be higher than on any other fire in California. The erosion rates by watershed are summarized in Table 4. Overall, the erosion rates within the fire perimeter, excluding unburned portions of watersheds, are approximately 23 tons/acre.

Table 4. Predicted erosion rates for a 2yr, 5yr and 10yr events for the HIRZ-DELTA fire:

Watershed	Erosion Rates by Watershed (Tons/Acre)		
	2 year storm	5 year storm	10 year storm
McCloud Imput	7.4	18.0	25.5
North Salt Cr	8.5	19.5	25.7
Salt Cr	5.6	12.1	17.0
Middle Salt Cr	7.6	16.4	22.2
Dog Cr	2.3	5.0	6.6
Shotgun Cr	2.9	6.2	8.3
Boulder Cr	8.8	18.2	23.9
Slate Cr	9.8	20.1	25.9
Halls Gulch	6.7	13.6	17.9
Hazel Cr	0.8	1.8	2.4
Watson Cr	5.9	12.1	15.9
China Cr	0.6	1.2	1.7
Upper Clear Cr	0.6	1.3	1.7
Whitlow Cr	5.8	15.5	20.9
Mosquito Cr	12.1	25.0	31.7
Campbell Cr	3.4	8.5	11.7
Sacramento River Input	8.1	17.1	22.4

E. Sediment Potential:

ERMiT estimates (part 3D) try to account for hillslope re-deposition, and sediment production numbers are delivery to the bottom of the hillslope. Many modeled hillslopes in this fire do have streams at the base of the slope; water percolates into the soils (depending on the degree of water repellency) and sediment is delivered into creeks below. Therefore it is roughly estimated that 50% of sediment estimates above would be delivered to the fluvial system and bulk it by 20 to 40%. However, the delivery ratio for the Delta fire is predicted to be much higher than on the Hirz Fire because lower slopes and riparian areas on the Hirz Fire had much less severity and can therefore filter much of the sediment before it is received by a water body.

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years):	**30**
B. Design Chance of Success, (percent):	**65**
C. Equivalent Design Recurrence Interval, (years):	**5**
D. Design Storm Duration, (hours):	**1**
E. Design Storm Magnitude, (inches):	**1.1**

F. Design Flow, (cubic feet / second/ square mile):	98.6
G. Estimated Reduction in Infiltration, (percent):	**35**
H. Adjusted Design Flow, (cfs per square mile):	**133.5**
	(35% increase)

PART V - SUMMARY OF ANALYSIS

A. Describe Critical Values/Resources and Threats:

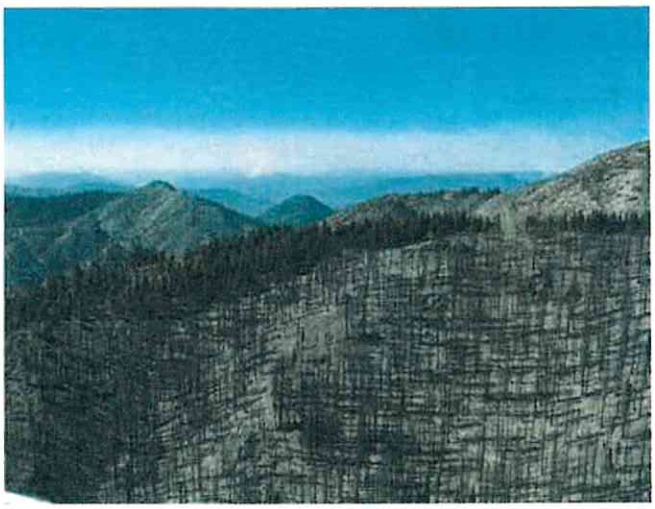
Background:

The Hirz fire began as 3 fires on August 9th, 2018 and was three separate human caused fires that escaped containment and quickly grew. NorCal Team 1 was called in to manage the fire on August 11th, 2018. Other than two small fires that burned in the Nawtawaket Mountain area in the 1920s and 30s the Hirz Fire burned in terrain that had not burned in over 100 years. The Hirz fire is the second largest fire to occur in this area. California Interagency Incident Management Team 5, CAL FIRE Incident Management Team 5, and the Shasta County Sheriff's Office went to unified command. Containment is occurred on 9/1/18. The Hirz fire has cultural and ceremonial sites important to the Wintun tribe and many sensitive wildlife species.

The Delta fire began on September 5th, 2018 as a human caused fire and as of September 30, burned approximately 63, 300 acres adjacent and west of the Hirz fire, and within many of the same watersheds as the Hirz Fire. The BAER team was analyzing the Hirz event when the Delta fire's forward progress had almost stopped, so the decision was made to analyze both fires together between September 17 and October 1, 2018. The Delta Fire spotted into the upper Clear Creek drainage on September 28 and burned almost 3000 acres before a moist storm halted spread of the fire on the night of September 29. This spot fire was not safe to enter or analyze at the time the BAER team was working, so the Shasta-Trinity Forest soil scientist and hydrologist will examine this spot burn when safe and amend this report with new information if needed.

The Hirz-Delta Fire burned across wide ecological gradients, and through previous fire scars from the 1999 High Fire and the Old fire of 1930. These previously burned footprints were dominated by shrub communities which largely experienced stand replacement in the Hirz Fire. The Hirz fire is composed of checkerboard ownership of federal and private. Much of the private land has been logged and planted creating an abundance of activity fuels on the forest floor. A large portion of the fire was in the West Girard Roadless Area consisting of large old growth Douglas fir. The Hirz fire has little fire history and logging creating a large ladder fuel component and tight crown spacing allowing for torching and crown runs. Plant communities affected by the fire include chaparral fields (e.g., manzanita, ceanothus, chamise); gray pine/knobcone pine/oak forests; mixed conifer forests; and upper montane forests at the highest elevations. The fire area was dominated by low and moderate soil burn severity and vegetation mortality.

It is very important to understand the difference between *fire intensity* or *burn severity* as discussed by fire behavior, fuels, or vegetation specialists, and *soil burn severity* as defined for watershed condition evaluation in BAER analyses. Fire intensity or burn severity as defined by fire, fuels, or vegetation specialists may consider such parameters as flame height, rate of spread, fuel loading, thermal potential, canopy consumption, tree mortality, etc. For BAER analysis, we are not mapping simply vegetation mortality or above-ground effects of the fire. Soil burn severity considers additional surface and below-ground factors that relate to soil hydrologic function, runoff and erosion potential, and vegetative recovery.

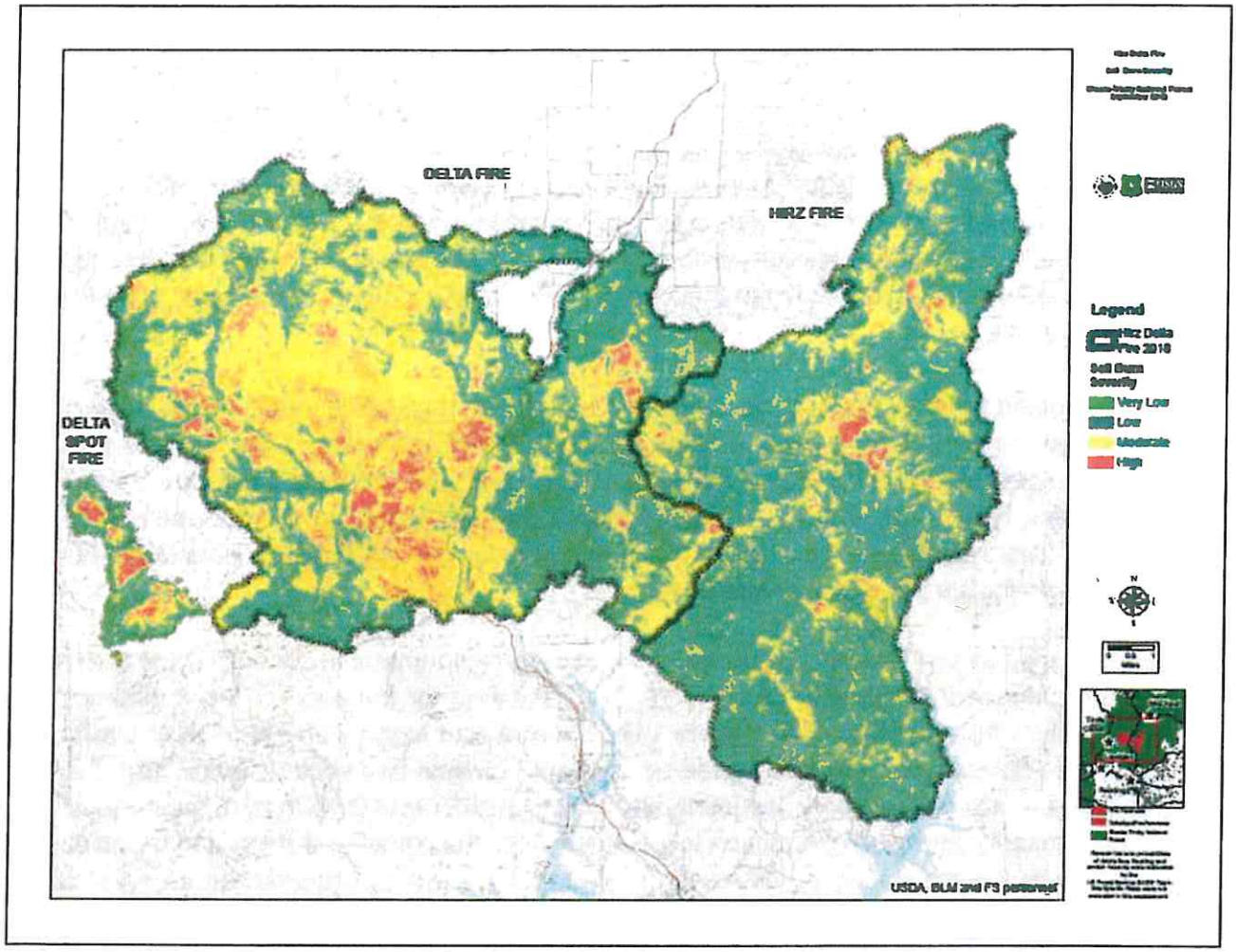


Tombstone Mtn. Oak Ck. headwaters high soil burn severity

Slate Creek area above Interstate 5 high soil burn severity

General trends are mixed conifer forested areas were moderate to high soil burn severity with 40 to 90 percent timber mortality. Open rocky mixed conifer with brush/grass areas had moderate to low soil burn severities and with 30 to 70 percent mortality (see pics above). The soil burn severity map below shows where the moderate and high soil burn severity occurs. These areas are drainages of Slate Creek, Boulder Creek, Mosquito Creek, South fork Shotgun Creek, N. Salt Creek, Tuna Creek, and Oak Creek areas which are at risk of flooding and sedimentation affecting roads, water quality, homes, and fish habitat.

HIRZ-DELTA-SPOT FINAL SOIL BURN SEVERITY MAP



Resource Condition Assessment Sections:

Soils

The Burned Area Emergency Response (BAER) Team assessed the Soil Burn Severity (SBS) on the Hirz and Delta Fire as one fire perimeter. The overall combined SBS was determined to be **4%** unburned & very low, **48%** low, **44%** moderate, and **4%** high. Severe soil heating was fairly rare and restricted to mostly to ridgetops and mid-slopes. Drainages such as Slate Creek, Mosquito Creek, and Halls Creek did see a disproportionate amount of high SBS Soil water repellency is a natural soil property in unburned soils but the severity and thickness increased within moderate and high burn severity, and spotty in low burn severity areas. Hydrophobic strength was often moderate but it was not uncommon to see water beading on the soil for more than 3 minutes. Estimated water repellency increased on approximately 48% of the fire area. On the Hirz fire there is near complete canopy cover in unburned & very low, low, and moderate soil burn severity resulting in needle cast and ground cover. The area around the two fires has some

of the highest soil erosivity in California due primarily to very high precipitation rates (up to 90 inches annual precipitation). In most, but not all pour-point watersheds, significant erosion and sedimentation is expected, averaging from 1.2 to 25 tons/acre for a 5-year runoff event.

Hydrology

Pre and Post Fire Peak Flow Model Results:
Stream peak flows are expected to increase during the coming winter due to reductions in soil ground cover and infiltration and decreased evapotranspiration from loss of vegetation. Peak flows will be bulked by ash, burned wood and other floatable debris, and sediment eroded from hillslopes and channels. Under these post-fire conditions, debris-laden floods could pose threats to critical values.

An EMA flood frequency analysis was performed using the new USGS method from Bulletin 17B (USGS April 2017) and the free downloadable USGS PeakFQ program. Data from the following 3 stream gages (McCloud River above Shasta, Sacramento above Shasta Lake, and Trinity River above Coffee Creek) were utilized to model flows for their associated burned subwatersheds. No gage data was available for Clear Creek so to be consistent with the approach used for the Carr Fire the hydrologists used Stream Stats.

Two, five and ten year storms flows were computed for watersheds of concern using the USGS gaged vs ungaged relationship (USGS 1977) established for the each of the 3 different flow regions which this fire intercepted (North Coast, Sierra and North East Regions of California). The pre-fire flows were increased based on expected erosion and sedimentation from the high and moderate soil burn severity assuming and 80% reduction in infiltration from the areas of high soil burn severity and a 60% reduction in infiltration from the cumulative (high and moderate soil burn severity areas). No increase in was modelled for the low or unburned areas. A separate bulking factor was developed from the debris flow predictions from the USGS Debris Flow modeling (See geology section for a description of the model and outputs). Using the Basin Hazard Ratings for debris flows which factors in both volume and probability of occurrence, using an identity function in ArcGis between the watersheds of concern and the debris flow hazard basin spatial data. A weighted average of the ratings was calculated for each drainage using an Excel pivot table function. Debris flow hazard ratings ranged from 1 to 3, so the weighted averages were divided by 3 to determine the percent increase in hazard. Bulking factors in most models for flow are typically capped at a value of 2. The Debris flow bulking was simply the percentage of predicted increase added to 1 giving result that ranged from 1.0 to 1.76.

Watershed modeling results are presented in Table 4 and discussed in the context of their implications to values at risk in the following subsections.

Table 4. Watershed Modeling Results for Post-Fire Peak Flows.

Modeled Watershed	Bulking Factor	Post-Fire % Peak Flow Increase
McCloud River	**1.03**	**3%**
Squaw Valley Creek	1.12	11%
Chiquito Cr	1.80	45%
Dutch Cr	1.68	40%
Hirz Cr	1.46	31%
Kabyai Cr	1.94	48%
Nawtawakit Cr	1.87	47%
NE Hirz Bay Trib	1.60	37%
Oak Cr	2.20	55%
Tom Dow Cr	1.81	45%
Tuna Cr	2.15	54%
Willtawaket Cr	1.96	49%
Sacramento R (Abv Shasta Lake)	**1.10**	**9%**
Boulder Cr	2.34	73%
Dog Cr	1.62	38%
Hazel Cr	1.45	31%
Mosquito Cr	2.32	57%
North Salt Cr	1.94	48%
NF North Salt Creek	1.85	46%
Middle Salt Creek	1.75	43%
Middle Salt Creek	1.91	48%
One Eye Creek	2.10	52%
Salt Cr	1.62	38%
Salt Cr (South)	1.73	42%
Shotgun Cr	1.66	40%
South Fork Shotgun Cr	1.89	47%
Slate Cr	2.68	63%
Little Slate Cr	2.94	66%
NF Slate	3.73	73%
Whitlow Cr	1.83	45%
Clear Creek (Abv Whiskeytown Res)	**2.09**	**52%**
Clear Creek (Delta Fire) <1% burned	1.01	1%
Clear Creek (Carr Fire)	2.12	52%
Upper Clear Cr	1.03	3%
East Fork Trinity River	**1.12**	**11%**
China Cr	1.17	15%
Halls Gulch	2.04	51%
Halls Diversion	2.07	52%
Big Watson Cr	1.78	44%

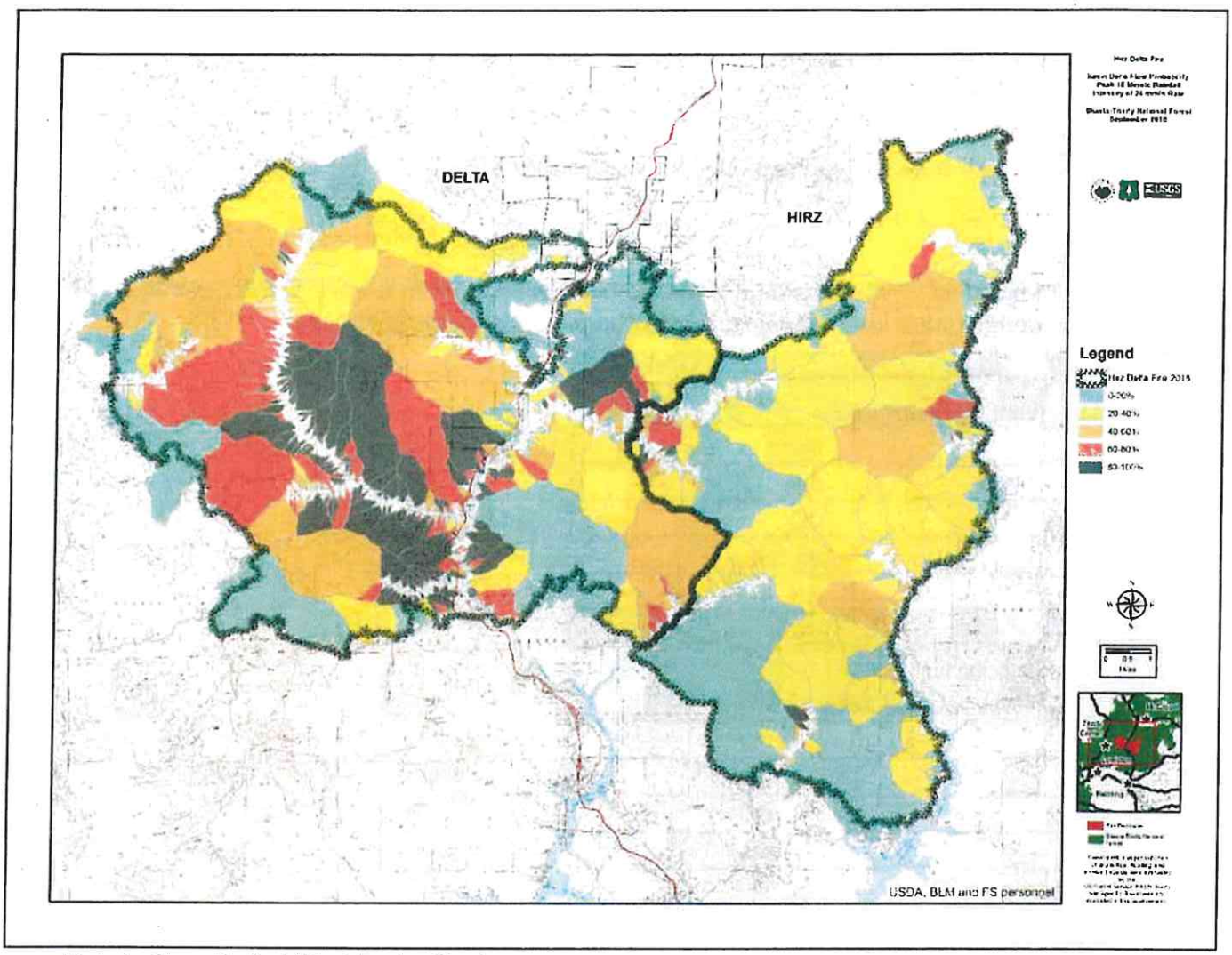
Watershed Conditions – Geology:

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 conditions, State, County, Private and Forest Service roads and infrastructure are at risk from rolling rocks, debris slides, debris flows and sediment laden flooding. Some of the most vulnerable Values At Risk (VAR's) in this burned area include Interstate Hwy 5 (I-5) and the railroad parallel to I-5, the Slate Creek Hydroelectric Project (including the powerhouse and the north & south intakes). Special attention and caution is recommended in areas where people are living or traveling through, working or recreating in or below the burned areas during or after storm events. Of highest concern are short duration – high intensity storms that tend to initiate/trigger debris flows (including summer thunder-storms). Beyond threats to life and property, as a result of the fire, excessive sedimentation and debris could adversely affect the quality and capacity of lakes and streams in and below the burn area.

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 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 this model 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 high to very high (60-80% and 80-100%) in some channels and watershed in the burn area. Some of these high risk watersheds include Boulder Creek, Little Slate Creek, Slate Creek, Watson Creek and Halls Gulch. Under these same conditions and in these same drainages, predicted volumes of debris flows are expected to range from 1K-10K cubic meters in some drainages and 10K-100K cubic meters in other drainages. From the debris flow combined hazard map it appears that the majority of these creeks mentioned above are predicted to produce debris flows of a moderate to high combine hazard.



Debris Flow Probability Map by Basin

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:

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

Forest Service Roads and Trails:

OHV Trails:

No walking or OHV trails were affected by the HIRZ-DELTA fire.

Roads:

320 miles of National Forest System Roads were impacted by the Hirz and Delta Fires and 137 miles are recommended for treatments. Further breakouts are detailed below.

Roads Recommended for Treatment Operational Maintenance Level		
ML 5	0.0	
ML 4	0.0	
ML 3	0.0	
ML 2	135.5	
ML 1	1.4	
Total	136.9	Miles
Roads Affected by the Fire Operational Maintenance Level		
ML 5	0.0	
ML 4	0.4	
ML 3	0.0	
ML 2	265.7	
ML 1	54.1	
Total	320.2	Miles

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 *Likely* in most locations and the magnitude of consequence *Moderate*, therefore the risk is estimated to be *High*.

Property – Road Infrastructure

Drainage dips and culverts are regular features along the alignment of roads affected by the fire but such features, which are draining slopes of moderate and high burn severity, are often inadequate for post-fire conditions and are subject to overtopping and diverting flow down the road prism, 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.

Ephemeral 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 possible. These failures obviously impact FS property but also threaten non-FS Property and Life & Safety downstream. 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 or may not occur in both these situations.

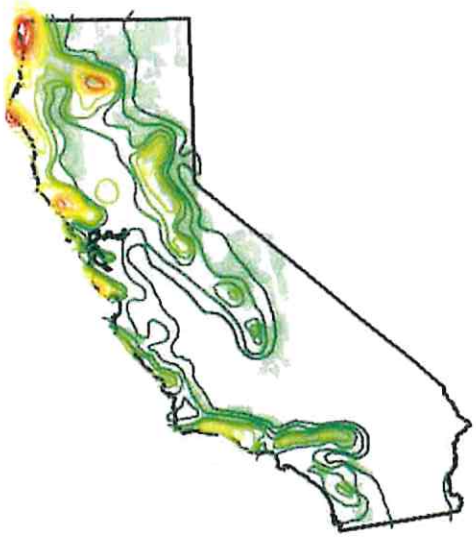
The probability of damage to these features and their host roads is deemed *Likely* in the majority of identified locations and consequences either *Moderate* or *Major* depending on site. A risk rating of either *High* or *Very High* has been thus attached. Detailed rankings for all surveryed roads are available in the full VAR table.

Soil Productivity:

Values at Risk – Threats to Soil Productivity and Hydrologic Function (Fire-Wide)
Probability of Damage or Loss: Very 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. Annual precipitation rates are as high as 90 inches.

The area of the Delta and Hirz Fires Have the highest rainfall erosivity in the state of California. The diagram at the right shows a peak in erosivity shown as a bull's eye in the analyzed fire areas. Rainfall **erosivity** is the power of rainfall to cause soil **erosion** by water and is dependent on the amount and intensity of precipitation (https://www.hydrol-earth-syst-sci.net/19/4113/2015/hess-19-4113-2015.pdf).



The effects of the erosivity on soil productivity is dependent on the degree to which the soil burned, the topography, and the soil type. The soils within Halls Gulch and the upper 2/3rds of Slate Creek are comprised of lower productivity soils derived from igneous rock. The soil productivity of these soils is dependent on the thin surface of the soil where soil nutrients are concentrated. With the high erosivity on low productivity with incinerated canopy and the low ground cover and conditions in moderate and high severity burn, it is very likely that erosion and sedimentation will occur in the Delta and Hirz fires in the first year where Moderate and High SBS occurred. The highest modeled erosion rates for a 5 year event exceeded 100 tons/acre.

In those areas that burned with High and Moderate SBS on soils with thin nutrient rich surface layers, the Magnitude of Consequences are *Moderate* because the productivity may be much reduced but there are likely no sites that will be ecologically type converted; though forest stand likely will be reduced until the natural recovery of the surface soils occurs. Because of the erosivity and reduced cover, it is Very Likely for enough soil to be eroded to affect soil productivity.

The expected significant erosion will likely reduce the soil productivity, whereas protecting these soils where we can will help stabilize this area, save topsoil from eroding and increase the likelihood to continue to grow health timber stands. Logs and other woody debris, such as stumps, root wads, bark, and piles of limbs, occur on the floor of most forest ecosystems. These features provide diversity in the environment and are of varying significance as habitat for terrestrial wildlife as well. Coarse wood and fine soil cover will also serve to reduce soil heating and subsequent drying.

Water Quality and Quantity:

Potential Critical Values at Risk (VARs)

A. Human Life and Safety, Property and Infrastructure

- Fisherman and recreationists could be at risk along sections of major Rivers and major tributaries during or immediately after large storm events due to the potential for debris flows. (Refer to geologic risks for greater details.)

- People using the roads and trails within and downslope of the burn area (in particular, sections of Interstate 5, railroad bridges stream crossings along the Sacramento River corridor, namely Slate Creek) All roads within high & moderate soil burn severity could be at risk due to the threat of rock fall, tree fall, debris and sediment flows, and road washouts. These same roads and trails are likely to be at risk of damage due to plugged culverts washing out and loss of road surface and fill, and damage to native road surfaces.

- Roads and stream crossings are more susceptible to plugging and damage from increased sediment loads as well as from floatable debris (ash and burned wood).

- Instream diversion dams in Slate Creek used for power generation is likely to have damage from incoming sediment loads and potential debris flows in the Main stem of Slate Creek. The Hall's Gulch Diversion Dam in the East Fork Trinity River Basin which is used for agricultural production is also likely to be impacted by large storm events that will likely deposit large amount of sediment in the flatter sections of the stream below the fire area.

- Water systems used by private land owners with stream intakes are likely to be damaged or buried due to high stream flows and potential debris flows. Increased sedimentation may lead to turbid water and plugging of filtration systems especially following large storm events.

B. Beneficial Uses of Water: Water Quality/Aquatic Habitat/Hydrologic Function

- Domestic and agricultural water supplies for the Halls Gulch small water systems may be affected by increased turbidity and sediment loads of incoming water as well increased erosion and sedimentation if transmission pipes and/or ditches are compromised.

- Hydroelectric power generation is likely to be compromised in Slate Creek primarily from impacts anticipated from the main stem of Slate Creek. The diversion dam and facilities on South Fork Slate Creek seems relatively safe, however the main stem Slate Creek Diversion which has the largest capacity is likely to have significant issues due to sedimentation.

- Water quality will also be degraded due to accelerated surface runoff and various erosion processes including mass wasting, debris flows, hillslope sheet and rill erosion as well as from failure of roads at stream crossings resulting in delivery of sediment to stream channels.

- Fisheries habitat is likely to be negatively affected in tributaries as well as the main stems of the McCloud and Sacramento Rivers due to large amounts of fine and bulked sediment loads coming from accelerated hillslope erosion and woody debris inputs that will be delivered to streams. Enriched flows debris and sediment laden flows can cause elevated nutrients, suspended sediment, turbidity, and accumulation of fines in pool habitat and spawning beds.

- Recreation from contact recreation (fishing/swimming/rafting) would be impacted following storms when waters are likely to become turbid or transport floating debris into Shasta Lake. Large volumes of wood are anticipated to be delivered to Shasta Lake via the McCloud River and Sacramento River.

- Tuna Creek Bridge was compromised prior to the Delta and Hirz fire. A boulder below the bridge is currently redirecting flows and scouring the stream bank whereby undermining the bridge footings. Increased flows combined with debris flows will significantly accelerate erosional forces and eventually lead to bridge failure.

Natural Resource Values at Risk - Threatened and Endangered Fisheries

There are no federally listed aquatic species within the watersheds affected by the Hirz and Delta Fire on USFS lands that meet the requirements to be considered BAER Critical Values. However, the fishery in the McCloud River is a significant value at risk culturally, recreationally and economically and warrants an evaluation of post fire impacts. Also, the aquatic resources impacted by the Delta Fire including the Sacramento River are important values at risk and warrant an evaluation of post fire impacts. There is potential that important spawning and rearing habitats could be affected by ash, debris flows, siltation, and channel morphology changes. Areas of moderate to high burn severity have the greatest potential to move sediment into stream systems and impact fisheries or other aquatic resources. Aquatic habitat and biota would be affected by such movement due to turbidity effects on water quality, and from loss of habitat due to sediment accumulation in pools and riffles. Sedimentation and ash deposits may also reduce the productivity of the stream system through effects on macroinvertebrates and reduce availability of spawning habitat.

There are a number of Forest Service sensitive species that also are known to occur or have potential to occur within the Hirz and Delta Fire area. Although the BAER process does not provide for treatments to protect non-T/E species, sensitive species are listed here in order to highlight predicted post-fire effects in the event that there are other opportunities for funding, research, and/or protection. Additionally, BAER treatments should be evaluated to determine if they could negatively or positively affect Sensitive species. USDA Forest Service sensitive species that have suitable habitat and the potential to be present in the area include hardhead, foothill yellow-legged frog, cascade frog, nugget pebblesnail, Shasta salamander and western pond turtle. It is likely that some sedimentation and siltation will occur which affects habitats for all aquatic species, especially those that depend on clean gravels for spawning, rearing and breeding.

Hirz-Delta Fire Watershed Response on Aquatic Values at Risk

McCloud River (Hirz Fire)

McCloud River was visited on September 17th, 19th, 20th and 21st 2018. The riparian corridor has remained intact overall, with small sections of burned stream banks along the mainstem. The areas that did burn to riparian habitat along the McCloud River are expected to quickly recover, lowering the concern for McCloud River trout impacts. All age classes of trout were observed during initial reconnaissance and adult fish were observed actively feeding. The soil burn severity map exposed two tributary drainages to the McCloud River that became the focus for on the ground aquatic impact evaluations. Overall, 59% of the Oak Creek watershed burned at high to moderate burn severity. Similarly Tuna Creek experienced 47% of the watershed that burned at high to moderate burn severity in the upper watershed.

The Hirz BAER team hydrologists evaluated and modeled the predicted post-fire watershed response. Hydrology modeling shows a moderate increase in discharge from pre and post fire discharges (see hydrology report). The level of effects to fish and frogs would depend on the size of the storm event. Adult fish and other aquatic species are not expected to be negatively affected by small or moderate levels of increased flows and sediments. In less severe storms, individuals would likely survive and not be displaced. A larger storm event would have greater levels of effects, especially on egg masses and juvenile fish. A large storm that results in debris flows carrying boulders, rocks, and large woody debris would be expected to have more severe effects to individuals. If storm events result in high sediment loading or debris flows, young of the year fish, egg masses, tadpoles, and frogs could be washed downstream, crushed by rocks and boulders moving through the system, or buried under debris/sediment.

Although there are areas of high burn severity in the upper watersheds tributaries of Oak Creek and Tuna Creek, the riparian habitat in the lower reaches are still functioning. Throughout the lower reaches of Oak Creek and Tuna Creek the majority of streambanks were well vegetated. Juvenile salmonids and one unidentified amphibian was observed in the lower reach of Oak Creek on September 20th, indicating survivorship of aquatic biota and temperature refugia near the channel. The riparian habitat in the lower reaches did not crown into the trees, so needle cast and leaf fall will provide ground cover. The majority of streambanks were well vegetated, this riparian buffer will also assist in filtering out sedimentation and ash from entering the system as well as maintaining suitable water temperatures.

Sacramento River (Delta Fire)

The Sacramento River was visited on September 24st – 28th 2018. The Sacramento River comprises a pool-riffle channel morphology. The river follows a sinuous path through a confined canyon surrounded by steep hillslopes. The channel substrate observed consisted of boulders, cobbles and gravels. Large woody material (LWM) is noticeably absent from the active channel likely due to the high peak flows which transport most LWM through the watershed into Shasta Lake. The river canyon has been modified substantially by the construction of Interstate 5 and the railroad grade. The Sacramento River is the east side boundary of the Delta Fire and flows south

to Shasta Lake. Water clarity at the time of observation was clear and all age classes of salmonids were observed. The riparian corridor has remained intact overall, with small sections of burned stream banks along the mainstem. No fish mortality was observed during field reconnaissance. The areas that did burn to riparian habitat along the Sacramento River are expected to quickly recover, lowering the concern for significant impacts to Sacramento River salmonid habitat. Hydrology modeling shows a relatively minor (approximately 7%) increase in discharge from pre and post fire discharges for the 2 year event (see hydrology report). Although there are some areas of high burn severity in the tributaries to the Sacramento River, approximately 86% of the Sacramento River affected by the Delta Fire burned at very low to low soil burn severity.

Treatments to Mitigate the Emergency – Aquatic Resources

The BAER assessment team has determined that an emergency condition **does not** exist for federally threatened or endangered aquatic species the fire area. Lack of historic records or known detections of federally listed aquatic species make it unlikely that ESA protected species occurs undetected in the fire area. In addition recent hydropower relicensing data also did not find any ESA listed aquatic species inside the Hirz Fire perimeter.

Native Plant Communities, including rare Sensitive and endemic species

Potential Values at Risk

The Hirz and Delta fire areas were largely intact native plant communities before these fires occurred, with the exceptions of Gilman Road and Interstate 5, which are heavily infested by non-native invasive plants (weeds). The risk to these native plant communities is from weed seeds and root fragments being transported into them from existing weed-infested camps, staging and parking areas, and roadsides breached for constructing firelines. Native plant communities where the fire removed canopy and exposed mineral soil, or where equipment disturbance created bare openings, are now vulnerable to colonization and rapid growth of weeds where there were none before these fires occurred. Invasive plants may prevent the recovery of native plant communities if establishment and expansion of new weed populations is allowed to happen unchecked.

Most of the Special Status Species plants that burned within the Hirz-Delta Fire are adapted to historic fire regimes and fire return intervals within their corresponding vegetation community. The majority of Special Status plant habitat burned at 54% low SBS followed by 32% moderate SBS, 8% was unburned and 6% was high SBS. Populations that burned at low intensity are expected to recover either by germination of seed banked in the soil or from surrounding intact plants, or by resprouting from surviving underground root structures, in the absence of further disturbance. Populations that burned at moderate intensity may have adaptations that allow them to survive postfire including deep roots insulated by rocky outcroppings, the ability to resprout, or seeds buried below the top few inches of the soil surface that are more likely to survive. Annuals were killed in moderate and high intensity areas and may have also lost their seed banks in the soil, in which case local extinction has occurred. Recolonization may occur by seed dispersal if there are nearby populations that survived. Perennials are expected to survive in low to moderate

intensity areas if underground parts were insulated by rocks or if root structures are deeply buried. The rare woody shrubs, Shasta snow wreath and common viburnum, are known to resprout from below ground buds after low to moderate severity fire. Klamath manzanita has been seen to re-sprout after mechanical removal, no data is available on the how this species responds to fire.

The Hirz and Delta fires, although contiguous, are not identical in their vegetation types or their rare plant floras, because of the prevalence of limestone outcrops in the Hirz fire, which are absent from the Delta fire; and the presence of ultramafic geology in the northeastern part of the Delta fire, which is absent from the Hirz fire landscape.

Rare plants that are known to occur in both fire footprints are generalists, without strong substrate affinities. As shown in Table 1, there are just four of these: northern clarkia, a disturbance-tolerant annual almost completely restricted to Shasta County; veiny arnica, Cantelow's lewisia, and blushing wild buckwheat, perennials that occur in forest openings and on rock outcrops.

Rare species of the Hirz fire include several with affinity for limestone, and geographic distributions limited to the eastern Klamath Range in Shasta County: Shasta maidenhair fern, Shasta snakeroot, Shasta limestone monkeyflower, Shasta fawn lily, and Shasta snow wreath.

Rare species of the Delta fire include many with affinity for the ultramafic geology and soils present in the northeastern part of the fire: Klamath manzanita, Oregon willow herb, Scott Mountain fawn lily, Scott Mountain bedstraw, Scott Mountain phacelia, Pickering's ivesia, Cascade grass-of-Parnassus, threadleaf beardtongue, Siskiyou phacelia, and Klamath Mountain catchfly. Nearly all of these species are narrow endemics to the Trinity ophiolite of the eastern Klamath Ranges.

Burned and bulldozed areas, now lacking vegetation that can normally outcompete invasive species, are vulnerable to the introduction and spread of invasive plants. Especially if native seed banks and soil productivity are compromised, invasive plants may spread from source infestations near the fire. In the low SBS areas, it will take at least one growing season (Summer 2019) until native vegetation can reestablish and compete with invasive species. In moderate to high SBS areas, vegetation recovery is expected to take longer and will vary based on pre-fire vegetation community and location within the fire perimeter. In highly disturbed areas such as dozer lines, vegetation recovery will be slower than in burned areas, and invasive plant propagules may have been introduced by equipment. Invasive species are likely to establish at a much faster rate in certain areas, further impacting native vegetation communities.

The introduction and establishment of invasive weeds is very likely to prevent native vegetation recovery and establishment.

Table 1. Invasive non-native plants known to occur in the Hirz and Delta fire footprints

Invasive Species in the Delta and Hirz Fire	
Aegilops triuncialis (Sims Flat area)	*Barbed goatgrass*
Ailanthus altissima	*Tree of heaven*
Bromus tectorum	*cheatgrass*

Centaurea solstitialis	*Yellow starthistle*
Centaurea stoebe ssp. micranthos	*Spotted knapweed*
Chondrilla juncea	*Rush skeletonweed*
Cirsium vulgare	*Bull thistle*
Cytisus scoparius	*Scotch broom*
Genista monspessulana	*French broom*
Hypericum perforatum	*Common St. Johnswort*
Isatis tinctoria	*Dyer's woad*
Linaria dalmatica	*Dalmatian toadflax*
Rubus armeniacus	*Himalayan blackberry*
Spartium junceum	*Spanish broom*
Verbascum thapsus	*Common mullein*

A weed washing station was established early in the incident. However, vehicles and equipment were only required to wash as part of the demobilization process after both Hirz and Delta Fires. This practice unfortunately increases the threat of the introduction and spread of weed seed and propagules within and adjacent to the Fires.

The health of the ecosystem is at risk of post-fire noxious weed introduction which could result in the following issues: increased erosion, increased fire frequency intervals, decreased native plant communities, reduced terrestrial and aquatic sensitive plant and fisheries habitat, and altered nutrient cycles.

Invasive nonnative plants and pathogens, including noxious weeds

The Shasta-Trinity NF currently has no Port Orford Cedar (POC) that is infected with root disease. An infected population within the Forest that was discovered along Scott Camp Creek in 2001 was treated repeatedly by girdling infected trees and pulling up seedlings until, after four years of no further sign of root disease, the population was declared disease-free in 2012.The rationale for monitoring riparian areas for POC root disease, where POC populations occur in the Delta Fire, and where vehicles used in the incident drove through streams with adjacent POC:

- The watersheds in the Delta Fire where POC occurs are now POC root disease free, and prevention is the preferred method of keeping them disease free.
- The root disease is almost always fatal.
- Treatment by removal of infected trees and seedlings is successful if detected early, as demonstrated at Scott Camp Creek.
- Vehicles used in the Delta Fire were not cleaned before entry into POC territory, and some may have been contaminated with POC root disease spores that could be released when driven through streams or wetlands.
- There is a limited number of low water crossings within POC territory within the fire perimeter that intersect with roads, dozer lines, and trails; so the monitoring task is of reasonable scale and has a high likelihood of successful implementation.

Phase 1 of monitoring consists of field verification of low water crossings in POC stands within the Delta Fire; logging coordinates and setting up photo points, and creating a GIS product to house the spatial and tabular data. This could be implemented any time the roads are accessible in the coming year, by a crew trained to recognize Port-Orford-cedar and with the capability to log GPS coordinates and necessary site attributes, take photos, and assemble the data into a GIS package. This first stage is proposed for BAER funding.

Phase 2 of monitoring consists of revisiting the locations identified in phase one, to check for presence of POC root disease 3-5 years from now. A field crew would be trained by a knowledgeable pathologist to verify the symptoms as being caused by POC root disease and charged to Forest Account and not BAER.

Threats to Public Safety

Recommendations are being made in this assessment to address threat to public and environmental health and safety resulting from infiltration of a sludge consisting of burned fiberglass and human waste and heavy woody debris into Shasta Lake as a result of the Hirz and Delta Fires.

Hirz Mountain Lookout

The vault toilet, and wooden deck surrounding it, at Hirz Mountain Lookout has been burned by the fire. The vault toilet building and vault were made of fiberglass. The building and vault burned to the level of waste in the vault creating a liquid combination of fiberglass and human waste. This structure is situated above an ephemeral stream that discharges into Shasta Lake, when fall rains commence the exposed vault will fill and spill the fiberglass/human waste sludge into the ephemeral stream. Public use of this improvement is unsafe and the exposed waste in the vault poses a threat to public and environmental health.

Woody debris flows into Shasta Lake

An unknown number of trees along the McCloud and Sacramento Rivers and the McCloud and Sacramento arms of Shasta Lake are dead or dying due to the effects of the fires. When fall rains commence there is a high probability that this debris will enter the McCloud and Sacramento Rivers and the McCloud and Sacramento arms of Shasta Lake and subsequently into Shasta Lake. Floating woody debris poses a significant navigational impediment and safety hazard to the users of Shasta Lake and Forest Service employees working on the lake.

Threats to Cultural Resources

Post-fire effects on cultural resources result from two types of disturbances. The first is natural; the degradation of sites from burned hazard trees falling and increased erosion within the burn area which causes an increase in sediment deposition, debris flows, and scouring of the landscape. The second is cultural; increased access to the resource as a result of a denuded

landscape that leads to a greater risk of looting, vandalism, and unauthorized OHV use. Each of these effects can also cause or exacerbate the other.

Critical Values for Heritage include all cultural resources which are listed on or potentially eligible for the National Register of Historic Places, Traditional Cultural Properties and Indian Sacred sites on National Forest lands. The fire areas are rich in cultural resources that represent Native American use of the area, as well as historic homesteading, ranching, and logging. It was necessary to prioritize sites as this is a large assessment in a relatively short amount of time.

Hirz Fire:

Archival research, GIS analysis, and field reconnaissance indicate that a minimum of 14 cultural resource sites occur on Forest Service lands within or immediately adjacent to the Hirz Fire perimeter. Sites within the burn include pre-contact village sites, ceremonial Winnemem Wintu sites, historic trash scatters/camps, a historic lookout (Hirz Mountain), and a historic trail. In addition, two of the fourteen sites are landscape-level Traditional Cultural Properties (TCPs), Hirz Mountain and Tombstone Mountain, and assessment of these TCPs will require consultation with affiliated tribes – which is beyond the scope of this assessment. Of these sites, GIS analysis of burn severity and possible damage from flood events prioritized 7 sites for assessment. All of these sites were assessed by a BAER team member archaeologist.

Field assessments indicated that most sites were unburned, or located in low burn severity. Sites were also unlikely to be at risk from post-fire watershed conditions, flooding, or debris flows. Although treatment is not recommended, a follow up assessment of Kabyai Creek Site (05-14-58-002) is recommended within the year to assess final tree mortality on the site and possible recommendations for tree felling.

Delta Fire:

Archival research, GIS analysis, and field reconnaissance indicate that a minimum of 72 cultural resource sites and 25 linear cultural resource sites occur on Forest Service lands within or immediately adjacent to the Delta Fire perimeter. Sites within the burn include pre-contact village sites and camps, historic trash scatters/camps, a historic lookout (Slate Lookout), logging camps, railroad grades, historic roads and trails. Of these, 10 sites were assessed for risk from burn severity and post-fire hydrologic and geologic events by BAER team archaeologists.

Field assessments indicated that although many sites were located in areas of high or moderate burn severity, these sites were either not at risk due to topographical location, site type, or the sites were lacking integrity. For example, many sites consisted of decomposed wood debris that likely lacked integrity after the fire burned through the area. Sensitive sites located along watersheds that were assessed were determined to not be at risk from flooding or debris flows. Several sites that burned in high severity were not assessed due to a spot fire that limited access to parts of the fire perimeter. These sites should be monitored or assessed as part of a supplemental BAER report. Site specific protection measures will be developed and utilized during implementation of BAER treatments for other resources.

Risk Assessment – Cultural Resource Sites

Probability of Damage or Loss: Unlikely.
Magnitude of Consequence: Moderate.
Risk Level: Low

Threats to Wildlife

Northern spotted owl and their critical habitat:
Owl habitats (territories and critical habitat) at Tombstone Mountain, Yellowjacket Mountain, Hazel Creek, Shotgun Creek, Fool Gulch and Slide Mountain West burned less intensely (more No Burn and Low Burn), and are still expected to be structurally intact. Treatments or salvage logging operations should avoid these areas, as they have a high probability of remaining occupied in the future. Further, understory burning which occurred within these stands should serve to enhance foraging habitats by reinvigorating understory vegetation growth.

Owl habitats (territory and critical habitat) at Slide Mountain East and Slide Creek burned more intensely (more moderate and high severity), and lost extensive amounts of canopy cover. It is questionable whether these habitats will continue to be occupied post-fire, due to structural changes in the nesting and roosting habitat within the stands. However, even if they are displaced, NSOW may continue to utilize the territory and critical habitat for foraging. Any treatments or salvage logging operations should be delayed until sufficient survey effort and analysis has been completed to determine if the stands continue to be occupied post-fire.

BAER treatments should be excluded from areas that overlap with NSOW territories and critical habitat. As previously stated, some of these treatments may involve mastication of standing trees in order to increase the woody material on the ground and contribute organic matter back into the soil. Modification of structural attributes within occupied suitable or critical habitats may alter the ability of NSOW to effectively utilize habitat by eliminating potential nesting and roosting sites.

B. Emergency Treatment Objectives:

Risk determination is dependent on the design storm selected and downstream values at risk. By using an average storm (2-year event) 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 determine if an emergency exists.

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

Land **90** % Channel **-** % Roads/Trails **85** % Protection/Safety **90** %

D. Probability of Treatment Success:

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

E. Cost of No-Action (Including Loss): $2,982,500

F. Cost of Selected Alternative (Including Loss): $1,482,200

G. Skills Represented on Burned-Area Survey Team:

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

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H. Treatment Narrative for Forest Service:

Land Treatments:
The proposed treatments on National Forest System lands can help to reduce the impacts of the fire, but treatments will not completely mitigate the effects of the fire. The treatments listed below are those that are considered to be the most effective on National Forest System lands given the local setting including topography and access.

Natural Recovery:
Vegetation in the mixed conifer and fir forests 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 Jeffrey, sugar, western, or ponderosa pine 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. Meadows dominated by grasses and forbs will recover within a year, because for the most part soil temperatures were not hot enough to kill root systems. The montane chaparral shrubs were mostly killed by the fire, but fire stimulates manzanita seeds stored in the soil to germinate. In riparian areas sedges and grasses were resprouting within 10 days of the fire, and most riparian shrubs are also likely to resprout.

Mastication Treatment to Protect Soil Productivity:

Ground-based equipment apply a more desirable mulch characteristics but tends to be slow with one masticator potentially treating 2-4 acres per day. With 4 masticators the rate would be 8 to 16 acres per day. Ground-based equipment would be limited on winter ground as long as conditions are safe and dry enough to work on, but with low ground pressure masticators wet operations can be extended. Total initial costs for treatment area 1 of 312 acres is $195,312 (see table below on specifics).

Resource	Acitivity	Total Acres	Total Days	Total cost
4 low ground pressure masticators	Mastication @ $600/ac	312	-	$191,400
Soil Scientist, GS-11 ($600/day)	Project monitoring	-	5 days	$3,000
Soil Scientist Travel	Project monitoring per diem	-	3 days	$500
Forest Service field vehicle	Transportation to worksite	-	5 days	$412
	Total Project Cost:			$195,312

Noxious Weed Detection and Eradication Treatments:

The purpose is to identify the establishment, monitor the spread, and control or eradicate invasive nonnative plants. The most effective noxious weed strategy after a disturbance is Early Detection and Rapid Response. Inventory and treatment by trained botanists/environmental specialists should begin in spring 2019 as soon as plant identification is possible. Priority should be given to areas impacted by fire suppression related activities and high SBS areas (refer to Treatment Specification forms in plan. The data collected from invasive weed surveys and treatments should include species, location, area infested and density. Treatments should be prescribed to control introduction and spread of invasive weeds in order to minimize the threat to native vegetation recovery.

Control of noxious and invasive weed infestations will include existing documented sites as well as new sites that may have been introduced during fire suppression operations. Integrated pest management techniques (manual, mechanical, and/or biological) will be utilized as appropriate to prevent the spread and establishment of weeds within the fire area. High priority species will be

decided at the discretion of the Shasta Trinity National Forest and will include California Invasive Plant Council (Cal-IPC) A and B rated weeds. For a list of A and B rated weeds visit: https://www.cal-ipc.org/plants/inventory/. High priority species for surveys and treatment in the Delta and Hirz fires include: yellow starthistle, dyers woad, knapweeds, tree of heaven, barbed goatgrass and Scotch, French and Spanish brooms.

On Shasta-Trinity National Forest lands Early Detection Rapid Response (EDRR) treatments of invasive species in native vegetation communities are proposed to mitigate this threat. The establishment of a weed washing station was not implemented until late in the incident, which is expected to increase the threat of the introduction and/or spread of invasive weed species that exist within and adjacent to the Hirz-Delta Fire. This specification outlines the application of manual treatments to reduce the competitive pressure of invasive weeds, including yellow starthistle, spotted knapweed, dyer's woad, St. Johnswort, tree of heaven, and brooms (French, Spanish and Scotch) on the establishment of native plant communities within the Hirz-Delta Fire. Application of manual treatments will greatly improve new recruitment of native species from surrounding unburned vegetation and seed germination from existing seeds stored within the seed bank. A high probability for the introduction and spread of invasive weeds exists in priority treatment areas where soil disturbance occurred related to suppression-related activities including dozerlines, handlines, staging areas and safety zones.

Inventory will occur in areas having high vegetation mortality as these areas have a high probability (>90%) for invasive species invasion. Some areas are excluded from treatment due to the native vegetation community's ability to recover post-fire (e.g. montane chaparral species in low to moderate vegetation mortality areas are expected to resprout and regenerate from seed). Various treatment methods will be utilized including hand pulling.

A Weed Detection Survey Report will be submitted to the Regional and Forest BAER Coordinators, Invasive Weed Coordinator and Forest Botanists. If weed introduction and spread has occurred, an interim BAER report will be completed to request eradication funding. Reporting costs are included in figures below.

Treatment Data for EERD Surveys:

Suppression Features	All Ownerships	On SHF	Treatments
Hirz Fire			
Hirz Dozer Line Completed	97 miles	46 miles	43 miles
Hirz Hand Line Completed	13.5 miles	8.7 miles	0 miles
Hirz Road as Completed line	12.2 miles	7.3 miles	0 miles
Hirz Drop points, Water Source, Helispots, and Staging Areas	60 points	24 points	24 points (5 acres)
Delta Fire			
Delta Dozer Line Completed	70 miles	28 miles	28 miles
Delta Hand Line Completed	16 miles	6 miles	0
Delta Road as Completed line	36 miles	13 miles	0

Delta Drop points, Water Source, Helispots, and Staging Areas	33 points	10 points	10 points (2 Acres)
Hirz-Delta Combined			
Dozer Line Completed	166 miles	74 miles	71 miles
Hand Line Completed	30 miles	15 miles	0
Road as Completed line	48 miles	20 miles	0
Delta Drop points, Water Source, Helispots, and Staging Areas	93 points	34 points	34 points (7 Acres)

Treatment Cost for EERD Surveys:

Feature	Quantity, Units	Cost/Unit	Totals
Hirz Fire			
Dozer Line	43 Miles	$1000	$43,000
Points	24 Points (5 acres)	-	$1000
Total Hirz	-	-	**$44,000**
Delta Fire			
Dozer Line	28 Miles	$1000	$28,000
Points	10 Points (2 acres)	-	$500
Total Delta	-	-	**$28,500**
Grand Total			**$71,000**

It will cost $1000 per mile for contracts and/or external partnerships to implement the survey work. Fleet and travel costs are included in these costs estimates.

Monitoring proposed for Port Orford Cedar (POC) Root Disease detection:

Phase one of monitoring consists of field verification of low water crossings in POC stands within the Delta Fire; logging coordinates and setting up photo points, and creating a GIS product to house the spatial and tabular data. This could be implemented any time the roads are accessible in the coming year, by a crew trained to recognize Port-Orford-cedar and with the capability to log GPS coordinates and necessary site attributes, take photos, and assemble the data into a GIS package.

Phase 2 of monitoring consists of revisiting the locations identified in phase one, to check for presence of POC root disease. A field crew would be trained by a knowledgeable pathologist to verify the symptoms as being caused by POC root disease. Phase 2 would need to be implemented by Forest Account funds.

Treatment Cost Proposed for Phase 1.

Estimated cost of POC stands and low water crossing surveys and treatment in the Delta Fire.

Personnel	Daily Rate	# Days	Cost
GS-11 Botanist	380	2	$760
GS-7 Bio Tech Crew Leader	200	7	$1,400
GS-6 Bio Tech Crew Member	170	7	$1,190
Subtotal:			$3,350
Fleet/Materials	**Cost**	**Miles/Units**	**Total**
Mileage (100 miles/day x 6 days)	1	600	$600
Subtotal:			$600
Total:			**$3,950**

Road Treatments:

Human Life and Safety Treatments:

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

3) **Hazard Tree Removal:** selective cutting of fire impacted trees in areas where the public may congregate (trailheads or campgrounds) or sites where USFS personnel are working (especially in implementation and maintenance of BAER treatments).

Hirz-Delta Fire - Life & Safety Treatment Schedule (Roads)				
Admin Closure	2	Each	$ 5,500.00	$ 11,000.00
Warning Signs	17	Each	$ 200.00	$ 3,400.00
Safety Total				$ 14,400.00

HirzDelta Fire: Shasta-Trinity Appendix A: National Forest System Roads with Treatments (Life & Safety)			Admin Closure Gate	Warning Signs
NFSR	Total Cost		ea	ea
34N17	$200			1.0
34N17	$200			1.0
37N31	$200			1.0
38N21	$200			1.0
36N20	$11,800		2.0	4.0
37N41	$200			1.0
37N16	$200			1.0
38N21	$200			1.0
36N63	$200			1.0
36N26Y	$200			1.0
SLATE MTN RD	$200			1.0
37N08Y	$200			1.0
35N77	$200			1.0
35N63	$200			1.0
Phase 2 Safety Treatment Total	$14,400.00			

Property Treatments:

1) **Ditch Reinforcement:** Expand existing ditch line to provide an intercept path for sheet flows off fire-impacted slopes and associated debris.
2) **Dip Reinforcement**: Expand existing relief or rolling dip to provide an intercept path for sheet flows off fire-impacted slopes and associated debris without filling in and diverting flow onto the traveled-way of the road.
3) **CMP Cleaning**: Remove brush which may collect debris and contribute to plugging, clear sediment/rocks to provide a clean intercept path and expand inlet basin to provide increased capacity. Clean barrel of culvert.
4) **CMP Riser Install**: Install riser of appropriate barrel size and height (field determined) to prevent culvert inlet from filling with debris from fire impacted slopes.
5) **CMP Removal**: Remove existing culvert and replace with rolling dip.

6) **Rolling Dip:** Provide relief flow path for flooded roadway or overwhelmed culvert crossings to minimize diversion potential, associated erosion and subsequent damage to road prism.
7) **Relief Dips:** Rolling dips for culverts with diversion potential and are located roughly 50' down-gradient to allow increased debris drop-out and maximum lifespan of drainage capacity.
8) **Install Overside Drain:** Install overside drain provide path for runoff from drainage dip to exit roadway and travel over fill slope without eroding fill slope. Length to be field verified.
9) **Clean Overside Drain:** Clean existing overside drain to restore runoff flow path from drainage dip.
10) **Armoring:** Use rip rap to armor points called out in treatment plan such as fill slope, toe of slope, lead off ditch, etc.
11) **Outsloping:** Add or improve existing outslope (2-4% gradient) of traveled-way to allow for sheet flow of runoff and debris from inside edge of traveled-way over the outside edge.
12) **Lead-off Ditch:** Add or improve ditch that will allow free flow of runoff from roadside ditch or drainage dip away from traveled-way.
13) **Roadway Storm Inspection and Response**: Monitor road drainage features, armoring and other treatments as they respond to significant storm events and subsequently repair damages that compromise the effectiveness of these efforts.
14) **Repair Stump Hole**: Repair of hole created by burned out tree stump and roots in roadway.
15) **Temporary Administrative Closure:** Prevent threat to life and safety and avoid natural resource degradation in impacted drainages.

Delta Fire: Shasta-Trinity NF Appendix A: National Forest System Roads with Recommended Property Treatments			Ditch Reinforcement	Dip Reinforcement	CMP Clearing	CMP Riser Install	CMP Removal	Rolling Dips	Relief Dips	Waterbars	Install Overside Drain	Clean Overside Drain	Armoring	Outsloping	Lead Off Ditch	Storm Response	Repair Stump Hole	Misc. (See Section III for details)	
NFSR	Total Cost	Miles Treated	mi	ea	ea	ea	ea	ea	ea	ea	ea	ea	ton	mi	ea	day	ea		Cost/Mile
Eye Creek Bridge	$ 10,000.00	0.1																$ 5,000.00	$ 50,000.00
34N17	$ 8,698.00	5.0		1	1				3		1	1		0.56		6	1		$ 1,739.60
36N02	$ 3,100.00	1.0		2					2							2			$ 3,100.00
36N20	$ 42,225.00	11.8	2.0	20	8	1		10	38			8	5			6	2		$ 3,593.62
36N20C	$ 1,800.00	0.6							2							1			$ 2,950.82
36N20G	$ 1,000.00	0.1							2								1		$ 7,692.31
36N20Y	$ 4,600.00	1.3							6							2			$ 3,633.49
36N26Y	$ 11,560.00	4.8		2	1			5	5			1		0.2		5			$ 2,408.33
36N26YC	$ 1,750.00	0.8							1					0.25	1	1	3		$ 2,187.50
36N31Y	$ 23,800.00	5.9		24					24						4	6			$ 4,027.07
36N31YD	$ 2,300.00	0.7							3							1			$ 3,194.44
36N44	$ 17,050.00	6.7		17					16							6			$ 2,540.98
36N44A	$ 3,850.00	1.5		3					3							2			$ 2,636.99
36N44B	$ 2,300.00	0.9		2					2							1			$ 2,500.00
36N44D	$ 2,300.00	0.9		2					2							1			$ 2,705.88
36N45	$ 9,650.00	4.5	1.0	3	2	1		4	2							4	1		$ 2,144.44
36N46	$ 3,850.00	1.3		3					3							2			$ 3,031.50
36N47	$ 4,600.00	1.7		4					4							2			$ 2,721.89
36N63	$ 5,850.00	2.0		2	1				7							2	1		$ 2,925.00
36N63C	$ 2,050.00	0.5		2					1						1	1			$ 4,100.00
36N63E	$ 1,800.00	0.5		2					1							1			$ 3,333.33
36N72	$ 1,800.00	0.3		2					1							1			$ 6,000.00
36N84	$ 1,800.00	0.5		2					1							1			$ 3,600.00
37N01Y	$ 1,550.00	0.3		1					1							1			$ 6,200.00
37N01YA	$ 1,300.00	0.2													2	1			$ 7,647.06

Delta Fire: Shasta-Trinity NF Appendix A: National Forest System Roads with Recommended Property Treatments			Ditch Reinforcement	Dip Reinforcement	CMP Clearing	CMP Riser Install	CMP Removal	Rolling Dips	Relief Dips	Waterbars	Install Overside Drain	Clean Overside Drain	Armoring	Outsloping	Lead Off Ditch	Storm Response	Repair Stump Hole	Misc. (See Section III for details)	
NFSR	Total Cost	Miles Treated	mi	ea	ea	ea	ea	ea	ea	ea	ea	ea	ton	mi	ea	day	ea		Cost/Mile
37N03	$ 1,905.00	0.7		3	1								1			1	1		$ 2,721.43
37N08Y	$ 24,850.00	7.9		18	4	2	1		25			4	4	0.1		6			$ 3,137.63
37N10Y	$ 13,200.00	4.0		12					12						4	4			$ 3,300.00
37N10YB	$ 3,050.00	1.2		3					3							1			$ 2,541.67
37N15	$ 17,550.00	5.0							24						3	6			$ 3,510.00
37N16	$ 2,400.00	2.0		1	1	1										2			$ 1,200.00
37N24Y	$ 4,600.00	1.8		4					4							2			$ 2,555.56
37N26	$ 3,800.00	0.9							5						2	1			$ 4,042.55
37N27	$ 2,800.00	0.5							3						2	1			$ 5,600.00
37N31	$ 24,260.00	7.5	1.0	5	3			2	30					0.2		6	8		$ 3,234.67
37N31D	$ 5,705.00	1.3	1.0	4			2	2					1			2	1		$ 4,364.96
37N31E	$ 1,050.00	0.6		1												1	2		$ 1,750.00
37N31G	$ 1,800.00	0.2							1						2	1			$ 8,571.43
37N31H	$ 3,100.00	1.1		2					2							2			$ 2,792.79
37N31J	$ 750.00	0.3		1					1										$ 2,419.35
37N32	$ 250.00	0.3		1															$ 925.93
37N40	$ 6,350.00	3.6		6					6						1	2			$ 1,788.73
37N42	$ 10,750.00	2.2	2.0	8	7				6						4	2			$ 4,931.19
37N45Y	$ 7,800.00	2.2							12						4	1			$ 3,513.51
37N62	$ 2,550.00	0.9		2					2						1	1			$ 2,771.74
37N64	$ 5,050.00	1.2			5				6							1			$ 4,208.33
37N64A	$ 2,050.00	0.6		2					1						1	1			$ 3,416.67
38N21	$ 12,470.00	9.0	1.0	10	4	1			5				4		1	6			$ 1,385.56
Totals	$343,788		8	177	38	6	3	23	278	0	1	14	15	1.3	33	106	21	$ 5,000.00	

Hirz Fire: Shasta-Trinity NF Appendix A: National Forest System Roads with Recommended Treatments			Ditch Reinforcement	Dip Reinforcement	CMP Clearing	CMP Riser Install	CMP Removal	Rolling Dips	Relief Dips	Waterbars	Install Overside Drain	Clean Overside Drain	Armoring	Outsloping	Storm Response	Repair Stump Hole	Misc. (See Section III for details)		
NFSR	Total Cost	Miles Treated	mi	ea	ea	ea	ea	ea	ea	ea	ea	ea	ton	mi	day	ea		Misc Notes	Cost/Mile
34N17	$ 21,880.00	9.5		6	5	3		3	6		3	1	10	0.1	6	1			$ 2,303.16
35N04	$ 12,450.00	4.6		6.0	1				3					1	6	3			$ 2,730.26
Totals	$34,330	14.1	0	12	6	3	0	3	9	0	3	1	10	1.1	12	4	0		

Hirz-Delta Implementation Costs				
GS-12 Salary	$ 7,050.00	15.0	$ 470.00	
GS-11 Salary	$ 7,065.00	15.0	$ 471.00	
Contract Mob and Bonding	$ 25,973.84			

Grand Total for Roads Treatments	$ 404,091.84

Delta-Spot Treatment Costs:

Road Costs	Rolling Dips (RD) /Armored Dips (AD)			Fill Burn-out Repair			Culvert Cleaning			
Road	Qty (each)	Each ($)	Total Cost	Qty (each)	Cost Each	Total Cost	Each	cost/each	Total Cost	Overall Total
8G012			$ -			$ -	4	$ 750	$ 3,000	$ 3,000
36N23	2	1000	$ 2,000	4	$1,800	$ 7,200	2	$ 750	$ 1,500	$ 10,700
36N29G	2	1000	$ 2,000			$ -	3	$ 750	$ 2,250	$ 4,250
36N50			$ -	2	$1,800	$ 3,600	3	$ 750	$ 2,250	$ 5,850
36N52	4	1000	$ 4,000			$ -	6	$ 750	$ 4,500	$ 8,500
36N71	1	1000	$ 1,000			$ -	1	$ 750	$ 750	$ 1,750
Storm-patrol										$ 2,200
Warning Signs (4ea)										$ 1,500
			$ 9,000			$ 10,800			$ 14,250	$ 37,750

Trail Treatments Cost:

No treatments necessary due to no trails.

Protection/Safety Treatments:

Large burned area road safety signs:

Posting of areas burned will alert the public to potential dangers of falling trees and rolling rocks. Repair of road signs burned will insure public safety (see treatment map). Closure and safety signs for roads that have potential for flooding and debris-flows with a 10yr-1hr storm will be 10 ea large (4x6 feet) signs (cost $500/sign for materials and installation) at all major interesctions into the forest that was burned. Safety signs for roads (cost $100/sign for materials and installation) will conform to USFS uniform sign standards. A total of 15 road signs will be replaced that were destroyed by the fire.

Debris booms for McCloud River and Sacramento River:

Debris will be captured, stored, and disposed. This will be achieved by creating a catchment boom that is approximately 1600' long and consisting of 12"-20"X32' logs chained and swiveled end to end and spanned across the river channel. Captured material will be pursed and dragged to a central location and left until the lake recedes enough to strand the material on dry land.

Treatment			Unit	Per unit cost	Amount	Cost
Capture						
	Salary		Days	$300.00	60	$18,000.00
	Boat		Hours	$80.00	120	$9,600.00
	Materials					
		Logs	Each	$250.00	100	$25,000.00
		Hardware		Varies		$ 5,000.00
Storage						
	Salary		Days	$300.00	28	$ 8,400.00
	Boat		Hours	$80.00	80	$ 6,400.00
						$72,400.00

Heritage Treatmets:

No treatments are recommended for cultural resources.

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 monitoring.

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

Hirz: P5L2ZM

HIRZ BAER Costs - P5L2ZM	NFS Lands					Other Lands				Money Left Total $
Line Items	Units	Unit Cost	# of Units	BAER $	Spent $	Units	Fed $	Units	Non Fed $	
A. Land Treatments										
NX Weed Det. Survey (dozer-lines)	mi	$1,100	40	$44,000	$0		$0		$0	$0
Subtotal Land Treatments				$44,000	$0		$0		$0	$0
B. Channel Treatments										
Subtotal Channel Treatments				$0	$0		$0		$0	$0
C. Road and Trails										
Roads - Stormproof & Stormpatrol	mi	$7,000	5	$35,000	$0		$0		$0	$0
Trails - none	mi	$0	-	$0	$0		$0		$0	$0
Subtotal Road & Trails				$35,000	$0		$0		$0	$0
D. Protection/Safety										
Safety (hazard and warning signs)	project	$2,300	1	$2,300	$0		$0		$0	$0
Boating Safety (debris booms)	each	$36,200	1	$36,200	$0		$0		$0	$0
Hazard Tree Removal (crew access and safety)	mi	$4,300	1	$4,300	$0		$0		$0	$0
Hazmat Cleanup	project	$3,800	1	$3,800	$0		$0		$0	$0
Heritage (none)	each	$0	-	$0	$0		$0		$0	$0
Subtotal Protection				$46,600	$0		$0		$0	$0
E. BAER Evaluation										
Assessment Team	0520	H5BAER18	---	---	$199,639	---	$0	---	$0	$0
Subtotal Evaluation				---	$199,639	---	$0	---	$0	$0
F. Monitoring										
Road Treatment Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Subtotal Monitoring				$1,000	$0		$0		$0	$0
G. Totals				**$126,600**	**$0**		**$0**		**$0**	**$0**
Previously approved						Comments:				
Total for this request				**$126,600**						

Delta: P5L4L8

DELTA BAER Costs - P5L4L8	NFS Lands					Other Lands				Money Left
Line Items	Units	Unit Cost	# of Units	BAER $	Spent $	Units	Fed $	Units	Non Fed $	Total $
A. Land Treatments										
NX Weed Det. Survey (dozer-lines)	mi	$1,100	26	$28,600	$0		$0		$0	$0
Soil Productivity Mastication	ac	$626	312	$195,312	$0		$0		$0	$0
Port Orford Invasive Detection Monitoring	mi	$500	8	$4,000	$0		$0		$0	$0
Subtotal Land Treatments				$227,912	$0		$0		$0	$0
B. Channel Treatments										
Subtotal Channel Treatments				$0	$0		$0		$0	$0
C. Road and Trails										
Roads - Stormproof & Stormpatrol	mi	$7,500	49	$367,500	$0		$0		$0	$0
Delta Spot Roads - Stormproof & Stormpatrol	project	$37,750	1	$37,750	$0		$0		$0	$0
Trails - none	mi	$0	-	$0	$0		$0		$0	$0
Subtotal Road & Trails				$405,250	$0		$0		$0	$0
D. Protection/Safety										
Safety (hazard and warning signs & gates)	project	$18,600	1	$18,600	$0		$0		$0	$0
Boating Safety (debris booms)	project	$36,200	1	$36,200	$0		$0		$0	$0
Hazard Tree Removal (crew access and safety)	mi	$4,300	1	$4,300	$0		$0		$0	$0
Interagency Coordination	project	$5,000	1	$5,000	$0		$0		$0	$0
Heritage (none)	each	$0	-	$0	$0		$0		$0	$0
Subtotal Protection				$64,100	$0		$0		$0	$0
E. BAER Evaluation										
Assessment Team	0520	H5BAER18	---	---	$199,639	---	$0	---	$0	$0
Subtotal Evaluation				---	$199,639	---	$0	---	$0	$0
F. Monitoring										
Road Treatment Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Land FLS Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Subtotal Monitoring				$2,000	$0		$0		$0	$0
G. Totals				$699,262	$0		$0		$0	$0
Previously approved				$466,200		Comments:				
Total for this request				$233,062						

PART VII - APPROVALS

1. for Forest Supervisor (signature) 10/25/2018 Date

2. For Regional Forester (signature) 10/30/18 Date

J. APPENDICES: Supporting Information:

Appendix A: Monitoring for Roads

Appendix B: Summary of Cost-Risk Analysis

Appendix C: Soil Productivity Treatment Units

Appendix A: Monitoring Protocols:

HIRZ-DELTA Fire
Road Effectiveness Monitoring

The 2500-8 report requests funds to monitor the effectiveness of road treatments on HIRZ-DELTA roads.

- 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:_____

Appendix B: Summary of Cost-Risk Analysis For All Resources:

HirzDelta Benefit Cost Analysis:

Total benefits of resources for whole fire FS lands:

All Resource	Value $
All roads (FS)	$2,000,000
Native plants	$550,000
Water quality	$1,000,000
Aquatics/fisheries	$1,000,000
Soil productivity	$300,000
Public safety	$1,000,000
Totals	**$5,850,000**

Proability of loss without and with treatments:

All Resource	Proability loss no treatments:	Proability loss w/ treatments:	Reduction in proability of loss
All roads (FS)	80%	10%	70%
Native plants	65%	20%	45%
Water quality	80%	40%	40%
Aquatics/fisheries	70%	30%	40%
Soil productivity	85%	40%	45%
Public safety	50%	10%	40%

Total cost of treatments on Forest Service:

HIRZ DELTA BAER Costs	NFS Lands					Other Lands				Money Left
Line Items	Units	Unit Cost	# of Units	BAER $	Spent $	Units	Fed $	Units	Non Fed $	Total $
A. Land Treatments										
NX Weed Det. Survey (dozer-lines)	mi	$1,100	65	$71,500	$0		$0		$0	$0
Port Orford Invasive Detection Monitoring	mi	$500	8	$4,000	$0		$0		$0	$0
Subtotal Land Treatments				$75,500	$0		$0		$0	$0
B. Channel Treatments										
Subtotal Channel Treatments				$0	$0		$0		$0	$0
C. Road and Trails										
Roads - Stormproof & Stormpatrol	mi	$7,500	54	$405,000	$0		$0		$0	$0
Trails - none	mi	$0	-	$0	$0		$0		$0	$0
Subtotal Road & Trails				$405,000	$0		$0		$0	$0
D. Protection/Safety										
Safety (hazard and warning signs & gates)	project	$20,900	1	$20,900	$0		$0		$0	$0
Boating Safety (debris booms)	project	$72,400	1	$72,400	$0		$0		$0	$0
Hazard Tree Removal (crew access and safety)	mi	$4,300	2	$8,600	$0		$0		$0	$0
Hazmat Cleanup	project	$3,800	1	$3,800	$0		$0		$0	$0
Interagency Coordination	project	$5,000	1	$5,000	$0		$0		$0	$0
Heritage (none)	each	$0	-	$0	$0		$0		$0	$0
Subtotal Protection				$110,700	$0		$0		$0	$0
E. BAER Evaluation										
Assessment Team	0520	H5BAER18	---	---	$199,639	---	$0	---	$0	$0
Subtotal Evaluation				---	$199,639	---	$0	---	$0	$0
F. Monitoring										
Road Treatment Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Land FLS Monitoring	ea	$1,000	1	$1,000	$0		$0		$0	$0
Subtotal Monitoring				$2,000	$0		$0		$0	$0
G. Totals				**$593,200**	**$0**		**$0**		**$0**	**$0**
Previously approved						Comments:				
Total for this request				**$593,200**						

All Resource	Benefit of treatment	Treatment Cost	B/C ratio	Justified
All roads (FS)	$1,400,000	$405,000	3.5	yes
Native plants	$247,500	$75,500	3.3	yes
Water quality	$400,000	$405,000	1.0	yes
Aquatics/fisheries	$400,000	$408,800	1.0	yes
Soil productivity	$135,000	$75,500	1.8	yes
Public safety	$400,000	$93,300	4.3	yes
	$2,982,500	**$1,463,100**	**2.0**	**yes**

Soil Productitivity Treatment Polygons Map:

Delta Soil Producitivity Treatments