



DRAFT WHITTIER BURNED AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST



The Whittier Fire of 2017 looking at Santa Ynez River drainage into Lake Cachuma.

A. Type of Report

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

B. Type of Action

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

The US Forest Service Burned Area Emergency Response (BAER) team has analyzed the entire Whittier Fire for post-fire damage. This report is a synopsis of BAER findings and the Forest Service's internal request for implementation funding **on Forest Service lands only**. Forest Service lands that burned are

very steep and remote with many values at risk both on FS land and off-Forest downstream values such as the El Capitan Resort, Dos Pueblos Ranch, Tecolote subdivision, drinking water for the city of Goleta and Santa Barbara, storage capacity of Lake Cachuma, Circle V Campground, the road leading to the Alegre Boy Scout Camp, hiking trails, native plants, fish, wildlife, and some cultural resources. Work to prepare these values at risk on Forest represents a small portion of the implementation work that will need to be done on the lands surrounding the National Forest; that is being addressed by the Natural Resource Conservation Service, Bureau of Reclamation along with many land owners who will use the information that the Forest Service has generated across the total burn area to focus their work.

A Burned Area Emergency Response (BAER) team was assembled by the Los Padres National Forest on July 24th to begin a rapid assessment of the Whittier Fire burned area. This US Forest Service team included the following specialists: wildlife biologists, archeologists, engineers, botanists, wildlife biologists, trails specialists, soil scientists, geologists, hydrologists, and recreation personnel.

PART II - BURNED-AREA DESCRIPTION

- A. Fire Name: Whittier Fire
- B. Fire Number: CA-LBOR-001770
- C. State: CA
- D. County: Santa Barbara
- E. Region: 5
- F. Forest: Los Padres
- G. Districts: Santa Barbara Management Unit
- H. Fire Incident Job Code: PFK4VE
- I. Date Fire Started: July 8, 2017
- J. Date Fire Contained: pending
- K. Suppression Cost: \$35+ million
- L. Fire Suppression Damages Repaired with Suppression Funds
 - 1. Dozerline repaired / waterbarred: 35 out of 66 miles as of 08/9/2017
 - 2. Hand line repaired: 7 out of 16 miles as of 08/9/2017

M. Watershed Number and Name:

Soil Burn Severity by Modified 7th-Field Subwatersheds affected by the Whittier Fire. Percent of watersheds burned are reported in parentheses.

Modified 7th-Field Subwatersheds	Total Acres	Unburned Acres (%)	Burn Severity (acres, %)		
			Low Acres	Moderate Acres	High Acres
Beal Canyon	1870	69 (4)	218 (12)	1180 (63)	403 (22)
Bear Creek	1863	1481 (79)	60 (3)	305 (16)	16 (<1)
Canada del Capitan	5276	3486 (66)	337 (6)	1314 (25)	137 (3)
Canada del Corral	4227	3312 (78)	118 (3)	705 (17)	90 (2)
DeVaul Canyon	1343	58 (4)	136 (10)	770 (57)	378 (28)
Dos Pueblos Canyon	5537	3269 (59)	338 (6)	1626 (29)	302 (5)
Eagle Canyon	3748	3692 (99)	20 (<1)	35 (<1)	0
Gato Canyon	2471	1402 (57)	212 (9)	744 (30)	112 (5)
Hilton Canyon	2010	1191 (59)	192 (10)	461 (23)	166 (8)
Hot Spring Canyon	1522	644 (42)	141 (9)	680 (45)	55 (4)
Las Llagas Canyon	1865	1852 (99)	12 (<1)	1 (<1)	0
Las Varas Canyon	2155	2143 (99)	7 (<1)	4 (<1)	0
San Lucas Creek/Mine Canyon	4298	3089 (72)	351 (8)	754 (18)	103 (2)
Tecolote Canyon	3830	2536 (66)	146 (4)	1085 (28)	62 (2)
Tequepis Canyon	3392	1451 (43)	482 (14)	1119 (33)	339 (10)
Unnamed 1	1408	472 (34)	97 (7)	548 (39)	290 (21)
Unnamed 2	1073	161 (15)	88 (8)	595 (55)	229 (21)
Winchester Canyon	3937	3905 (99)	20 (<1)	12 (<1)	0

N. Total Acres Burned: Whittier 2 Fire Assessment Area: 18,430
(NFS Acres 15,740; BOR 1,117; Private 1,650)

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

- Coastal Sage Scrub
- Chaparral
- Oak Woodland

Vegetation communities were classified based on information obtained from CALVEG (USDA, 2009).

P. Soil:

The Whittier Fire soil survey is dominated by one soil map unit (Maymen, 82%) occurring as several variants of slope range, soil profile rock content, and amount of non-soil rock outcrop. Along with four additional soil map units, these five mapped soils comprise 96.3% of the area.

Soil Map Unit	Acres	%
Maymen-Rock outcrop complex , 50 to 75 percent slopes	9792	53.1%
Maymen stony loam, 45 to 75 percent slopes	2155	11.7%
Rock outcrop-Maymen complex, 75 to 100 percent slopes	2028	11.0%
Maymen stony fine sandy loam, 30 to 75 percent slopes	1207	6.5%
Shedd silty clay loam, 45 to 75 percent slopes	976	5.3%
Chamise shaly loam, 45 to 75 percent slopes	928	5.0%
Santa Lucia shaly clay loam, 45 to 75 percent slopes	417	2.3%
Positas cobbly fine sandy loam, 2 to 15 percent slopes	253	1.4%
Total	17756	96.3%

Q. Geologic Types: The Whittier wildfire area is underlain entirely by sedimentary rock formations, ranging in age from the oldest, late Cretaceous age (~100.5 million years old) to younger late Miocene (5.3 million years old), and overlain by Quaternary alluvial and surficial sediments to present age. The majority of those rock types are of sandstone or shale composition with some conglomerate. Invariably, rock formations mapped as sandstone have thinner interbeds of shale, and formations mapped as shale have relatively thinner interbeds of sandstone (Dibblee, 1966).

R. Miles of Stream Channels by Order or Class: 38 Miles Perennial, 18 Miles Intermittent, and 13 miles ephemeral

S. Transportation System:

- Roads: 16 (5 FS, 3 BOR, 3 County, 5 private) miles
- Trails: 4 miles

PART III - WATERSHED CONDITION

A. Soil Burn Severity by total and FS (acres):

Owner	Acres Burned				
	Unburned	Low	Moderate	High	Total
Bureau of Reclamation	75	424	617	2	1117
Undetermined/Private	186	456	973	35	1650
USDA FOREST SERVICE	744	1887	10251	2645	15529
Total Acres	1006	2767	11841	2682	18296
Total Percent	6	15	65	14	

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

Parameters commonly used to define fire intensity or burn severity on vegetation are flame height, rate of spread, fuel loading, thermal potential, canopy consumption or tree mortality. Soil burn severity for BAER analysis considers additional surface and below-ground factors that relate to soil hydrologic function, runoff and erosion potential, and vegetative recovery. Indicators of soil burn severity include degradation of surface structure, loss of soil organic matter, and consumption of fine roots and formation of water repellent layers. Whittier BAER Soil Scientists followed standard soil burn severity mapping methods fully described in the Field Guide for Mapping Soil Burn Severity (http://www.fs.fed.us/rm/pubs/rmrs_gtr243.pdf).

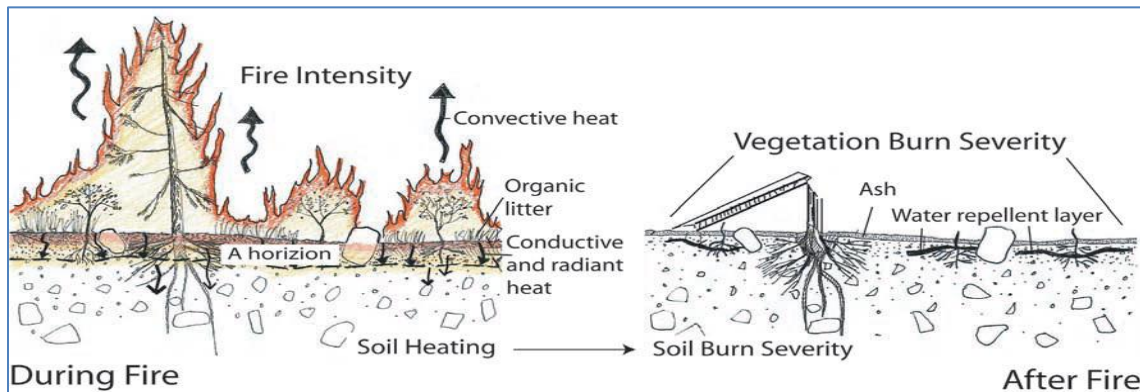
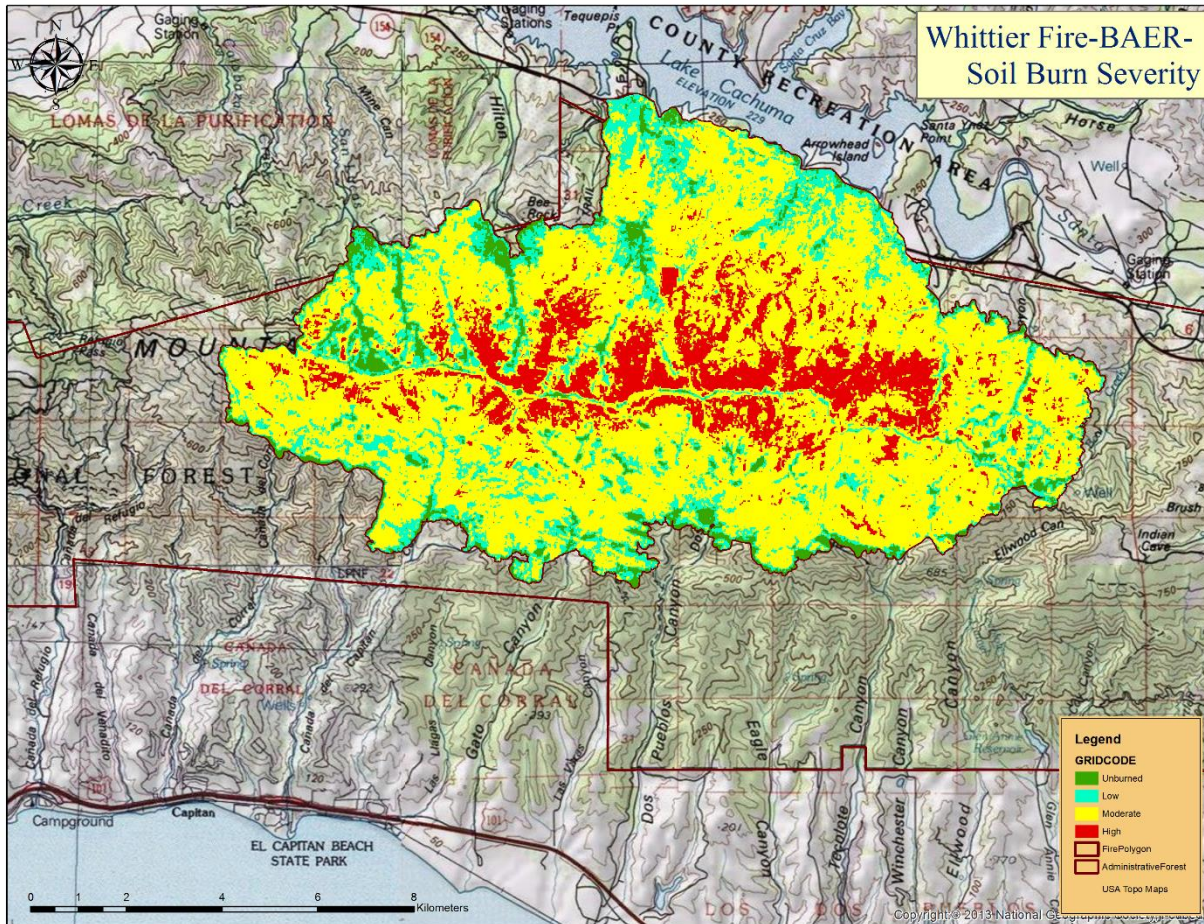


Figure above illustrates the effect of fire intensity on above-ground vegetation and Below ground soil properties (Graphics by Mike Hankinson, National Park Service)

The following soil burn severity map (Figure 1) illustrates the general soil burn severity pattern on the landscape. The soil burn severity is overwhelmingly moderate (65%) and high (15%). In most of the moderate burn severity, and some of the high burn severity (particularly on south-facing slopes), there is very little vegetation or ground cover remaining except surface rock. There is only 15% low soil burn severity because of the high pre-fire ground cover, and partly because the fire was heavily wind-driven and in deep chaparral that has not burned since 1955. Very low soil burn severity was 6% of the fire area.

Figure 1 – Soil Burn Severity Map for the Whittier Fire



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

Figure 2 – Fire Soil Burn Severity Examples

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

Figure 3 – Landscape examples for soil burn severity

<p>High soil burn severity landscape</p>	<p>Moderate soil burn severity landscape</p>	<p>Low soil burn severity landscape</p>

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

Selected Factor Influencing Soil Burn Severity: Weather

Weather conditions which influenced fire behavior. For example the fire progression was extreme due to strong winds and heavy brush and flashy fuels and moved north from the Whittier Camp along Lake Cachuma to the top of Santa Ynez within a few days of ignition. The fire then moved in a southerly direction, burning the headwaters of Goleta.

Selected Factor Influencing Soil Burn Severity: Terrain

Steep terrain and chimney canyons played a role in fire behavior along with wind patterns. South and southwest slopes typically have lower humidity, higher fuel temperatures and are more exposed to summer winds. These areas had more brush and flashy fuels creating rapid fire spread. With these conditions strong downslope winds (“sundowners”) increased burn intensity above the community of Goleta.

Selected Factor Influencing Soil Burn Severity: General Vegetation, Density, and Fire History

Vegetation cover type, density and fuel loading also influenced the soil burn severity patterns especially areas that have burned in the past (Sherpa fire 2016). Areas inland are not influenced by coastal fog and humidity experienced moderate to high burning on north-facing slopes and on south-facing slopes influenced by “sundowners”.

Selected Factor Influencing Soil Burn Severity: Soil Type/Surface Layer Texture

Soil type also influenced soil burn severity patterns. Fire effects on soils such as degradation of structure, changes in soil color, consumption of fine roots and depth of water repellent layers were strongly influenced by soil surface texture. In soils with clay loam surface textures, fire effects on soil were commonly minimal and water repellency generally occurred at the surface. In soils with sandy loam and fine-gravelly loam surface textures, fire effects on soil were common to depths of up to an inch and water repellency was observed at depths of up to 4 inches.

Initial Interpretation for Recovery of Hillslope Stability: Ground Cover

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

B. Soil Resource Condition Assessment Sections:

The Whittier Fire burned approximately 18,000 acres of the Santa Inez mountains immediately north of Santa Barbara, CA on the Los Padres NF. Elevations of the burned area range 850 – 4200 ft with mean slope of 47%. Vegetation was dominated by chaparral including chemise, manzanita, and scrub oak. Limited components of grasslands were present at lower elevations and dry conifer stands at upper elevations. The area last burned in 1955 (60 yr return). Annual precipitation for the burned area changes rapidly with elevation from the ocean (12 inches) to ridgeline (40 inches) because of orographic uplift however the burned area does not experience a strong “rain shadow” effect.

Despite the ruggedness of this landscape the area is near completely soil mantled with interspersed rock outcrops, typical of this region. Soil profile development and depth on the steep slopes are generally

low. The soils on the dissected fan remnant debris fans are deep well-developed soils. Large cobble, stone and boulder accumulations with little associated soils occupy the channel bottoms of the drainages that dissect the fan remnants. These rock strewn drainages are a result of debris flows emanating from the steep slopes.

Rock content and soil texture vary depending on upper hillslope or lower fan location. Upland hillslope soils are generally shallow, coarse textured colluvium and residuum with rock content increasing with depth towards sandstone bedrock. The surface is generally covered in over 50% coarse fragments due to colluvial deposition originating from sand stone rock shelves and outcrops. The soil texture is primarily sandy loam. In contrast, fan soils are deep, fine-textured soils with high amounts of silts and clays derived from shale parent material and aeolian basin deposits. There is very little rock outside of the debris flow deposits and tends to be loams, clay loams, and silt loams. In undisturbed (prefire) state soils in the area have relatively thin litter layers of loose, small organic material mixed weakly into thin mineral surface horizons. Where fire passes through, the standing chaparral vegetation tends to burn completely. This soil/vegetation combination – both attributable to strong a strong water-limited climate - lead extensive postfire denudation and near complete collapse of inherently weakly aggregated soil in the top 0.5-2 cm. As such the main source of postfire vulnerability is loss of soil cover not soil thermal impacts per se, and the soil burn severity is extensively ‘moderate’ despite a drastic visual change in vegetation. Based on a recent adjacent burn (Sherpa Fire) following an abundant rain season, advanced postfire recovery of soil cover is not expected after the first year of recovery where soils were not well developed. Vegetation recovery with respect to watershed function is expected within 3-5 years, with north aspects favored due to moister conditions.

C. Water Repellent Soils:

Characteristic of chaparral vegetation communities, soils in the burned area are naturally hydrophobic. Fire-enhanced hydrophobic strength, in the form of thickening and deepening of the hydrophobic layer, was observed in approximately 70% of the observed fire area. Soils that burned with moderate and high soil burn severity resulted in near complete vegetation canopy and organic horizon removal, leaving surface rock (where present) as the only effective ground cover.

Field-verified soil burn severities (SBS) are mostly moderate (64%) and high (15%) with spatial distribution that generally follows topography and moisture. Moderate SBS is extensive and mostly continuous. Most high SBS straddles the ridgeline and shoulder slopes. Low SBS is mostly confined to channels and incisions.

D and E. Sediment Potential:

Erosion rates in the Whittier burned area increased from 0.1 to 6.2 tons/acre for a 2-year runoff event.

Event intensity (return period yrs)	Pre-Fire (Tons\Acre)	Post-Fire (Tons/Acre)
2	0.1	6.2

The Whittier Fire burned portions of four 6th-Field Sub-watersheds and eighteen modified 7th-Field Sub-watersheds (see Tables 1 and 2). Major streams within the burn area include Canada del Corral, Canada del Capitan, Gato Canyon, Dos Pueblos Canyon, Tecolote Canyon, Hot Springs Canyon, DeVaul Canyon, Tequepis Canyon, Hilton Canyon and San Lucas Cr. There are 38.5 miles of perennial streams, 18.2 miles of intermittent channels and 13.5 miles of ephemeral channels within the fire area.

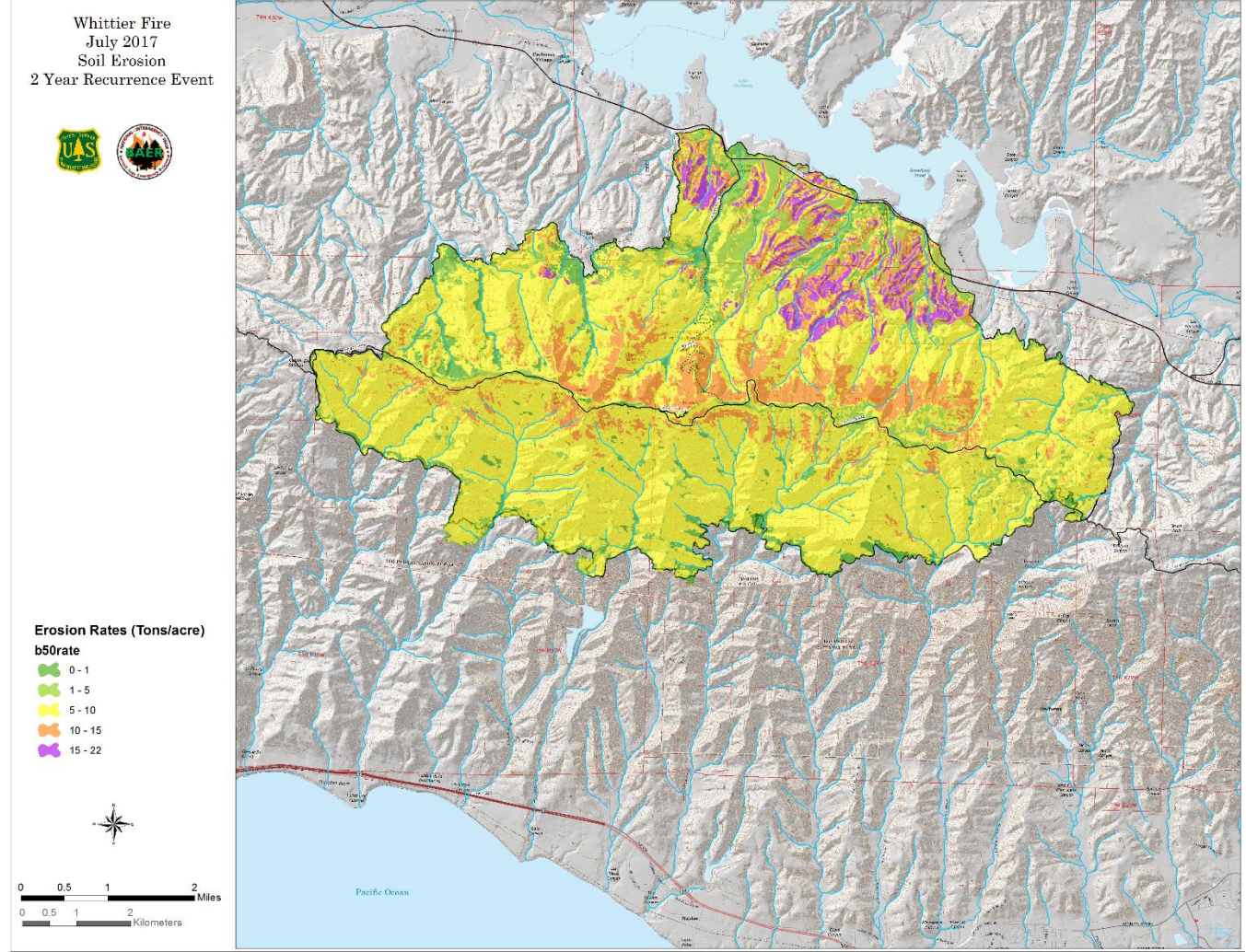
Substantial increases in erosion is expected in all individual pour point locations under modest rainfall intensity scenarios.

The largest watershed is the Dos Pueblos Watershed with 4,564 acres and is projected to contribute 4.2 tons/acre on a 2 year storm. Duvall and Tequepis Canyons, both located on the north-facing side of the burned area, are expected to experience the highest rates of soil transport from both hillslopes as well as fan remnants that contain high amounts of erodible silt. Tecolote, a south facing watershed that burned incompletely, is predicted to experience the lowest net soil lost but this value is still substantial. Interested readers are directed to the Whittier Soil BAER report for more detailed information.

Expected erosion rates for individual watershed and catchment locations burned by the Whittier Fire under two rainfall intensity scenarios.

Watershed	Acres	2 Year	
		Unburned	Burned
Canada del Capitan	3911	0.1	6.8
Canada Del Corral	3042	0.1	7.7
Dos Pueblos	4564	0.1	4.2
Duvall Canyon	1099	0.1	10.3
Gato Canyon	2189	0.1	4.1
Hilton Canyon	2083	0.2	3.7
Tecolote Canyon	3644	0.2	2.9
Tequepis Canyon @ CircleV	810	0.1	8.6
Tequepis Canyon @ Hwy 154	1507	0.1	7.5

Figure 4 – Sediment Delivery for 2-Year Runoff Event



Hydrology

The Whittier Fire burned portions of four 6th-Field sub-watersheds and eighteen modified 7th-Field sub-watersheds. Major streams within the burn area include Canada del Corral, Canada del Capitan, Gato Canyon, Dos Pueblos Canyon, Tecolote Canyon, Hot Springs Canyon, DeVaul Canyon, Tequepis Canyon, Hilton Canyon and San Lucas Cr. There are 38.5 miles of perennial streams, 18.2 miles of intermittent channels and 13.5 miles of ephemeral channels within the fire area.

Wildfires primarily affect water quality through increased sedimentation. As a result, the primary water quality constituents or characteristics affected by this fire include color, sediment, settleable material, suspended material, and turbidity. Floods and debris flows can entrain large material, which can physically damage infrastructure associated with the beneficial utilization of water (e.g., water conveyance structures; hydropower structures; transportation networks). The loss of riparian shading and the sedimentation of channels by floods and debris flows may increase stream temperature. Fire-induced increases in mass wasting along with extensive tree mortality can result in increases in floating

material – primarily in the form of large woody debris. Post-fire delivery of organic debris to stream channels can potentially decrease dissolved oxygen concentrations in streams. Fire-derived ash inputs can increase pH, alkalinity, conductivity, and nutrient flux (e.g. ammonium, nitrate, phosphate, and potassium), although these changes are generally short lived. Post-fire increases in runoff and sedimentation within the urban interface, and burned structures and equipment within the fire perimeter may also lead to increases in chemical constituents, oil/grease, and pesticides.

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

Historical information from prior fires in this area can be used to predict how the landscape will respond to this fire. The north half of the Whittier Fire drains into Lake Cachuma (the lake). The lake is a product of the 1948 Cachuma Project which was completed in 1956 and consisted of the Bradbury Dam, Tecolote Tunnel and the South Coast Conduit. Surface water supplies from the lake and two other reservoirs upstream, as well as the State Water Project, comprise the largest percentage of water used by the citizens of the South Coast of Santa Barbara County. Historically, Lake Cachuma alone has provided up to 85% of the water needs for approximately 340,000 acres of agriculture and 250,000 residents (<http://www.sbcgj.org/2016/LakeCachuma.pdf>).

The original design capacity for Lake Cachuma was 205,000 acre feet. Recent fires such as the Zaca Fire have contributed greatly to siltation in all of the Santa Ynez River reservoirs. Past attempts to remove silt were suspended due to environmental concerns. Furthermore, cost calculations demonstrate future attempts would be prohibitively expensive. By 1995, siltation reduced the lake's capacity to 190,000AF and by 2013 the capacity was at 184,121 AF, an overall loss of 11% of the original capacity.

Design Flow Runoff Response

Before an adjusted design flow can be determined, pre-fire design flow must be calculated. This is the flow expected to occur prior to the fire and the flow responsible for forming present day channel conditions. These flows are used to estimate proper performance of culverts and other drainage structures. After a fire it is necessary to predict the increase in runoff that results from reduced infiltration from soil hydrophobicity and lack of ground cover. These predictions are based upon a pre-fire design flow, or the flow responsible for forming the present day channel conditions. Pre-fire design flow estimates are based on existing gage station information and streams surveyed within or adjacent to the immediate fire area. These estimates assume pre-fire ground infiltration and ground cover conditions.

Adjusted design flow is calculated using the same relationships as design flow. However, runoff response is estimated by assuming an increase in runoff commensurate with burn severity in terms of recurrence interval. This recurrence interval estimates the response of the newly burnt landscape to an average annual storm. The Whittier Fire is expected to respond to an average rainfall event (an event usually associated with the 2-year storm or a storm with a 50% chance of occurrence in any given year), differently for the low, moderate, and high severity burned areas. Based on personal communication with other BAER hydrologists as well as observations of post-fire watershed response in the Sherpa Fire area (adjacent to Whittier Fire area), the following post-fire assumptions were determined for Whittier;

- the acres of unburned and low soil burn severities would be modeled to have a discharge associated with the 2 year (Q2) flow.
- the acres of moderate and high soil burn severities would be modeled to have a discharge associated with the five year (Q5) flow.

These values were then added together to provide a predicted post-fire discharge value for each watershed above a designated point of interest, or pour-point. The burn severity values from the 2016 Sherpa Fire were also included in the post-fire discharge predictions for Canada del Corral and Canada del Capitan pour-point drainages.

For this fire, the USGS StreamStats model was utilized to predict the 2-year pre-fire flow. This model utilizes regression analysis from gaged streams in California to estimate water discharge on ungaged streams. In addition these predictions were compared and adjusted to also take into account the discharge regressions developed by Rowe, Countryman and Storey (1949).

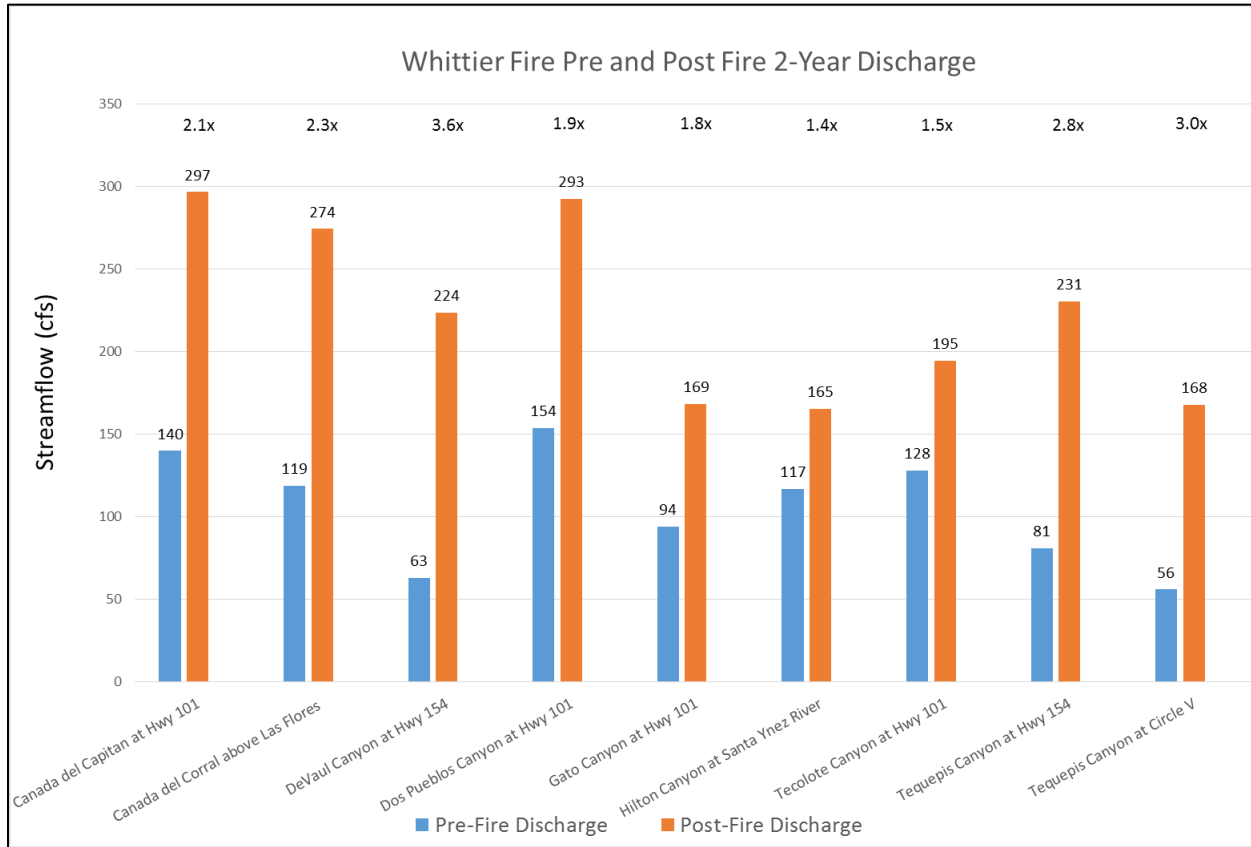
Pour points of interest were developed for modeling purposes and to assess potential values at risk for the Whittier Fire. See Table 4 and Figure 2 for pour point watersheds affected by the Whittier Fire and the associated burn severity acres.

Table 4: Pour Point Watersheds affected by the Whittier Fire. Percent of watersheds burned are reported in parentheses.

Pour Points	Total Acres	Unburned Acres, %	Burn Severity		
			Low Acres	Moderate Acres	High Acres
Canada del Capitan at Hwy 101	3915	2135 (55)	331 (8)	1312 (34)	139 (4)
Canada del Corral above Las Flores	3045	2145 (70)	113 (4)	698 (23)	89 (3)
DeVaul Canyon at Hwy 154	1100	11 (<1)	74 (7)	647 (59)	369 (34)
Dos Pueblos Canyon at Hwy 101	4568	2297 (50)	341 (7)	1628 (36)	302 (7)
Gato Canyon at Hwy 101	2192	1132 (52)	208 (9)	740 (34)	112 (5)
Hilton Canyon at Santa Ynez River	2088	1246 (60)	191 (9)	481 (23)	171 (8)
Tecolote Canyon at Hwy 101	3648	2358 (65)	144 (4)	1085 (30)	61 (2)
Tequepis Canyon at Hwy 154	1509	99 (7)	280 (19)	799 (53)	331 (22)
Tequepis Canyon at Circle V	810	48 (6)	123 (15)	388 (48)	250 (31)

Figure 3 provides the predicted post burn discharges in cubic feet per second for the watersheds affected by the fire. Increases in water yield as a percentage of the change from pre to post fire conditions are also included at the top of Figure 3.

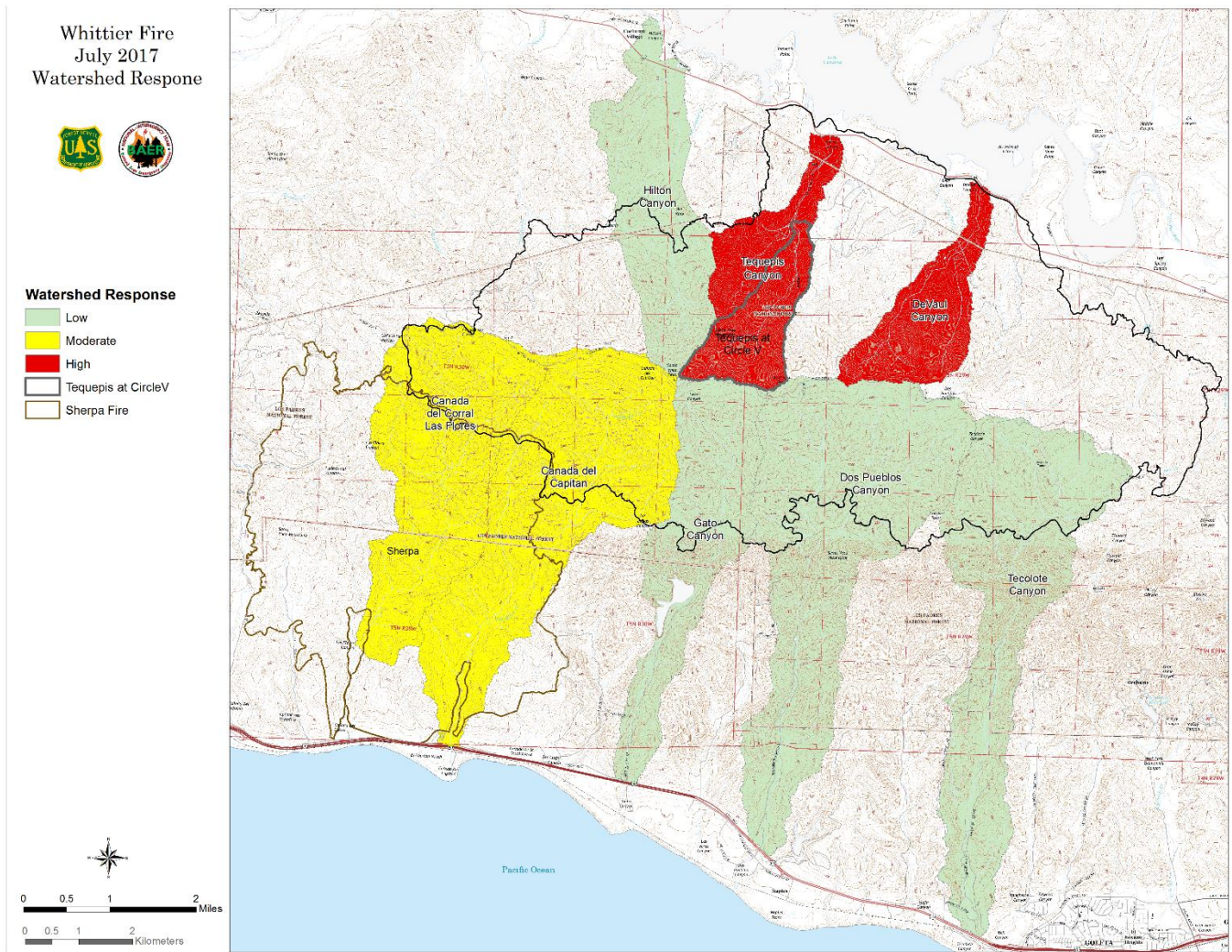
Whittier Fire Pre and Post Fire 2-year Discharges at designated Pour Points.



The watershed that was modeled to have the biggest relative increase is DeVaul with a 3.6 times increase with a flow that increases from 63 cfs pre-fire to 224 cfs post fire.

Due to the steepness of these drainages and the amount of high and moderate burn severity (large areas now devoid of vegetation and groundcover) after the fire, the first large runoff producing storm is expected to create increased surface flow, erosion and sediment production. This scenario coupled with existing wet antecedent soil conditions from previous storms could trigger a potential flood event and/or debris flow with high sediment volumes. The highest amounts of sediment yields from the burned watersheds are expected during the first three years after the fire.

Figure 5 – 2-Year Storm Watershed Response



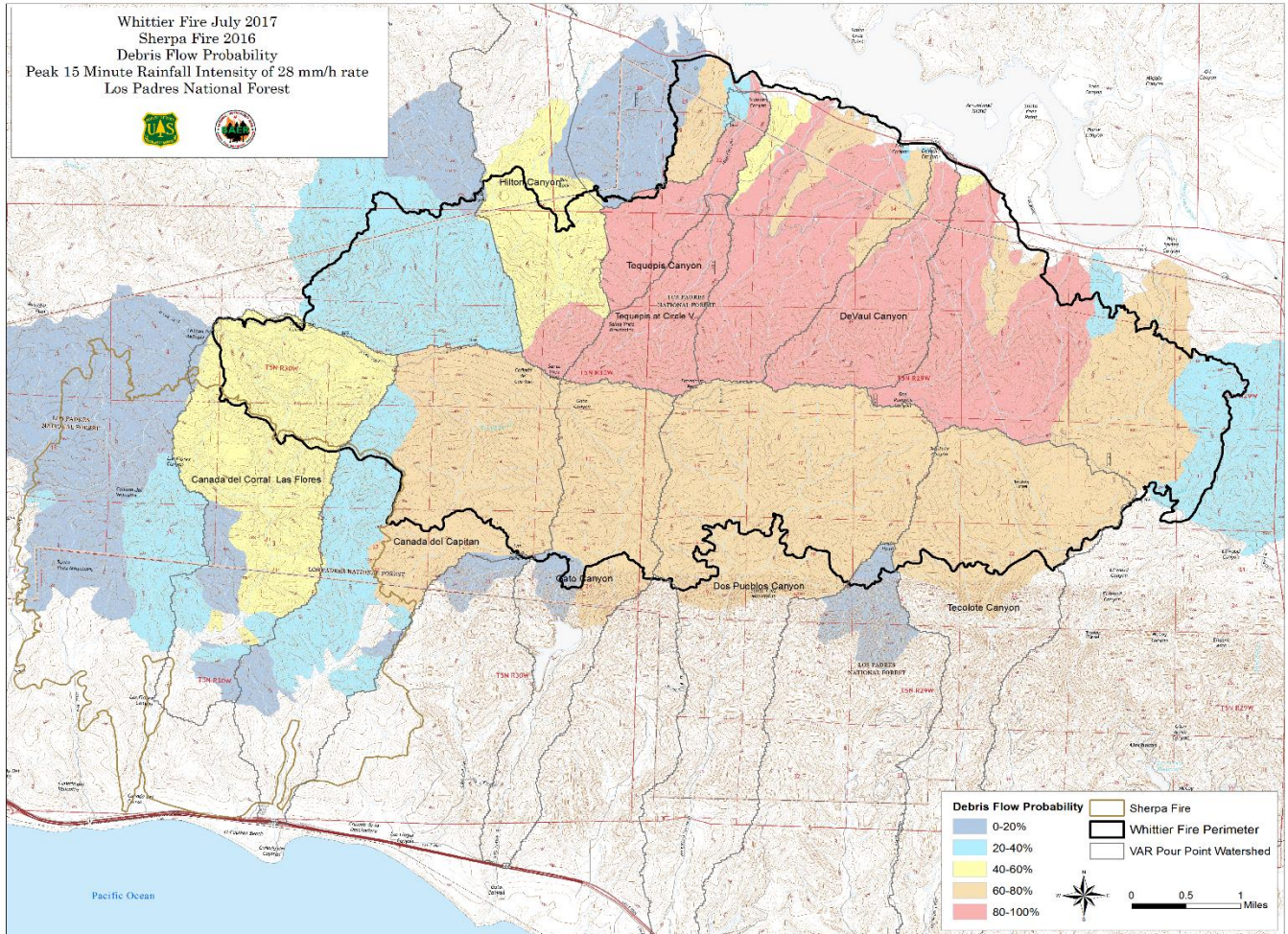
Debris Flow Potential:

The US Geological Survey (USGS) - Landslide Hazards Program, has developed empirical models for forecasting the probability and the likely volume of post-fire debris flow events. To run their models, the USGS uses geospatial data related to basin morphometry, burn severity, soil properties, and rainfall characteristics to estimate the probability and volume of debris flows that may occur in response to a design storm (Staley, 2016). Estimates of probability, volume, and combined hazard are based upon a design storm with a peak 15-minute rainfall intensity of 12 – 40 millimeters per hour (mm/h) rate, equal to 0.47 – 1.57 inches per hour rate. . We selected a design storm of a peak 15-minute rainfall intensity of 28 millimeters per hour (mm/h) rate (equal to 1.1 inch/hr rate) to evaluate debris flow potential and volumes since this magnitude of storm seems likely to occur in any given year.

Based on USGS debris flow modeling it appears that under conditions of a peak 15-minute rainfall intensity storm of 28 millimeters per hour (1.1 inch/hr.), the probability of debris flows occurring is 80-

100% in the majority of the main channel/creeks in the burn area. Under these same conditions, predicted volumes of these debris flows are expected to range from 10K-100K cubic meters in these same channels. From the debris flow combined hazard map it appears that the majority of creeks in the burn area are predicted to produce debris flows of a high combine hazard.

Figure 6 – Predicted Debris Flow Probabilities for the Whittier Fire



PART IV - HYDROLOGIC DESIGN FACTORS

Table 3. Hydrologic design factors

A	Estimated Vegetative Recovery Period	3-5 years
B	Design Chance of Success	80%
C	Equivalent Design Recurrence Interval	2 years
D	Design Storm Duration	1 hour
E	Design Storm Magnitude	0.94 inches
F	Design Flow	23 cfs/mi ²
G	Estimated Reduction in Infiltration	25%
H	Adjusted Design Flow	38 cfs/mi ²

PART V - SUMMARY OF ANALYSIS

A. Describe Critical Values/Resources and Threats:

Background:

The Whittier Fire started July 8, 2017 and burned a total of 18,460 acres from Lake Cachuma over to Goleta Heights CA, between 1,000 and 4,300 foot elevations. The average slope of the burned area is 45%. The fire started at Whittier Camp by an illegal campfire from unknown source (under investigation) and rapidly spread. The fire burned over private, Bureau of Reclamation, and National Forest land ownerships (Table 5), and has impacted the communities of Cachuma Village, Goleta, and Santa Barbara, and other small communities along the Hwy 154 along Lake Cachuma. A Total of 16 homes were destroyed with 30 outbuildings destroyed. The fire progression was extreme due to strong winds and heavy, flashy fuels and moved south from Whittier Camp to Goleta Heights.

Summary of Whittier Fire BAER Values at Risk

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

Human Life and Safety

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

Property

- USFS system roads
- USFS trails
- USFS campgrounds
- Water diversion and conveyance infrastructure

Natural Resources

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

Cultural Resources

- Prehistoric sites
- Historic sites

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

Values at Risk Matrix:

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

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

Private Property (Property and Life Safety) - Private Homes and Structures: The BAER team did identify some private residences and structures at increased risk from post wildfire processes. However, extensive inventory of structures and other values on private land was not conducted. Information sharing and outreach efforts with NRCS and Santa Barbara County departments of transportation and emergency services focusing on potentially affected communities are proposed to increase awareness of burned area conditions and potential impacts to private values.

Property Values at Risk - Forest Service Roads

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

Human Life and Safety: As a result of the burned watersheds it was determined through the BAER Risk Assessment process that it is very likely that the burned steep hill sides above some road segments pose a risk to road users from rock fall, debris flows, landslides and flash flooding. Resulting in hazards to road users from the potential loss of road function, denial of access, and entrapment. The magnitude of this occurrence has major consequences and is considered a high risk to life and safety of road users on the County segment of 5N19 West Camino Cielo road located on FS lands from MP 5.1 near the Winchester Gun Club to MP 13.6 at the start of Forest Service jurisdiction and from MP 13.6 to 16.6 along the surfaced segment of NFSR at the NE edge of the fire. And the NFSR segments of road 6N04 Tequepis Canyon road at MP 0.5 steep shale rock cut and the potential for flash flooding at MP 0.7 and 0.8 at two concrete low water crossings on Tequepis creek.

Caltrans representatives were informed of the potential for debris flows plugging culverts under Highway 101 and Highway 154 at cooperator meetings.

Property: It has been determined through the BAER Risk Assessment process that it is possible that post burn conditions will increase runoff and the movement of sediment into some road drainage features, such as culvert inlets, over side drains, roadway dips and runouts along the County segment of 5N19 West Camino Cielo road, from MP- 5.1 near the Winchester Gun Club to MP-13.6 start of Forest Service jurisdiction, and from MP 13.6 to MP-16.6 along the surfaced segment of NFSR to the NW edge of the burn. The magnitude of this occurrence is considered moderate and puts property (the road) at risk for blockage and uncontrolled water to divert, resulting in likely damage to the invested road improvements, and a risk to road users.

Resource Values / Cultural Resources: Archaeological surveys adjacent too roads within the burn perimeter identified 20 historic era sites. The BAER risk assessment along with consultation with the Arch. team determined that road related flooding, debris flows and rock fall would not impact these sites.

A. Findings on the Ground Surveyed

The field survey was conducted over July 25 – July 29 (5 days) by the road engineer along with field coordination with the Hydrologist and Geologist. Forest Service road 18S05.2 within the fire perimeter;

B. Consequences of the Fire on Values at Risk

- **Life and Safety:** Treatments to mitigate the risks to life and safety is administrative closure of the burn area. Install closure gates, install closure signs and install BAER warning signs at main entry points. To support the Forest closure order and ensure safety for Forest visitors and protection to Forest resources during the recovery period, gates, closure signs, warning, and information signs will be placed around the fire perimeter at main entry points trailheads, and other strategic locations.
- **Property):** As a result of the burned watersheds, it has been determined through the BAER risk assessment process/matrix, that the risk to West Camino Cielo road is considered high with moderate consequences. Damage to the invested road improvements, loss of road functions, and forest users' access to recreation opportunities.

C. Emergency Determination

This assessment determines an emergency and high risk related to life-safety and property related to the Forests developed road system.

- a. **Life and Safety** - It has been determined through the BAER Risk Assessment process that it is possible that post burn conditions will increase runoff and the movement of sediment into some road drainage features, such as culvert inlets, over side drains, roadway dips and runouts along the County segment of 5N19 West Camino Cielo road, from MP- 3.9 at the Winchester Gun Club to MP-13.6 start of Forest Service jurisdiction, a distance of approximately 10.0 miles and from MP 13.9 to MP-16.6 along the surfaced segment of Forest Service to the NW edge of the burn. A distance of approximately 3.0 miles the magnitude of this occurrence is considered moderate and puts property (the road) at risk for blockage and uncontrolled water to divert, resulting in likely damage to the invested road improvements, and a risk to road users.
- b. **Property** - Risk to road improvements and loss of road functions is considered to be possible with moderate consequences on segments of these roads. Diversion of uncontrolled water from road drainage courses on to the road surface results in degradation and unacceptable erosion, gullies, loss of road functions, and denial of access to road users.

Risk Assessment – Forest Service roads

- Probability of Damage or Loss: Likely. This determination is based on the expectation that increased erosion and sediment will occur and could plug drainage structures along roads.
- Magnitude of Consequence: Moderate. This determination was made based on the amount of damage that would occur if culverts were temporarily plugged.
- Risk Level: High

Property Values at Risk - Forest Service Trails

As described in the BAER recreation, hydrology, and geology reports there is potential for damage to occur on trails within the fire perimeter. In addition to impacts to Forest Service trails, this report also describes increased risk for the safety of trail users.

Potential impacts to trails include erosion of trail tread, damage to trail drainage features, sediment or debris deposition on trails and impacts to trail crossings. For complete details see recreation report in project folder.

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

Some system trail segments have been found to be at high risk of damage and/or loss. These findings are based on proximity to moderate and high burn severity areas, side hill slope, soil characteristics, and results of aerial and on-the-ground surveys. The trail in question is the Tequepis Trail (29W06).

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

Water Quality:

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

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

Impacts to Domestic water users

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

Treatments: Share assessment information with water users and NRCS. Increase maintenance at water intake facilities. Monitor system during storm events. Consider adding storage to ensure a clean water sources during high turbidity events.

Natural Resource Values at Risk – Water Quality

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

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

- Exxon Mobile Processing Plant at the confluence of Las Flores Canyon and Canada del Corral.
- Lake Cachuma and the associated Bradbury Dam, Tecolote Tunnel, and water intake facility.
- Private lands and resources (including residences, buildings, roads, bridges, culverts, ranches, camps, resorts, other structures, etc.) along Canada del Capitan, Gato Canyon, Dos Pueblos, Tecolote Canyon, DeVaul Canyon, Tequepis Canyon and Hot Spring Canyon. Other drainages may have similar resources at risk, but had less acres burned upslope.
- Hwy 101 stream crossing culverts and bridges under the jurisdiction of California Department of Transportation (CalTrans).
- Hwy 154 stream crossing culverts and bridges under the jurisdiction of CalTrans.
- West Camino Cielo Road under the jurisdiction of Santa Barbara County

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

Water Quality

- The most noticeable effects on water quality will be increased sediment and ash from the burned area into Lake Cachuma, although this may largely depend on volume at the time of runoff events.
- OHV trespass along West Camino Cielo can accelerate erosion on burned areas. Now that the brush barriers are gone, this problem has already increased dramatically within weeks of the fire.

Treatment: Share assessment information with private landowners and BOR, and NRCS. Increased post-fire flood flows may overwhelm existing NFS and private road crossing structures, causing washouts, and stream diversion down the road. This can result in a threat to public safety, damage to infrastructure, and increased sediment delivery to downstream channels.

- Magnitude of Consequences: Moderate
- Probability of Damage or Loss: Likely
- Risk: Intermediate
- Storm patrols should be conducted by all relevant parties to ensure that blockage of crossing structures do not occur during the first runoff producing storms. Roads should be storm-proofed as necessary. *Because of the high probability of OHV motorcycle trespass on West Camino Cielo road from dense local populations, it will be necessary to patrol this area 3-4 days a week.*
- Share assessment information with local communities, landowners, water users, permit holders, NRCS, and NOAA/NWS to facilitate preparation for fall and winter storm.

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

Plant Communities of the Whittier Fire Burned Area

There are no known locations of federally Threatened or Endangered plant species within the fire area. There are Forest Service Sensitive or Survey and Manage species locations within the fire area.

Forest Sensitive & Endemic Botanical Species

No federally listed Threatened or Endangered plant species or their critical habitats are known to occur within the Whittier Fire. Seven Forest Service Sensitive or Forest Plan Endemic plant species are documented within that same area. They are shown in the following list.

The R5 Sensitive Plants with potential to be affected by noxious weeds are:

- Sonoran maiden fern (*Thelypteris puberula* var. *sonorensis*)
- Refugio manzanita (*Arctostaphylos refugioensis*)
- Late-flowering mariposa lily (*Calochortus weedii* var. *vestus*)
- Santa Barbara honeysuckle (*Lonicera subspicata* var. *denudata*)
- Santa Ynez false lupine (*Thermopsis macrophylla*)
- Ojai fritillary (*Fritillaria ojaiensis*)
- Mesa Horkelia (*Horkelia cuneata* ssp. *puberula*)

Recommendations: Re-visit known populations and document any damage to them. Determine if there are any measures that may be possible to aid their recovery and implement them. Monitor the recovery.

Invasive plants and Noxious Weeds

The following table refers to known invasive plant and noxious infestations along major access roads to the fire perimeter. Additional weeds populations were observed in developed and repeatedly disturbed areas adjacent to the burn. Priority infestations for treatment are those adjacent to dozer-lines, hand lines, drop points and riparian areas.

Common Invasive Noxious Weeds Known In, and Adjacent to the Whittier Fire Area

Scientific Name	Common Name
<i>Centaurea solstitialis</i>	Yellow starthistle
<i>Carduus pycnocephalus</i>	Italian thistle
<i>Centaurea melitensis</i>	Tocalote
<i>Cirsium vulgare</i>	Bull Thistle
<i>Foeniculum vulgare</i>	Wild fennel
<i>Spartium junceum</i>	Spanish broom
<i>Cortaderia selloana</i>	Pampas grass
<i>Phalaris aquatica</i>	Harding grass

During fire suppression operations, more than 66 miles of dozer line, 16 miles of hand line, and 19 miles of road completed as dozer line were constructed on National Forest. Of this, over 27 miles of dozer line and over 10 miles of hand line were constructed on National Forest. The majority of dozer lines were contingency lines located well away from the fire perimeter. In addition, there are a number of roads within the fire area of operations which could also serve to disperse weed seeds. Dozer lines, drop points, and safety zones serve as weed dispersal areas or corridors and suppression equipment can act as weed vectors. Movement of fire suppression and rehab equipment can disperse and spread noxious weeds to and from areas within the fire and among home units. Dispersal of weeds from fire equipment movement poses a significant risk to post-fire regeneration. Roadsides and dozer lines will be most impacted by this threat.

Threats to Forest Sensitive Species:

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

Significantly, several miles of dozer and hand lines constructed along West Camino Cielo Road passed through populations of Forest Service Sensitive plants. This did two things. First it removed both plants and the seed bank from areas where the dozers worked. This could significantly affect the recovery of native vegetation including Forest Service Sensitive species. Second, it opened the habitat occupied by Forest Service Sensitive species to invasion by noxious weed species on the newly exposed bare soil. The fact that this has happened two years in a row compounds the impacts to these species.

Additionally, 1.2 miles of new dozer line was constructed on the north side of the Sherpa Fire perimeter last year in a location that had never before been disturbed by any clearing or dozer activity was reopened again during the Whittier Fire. This has increased the opportunity for invasive species to establish where there had not been any before.

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

There are 17 sub-watersheds which were affected to varying degrees by the Whittier Fire. 1) San Lucas Creek/Mine Canyon, 2) DeVaul Canyon, 3) Canada del Capitan, 4) Dos Pueblos Canyon, 5) Eagle Canyon, 6) Gato Canyon, 7) Winchester Canyon, 8) Canada del Corral, 9) Las Llagas Canyon, 10) Las Varas Canyon, 11) Bear Creek, 12) Hilton Canyon, 13) Beal Canyon, 14) Unnamed 1, 15) Unnamed 2, 16) Hot Spring Canyon, and 17) Tequepis Canyon. Impacts to these watersheds were evaluated as part of the wildlife, and the other BAER specialist reports.

This assessment evaluates the effects of the Whittier Fire and the potential effects of the burned area emergency response (BAER) treatments on the following federally-listed fish and wildlife species:

California condor (*Gymnogyps californicus*), California red-legged frog (*Rana draytonii*) and designated critical habitat for California red-legged frog, Steelhead trout (*Oncorhynchus mykiss*), South-Central California Coast (SCCC) Distinct Population Segment (DPS).

Table 1. A summary of determinations for Threatened and Endangered species and the related emergency condition.

Species	Emergency Condition
California condor	None
California red-legged frog	Direct mortality from the fire, Impaired habitat use due to sedimentation, debris flows.
California red-legged frog critical habitat	Impaired habitat due to high water flows, sedimentation and debris flows.

While negative impacts to both California red-legged frog and their respective critical habitats are considered likely and very likely, it is considered unfeasible for BAER treatments to effectively prevent the sedimentation and debris flows which are expected to result to the level where it can positively affect their natural recovery.

An assessment of different wildlife VARs in relation to potentials for flooding, soil erosion/sedimentation events and debris flows indicated that California red-legged frog populations and habitats (suitable and critical habitat) are likely to be adversely affected by post-fire impacts for 2-3 years afterwards. Impacts to populations, particularly from debris flows, may result in extirpation of local populations. However, CRLF are adapted to ecological systems with a frequent fire return interval, and are capable of re-colonizing habitats in a short period of time if environmental conditions are favorable. Post-fire impacts to habitat can be more problematic. Under average environmental conditions, riparian aquatic systems may recover from post-fire effects in 4-5 years. However, wildfires followed by drought conditions, such as experienced from 2012-2016, cause a lag in ecological recovery due to insufficient precipitation to flush sediments out of the aquatic system.

Following the fire it is recommended that biological surveys for and red-legged frogs and their habitats are conducted to assess post-fire response and recovery. This will inform biological staff on the Los Padres NF regarding whether natural recovery is occurring as anticipated, or whether additional conservation measures might be necessary. If natural recovery is impeded, the habitat affected by the Whittier Fire can be re-populated from surrounding populations using non-BAER funding. The probability of success for re-population from neighboring unaffected creeks is much higher than from any form of slope treatment.

Natural Resource Values at Risk - Threatened and Endangered Fisheries

A rapid aquatic analysis was based on site reconnaissance, ground truthing and aerial review between July 18 – 27, 2017. Owing to time constraints, streams designated by the National Marine Fisheries Service (NMFS) as critical habitat for federally endangered Southern California steelhead were given highest priority for field assessments. Areas with moderate to high burn severity were the areas of focus for this assessment on stream systems within the Los Padres National Forest (LPNF) and proximate lands outside of LPNF jurisdiction with the potential to be impacted by the Whittier Fire.

A significant percentage of the fire area burned intensely, consuming all organics on the soil surface including leaves on standing live vegetation. The burn severity of the entire area within the Whittier Fire was estimated as 6 % low, 23 % moderate, 5 % high, and 66 % unburned. There were 21 subwatersheds (HUC7) affected by the Whittier Fire, and six of those have steelhead critical habitat impacted by the fire. An average of 37 % of these subwatersheds (i.e., having designated steelhead critical habitat within them) were burned by the Whittier Fire.

Areas of moderate to high burn severity have the greatest potential to mobilize sediment into stream systems, reduce productivity and benthic macroinvertebrate populations and reduce the availability of spawning and rearing habitat, all impacting fisheries. Stream ecosystem impacts include changes in geomorphology (e.g., sediment filled pools and riffles), decreased pool depth, loss of habitat, increased solar radiation owing to losses in riparian cover, changes in water quality, increased dissolved nutrients and pH, and changes in pool:riffle ratios (Dunham et al. 2003, Earl and Blinn 2007, Aha et al. 2014). For fish, habitat loss, reduced riparian cover, changes in water quality, increased temperature, and reduced prey availability all affect fish population responses to fire including increased mortality and extirpation. However, these effects may be pronounced or muted depending on the fire burn severity, timing of subsequent rainfalls, intensity and duration of ensuing rains, and volume of debris and sediment entering streams.

Based on the above assessment, it is my determination that an emergency does exist for federally endangered Southern California steelhead and designated critical habitat and water quality in Hilton and Dos Pueblos Creeks (both currently steelhead occupied). Specific treatments that maintain stream migration corridors and improve chances for anadromy will alleviate restrictions or blockages that result in freshwater residency, exclusively. These steps include monitoring culverts and underpasses and potentially relocating fish to nearby stream systems by agencies authorized with this authority (i.e., NOAA, CDFW). Emergencies also exist for steelhead critical habitat and water quality for Tecolote, Gato, and Canada del Capitan Creeks; however, these systems currently do not support steelhead so no specific treatments are recommended. Likewise, no treatments are recommended for Mine Canyon and San Lucas Creeks.

There are two emergency situations related to the Whittier Fire including 1) steelhead critical habitat and 2) water quality. There is a potential for stream habitat degradation owing to increased sedimentation, greater channel instability, and higher nutrient concentrations and alkalinity. Mitigation measures to reduce potential impacts to stream habitat and water quality will rely on road treatment packages to minimize these effects and eliminate the “emergency” situation under BAER guidelines.

It is also recommended that the following work/monitoring be pursued by local, state and federal agencies (e.g., CDFW, NOAA) using non-BAER funding:

- Steelhead in Hilton and Dos Pueblos Creeks should be monitored to evaluate post-fire effects. Snorkel surveys over several years will determine the status of these fish populations and whether fish relocations are warranted. If this step is not taken, Step 2 should be considered.
- Consider relocating fish to nearby stream locations that have *O. mykiss* with a common genome. The probability of success for re-population from neighboring unaffected creeks is much higher than from any form of slope treatment. In order for slope treatments to be effective they would have to reduce all forms of sediment, including debris flows, significantly and our analysis does not show this to be feasible.
- Water quality samples in Hilton and Dos Pueblos Creeks should be collected to elucidate chemical changes post-fire and potential consequences for all aquatic biota.

Soil Productivity Values at Risk

Threats to Soil Productivity:

Probability of Damage or Loss: Likely

Magnitude of Consequences: minor

Risk Level: Low

An elevated level of erosion can be expected in the aftermath of the fire based on modeling of erosion and sedimentation and erosion risk analysis. However, this is a fire-adapted ecosystem that has evolved in the presence of fire, which falls within the range of natural variability and would therefore indicate a minor magnitude of consequence. This would also indicate a low risk level to soil productivity. Current soil and soil productivity is a product of a long term balance between erosion, mostly post-fire, and soil formation. Where the fire regime remains similar to prehistoric times, it's logical to suppose that soil productivity will not be impaired by any single fire and post-fire erosion. The Whittier fire area last burned in 1955 which is 62 years ago. Pre-settlement fire return intervals were about 23- 76 years. OHV trespass also can aggravate soil erosion along West Camino Cielo road.

The Whittier Fire BAER team assessed the landscape for the effectiveness of *potential* land treatments; specifically soil cover additions by methods such as straw mulching, wood straw or hydro-mulching. To consider the maximum benefit of treatments, both private and public land were considered. Our analysis showed the percentage of each pour point watershed that could be treated following the feasibility analysis. It is generally considered to treat watersheds if at least 50% of the watershed can be treated. The greatest area of a watershed that could be treated is DeVaul and Taquepis watersheds (see Appendix A: Land Treatment Feasibility Analysis Methodology for land treatments).

Many of the slopes with the highest predicted erosion are too steep to effectively treat with mulch. Of the ground that is treatable, not enough acres were present to significantly reduce erosion especially when other forms of sediment production such as debris flows and gullyng are taken into account (which soil erosion models do not).

Operators of the Cachuma Reservoir have indicated that even small amounts of sediment reductions are important to the long term carrying capacity of the reservoir and are conducting a cost/benefit analysis of slope treatment options.

Property Values at Risk - Heritage Sites

Fire-effects to cultural resources occur at several levels. The first are the direct effects of the fire itself—ranging from the destruction of cultural material to more subtle effects such as resetting the obsidian hydration clock or introducing modern carbon into a site’s assemblage. Post-fire risks to cultural resources fall into two categories: 1) degradation from erosion, soil deposition, mass wasting and other geological effects brought about by vegetation loss, and 2) increased public access stemming from loss of vegetation cover and resulting in risk for looting, vandalism, and vehicular impacts. The cultural resources assessment centers on post-fire conditions that could directly or indirectly result in adverse effects to known cultural resource sites. Adverse effects may include the potential to bury surface and subsurface cultural resources to prohibit discovery; the possibility of soil movement that would change the context of the remains which are vital to any scientific analysis or interpretation value; and increasing the visibility of site locations that would make them more susceptible to looting or vandalism.

Archival research, GIS analysis, and field reconnaissance indicate that a minimum of 30 cultural resource sites on Forest Service lands are within or immediately adjacent to the Whittier Fire burn perimeter. Cultural resources consist of Native American habitation sites/villages, milling areas, shell middens, rockshelters with pictographs, lithic scatters and two sacred sites. Historic land use is represented by homesteading activities, rock walls and alignments, and historic artifacts such as trash dumps, historic glass and hardware. These sites are susceptible to flooding, debris flows, increased erosion, and in threat from looting, vandalism, and unauthorized off-highway vehicle (OHV) use as a result of a denuded landscape. All sites are unevaluated with respect to eligibility for the National Register of Historic Places, and under Forest Management policy and the 2014 Region 5 Programmatic Agreement with the California State Historic Preservation Officer are considered to be eligible for the purpose of this analysis.

Table 1: Known Cultural Sites on Forest Service Land

FS Site Number	Trinomial	Site Type	Recorder	Year
<u>0507-54-056</u> -Site is described as a sparse lithic scatter.	<u>CA-SBA-0892</u>	<u>Prehistoric</u>	<u>J. Tainter</u>	<u>1971</u>
<u>0507-54-057</u> -Site is described as a light lithic scatter, homestead, and historic camp activities.	<u>CA-SBA-1457</u>	<u>Historic/Prehistoric</u>	<u>J. Johnson</u>	<u>1978</u>
<u>0507-54-267</u> -Site is described as a light lithic scatter completely destroyed by bulldozer activity.	<u>CA-SBA-0896</u>	<u>Prehistoric</u>	<u>J. Tainter</u>	<u>1971</u>
<u>0507-54-286H</u> -Historic 19 th century Step Homestead.	<u>CA-SBA-1458</u>	<u>Historic</u>	<u>J. Johnson</u>	<u>1978</u>
<u>0507-54-314</u> -Site is described as a light chert lithic scatter, determined ineligible for the NRHP.	<u>CA-SBA-2006</u>	<u>Prehistoric</u>	<u>K. Osland</u>	<u>1985</u>
<u>0507-54-327</u> -Site is described as a lithic scatter.	<u>CA-SBA-2025</u>	<u>Prehistoric</u>	<u>C. Bettison</u>	<u>1986</u>
<u>0507-54-328</u> -Site is described as a light lithic scatter with ground stone.	<u>CA-SBA-2026</u>	<u>Prehistoric</u>	<u>D. Reeves</u>	<u>1986</u>

<u>0507-54-330H</u> -Stone and cement cistern.	<u>CA-SBA-2035</u>	<u>Historic</u>	<u>E.R. Blakely</u>	<u>1986</u>
<u>0507-54-373</u> -Site is described as a light chert lithic scatter, determined ineligible for the NRHP.	<u>CA-SBA-2281</u>	<u>Prehistoric</u>	<u>D. Reeves</u>	<u>1986</u>
<u>0507-54-376</u> -Site is described as a light chert lithic scatter, determined ineligible for the NRHP.	<u>CA-SBA-2303</u>	<u>Prehistoric</u>	<u>D. Reeves</u>	<u>1986</u>
<u>0507-54-459H</u> -1937 spring box for Camp Cielo.	<u>CA-SBA-2529</u>	<u>Historic</u>	<u>L. Schub</u>	<u>1992</u>

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

Protection/Safety

Human Life and Resource protection (Fire Area Closure): To support the Forest closure order and ensure safety for Forest visitors and protection to Forest resources during the recovery period, road closure and information along with BAER warning, signs will be installed around the fire perimeter at main entry points, trailheads and other strategic locations.

B. Emergency Treatment Objectives:

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

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

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

D. Probability of Treatment Success

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

E and F. Summary of VAR Tool Calculations (see Appendix E):

- Market Resource Values (direct losses and loss of use): \$935,000
- Whittier 2 Fire Treatment Cost: \$152,850
- Benefit/cost ratio = 6.1

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

G. Skills Represented on Burned-Area Survey Team:

Hydrology	Soils	Geology	Engineering
Archeology	Recreation	Botany	Wildlife & Fisheries

Team Leader: Brad Rust	Email: brust@fs.fed.us	Phone: 530-226-2427
Pancho Smith	District Ranger	jsmith03@fs.fed.us
Kevin Cooper	BAER Team Coordinator	kccooper@fs.fed.us

H. Treatment Narrative for Forest Service:

Land Treatments:

Invasive Weed Detection Surveys

The unknowing introduction of invasive noxious weeds into areas disturbed by fire suppression and suppression repair has the potential to establish persistent weed populations and presents a high risk to values at risk. These persistent invasive weed populations could affect the structure and habitat function of plant communities within the burn area. Forest Service direction is to minimize the establishment of non-native invasive species to prevent unacceptable degradation of the burned area. Consequently, delayed assessment of roads, dozer lines, hand lines, drop points, and safety zones is necessary to detect the spread and introduction of weeds in the first year after fire. Assessing the establishment of weeds and treating small outlying populations before they expand, will prevent the weeds from becoming serious threats to the recovery of native plants and Forest Service Sensitive species.

The treatment is noxious weed detection surveys of all roads, dozer lines, drop points, and safety zones affected by the Whittier Fire on NFS lands. These areas will be surveyed for evidence of introduction or spread of noxious weeds. If any new or outlying populations are found, these will be mapped and documented for future treatment and where possible hand treatments will be applied during at the same time the surveys are conducted.

Inspect all areas and monitor for newly established weed occurrences or the introduction of new invasive species. Monitoring will include documentation and hand pulling small new weed occurrences at the time of inspection. New weed occurrences will be pulled to root depth, placed in sealed plastics bags, and

properly disposed. Additionally, tamarisk infestations can be treated with herbicide as per the soon to be completed tamarisk removal EIS.

Inspections and monitoring should be accomplished during April - August 2017. Based upon the first year's survey, additional surveying may be requested for up to three years. BAER funding is only requested for the first year after fire.

D. Treatment Cost

<u>GS-11 Botanist/Resource Officer</u>	<u>\$465/day x 10 days =</u>	<u>\$4,650</u>
<u>3 GS – 4 Bio Techs</u>	<u>\$140/day x 3 techs x 2 pay periods (20 days) =</u>	<u>\$8,400</u>
<u>Mileage:</u>	<u>450 miles @ 0.45/mile =</u>	<u>\$203</u>
	Total Cost Estimate for FY 2018 =	\$13,253

Natural Recovery

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

Hillslope mulching

Typical land treatments to reduce runoff and peakflows/flooding include hydromulch and strawmulch. These treatments are not effective on slopes over 65% (hydromulch) or 50% for straw mulch). Straw mulch also is ineffective in windy areas that blow the straw around. Wood mulch can be used on steeper slopes and can be used in areas with higher winds than straw mulch. Hillslope treatments are not required to address an emergency on Forest Service lands but could reduce sediments into Lake Cachuma (off-Forest) slightly. It is estimated that the volume of sediment reduced into Lake Cachuma from two 2-year storms would approximate 10 acre feet of sediment if highly erosive soils are treated.

At the time of this initial request, slope treatments are not being requested.

Road and Safety Treatments:

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

Road Treatments:

The following road and safety treatments were identified for the Whittier Fire burned area:

- Install BAER warning signs

- Install closure signs
- Install Flash Flood and Rock Fall signs
- Install Traffic Control Gates and associated fence barriers
- Install wooden Barricades (Road Closed signs)
- Restore Drainage function (storm proofing)
- Storm inspection and response. (storm patrol)

Road Treatment Costs Estimate:

Item	Unit	# of Units	Unit Cost	Total
Restore Drainage Function (Storm Proofing) 5N19.3 NFSR	Mile	3.0	1,000	3,000
Restore Drainage Function (Storm Proofing) 5N19.2 SB Co.	Mile	8.5	1,000	8,500
Storm Inspection and Response 5N19 3.0 mi NFSR	Days	3	1000 / mi.	9,000
Storm Inspection & Response 6N04 0.5 mi. NFSR R/W	Days	3	1000 / mi	1,500
Sub Total				\$22,000
Contract prep, Administration and Implementation	%	1	25	\$5,500.00
Total				\$27,500.00

Safety and Protection

The following locations were identified as a strategy for utilizing existing gates and installing new gates and barriers for safety and protection and to facilitate the fire area closure order. 5N19 West Camino Cielo road utilizes existing FS gate at MP- 3.9 at the East end of the road near the Winchester Gun Club. Utilizes the existing FS gate at MP- 11.6 just East of the Broadcast Peak intersection. Install new traffic control gate and associated pipe rail barrier at MP-17.0 just outside of the NW burn perimeter. Place movable type -3 wooden barricades with road closed signs on road 6N04 near the intersection with Highway-154.

Trail Treatments

To mitigate threats to life and health, close trails and recreation sites affected by the fire (as part of an area closure) for the first winter following the fire, and prior to lifting the closure, install warning signs at all trailheads within or leading to the burned area. Trailheads requiring warning signage are Tequepis Trail (Forest Trail 29W06), whose termini are West Camino Cielo Road and Tequepis Canyon Road (Forest Road 6N04).

To mitigate threats to property install trail erosion structures (rolling dips, check dams, log erosion barriers, and drainage armoring) to maintain natural drainage patterns and maintain trail stability during increased flows. Rolling dips, check dams, and log erosion barriers (LEBs) will stabilize trail tread and prevent further erosion caused by the loss of vegetation and root systems previously supporting outer trail edge. Armoring key ephemeral drainages is done by placing rock in a rip-rap fashion below trail in drainages to dissipate energy of across trail water flows and prevent down slope head cutting and trail loss. LEBs may be used in place of rock armoring when rock is unavailable.

Specific treatments recommended for the Tequepis Trail are:

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

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

Storm Proofing: Installing trail drainage structures will maintain natural drainage patterns and trail stability for the increased flows during the first winter. Storm proofing measures relevant to fire-related concerns found on the Whittier Fire trail system include: (1) cleaning and improvement of 16 existing rolling dips; (2) installation of 28 additional rolling dips, including one on an abandoned road that intersects the trail; (3) removal of a plugged culvert and installation of an armored low water crossing in its place; (4) armoring seven key ephemeral drainages to prevent head cutting and loss of trail tread. The last action will require the placement of rock or logs below drainages to dissipate the energy of off-trail water flows and decrease the likelihood of down bank erosion. In addition to protecting the trail itself, these stabilization measures will also reduce detrimental effects to downstream values at risk.

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

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

Estimated costs for these treatments are summarized in the following tables:

Table 1: BAER Treatment Recommendations (see Error! Reference source not found.)

Site/Trail	Recommended Emergency Response Action	Recommended Specific Action
Lower 1.45 miles of the Tequepis Trail	Trail prism drainage treatment and monitoring	Clean out / improve approximately 16 existing rolling dips / waterbars, install approximately 28 new rolling dips, replace one plugged culvert with an armored low water crossing, and armor seven other drainage crossings.
All trails and recreation sites within the burned area	Closure for first winter	Can be implemented as part of an area closure. Trails and recreation sites should be inspected prior to lifting the closure.
Major entry points into burned area	Install closure signs	Can be implemented as part of an area closure.
Trailheads leading into burned area	Install warning signs prior to lifting of closure	Install signs at each end of the Tequepis Trail, to remain after closure is lifted.

Estimated Treatment Costs:

Table 2: Trail Treatment Costs

Trail Treatment Components				
Item	Unit	Unit Cost	# of units	Total Cost
Project labor (four person crew)	pay period	10000.00	1	10000.00
Per Diem (four person crew)	pay period	2220.00	1	2220.00
Campsites (6 nights, \$50/night)	pay period	300.00	1	300.00
Motel (4 rooms, one night, \$219/night/room)	pay period	876.00	1	876.00
Trail dozer towing vehicle	mile	1.02	1000	1020.00
Trail dozer utility vehicle	mile	0.67	1000	670.00
Trail dozer fuel / oil / incidentals	day	75.00	8	600.00
Project administration	day	420.00	1	420.00
Project assistance	day	280.00	2	560.00
Resource specialist consultation & oversight	day	425.00	2	850.00
Local unit vehicles	miles	0.75	240	180.00
Total				17,696.00

Project labor requirements assume that a trail dozer accompanied by an operator, a swamper, and two laborers will be used to perform the treatment work. Project labor cost estimates assume an off-Forest force account crew with an average cost to government for each crew member of \$250/day. One vehicle

will be capable of towing the trail dozer carrier and the other will provide support. Mileage includes round-trip travel between the home unit and the project area.

Funds are also included to pay for a District recreation officer from the local unit (\$420/day) to administer the project, for a field ranger (\$280/day) to assist the off-Forest crew, and for local resource specialists (archaeologist / wildlife biologist / fisheries biologist / botanist, average \$425/day) to provide consultation and oversight.

Table 3: Monitoring Costs

Monitoring Components				
Item	Unit	Unit Cost	# of units	Total Cost
Labor (two inspectors for one full day each)	tour	560.00	6	3360.00
Vehicle (60 miles @ 0.75/mile)	tour	45.00	6	270.00
Total				3,630.00

Each monitoring inspection tour will cover the treated area of the trail and will require two inspectors for safety reasons (\$280/day each). The budget allows for monthly inspections during the winter season (November through April), which should be sufficient to allow minor damage to be corrected and major damage to be reported after each round of significant weather events.

Protection/Safety Treatments

Burned Area Closure and Warning Signs

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

Roads requiring such signage are Forest Road 5N19 (Camino Cielo), Whittier and Circle V Campgrounds, Rancho Alegre Road (6N04), and Refugio Road (5N19).

Install closure and information signs at the existing gates location of 5N19 Broadcast Peak and at Winchester Gun Club areas. Once the area closure has been lifted, install BAER warning signs at these locations.

Signs and Gates Treatment Costs Estimate:

Item	Unit	# of Units	Unit Cost	Total
Install Gate	Each	1	10,000	10,000
Install Pipe Rail Barriers	LF	250	30	7,500
Install BAER Warning Signs	Each	8	500	4,000
Road Closure Signs & Info.	Each	8	250	2,000

Install Rock Fall Signs	Each	4	150	600
Install Flash Flooding Signs	Each	8	150	1,200
Sub Total				\$25,300.00
Mobilization, Contract prep, Administration and Implementation	%	1	30	\$7,500.00
LEO patrol of West Camino				\$45,500
Total				\$78,300.00

Heritage Treatments

When the BAER Risk Matrix is applied to cultural resource sites in the Whittier Fire, the risk to cultural sites is high.

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

Treatments to Mitigate the Emergency

Exposed Cultural Resources:

(a) Treatment Type: Install signage related to the Archaeological Resource Protection Act and other policy to help protect exposed sites of being looted.

(b) Treatment Objective: Provide an avenue to prosecute looters within the burn area and prevent the destruction of important cultural resources.

(c) Treatment Description: 11 ½” by 16” plastic educational signs that inform the public about the importance of cultural resources and the laws protecting them. Signs will be both in English and Spanish. Informational signs increase the viability of criminal prosecution through the Archaeological Resource Protection Act of 1979 (ARPA). The signs will be installed at campgrounds, trailheads, and access points located around and within the burn area. Patrolling is required to assess the effectiveness of signage and that educational and awareness signage remains present and legible. It's proposed to conduct these patrols using both a volunteer workforce from the Forest's Site Steward Program and Forest Recreation Technicians. The Forest Heritage Program Manager will supervise the volunteer patrol crew and be responsible for final report preparation, site records, maps, and other documentation. Forest Service Law Enforcement will be contacted to respond to any illicit activities pertaining to cultural resources.

Treatment Cost:

Line Item	Units	Unit cost	Total Cost
GS-9 Archaeologist	5 Days	\$360	\$1,800.00
GS-5 Recreation Tech	2 Days	\$250	\$500.00
GSA Vehicle Mileage	500 miles	\$0.16/Mile	\$80.00
11 ½ “ x 16” Plastic Signs	25	\$17.75	\$443.75
Total			\$2,823.75

Implementation Team Leadership and Coordination

Interagency Coordination:

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

Table 11 – BAER Interagency Coordination

Item	Unit	Cost	Number	Total
Coordination with Public & Private	ea	\$500	15	\$7,500

I. Monitoring Narrative:

(Describe the monitoring needs, what treatments will be monitored, how they will be monitored, and when monitoring will occur. A detailed monitoring plan must be submitted as a separate document to the Regional BAER coordinator). See Appendix B below for road, trail, and heritage monitoring.

Part VI – Emergency Stabilization Treatments & Source of Funds, Los Padres NF Initial Request

Click red icons for notes.	NFS Lands					Other Lands				Money Left
Line Items	Units	Unit Cost	# of Units	BAER \$	Spent \$	# of Units	Fed \$	# of Units	Non Fed \$	Total \$
A. Land Treatments										
Hydro-mulching	ac	\$3,500	0	\$0		770	\$2,695,000	\$0	\$0	\$0
Invasive Weed Detection Survey	mi	\$200	67	\$13,400	\$0		\$0		\$0	\$13,400
<i>Subtotal Channel Treatments</i>				\$13,400	\$0		\$2,695,000		\$0	\$13,400
B. Channel Treatments - none										
<i>Subtotal Channel Treatments</i>				\$0	\$0		\$0		\$0	\$0
C. Road and Trails										
Road Stormproofing	project	\$27,500	1	\$27,500	\$0				\$0	\$27,500
Trail Stormproofing	project	\$17,696	1	\$17,696	\$0		\$0		\$0	\$17,696
<i>Subtotal Road & Trails</i>				\$45,196	\$0		\$0		\$0	\$45,196
D. Protection/Safety										
Heritage Protection	project	\$2,824	1	\$2,824	\$0		\$0		\$0	\$0
Closure Gates, Barriers, and Signs	project	\$78,300	1	\$78,300	\$0		\$0		\$0	\$0
Coordination with Public & Private	days	\$500	15	\$7,500	\$0		\$0		\$0	\$0
<i>Subtotal Protection</i>				\$88,624	\$0		\$0		\$0	\$88,624
E. BAER Evaluation										
Assessment Team	0520	H5BAER	---	---	\$130,570	---	\$0	---	\$0	\$0
	---	---	---	---	\$0	---	\$0	---	\$0	\$0
<i>Subtotal Evaluation</i>				---	\$130,570	---	\$0	---	\$0	\$0
F. Monitoring										
Trail Treatment Monitoring	ea	\$3,630	1	\$3,630	\$0		\$0		\$0	\$0
Heritage Treatment Monitoring	ea	\$1,000	1	\$1,000	\$0		\$0		\$0	\$0
Road Treatment Monitoring	ea	\$1,000	1	\$1,000	\$0		\$0		\$0	\$0
<i>Subtotal Monitoring</i>				\$5,630	\$0		\$0		\$0	\$5,630
G. Totals				\$152,850	\$0		\$2,695,000		\$0	\$152,850
Previously approved						Comments: other federal lands and private potential treatment cost for helimulching				
Total for this request				\$152,850						

PART VII - APPROVALS

1. _____
 Los Padres N.F. Forest Supervisor (signature) _____ Date

2. _____
 Regional Forester (signature) _____ Date

APPENDICES: Supporting Information:

Appendix A: Whittier Fire Fire BAER Team

Appendix B: Monitoring for Roads, Trails, and Heritage

Appendix C: Whittier Values at Risk Matrix, Treatments and Recommended Post-Fire Response

Appendix D: Land Treatment Feasibility Analysis Methodology

Appendix E: Summary of Cost-Risk Analysis

Appendix F: Treatment Maps for the Whittier Fire

Appendix A: Whittier Fire BAER Team:

NAME	POSITION	EMAIL	HOME FOREST	CELL PHONE	WORK PHONE
Ken Heffner	Deputy Forest Supervisor	kheffner@fs.fed.us	LPF	805-689-8137	805-961-5733
J. Pancho Smith	District Ranger	jsmith03@fs.fed.us	LPF	805-448-0276	805-967-3481 x217
Kevin Cooper	BAER Coordinator	kccooper@fs.fed.us	LPF	805-680-0318	805-925-9538 x216
Andrew Madsen	PAO	andrewmadsen@fs.fed.us	LPF	805-895-0841	805-961-5759
Pete Crowheart	Tribal Liason	crwhart@fs.fed.us	LPF	805-245-5756	
Brad Rust	Team Leader	brust@fs.fed.us	LPF	530-917-0434	530 226-2427
J. Yonnie Schwartz	Geologist	jonathanschwartz@fs.fed.us	LPF	805-698-9752	805-646-4348 x311
Deb Evans	Engineering	deborahlevans@fs.fed.us	LPF	208-830-4270	805-961-5772
Rusty LeBlanc	Engineering	rleblanc14@gmail.com	STF	209-591-7518	209-532-7761
Marilyn Porter	GIS	mrporter@fs.fed.us	LPF	714-305-9177	805-961-5721
Steve Galbraith	Archaeologist	sgalbraith@fs.fed.us	LPF	805-729-5587	805-967-3481
K. Renee Barlow	Archaeologist	katherinebarlow@fs.fed.us	LPF	831-277-7650	831-277-7650
Rob Tanner	Hydrologist	rtanner@fs.fed.us	Deschtes	503-812-3221	541-383-5566
Sam Prentice	Hydrologist (T)	samueleprentice@fs.fed.us	CNF	530-848-0000	
Eric Nicita	Soil Scientist	enicita@fs.fed.us	ENF	530-748-5827	530-621-5290
Kristie Klose	Fisheries	kristieaklose@fs.fed.us	LPF	805-961-5745	805-252-7019
Patrick Lieske	Wildlife	pdlieske@fs.fed.us	LPF	805-699-1054	805-961-5746
Lloyd Simpson	Botany	lsimpson@fs.fed.us	LPF	805-901-2869	805-646-4348 x316
C. Mike Heard	Trails	charlesmheard@fs.fed.us	LPF	408-499-7257	650-261-1776
Kathy Murphy	Plans/Logistics/Finance	kathymurphytahoe@gmail.com	TNF	530-414-1350	

Appendix B: Monitoring Protocols:

Whittier Fire
Road Effectiveness Monitoring

The 2500-8 report requests funds to monitor the effectiveness of road treatments on Whittier 2 Fire Fire roads.

4. Monitoring Questions

- Is the road-tread stable?
- Is the road leading to concentrating runoff leading to unacceptable off-site consequences?

2. Measurable Indicators

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

3. Data Collection Techniques

- Photo documentation of site
- Inspection Checklist (attached)

4. Analysis, evaluation, and reporting techniques

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

Road Inspection Checklist

Date: _____
Time: _____

Inspector _____
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: _____

Whittier Fire
Trail Effectiveness Monitoring

The 2500-8 report requests funds to monitor the effectiveness of trail treatments on Forest Trails in the Whittier 2 Fire.

1. Monitoring Questions

- Is the trail tread stable?
- Is the trail leading to concentrating runoff leading to unacceptable off-site consequences?

2. Measurable Indicators

- Rills and/or gullies forming on the trail
- Loss of trail bed

3. Data Collection Techniques

- Photo documentation of site
- Inspection Checklist (attached)

4. Analysis, evaluation, and reporting techniques

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

Trail Inspection Checklist

Date: _____
Time: _____

Inspector _____
Forest Trail _____

Describe locations reviewed during inspection: _____

Was there trail damage?

Did the trail crossing fail? _____.

GPS) _____

Describe damage and cost to repair? (GPS) _____

Photo taken of trail damage _____

Recommended actions to repair: _____

Whittier Fire
Cultural Site Effectiveness Monitoring

The 2500-8 report requests funds to monitor the effectiveness of native grass treatment on Whittier 2 heritage sites.

4. Monitoring Questions

- Is the grass with good cover stable?
- Is the grass being undercut by concentrated runoff leading to unacceptable on-site erosion?

2. Measurable Indicators

- Rills and/or gullies forming around the artifacts
- Loss of artifacts

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 and there is extensive rilling 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.

Heritage Protection Inspection Checklist

Date: _____

Inspector _____

Time: _____

Forest Road Nearby _____

Describe locations reviewed during inspection: _____

Was there artifact damage?

Was artifacts covered or eroded? _____.

GPS) _____

Describe damage and cost to repair? (GPS) _____

Photo taken of artifact damage _____

Recommended actions to repair: _____

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

Whittier BAER Risk Matrix																	
VAR	Latitude	Longitude	Value	Type of Risk	Post Fire Threats	Probability			Magnitude of Consequences			Risk			Treatment to Manage Potential Post Wildfire Impacts		
						Life	Property	Other	Life	Property	Other	Life	Property	Other	Life	Property	Other
			or Location														
			Throughout	Hydrologic Function	Loss of Hydrologic Function	Flooding, Sediment	Likely	Likely	Likely								
			West Camino Cielo Ridge	Soil Productivity from OHV Trespass	OHV trespass, loss of soil productivity	erosion			Likely	Moderate			High	Closure	Barriers	FS	
1			Hwy 154	Hwy 154 culverts	Infrastructure, undersized culverts	erosion, flooding								Interagency Coord		Caltrans	
2			Various Streams	T & E steelhead & associated habitat	Aquatics, Water Quality	habitat destruction			Possible	Moderate			Intermediate			FS	
3	34°35'14.60"N	119°57'50.63"W	Lake Cachuma	Lake Cachuma water quality	Infrastructure, loss of storage capacity w/sediment	sediment										BOR, districts	
4			Lake Cachuma	Water quality for Goleta and Santa Barbara	Aquatics, Water Quality	sediment, water treatability										water districts	
5	34°33'57.24"N	119°55'51.27"W	Lake Cachuma	Lake Cachuma Tecolote intake	Water Quality	sediment, flooding										water districts	
6			Throughout	T & E Red-legged frog suitable/critical/occupied habitat	Aquatics, Water Quality	sediment			V Likely	Major			V High			FS	
7			Throughout	Arch sites (20 ea)	Heritage	erosion			Unlikely	Minor			V Low		none	FS	
8	34°32'17.59"N	119°57'23.08"W	Tequepis trail (29W06)	Tequepis trail (29W06)	Infrastructure	erosion			Likely	Major	Moderate		V High	High	Closure	stormproof	FS
9			Throughout	Condor suitable habitat	Mortality	Micro trash ingestion	Likely	Likely			Major			Intermediate		Clean up shooting areas	FS, F&W
10			Throughout	Pvt water sources on FS lands (water lines, spring boxes) SUP	Infrastructure	erosion									inform users		FS, SUP
11	34°28'14.01"N	120°1'18.87"W	El Capitan Resort	El Capitan canyon	Life, Safety, Infrastructure	flooding, erosion								Interagency Coord		County, pvt.	
12	34°28'52.19"N	120°2'23.74"W	Exxon oil field tanks, pipes, refining station	Las Fores Canyon	Infrastructure	flooding, erosion								Interagency Coord		pvt.	
13			Hwy 101	Hwy 101 culverts	Infrastructure, undersized culverts	flooding								Interagency Coord		Caltrans	
14	34°33'4.82"N	119°57'21.56"W	Circle V Ranch	Circle V Ranch	Infrastructure	erosion										FS, SUP	
15	34°30'10.84"N	119°48'9.41"W	Rancho Alegre Boy Scout Camp	Rancho Alegre Boy Scout Camp	Infrastructure	erosion										pvt.	
16	34°26'35.96"N	119°55'0.54"W	Tecolote community	Tecolote Canyon	Life, Safety, Infrastructure	flooding, erosion								Interagency Coord		County, pvt.	
17	34°33'34.89"N	119°57'12.39"W	Life/safety associated w/ Tequepis Road 6N04	Tequepis Road 6N04	Safety, road structure	rock fall			Possible	High	Moderate		Intermediate	Barricades/BAER signs	Storm Patrol	FS, BOR	
18	34°31'4.91"N	120°8'40.34"W	Life/safety associated w/Road 5N19 Camino Cielo	Camino Cielo	Safety, road structure	rock fall			Possible	High	Moderate		Intermediate	Gate Rd both ends; BAER signs @ entry pts	Storm Patrol	FS, county	
19			Throughout	Native Plant Communities	Habitat	Invasive weeds			Likely		Moderate		High		weed detection	FS	
20			Throughout	Private roads and bridges	Infrastructure	flooding										County, pvt.	
21			Railroad	Railroad Underpass	Infrastructure	flooding										Railroad	
22	34°32'13.36"N	119°51'30.21"W	Stagecoach culvert?	Stagecoach culvert?	Infrastructure	flooding										County?	
23			Throughout	Private homes	Infrastructure	flooding, erosion											NRCS, pvt.
25			Adjacent W Camino Cielo Rd	Life/Safety associated w/ Target Shooting Areas	Infrastructure, Hazmat	erosion	Unlikely	Unlikely		Moderate	Minor		Low	Very Low	None	None	FS

Appendix D: Land Treatment Feasibility Analysis Methodology

The Whittier Fire resulted in elevated risk to many public and private facilities. This elevated risk includes threats to life and property as a result of increased hydrologic response and debris flows. The Whittier BAER team assessed the landscape for the effectiveness of potential land treatments; specifically soil cover additions by methods such as straw mulching, wood straw or hydro-mulching. To consider the maximum benefit of treatments, both private and public land were considered. The following methodology was used to assess the feasibility and effectiveness of land treatments.

- **Slope:** A slope map was created with a 20%-60% range. Erosion is strongly dependent on slope. Erosion still occurs on slopes less than 20%, but the efficacy of treatments drops off as slopes become more gentle. BAER teams generally do not recommend treatments on these slopes. Also, there is very little slopes less than 20%. Slopes greater than 60% are too steep for mulch treatments to stay in place; mulch strands tend to rapidly migrate downslope with gravity.
- **Burn Severity:** Only soil burn severities of *Moderate* and *High* are considered for land treatments. Soil severities of *Low* and *Unburned* have enough soil cover remaining to ameliorate flow and sedimentation.
- **Topography:** Using the previously mentioned characteristics as treatment sideboards, topographical and vegetation characteristics were used to manually derive potential treatment units. Figure D-1 illustrates the potential treatment units. Factors used to evaluate placement of units include:
 - **Slope profile:**
 - If a slope has a low or unburned soil severity at the toe of the slope, this is considered a filter that would trap and minimize sediment transport to a watercourse.
 - If a slope is very rocky or rock outcrop, mulch is not effective and therefore not considered.
 - Slopes with a mosaic of soil burn severities or vegetation with retained crown are not considered because the mosaic pattern interrupts surface flow and, subsequently, sediment transport to watercourses.
 - Buffers of approximately 100 feet from perennial streams are considered as non-mulch areas. Mulch applied in streams may contribute to culvert plugging and mulch applied to streambanks may suppress streamside vegetation which is essential for long-term stream bank stability.
 - **Aspect:** North versus south aspects were an important factor in the Whittier assessment for treatment polygons. Slopes with a north aspect supported a pre-fire community of extremely dense and tall mixed chaparral with a significant dead fuel component whereas the south aspect supported a community of mixed chaparral and coastal chaparral communities with a lower fuel loading. North slopes are generally more moist and will recover more quickly than drier south facing slopes.

- **Results:** Figure D-1 shows the maximum percentage of each pour point watershed that could be treated following the feasibility analysis. D-2 shows land ownership and D-3 shows maximum treatment areas by erosion rates.

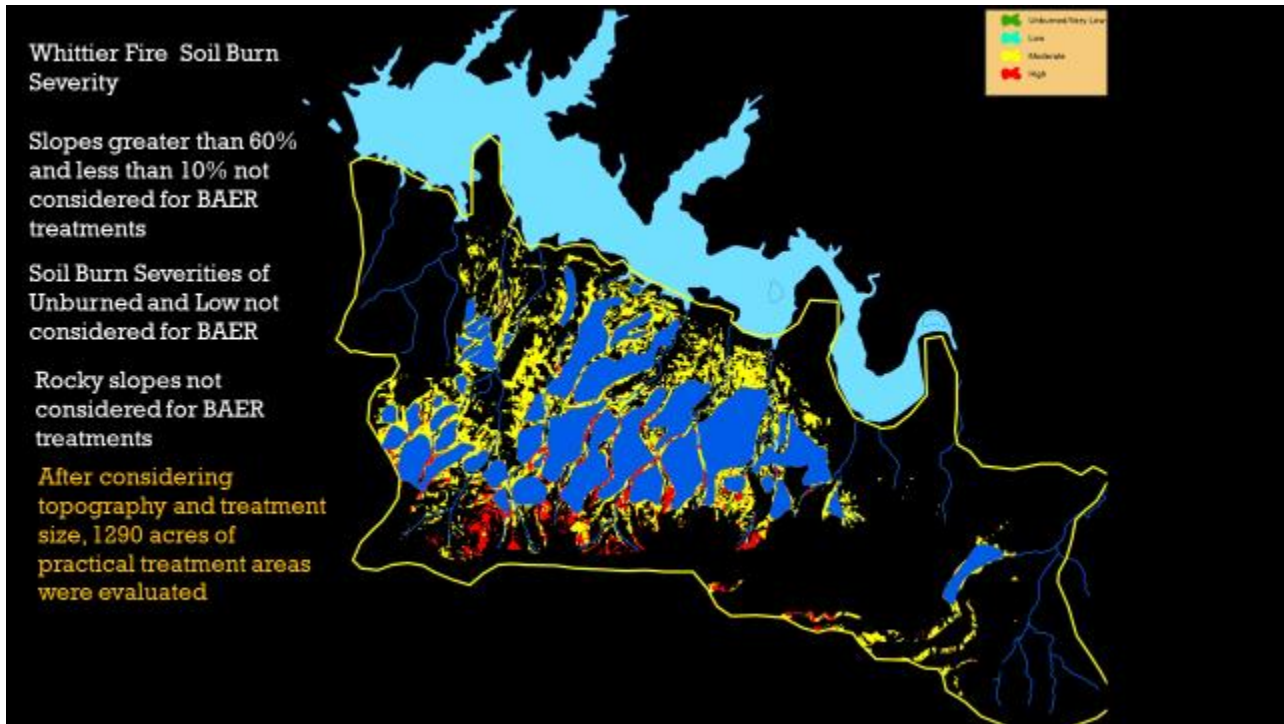
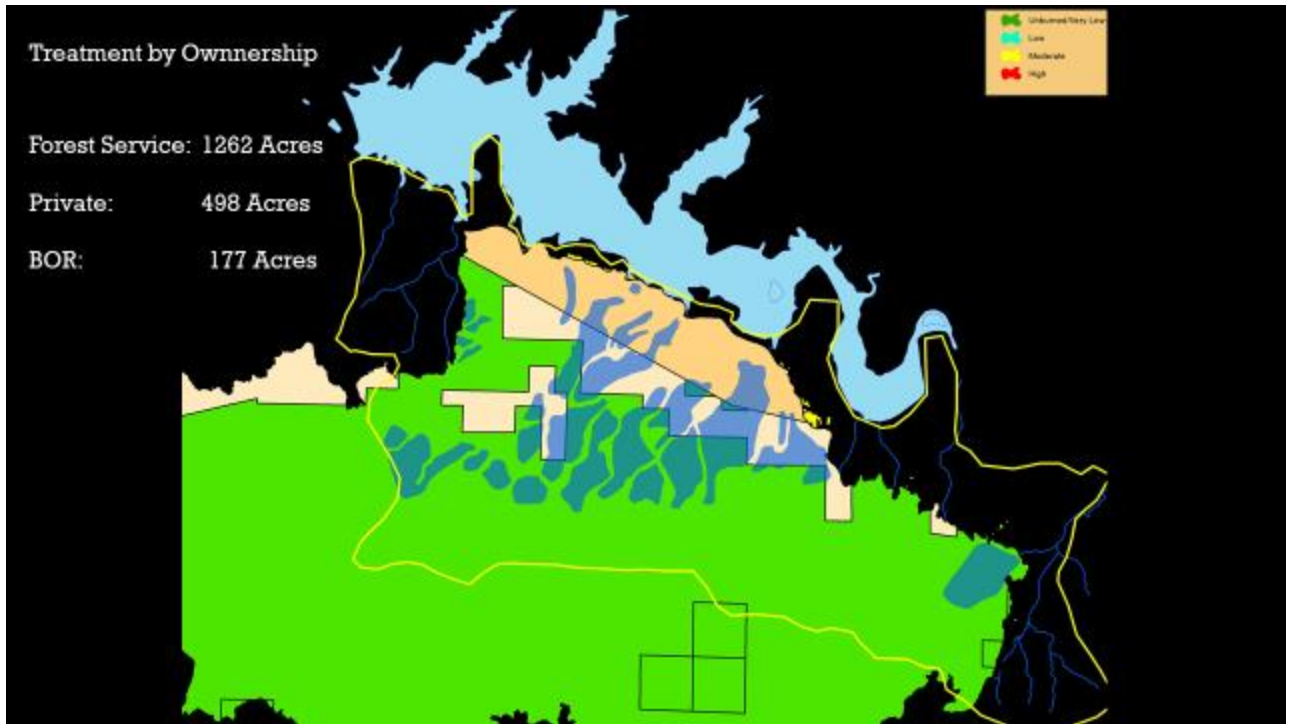
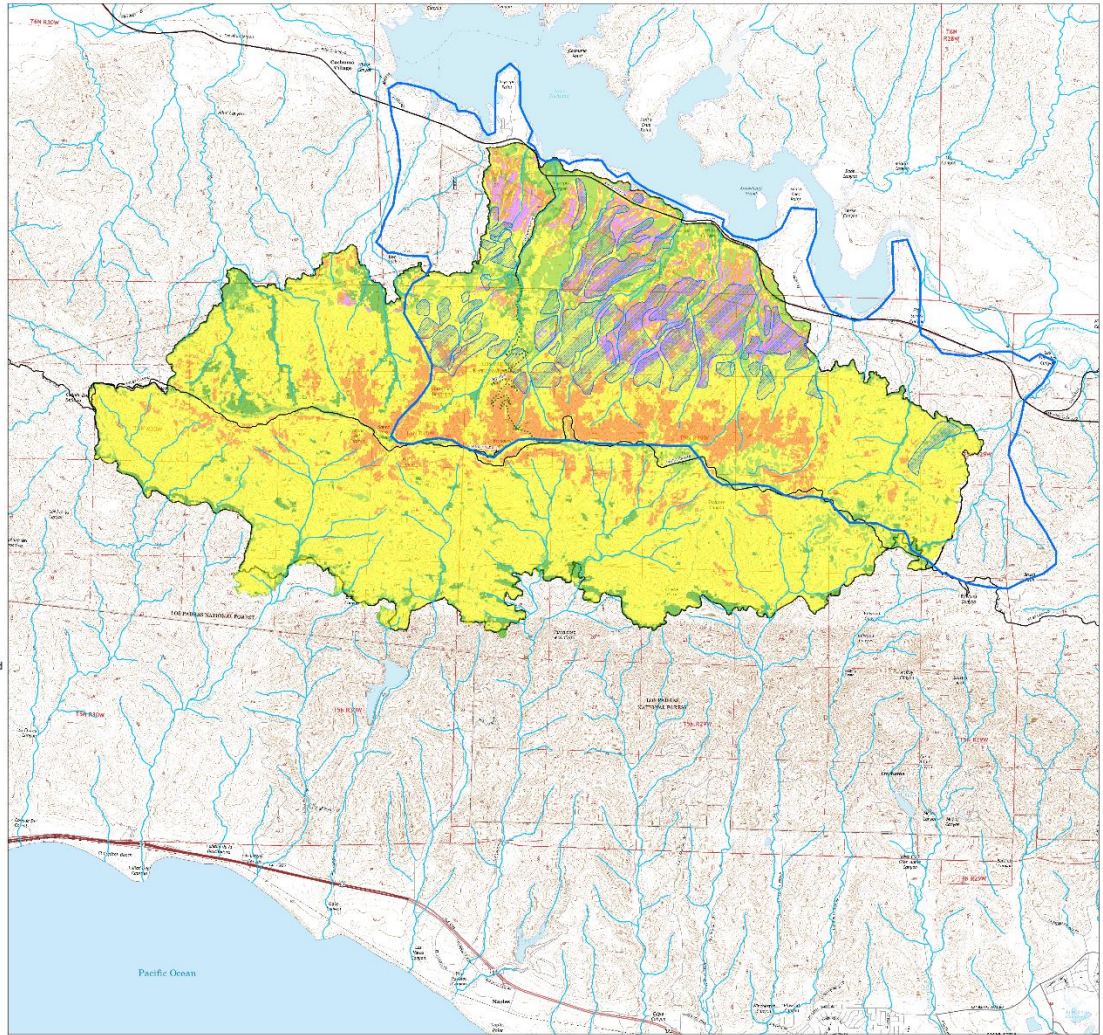
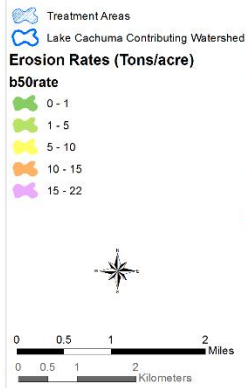


Figure D-1. Maximum feasible area that could be treated for slope stability. For maximum cost/benefit only soils with high erosion rates within these polygons would be treated.



D-2. Maximum treatment polygons by land ownership.

Whittier Fire
July 2017
Soil Treatment Areas



D-3. Maximum treatment polygons by soil erosion rates.

Appendix E: Summary of Cost-Risk Analysis

Whittier Fire Benefit Cost Analysis:										
Total benefits of resources for whole fire FS lands:										
All Resource										
		Value \$								
Roads at risk		\$450,000								
Trails		\$50,000								
Soil productivity		\$400,000								
Threatened and Endangered Species (fish and wildlife)		\$1,000,000								
Native Plant Communities near invasives		\$500,000								
Heritage Resources		\$500,000 Heritage resources are not a market value.								
Public safety		\$1,000,000 Human life and/or safety is not a market value. Estimated cost of injury accident.								
Probability of loss without and with treatments:										
All Resource										
		Probability loss no treatments:			Probability loss w/ treatments:			Reduction in probability of loss		
Roads at risk		50%			30%			20%		
Trails		60%			20%			40%		
Soil productivity		60%			35%			25%		
Threatened and Endangered Species (fish and wildlife)		40%			30%			10%		
Invasive Plants		40%			20%			20%		
Heritage Resources		10%			5%			5%		
Public safety		70%			20%			50%		
Total cost of treatments on Forest Service:										
Click red icons for notes.										
NFS Lands										
Other Lands										
Money Left										
Line Items	Units	Unit Cost	# of Units	BAER \$	Spent \$	# of Units	Fed \$	# of Units	Non Fed \$	Total \$
A. Land Treatments										
Invasive Weed Detection Survey	mi	\$200	67	\$13,400	\$0		\$0		\$0	\$13,400
<i>Subtotal Channel Treatments</i>				\$13,400	\$0		\$0		\$0	\$13,400
B. Channel Treatments - none										
<i>Subtotal Channel Treatments</i>				\$0	\$0		\$0		\$0	\$0
C. Road and Trails										
Road Stormproofing	project	\$27,500	1	\$27,500	\$0				\$0	\$27,500
Trail Stormproofing	project	\$17,696	1	\$17,696	\$0		\$0		\$0	\$17,696
<i>Subtotal Road & Trails</i>				\$45,196	\$0		\$0		\$0	\$45,196
D. Protection/Safety										
Heritage Protection	project	\$2,824	1	\$2,824	\$0		\$0		\$0	\$0
Closure Gates, Barriers, and Signs	project	\$78,300	1	\$78,300	\$0		\$0		\$0	\$0
Coordination with Public & Private	days	\$500	15	\$7,500	\$0		\$0		\$0	\$0
<i>Subtotal Protection</i>				\$88,624	\$0		\$0		\$0	\$88,624
E. BAER Evaluation										
Assessment Team	0520	H5BAER	---	---	\$130,570	---	\$0	---	\$0	\$0
<i>Subtotal Evaluation</i>				---	\$130,570	---	\$0	---	\$0	\$0
F. Monitoring										
Trail Treatment Monitoring	ea	\$3,630	1	\$3,630	\$0		\$0		\$0	\$0
Heritage Treatment Monitoring	ea	\$1,000	1	\$1,000	\$0		\$0		\$0	\$0
Road Treatment Monitoring	ea	\$1,000	1	\$1,000	\$0		\$0		\$0	\$0
<i>Subtotal Monitoring</i>				\$5,630	\$0		\$0		\$0	\$5,630
G. Totals										
				\$152,850	\$0		\$0		\$0	\$152,850
Previously approved										
Total for this request				\$152,850		Comments: other federal lands and private treatment cost for helimulching				
All Resource										
		Benefit of treatment			Treatment Cost		B/C ratio	Justified		
Roads at risk		\$90,000			\$28,500		3.2	yes		
Trails		\$20,000			\$22,326		0.9	yes		
Soil productivity		\$100,000								
Threatened and Endangered Species (fish and wildlife)		\$100,000								
Invasive Weeds		\$100,000			\$13,400		7.5	yes		
Heritage Resources		\$25,000			\$2,824		8.9	yes		
Public safety		\$500,000			\$85,800		5.8	yes		
		\$935,000			\$152,850		6.1			

Appendix F: Treatment Map - Whittier Fire

Whittier Fire
July 2017
BAER Treatments



- Trail Treatments**
 - ▲ Construct Drainage Armoring
 - ▲ Construct New Rolling Dip
 - ▲ Improve Existing Rolling Dip
 - Warning Sign
- Road Treatments**
 - ⬇ Existing Gate
 - ⬆ Install New Gate
 - Install Signs Flash Flood - Rockfall
 - Install Signs Locked Gate Ahead
 - ▲ Install Signs Road Closed - BAER Warning
 - ▨ Install Barricades (wood)
 - Restore Drainage Function
 - Storm Inspection and Response
 - ⊞ Noxious Weed Treatments
 - ▭ Whittier Fire Perimeter

