

Watershed Emergency Response Team Evaluation

CZU LIGHTNING COMPLEX



CA-CZU-005205

October 1, 2020



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State of California

Watershed Emergency Response Team (WERT)

CZU LIGHTNING COMPLEX FIRE – WERT ASSESMENT EXECUTIVE SUMMARY

CA-CZU-005205 WERT Evaluation

Mission Statement: The California Watershed Emergency Response Team (WERT) helps communities prepare after wildfire by rapidly documenting and communicating post-fire risks to life and property posed by debris flow, flood, and rockfall hazards.

The findings included in this report are not intended to be fully comprehensive or conclusive, but rather to serve as a preliminary tool to assist Santa Cruz and San Mateo County Offices of Emergency Management, County Sheriffs, local first responders, Santa Cruz County Department of Public Works, County of San Mateo Department of Public Works, Caltrans, the California Governor’s Office of Emergency Services, the United States Department of Agriculture Natural Resource Conservation Service, water districts, utility companies, and other responsible agencies in the development of more detailed post-fire emergency response plans. It is intended that the agencies identified above will use the information presented in this report as a preliminary guide to complete their own more detailed evaluations, and to develop detailed emergency response plans and mitigations. This report should also be made available to local districts, residents, businesses, and property managers so that they may understand their proximity to hazard areas, and to guide their planning for precautionary measures as recommended and detailed in this document.

The CZU Lightning Complex started as a series of lightning fires on August 16, 2020 across western Santa Cruz and San Mateo counties. The fire was fully contained on September 22, 2020, a total 86,509 acres burned, with 1,450 structures lost and one fatality.

Due to its proximity to residential areas and critical infrastructure, the burned area was evaluated by an interagency WERT. The WERT rapidly evaluated post-fire watershed conditions, identified potential **Values-at-Risk (VARs)** related to human life-safety and property, and evaluated the potential for increased hazards of rockfall as well as post-fire flooding and debris flows. The team also recommended potential emergency protection measures to help reduce the risks to those values.

Summary of the Key WERT Findings

- The degree of fire-induced damage to soil is called “soil burn severity” and is a primary influence on increased runoff generation and the occurrence of post-fire watershed hazards (e.g., debris flows and flooding). Moderate and high soil burn severity typically create the most impacts.
- Approximately 43 percent of the CZU Lightning Complex burned at moderate to high soil burn severity, whereas the remaining portion of the fire (57 percent) burned at low to very low soil burn severity. The relatively large proportion of moderate to high soil burn severity means that the overall likelihood and magnitude of hazards are relatively high for some areas downslope/downstream of the fire.

- 111 VARs were identified within and downslope/downstream of the fire.
- 19 VARs were determined to have a high life-safety threats, while 35 VARs had a moderate risk to life-safety. Most of the high life-safety threats were associated with potential debris flow hazards. Many include multiple structures on alluvial fan deposits in the Boulder Creek area, and along State Routes 9 and 236.
- 28 VARs were determined to have a high threat to property, and these were mostly associated with debris flow and/or flood hazards.
- There is significant risk to water supply infrastructure for the San Lorenzo Valley Water District from the physical impact of floods and/or debris flows, and potential impacts to water quality for some of the surface water intakes for the City of Santa Cruz.
- United State Geological Survey (USGS) debris flow model results are presented in terms of “combined debris flow hazard”, which reflects both the likelihood of debris flow occurrence and the magnitude of potential debris volume. Basins with a high likelihood of debris flow occurrence and/or relatively high magnitude of debris production have a “high combined hazard”, whereas basins with a low likelihood of debris flow occurrence and/or a relatively low magnitude of debris production have a “low combined hazard.”
 - A storm scenario of approximately 0.20 inches in 15-minutes (i.e., 0.79 in hr⁻¹ or 20 mm hr⁻¹ for the 15-minute duration) equates to a moderate combined hazard for the western and interior portions of the fire, and generally low combined hazard for the eastern portion of the fire (see Figure 9).
 - A storm scenario of approximately 0.31 inches in 15-minutes (i.e., 1.26 in hr⁻¹ or 32 mm hr⁻¹ for the 15-minute duration) equates to a high combined hazard for the western and interior portions of the fire, and generally a moderate level of hazard for watersheds adjacent to State Routes 9 and 236, and the Boulder Creek area.
 - A storm scenario of approximately 0.39 inches in 15-minutes (i.e., 1.57 in hr⁻¹ or 40 mm hr⁻¹ for the 15-minute duration) equates to a high combined hazard for the western and interior portions of the fire, and a moderate and/or high level of hazard for watersheds adjacent to State Routes 9 and 236, and the Boulder Creek area.
- Potential peak flow response is predicted to be highest in the Waddell, Scott, and Big Creek watersheds, although peak flows can be greatly magnified within any watershed with a high proportion of moderate and/or high soil burn severity.
- The ERMiT post-fire surface erosion model predicts a relatively high rate of surface erosion for the Waddell, Scott, and Big Creek drainages due to the preponderance of moderate and high soil burn severity within those watersheds. Median predicted erosion rates for a 2-year recurrence interval storm during the first year after the fire range from 8.6 to 9.4 tons per acre, depending upon the spatial scale of prediction.

General Recommendations

The WERT's objectives for the burned area were to quickly identify potential post-fire life-safety and property threats, including those from debris flows, flooding, rockfall, and erosion. General recommendations include:

- Utilize early warning systems available to homeowners, particularly those located in debris flow and flood-prone areas. The WERT recommends the use of Santa Cruz County and San Mateo County recommended emergency alert notification systems (CodeRED and SMCAAlert).
 - Monitor short duration rainfall intensities and observe post-fire watershed response in the event that the initial National Weather Service (NWS) debris rainfall thresholds are too high.
- Have engineering and geology professionals working for the Santa Cruz County and San Mateo County Department of Public Works assist in clearly communicating the high potential and high risk/consequences of post-fire watershed hazards to the agencies responsible for emergency planning and response (e.g., Santa Cruz and Santa County Office of Emergency Services (OES) and CAL FIRE CZU San Mateo-Santa Cruz Unit).
- Increase the situational awareness of affected residents and the communities regarding the hazards and risks associated with living downstream/downslope of burned areas.
- Perform monitoring and maintenance of road drainage and storm drain infrastructure, particularly along the western and interior portions of the fire.
- Place temporary signage in areas of potential post-fire rockfall, debris flow, and flooding hazards.
- Utilize temporary flood control and structure protection (e.g. sandbags, K-rails, Muscle Wall) where appropriate.
- Monitor and/or remove accumulated debris from within channels that are subject to post-fire flooding where there is an elevated risk to life-safety and/or property.

1. INTRODUCTION

Background

This report presents the results of a rapid evaluation of post-fire geologic and hydrologic hazards to life-safety and property (i.e., collectively known as “Values-at-Risk”) for private lands and state lands affected by the 2020 CZU Lightning Complex in Santa Cruz and San Mateo counties, California (Figure 1). A primary concern for burned watersheds is the increased potential for damaging flood flows, debris flow occurrence, rockfall from steep slopes and hillslope erosion. As winter approaches, it is critical that people who live in and downstream from large wildfires implement emergency protection measures (EPMs) where appropriate, remain alert of weather conditions, and be ready to evacuate if necessary during large and high intensity storms.

The WERT performed a field evaluation of the burned area from August 28, 2020 to September 5, 2020, with additional field work occurring on September 11, 2020. The CZU Lightning Complex WERT team members are listed in Table 1.

This document summarizes downslope/downstream Values-at-Risk (VARs) and makes specific and general recommendations to reduce life-safety and property exposure to post-fire hazards on private lands and state lands. Other WERT/USGS products associated with this report include GIS data in the form of shapefiles and raster files. Clear communication of life-safety and property hazards is an objective of the WERT process, and the use of these spatial data is a critical component for communicating hazards in a planning and operational context. These data have been shared with federal, state, and local responsible agencies.

Table 1. CZU Lightning Complex WERT members.

Name	Position	Agency	Expertise-Position
Drew Coe; RPF 2981	Team Lead	CAL FIRE	Hydrology/Forestry
Dave Longstreth; PG 6436; CEG 2068	Co-Team Leader	CGS	Engineering Geology
Jacob Lee; PG 8865; CEG 2633	Team Member	CGS	Engineering Geology
Chris Grysza; PG 9142; CEG 2640	Team Member	CGS	Engineering Geology
John Ramaley; RPF 2504	Team Member	CAL FIRE	Forestry
Andrew Hubbs, RPF 2897	Team Member	CAL FIRE	Forestry
Adjunct Team			
Pete Roffers; PG 9100	Adjunct Member	CGS	GIS/Geology
Sol McCrea; CFM 3527	Adjunct Member	CGS	GIS
Will Olsen	Adjunct Member	CAL FIRE	Hydrology/GIS

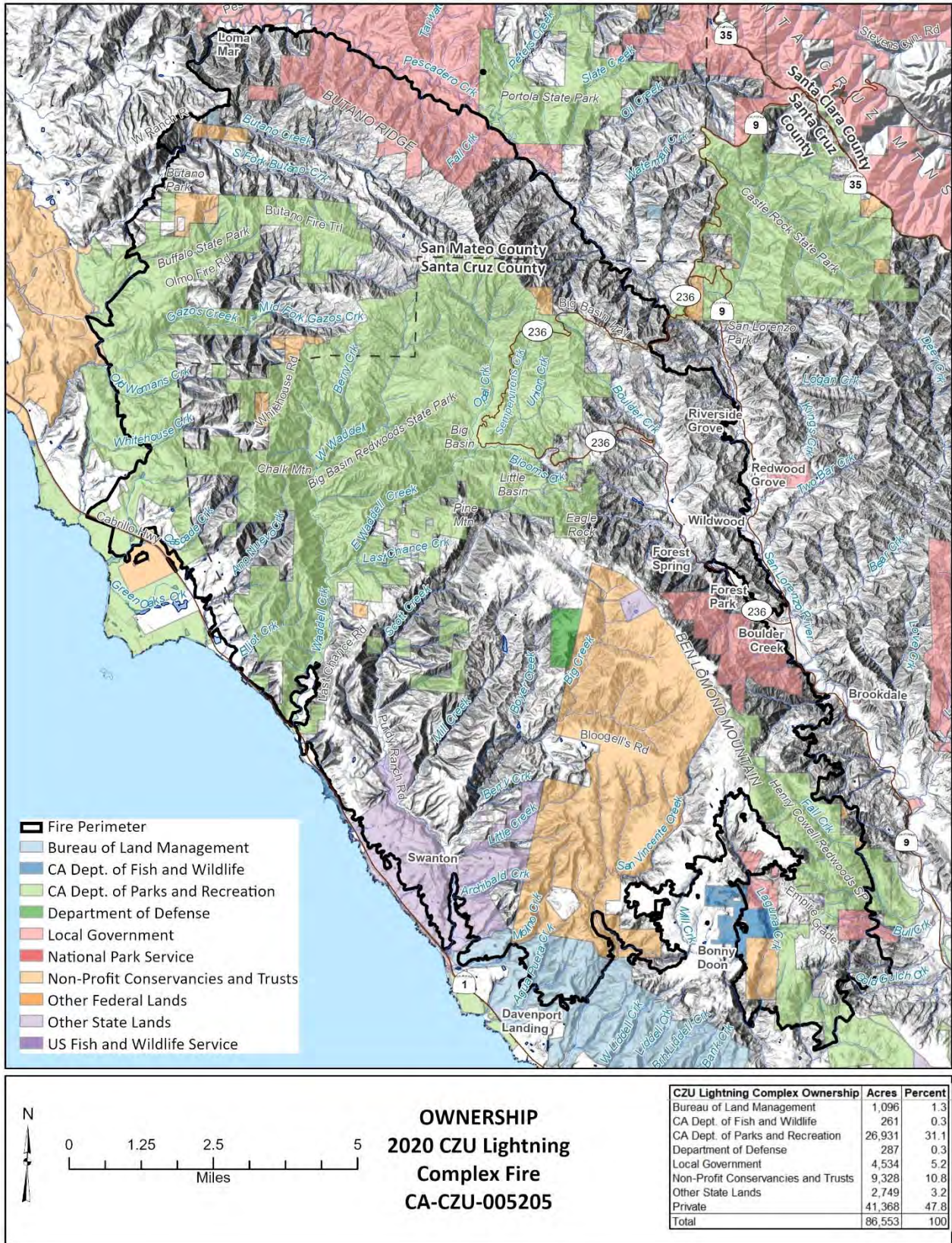


Figure 1. Ownership map for the CZU Lightning Complex.

The area burned by the CZU Lightning Complex is composed of various types of ownership, including federal, state, and private landholdings. Figure 1 and Table 2 provide the spatial distribution and proportion by ownership type.

Table 2. Proportion of the CZU Lightning Complex by ownership type.

CZU Lightning Complex Ownership	Acres	Percent
Bureau of Land Management	1,096	1.3
CA Dept. of Fish and Wildlife	261	0.3
CA Dept. of Parks and Recreation	26,931	31.1
Department of Defense	287	0.3
Local Government	4,534	5.2
Non-Profit Conservancies and Trusts	9,328	10.8
Other State Lands	2,749	3.2
Private	41,368	47.8
Total	86,553	100

Objectives and Scope

Primary objectives for the WERT are to conduct a rapid preliminary assessment to:

- Identify types and locations of on-site and downstream threats to life-safety, property, and critical infrastructure (i.e., Values-at-Risk [VARs]) from post-fire flooding, debris flows, rockfall, erosion, and other hazards that are elevated due to post-fire conditions.
- Determine relative risk to these values using a combination of state-of-the-art analytical tools (e.g., post-fire debris flow likelihood model) and the best professional judgement of licensed geohazard professionals (i.e., Professional Geologists; Certified Engineering Geologists).
- Develop preliminary emergency protection measures needed to avoid or minimize life-safety and property threats.
- Communicate findings to responsible entities and affected parties.

It is important to emphasize that the WERT performs a rapid evaluation of post-fire hazards and risk. A complete characterization of post-fire hazards and/or in-depth design of protection measures is beyond the scope of the WERT evaluation. However, findings from the WERT evaluation can potentially be used to leverage emergency funds for emergency treatment implementation and more detailed site investigation and/or treatment design.

The WERT's goal is not to reduce hillslope runoff and erosion, rather the goal is to minimize risk to life-safety and property values downslope and/or downstream of the fire area. Prescribing treatments to reduce hillslope runoff and erosion is beyond the scope of the WERT. However, the data products generated by the WERT can provide the basis for evaluating restoration and/or mitigation options beyond the immediate life-safety and property focus of the WERT evaluation process.

2. PHYSICAL SETTING

Topography, Climate, and Vegetation

The CZU Lightning Complex burned area is situated on Ben Lomond Mountain, a large eroded mass of granitic rock mantled with sedimentary rock located northwest of the City of Santa Cruz, in the Coast Ranges geomorphic province. Much of the burned area contains steep slopes, with much of the area exceeding 50-60 percent (Figure 2).

Vertical uplift on the Ben Lomond fault located along the San Lorenzo River and Boulder Creek forms steep escarpment topography along the eastern flank of Ben Lomond Mountain. The escarpment is incised with streams forming bowl shaped basins that flow eastward to the San Lorenzo River. Many of the mouths of the basins contain alluvial surfaces and fans, likely due to erosion of sheared bedrock and soils within steep slopes.

The southwest flank of Ben Lomond Mountain, overlooking the Pacific Ocean, is a relatively broad sloping surface with stair-step topographic benches that were cut by marine wave erosion at a time when the land was lower relative to sea level than it is at present. These benches, called marine terraces, were preserved by gradual uplift of the terrain. The broad surface that forms the western side of the mountain is cut by a series of semi-linear southwest flowing streams occupying narrow “V” shaped valleys separated by relatively flat-topped ridges that drain to the Pacific Ocean.

Topography in the southern portion of Ben Lomond Mountain can be irregular where it is underlain by marble, forming knobs and short ridges with intersecting valleys. The topographic pattern is caused by dissolution of the marble by water flowing through fractures in the rock. This sort of topography is referred to as “karst” topography.

The Santa Cruz Mountains have a Mediterranean climate typical of most of California, with most of the annual precipitation falling between November and April, totaling more than 50 inches (127 cm) annually on the western side. Heavy summer fogs frequently cover the western ocean-facing slopes and valleys, resulting in drizzle and fog drip caused by condensation on the coast redwoods, pines, and other trees, which sustains the moisture-loving redwood forests. Due to a rain shadow effect, precipitation on the eastern side of the range is less, about 25 inches (64 cm) a year. Snow falls a few times a year on the highest ridges, and more rarely the higher valleys receive light dustings.

Predicted rainfall intensities from within and/or downstream of the burned area show that one-year recurrence intervals range from 1.40 to 1.76 in hr^{-1} for the 15-minute duration, and 0.97 to 1.19 in hr^{-1} for the 30-minute duration (Table 3). Ten-year recurrence intervals can be as high as 3.08 in hr^{-1} for the 15-minute duration, and 2.09 in hr^{-1} for the 30-minute duration (Table 3) (https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html).



Table 3. Recurrence intervals (RI) for 15-minute and 30-minute rainfall intensities by location (inches per hour). Data from NOAA Atlas 14 (https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html).

Location	1-yr RI	2-yr RI	5-yr RI	10-yr RI
	15-minute duration			
Boulder Creek (SR 9 and SR 236)	1.76	2.14	2.65	3.08
Swanton Road (Scott and Big Creek Confluence)	1.4	1.72	2.14	2.48
Ben Lomond Mountain (2640 ft)	1.66	2.08	2.62	3.04
Location	30-minute duration			
Boulder Creek (SR 9 and 236)	1.19	1.45	1.79	2.09
Swanton Road (Scott and Big Creek Confluence)	0.97	1.19	1.48	1.72
Ben Lomond Mountain (2640 ft)	1.14	1.43	1.8	2.08

Fire History

Fire history can be a useful metric for fuel loading and the energy expenditure for fire. The areas with the least frequent fire theoretically correspond with the highest potential unit area biomass for a given vegetation type, indicating that sufficient fuels may exist to increase potential soil damage. Figure 3 indicates that the largest previous fire within the burned area was the 2009 Lockheed Fire. In general, much of the burned area has not been subject to significant fire within recent recorded history.

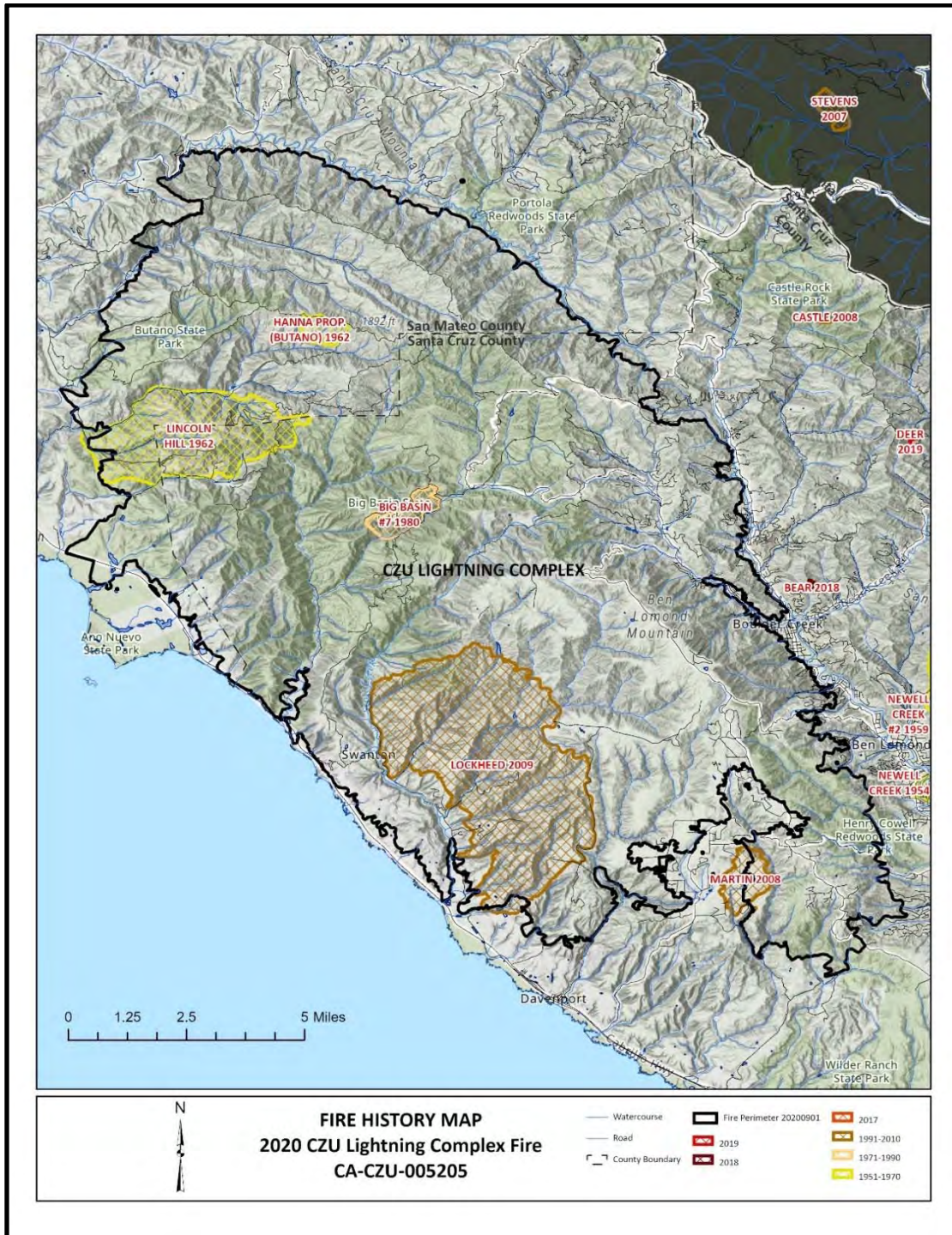


Figure 3. Fire history map for the CZU Lightning Complex and surrounding area.

The most destructive and well-known flood in the history of Santa Cruz occurred on December 22, 1955. The San Lorenzo River reportedly overtopped its banks on both sides with flood waters as much as 8 feet in downtown Santa Cruz (McMahon, 1997). Recorded peak flows were 30,400 cubic feet per second (cfs) for the 1955 flood event on the San Lorenzo River at Big Trees (36 year RI) and 9,420 cfs on Pescadero Creek near Pescadero

(USGS, 1956; Blodgett and Chin, 1989). Anecdotal accounts of the storm event include descriptions of landslides fatally impacting homes.

Following the 1955 flood, from 1957 to 1959 the U.S. Army Corps of Engineers modified the lower three miles of the San Lorenzo River through the City of Santa Cruz into a channelized levee flood control structure (City of Santa Cruz, 2003).

The January 1982 El Niño storm produced flows along the San Lorenzo River that raised the level of the water within 2 feet of the top of the levee, the highest flows have come to breaching the levee since construction (McMahon, 1997). Historical peak flows recorded during the historic January 1982 storm on tributaries downstream of the burned area are presented in the following table (Ellen and Wieczorek, 1988) (Table 4).

Table 4. Selected peak flows recorded during the storm of January 1982. These may represent minimum flows, as anecdotal reports suggest some gauging stations were destroyed/damaged by the floods.

USGS Station	Stream	Drainage Area (km ²)	Discharge (m ³ /s)	Discharge (cfs)
11160020	San Lorenzo River near Boulder Creek	15.98	30	1,037
11160500	San Lorenzo River at Big Trees	274.54	841	29,703
11160060	Boulder Creek at Boulder Creek	29.27	99	3,500
11161900	Scott Creek above Little Creek, near Davenport	65.01	120	4,220
11162500	Pescadero Creek near Pescadero	118.88	266	9,401
11162540	Butano Creek near Pescadero	47.40	59	2,100

As observed in the field, it appears that many tributaries downstream of the burned area have potential to move laterally once the creeks/streams exit their canyons, due to relatively unconstrained topography and high sediment loads. Historical records of past floods on the San Lorenzo River prior to channelization indicate that the river repeatedly overtopped during significant storm events (McMahon, 1997 and DWR, 2013). Tributaries immediately downslope of the burned area along the Highway 9 corridor in the Boulder Creek area and along Highway 1 display alluvial fan morphology, with multiple possible flow paths below the fan apex evident in the LiDAR hillshade imagery (Santa Cruz County, 2020).

Geology and Landslides

The CZU Lightning Complex burned area is located within the northwest-southeast trending Santa Cruz Mountains, part of the Coast Ranges geomorphic province (CGS, 2002). Geologic units that underlie the burned area are separable into three major groups: granitic rocks of Ben Lomond Mountain (Kqd, ga, gd, and hcg); pre-Cretaceous age metasedimentary rocks (composed of mainly schist and quartzite [sch] and marble [m]); and Tertiary to

Quaternary-age sedimentary rocks (primarily Santa Cruz Mudstone [Tsc] and Butano Sandstone [Tb and Tbl] with smaller areas underlain by the Purisima Formation [Tp], Vaqueros Sandstone [Tvq], Rice Mudstone [Tsr], and Quaternary sedimentary deposits [Qs, Qal, and Qmt], among others) (Santa Cruz County, 2009; Brabb et al, 2000). A geologic map of the burned area and vicinity is presented below (Figures 4a and 4b).

The geologic structure of within burned area is primarily controlled by Ben Lomond Mountain (Kqd), a granitic intrusion that has been uplifted along its steep northeastern flank, forming the slopes west of Boulder Creek. The magma intrusion resulted in burial and subsequent metamorphism of the former crustal rocks into metasedimentary rocks (sch and m), which underlie the southeast corner of the burned area. In the western and northern portions of the burned area, Tertiary to Quaternary-age sedimentary rocks unconformably overlie the granitic rocks of Ben Lomond Mountain (Kqd); these rocks are moderately folded and faulted (Tb, Tpl, Tvq Tsr) to relatively undeformed (Tsc, Tp, Qs, Qal, Qmt) (County of Santa Cruz, 2009).

The northwest-southeast structure of the Coast Ranges is controlled by a complex of faults within the San Andreas Fault system, including the San Gregorio, Zayante-Vergeles, Butano, and Ben Lomond faults, which are identified within and/or immediately adjacent to the burned area (Jennings and Bryant, 2010; Stanley and McCaffrey, 1983). Active faults mapped within the burned area include the San Gregorio, Zayante-Vergeles, and Butano faults, which are located within areas that are relatively unpopulated (Jennings and Bryant, 2010).

In contrast, the Ben Lomond Fault, a subsidiary fracture within the San Andreas Fault system is not considered active within the past 85,000 years (Stanley and McCaffrey, 1983). However, the Ben Lomond Fault trends along San Lorenzo River Valley which supports the communities of Felton, Ben Lomond, and Boulder Creek. Regional geologic maps show the fault located east of Felton and Ben Lomond, and west of Boulder Creek (Brabb et al., 2000; Stanley and McCaffrey, 1983). The Ben Lomond Fault has a near vertical slip surface; slopes immediately upslope to the west of Boulder Creek are steep and composed of bedrock that is heavily fractured, jointed, and shattered (Stanley and McCaffrey, 1983). The slopes are eroded with streams forming somewhat bowl-shaped basins that flow eastward to the San Lorenzo River. Many of the mouths of these basins contain what appear to be pre-historic alluvial surfaces and fans that are developed with residential communities, businesses, and other infrastructure.

For these reasons, the majority of highest risk post-fire debris flow hazards to life-safety were identified within the communities of Boulder Creek and Ben Lomond.

History of Landsliding

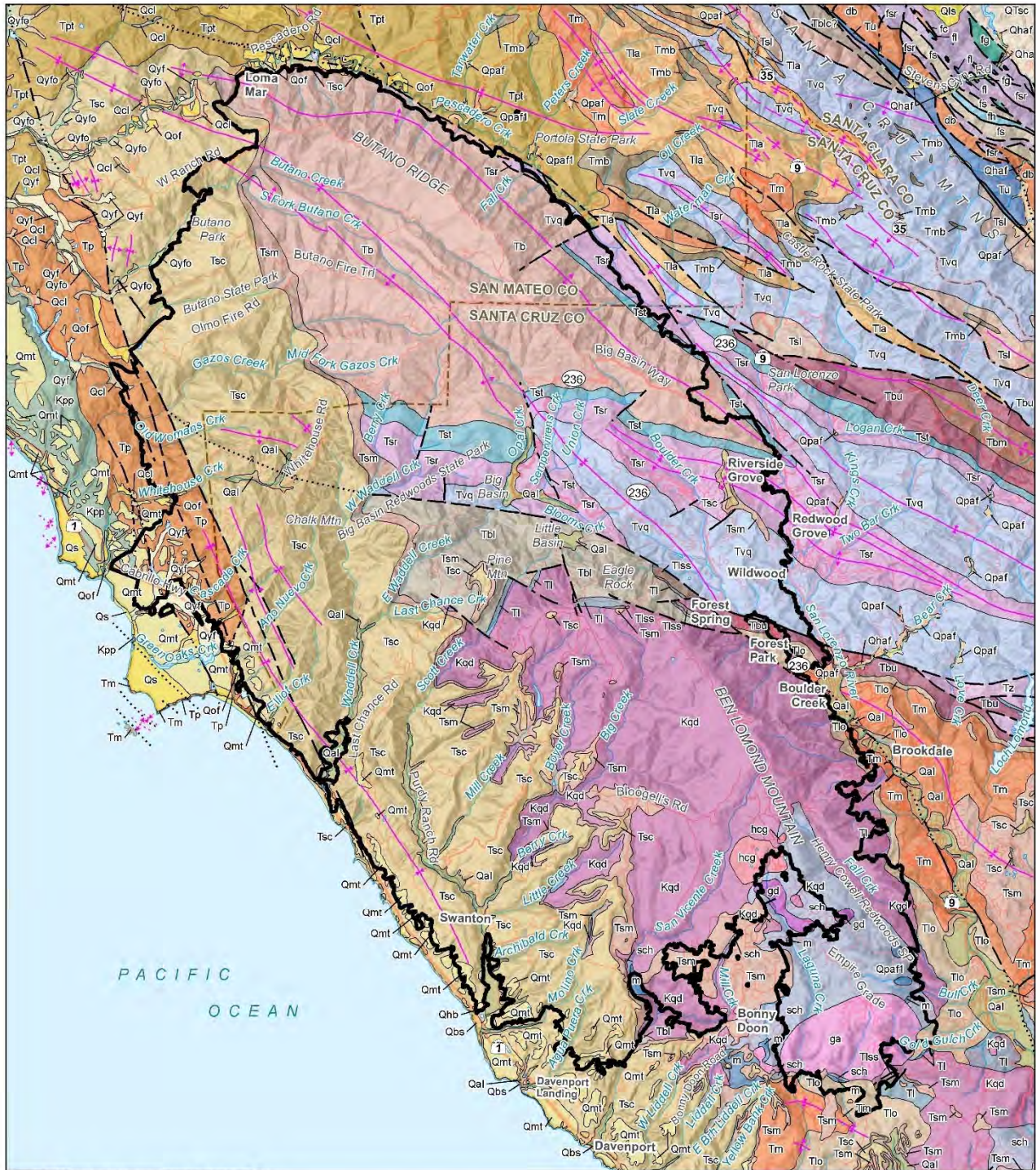
Storm driven landsliding is quite prevalent in the area of the CZU Lightning Complex Fire. Post-fire effects such as loss of soil cover, vegetation, and canopy, as well as fire driven soil heating will exacerbate landslide hazards, in many cases significantly.

Storm driven shallow landslides and debris flows are regularly triggered within the Santa Cruz Mountains during heavy rainfall seasons (Cooper, 1975; Ellen et al., 1997a and 1997b; Baum et al., 1999). Hundreds of debris flows and shallow landslides were triggered within the vicinity of the burned area during the January 1982 El Niño storm, including the Love Creek

Landslide, located east of the burned area near Ben Lomond, which buried 9 homes and killed 10 people (Cotton and Cochrane, 1982; Ellen et al., 1997a,b). Throughout Santa Cruz County, a total of 15 people died, 135 homes were demolished, and 300 homes were damaged as a result of landslides generated during the January 1982 storm (Smith and Hart, 1982). From January 3 to 4, 1982, 12.74 inches of rainfall occurred in Boulder Creek over the period of 24 hours (Griggs, 1982). Peak rainfall intensities during the storm ranged from 0.2 to 0.3 inches per 15-minutes (i.e., 0.8 to 1.2 in hr⁻¹ or 20 to 30 mm hr⁻¹ for the 15-minute duration) (NOAA, 1982).

At least 165 debris flows were triggered during the El Niño winter of 1996 and 1997. While debris flows were initiated in the City of Santa Cruz, higher concentrations of debris flows were observed in the areas around Swanton and Boulder Creek (Baum et al., 1999).

As stated above, shallow landslides and debris flows are a commonly triggered in the Santa Cruz Mountains as a result of heavy and/or intense winter storms (Figure 5). There has not been a significant wildfire of the scale and intensity of the CZU Lightning Complex within the region within recorded history. Observations conducted during this evaluation indicate that many of the basins that drain towards developed areas were burned at high to moderate severity and that much loose and weathered bedrock material was observed perched on steep drainage slopes. USGS modeling indicates moderate to high probabilities of debris flows within some of the basins. It is reasonable to assume potentially adverse effects to shallow slope stability will be exacerbated for the next several winter seasons because of the wildfire.





Source: Geologic map and map database of the Palo Alto 30' X 60' quadrangle, California, E.E. Brabb, R.W. Graymer, and D.L. Jones, 2000.

Elevation source: 2005 NEXTMap InSAR

Geologic Map CZU August Lightning Complex CA-CZU-5205

CZU August
Lightning Complex
San Mateo and
Santa Cruz
Counties

 CZU Fire Perimeter
 Road

0 1 2 3 4 5 Miles

Figure 4a. Geologic map of the CZU Lightning Complex.

Geologic Map Units - CZU August Lightning Complex

Holocene

af	Artificial fill (Historic)
Qbs	Beach sand (Historic)
Qhb	Basin deposits
Qhaf	Alluvial fan and fluvial deposits
Qyf	Younger (inner) alluvial fan deposits
Qyfo	Younger (outer) alluvial fan deposits
Qcl	Colluvium: loose to firm, friable, unsorted
Qs	Sand dune and beach deposits
Qal	Alluvium: unconsolidated gravel, sand, silt, clay
Qls	Landslide deposits (Pleistocene and/or Holocene)

Pleistocene

Qpaf	Alluvial fan and fluvial deposits
Qpaf1	Alluvial terrace deposits
Qof	Older alluvial fan and stream terrace deposits
Qmt	Marine terrace deposits
QTsc	Santa Clara Formation (lower Pleistocene and upper Pliocene)

Pliocene and Upper Miocene

Tp	Purisima Fm.: sandstone, siltstone, mudstone
Tpp	Pomponio Mudstone Member: shale and mudstone
Tpt	Tahana Member: sandstone and siltstone

Miocene

Tsc	Santa Cruz Mudstone: mudstone, siltstone, sandstone
Tsm	Beach sand (Historic)
Tm	Basin deposits
Tlo	Alluvial fan and fluvial deposits
Tuv	Younger (inner) alluvial fan deposits
Tla	Younger (outer) alluvial fan deposits
Tmb	Colluvium: loose to firm, friable, unsorted
Tvq	Sand dune and beach deposits

Map Symbols

	Contact – Solid where accurately located; long dash where approximately located; short dash where inferred
	Fault – Solid where accurately located; long dash where approximately located; short dash where inferred; dotted where concealed; queried where uncertain
	Anticline – Dashed where approximately located
	Syncline – Dashed where approximately located; dotted where concealed

Oligocene and Eocene

Tz	Zayante Sandstone: non-marine sandstone
Tsl	San Lorenzo Fm.: shale, mudstone, and siltstone
Tsr	Rices Mudstone Member: unbedded mudstone, siltstone
Tst	Twobar Shale Member: laminated shale with mudstone
Tb	Butano Sandstone: coarse-grained arkosic sandstone
Tbu	Upper sandstone member: arkosic sandstone
Tbm	Middle siltstone member: pyritic siltstone
Tbl	Lower conglomerate and sandstone member
Tblc	Conglomerate: sandy pebble conglomerate
Tu	Unnamed sedimentary rocks: mudstone, shale, argillite

Paleozoic and Mesozoic

Tl	Locatelli Formation: micaceous siltstone
Tlss	Sandstone: medium-grained arkosic sandstone
Kpp	Pigeon Point Formation: sandstone and conglomerate
Kqd	Granitic rocks of Ben Lomond Mountain
ga	Granite and alaskite
hcg	Hornblende-cummingtonite gabbro

Cretaceous and Jurassic

KJv	Unnamed volcanic rocks
fs	Sandstone: fine to coarse-grained sandstone (graywacke)
fg	Greenstone: pillow lavas, breccias, tuffs
fc	Chert
fl	Limestone: finely to coarsely crystalline limestone
fh	Argillite: argillite and shale with sandstone
fsr	Sheared rock (melange): graywacke, siltstone, shale
sp	Serpentinite (Cretaceous and/or Jurassic)
db	Diabase and gabbro

Mesozoic or Paleozoic

gd	Gneissic granodiorite
sch	Metasedimentary rocks: pelitic schist and quartzite
m	Marble

Geology
CZU August Lightning Complex
CA-CZU-5205

Figure 4b. Geologic map legend for the CZU Lightning Complex.

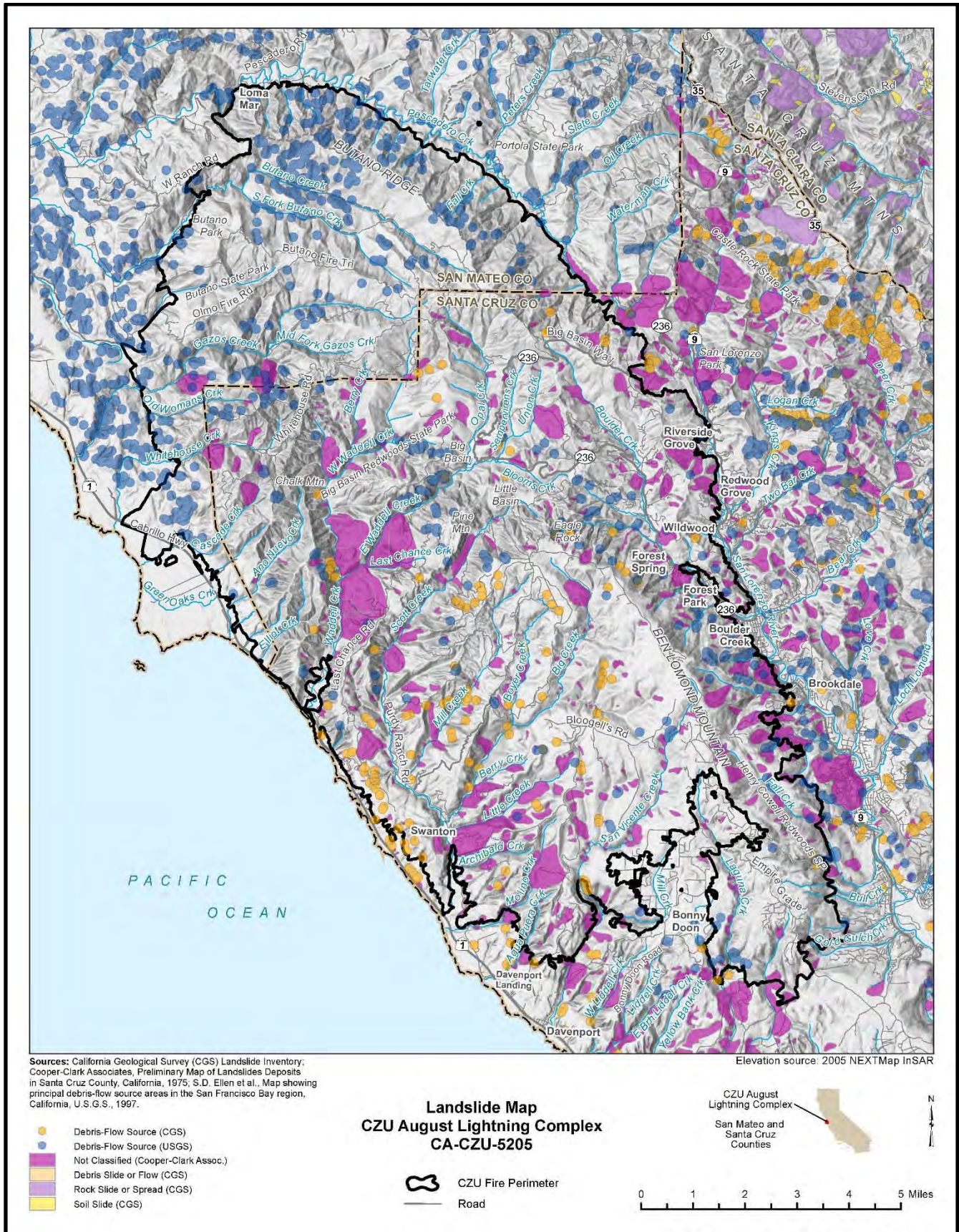


Figure 5. Landslide map for the CZU Lightning Complex.

Regional Estimates of Post-Fire Debris Flow Triggering Rainfall

The 2020 CZU Lightning Complex is located in an area with similar geologic and meteorological conditions observed in the Big Sur area. Both areas contain several major bedrock units west of the San Andreas Fault (Rosenberg and Wills, 2016). In both areas the Mesozoic granitic rocks are deeply weathered and have broken down mineral grains leading to "decomposed" or weakened rocks. Regional information from the Big Sur area can reasonably be applied to the Santa Cruz area.

Records indicate that since the late 1800s there have been 10 large wildfires in the Big Sur area (Longstreth, 2013) (Table 5). Documentation of historic post-fire debris flow events is generally limited to locations near the Big Sur River along the Pacific Coast Highway. Historic debris flows documented within the Big Sur River area indicate that since 1908 a minimum of nine debris flow events have occurred following wildfire (Cleveland, 1973; Jackson, 1977; JRP Historical Consulting Services, 2001; Wills et al., 2001; Longstreth, 2013).

The historic debris flow precipitation thresholds documented for the steep watersheds in the Big Sur area suggest that at 1-hour durations, precipitation on the order of 0.73 inches (19 mm) may be enough to generate debris flows. It appears reasonable that because of the similar geologic conditions and meteorological affects, similar thresholds may be applicable to the Santa Cruz area. This comparison is under the assumption that burn extent and severity, topographic characteristics, and sediment availability are similar between watersheds issuing past debris flows.

Table 5. Summary of triggering rainfall for post-fire debris flows in the Big Sur area.

Date/Year Debris Flow Documented	Measured Precipitation	Fire Name
1908, 1909, 1910	N/A	N/A
12 October, 1972	0.82 in hr ⁻¹	Molera
15 October, 1972	0.73 in hr ⁻¹	Molera
15 November, 1972	1.76 in hr ⁻¹ (15-minute duration)	Molera
August, 1978	N/A	Marble Cone
February, 1986	N/A	Rat Creek, Gorda
7 April, 2009	0.84 in hr ⁻¹	Basin Complex-Indians

Hazardous Minerals

Hazardous minerals in the Coast Ranges province are often associated with asbestos, chromium, and other heavy minerals. Based on our limited review of regional geologic maps (Brabb et al., 2000), minor concentrations of partially serpentinized ultramafic rock might be

present within the portion of the burned area north of Bonny Doon underlain by hornblende-cummingtonite gabbro (hcg) (Figure 6).

Asbestos is classified as a known carcinogen by state, federal and international agencies. State and federal health officials consider all types of asbestos to be hazardous. There is no agreed-upon “safe” level of asbestos exposure because there is insufficient scientific information to support the identification of an exposure level at which there would be zero risk of cancer.

Cenozoic sedimentary rocks containing naturally occurring metals are mapped throughout the western and northern portions of the burned area. These mapped units have the potential for locally elevated concentrations of naturally occurring metals, including cadmium, selenium, and uranium.

Two aggregate quarries are located along the southern border of the burned area. Extraction and processing associated with quarrying operations will produce dust and airborne particulates which can cause or aggravate existing respiratory conditions when inhaled. The quarry is likely to experience an increased level of flow and runoff during large storm events. The excess runoff and flow through the quarries could result in an increase in sedimentation to Gold Gulch Creek and San Vicente Creek.

Based on our review of the California Department of Conservation CalGEM Well Finder (<https://maps.conservation.ca.gov/doggr/wellfinder/>), there are about a dozen plugged “dry hole” oil wells within the perimeter of the burned area. They are primarily located on ridges and hilltops and outside of floodplains. Based on the well locations, it appears unlikely that debris flows and/or flooding will result in adverse impact to the wells.

The locations of potential mineralogical hazards, including existing quarry and mine locations and plugged gas and oil wells, are shown on the Mineral Hazard Map (Figure 6).

Information regarding the hazardous minerals discussed above can be found at the California Office of Environmental Health Hazard Assessment (<https://oehha.ca.gov/chemicals/>).

For additional mineral hazards information, see:

<https://pubs.usgs.gov/fs/2005/3014/>

<http://www.mindat.org/loc-25791.html>

<http://www.who.int/mediacentre/factsheets/fs361/en/>

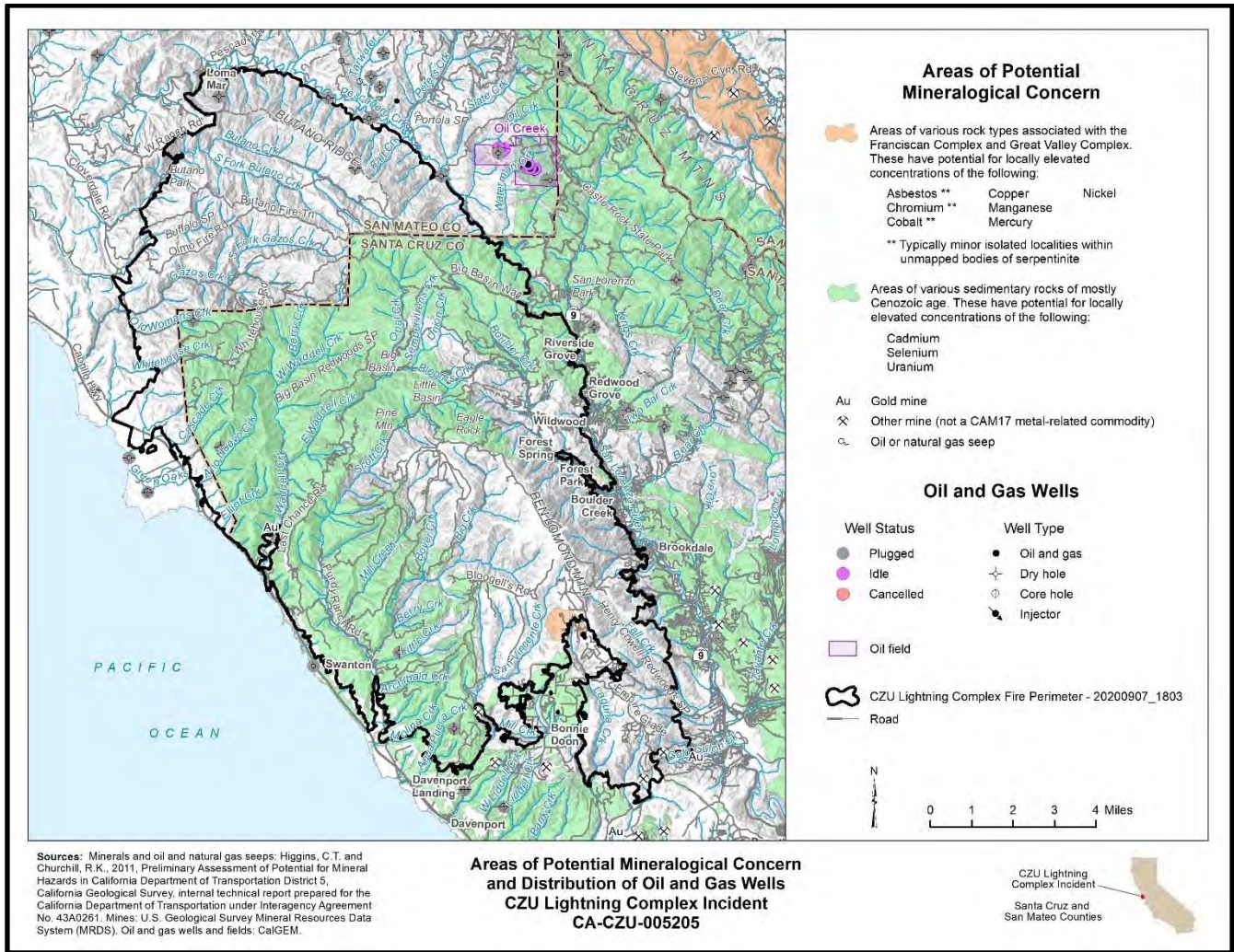


Figure 6. Mineral hazards map for the CZU Lightning Complex.

Development and Key Infrastructure

The CZU Lightning Complex primarily burned in areas bounded by State Route 1 to the west, State Routes 9 and 236 to the east, and Pescadero Road to the north. Drainage structures and road prisms associated with these state highways, county and private road systems are potentially affected by post-fire conditions. State Parks within or downstream of the burned area include Ano Nuevo State Park, Big Basin State Park, Butano State Park, Cascade Ranch State Park, Henry Cowell Redwoods State Park, and Wilder Ranch State Park. County parks include Pescadero Creek County Park. Considerable park infrastructure is within and/or downstream of the burned area. Other key infrastructure include the Boulder Creek Elementary School, which is situated on an alluvial fan in the San Lorenzo River Valley.

Community and municipal water systems affected by the fire include surface water intakes and/or pipelines of the San Lorenzo Valley Water District, the City of Santa Cruz, and the community of Davenport. The San Lorenzo Valley Water District and City of Santa Cruz

systems are heavily reliant on surface water from the San Lorenzo River and its tributaries. The community of Davenport receives its water from San Vicente Creek.

3. REMOTE SENSING AND MODELING RESULTS

Soil Burn Severity

Based on the experience of the WERT members, the burned area has an atypical amount of moderate and high soil burn severity (SBS) for a humid, forested area (Figure 7). Approximately, 43 percent of the burned area is composed of moderate (34.1 percent) to high (9.1 percent) soil burn severity; the remaining portion of the area is composed of low (40.1 percent) and/or very low to unburned (16.8 percent) (Table 6).

Observations from the field indicated that areas burned at high soil burn severity were typified by a loss of surface cover and by a moderate level of soil structure alteration. Water repellency was consistently observed at depth (approximately 1 inch) in soils derived from granitic parent materials. Water repellency was less noticeable in the soils derived from sedimentary rock. In addition, the team observed areas under unburned redwood canopy that were mapped as low soil burn severity with the BARC imagery that exhibited soil damage characteristics of moderate soil burn severity. Further, the team observed that contrary to many other fires, the surface cover (duff) was significantly removed during the fire in the areas mapped as low and very low burn severity, thus leaving significant amounts of bare soil which is more typical of higher burn severities.

Table 6. Soil burn severity for the CZU Lightning Complex.

Soil Burn Severity	Acres	Percent
Unburned/Very Low	14,188	16.8
Low	33,950	40.1
Moderate	28,870	34.1
High	7,675	9.1
Total	84,683	100

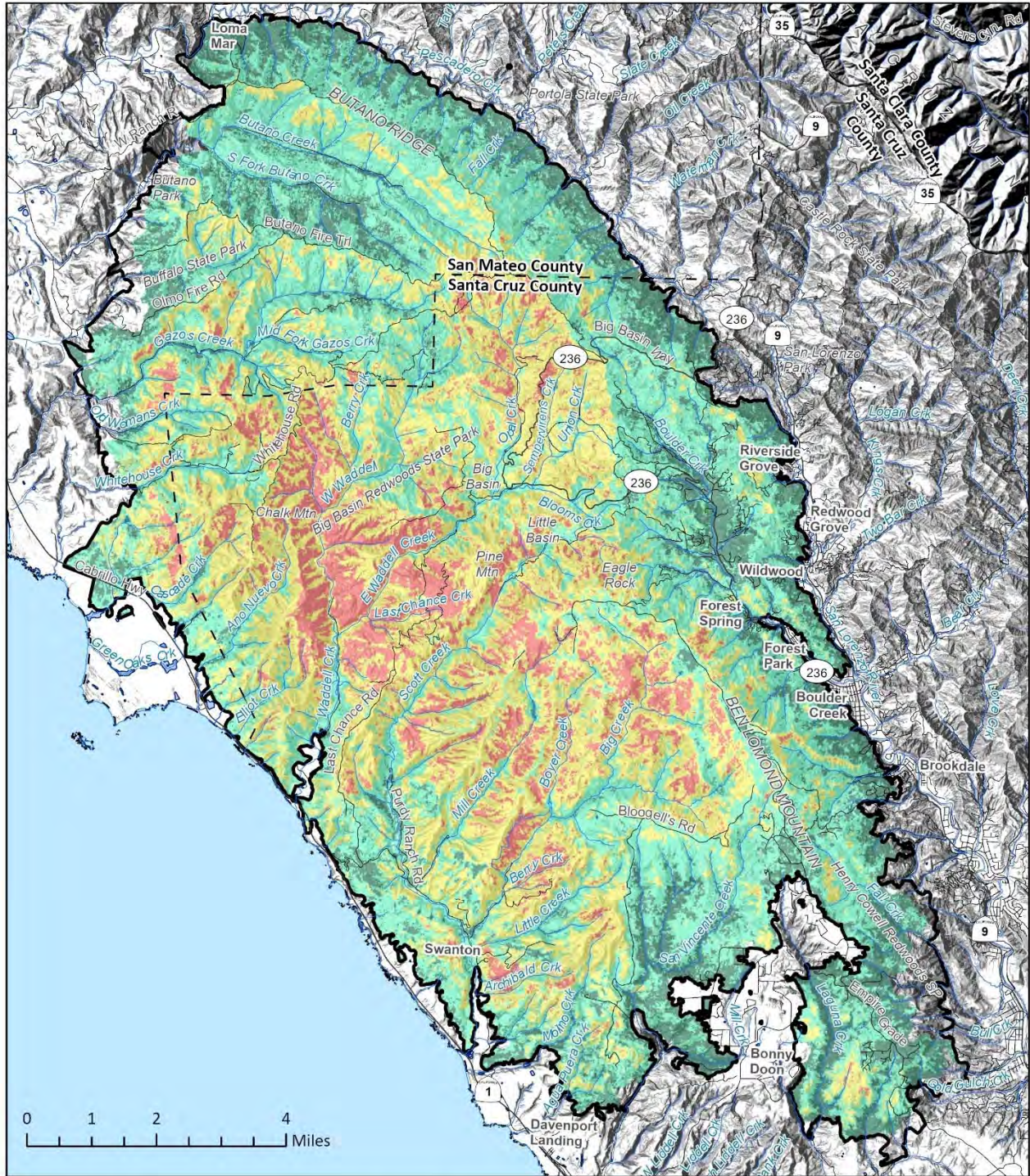


Figure 7. Soil burn severity map for the CZU Lightning Complex.

Post-Fire Hydrology

Post-fire increases in peak flow were estimated for a number of watersheds (i.e., pour points watersheds) draining the CZU Lightning Complex (Figure 8). Post-fire peak flow increases were estimated using the USFS “Rule of Thumb Method” (Foltz, 2009), with a bulking factor that depends upon the proportion of the watershed area by soil burn severity class (Gusman, 2011). Post-fire peak flow increases were only estimated for Butano, Gazos, Waddell, Scott, and Big Creek. The proportion of the watershed burned by soil burn severity class was also extracted for San Vicente Creek and Laguna Creek, as well as two locations along the San Lorenzo River to address threats to municipal/community water supply as discussed in Section 5 of this report.



Figure 8. Pour point watersheds for the CZU Lightning Complex. Post-fire peak flows were estimated for Butano, Gazos, Waddell, Scott, and Big Creek. Proportion of watershed area by soil burn severity was extracted for San Vicente Creek, Laguna Creek, and the San Lorenzo River at two locations to inform threats to municipal water supply.

Bulked post-fire flow modifiers for the 2- to 10-year recurrence interval flow are expected to range from 1.4 to 2.7 for the pour points. The highest flow increases are expected to be in the Scott Creek (2.7), Waddell Creek (2.6), and Big Creek (2.6) watersheds. Butano Creek and Gazos Creek are expected to be less affected due to the relatively low proportion of moderate and high soil burn severity. Boulder Creek has a bulked post-fire modifier of 1.4 for the 2- to 10-year recurrence interval flow, suggesting relatively low potential for flooding (Table 7).

Table 7. Estimated bulked post-fire flow multipliers for the pour point watersheds.

Pour Point	Area (mi ²)	Total Unb/ Very Low %	Moderate %	High %	Clear Water Flow Modifier	Bulking Factor	Bulked Post-Fire Modifier
Butano Creek	9.5	20.5	15.2	0.4	1.2	1.2	1.4
Gazos Creek	11.5	21.0	30.2	3.6	1.3	1.3	1.7
Waddell Creek	22.5	0.8	54.5	23.5	1.8	1.5	2.6
Scott Creek	5.9	0.3	61.5	21.2	1.8	1.5	2.7
Big Creek	11.2	1.5	55.0	19.7	1.7	1.5	2.6
Boulder Creek	11.5	84.6	14.2	1.1	1.2	1.2	1.4

Methods for post-fire flow increases do not apply to larger watersheds such as the San Lorenzo River due to their large drainage areas (>100 mi² near Felton), and less direct linkage to burned hillslopes. By the time the San Lorenzo River reaches the Felton and Santa Cruz area, less than 20 percent of the watershed is burned, with the preponderance of the burned area being low to very low soil burn severity (>87 percent). Flooding along the San Lorenzo River may occur if tributary drainages initiate floods or debris flows. Peak flows associated with debris flows can be much higher than those associated with post-fire elevated flood flows (Kean et al., 2016), and may exacerbate local flooding along Boulder Creek and the San Lorenzo River, especially in tributaries with a high combined hazard for debris flows.

Post-Fire Debris Flow Hazard

The USGS Debris Flow model was used to calculate combined debris flow hazard for the CZU Lightning Complex burned area. The combined hazard reflects the potential likelihood of a debris flow occurring as well as the volumetric yield of the debris flow (Table 8), and is the preferred method to display the potential for post-fire debris flows (Dr. Dennis Staley, USGS, personal communication, 2018). Combined hazard is simulated for the 20, 32, and 40 mm hr⁻¹ 15-minute storm event.

Figure 9 shows the combined hazard for the 15-minute 20 mm hr⁻¹ storm event. This storm event is consistent with rainfall thresholds that triggered post-fire debris flows in the Big Sur area, and is a reasonable initial threshold for triggering an Early Warning System. Figure 9 suggests that large portions of the western side of the fire and some select basins on the eastern side (e.g., Clear Creek; SR 236 corridor) will generally have a moderate combined hazard for debris flows following approximately one-fifth an inch of rainfall in 15-minutes.

Figure 10 shows the combined hazard for the 15-minute 32 mm hr⁻¹ storm event (i.e., approximately 0.3 inches in 15-minutes). Figure 10 indicates much of the western portion of the fire has a high combined hazard, while much of the SR 9 and 236 corridors have a moderate combined hazard for debris flows. Finally, Figure 11 shows the combined hazard for the 15-minute 40 mm hr⁻¹ storm event (i.e., approximately 0.4 inches in 15-minutes), which is slightly less than the 1-year recurrence interval storm event for areas within and/or downstream of the fire footprint (Table 3). Figure 11 indicates most of the fire has a high and/or moderate combined hazard for debris flows, with multiple high hazard basins occurring within the SR 9 and 236 corridors.

Table 8. A schematic illustrating the concept of combined debris flow hazard.

Combined Hazard Classification

		Debris Volume (m ³)			
		<1,000	1,000 - 10,000	10,000-100,000	>100,000
Probability of Debris Flow	0-20%	Low		Moderate	
	20-40%	Moderate			
	40-60%			High	
	60-80%				
	80-100%				

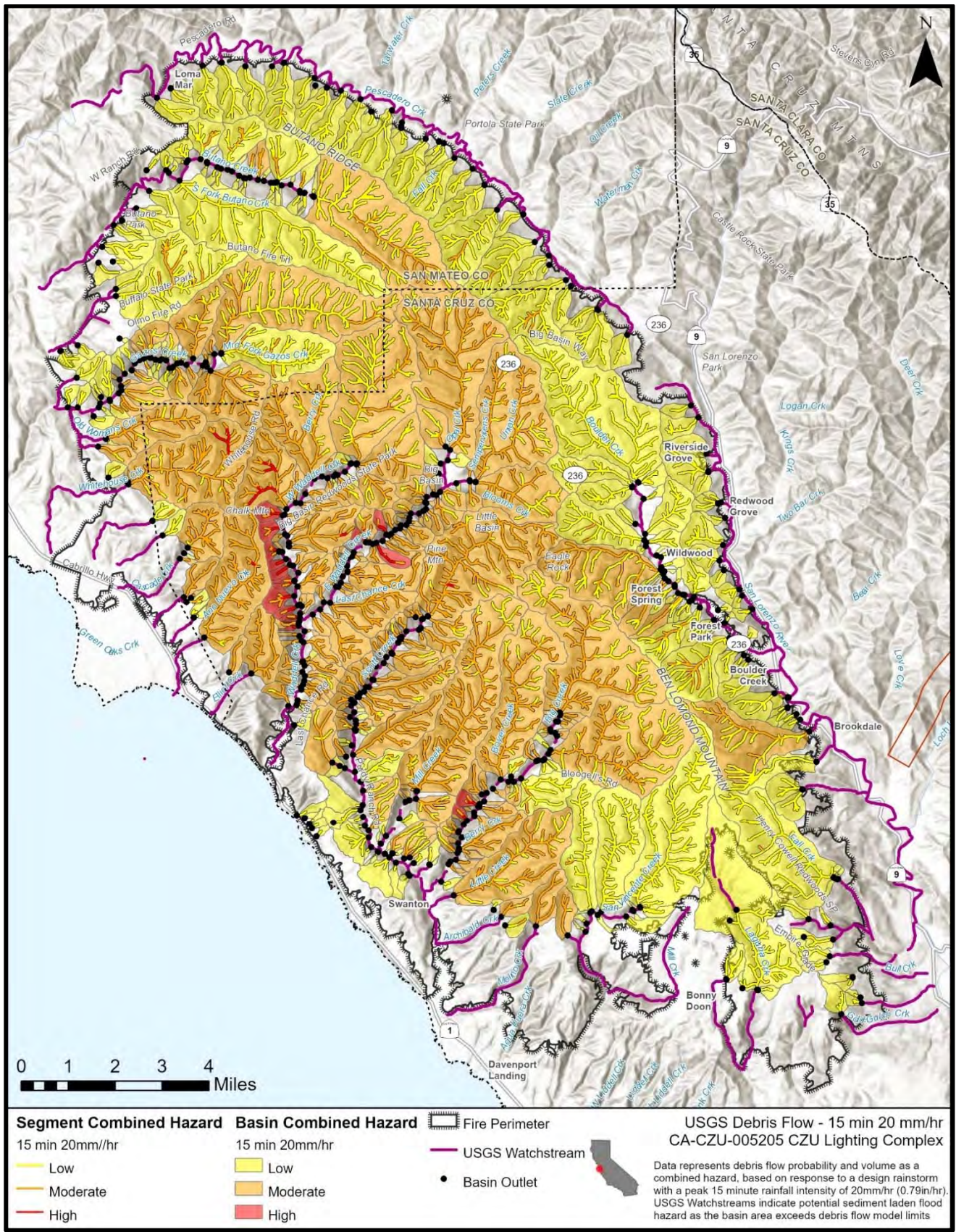


Figure 9. USGS debris flow model results for the 15-min 20 mm hr⁻¹, CZU Lightning Complex.

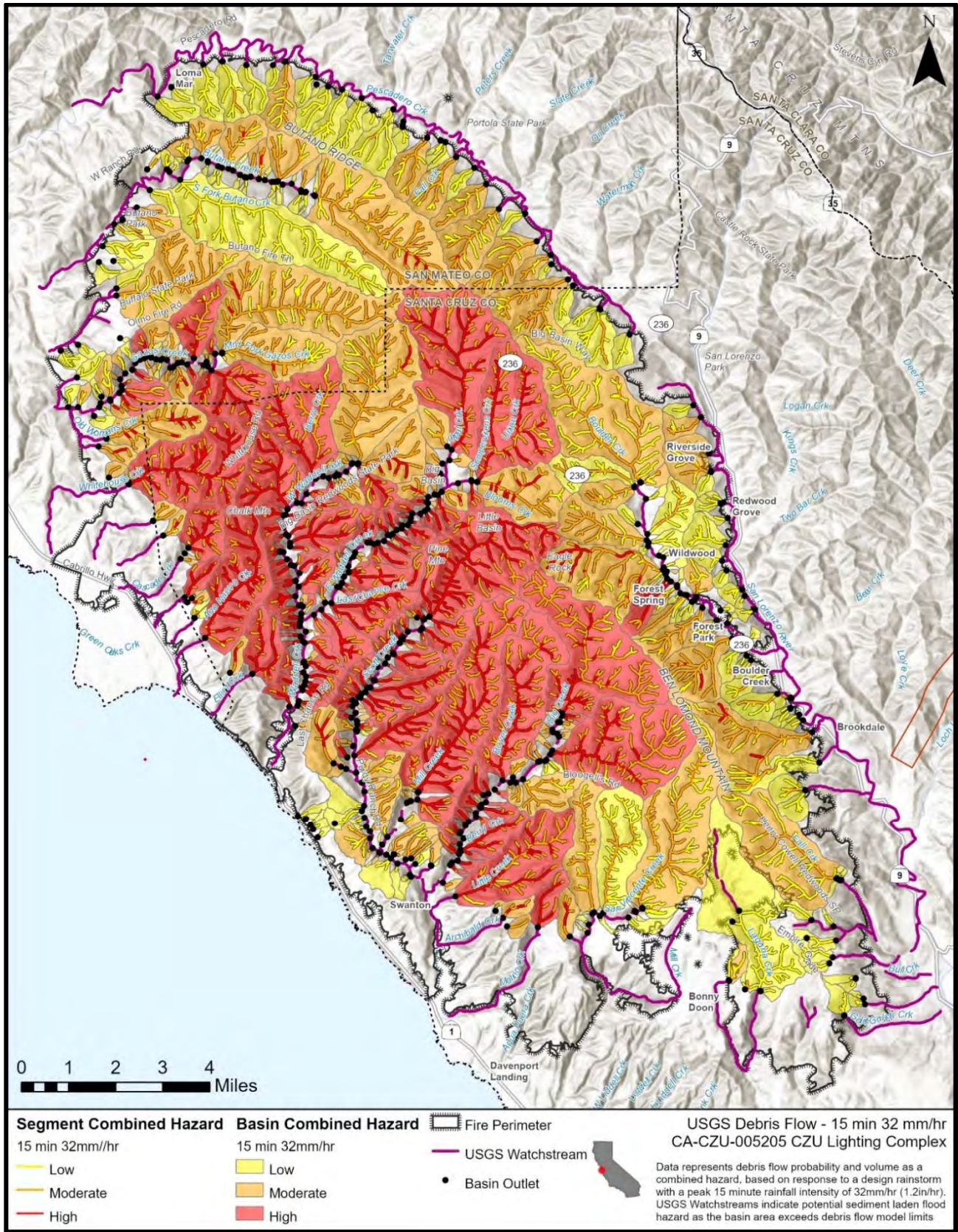


Figure 10. USGS debris flow model results for the 15-min 32 mm hr⁻¹, CZU Lighting Complex.

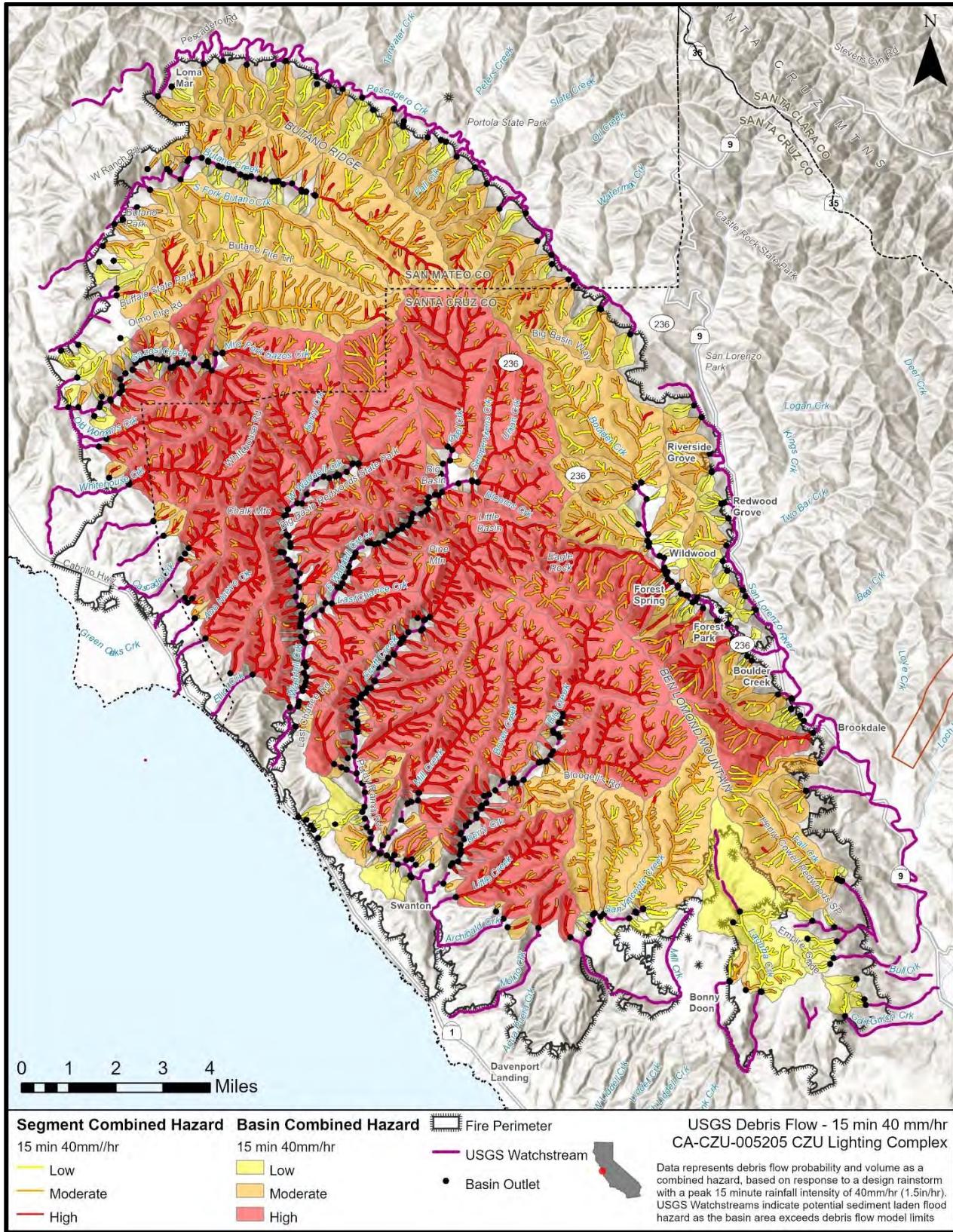


Figure 11. USGS debris flow model results for the 15-min 40 mm hr⁻¹, CZU Lightning Complex.

The USGS debris flow model can also calculate the 15-minute rainfall intensity necessary to trigger a debris flow with a probability of 50 percent. Figure 12 indicates that much of the western portion of the fire might see a triggering of debris flows when 15-minute intensities fall within the range of 12 to 24 mm hr⁻¹ (i.e., 0.47 to 0.94 in hr⁻¹). The eastern portion of the fire near the SR 9 and 236 corridors have basins with likely rainfall thresholds that range from 28 to 40 mm hr⁻¹ (1.1 to 1.5 in hr⁻¹). The spatially explicit calculation of basin specific rainfall thresholds can be a useful tool for revising rainfall thresholds if the initial Early Warning System threshold is deemed too conservative based on monitoring and observations.

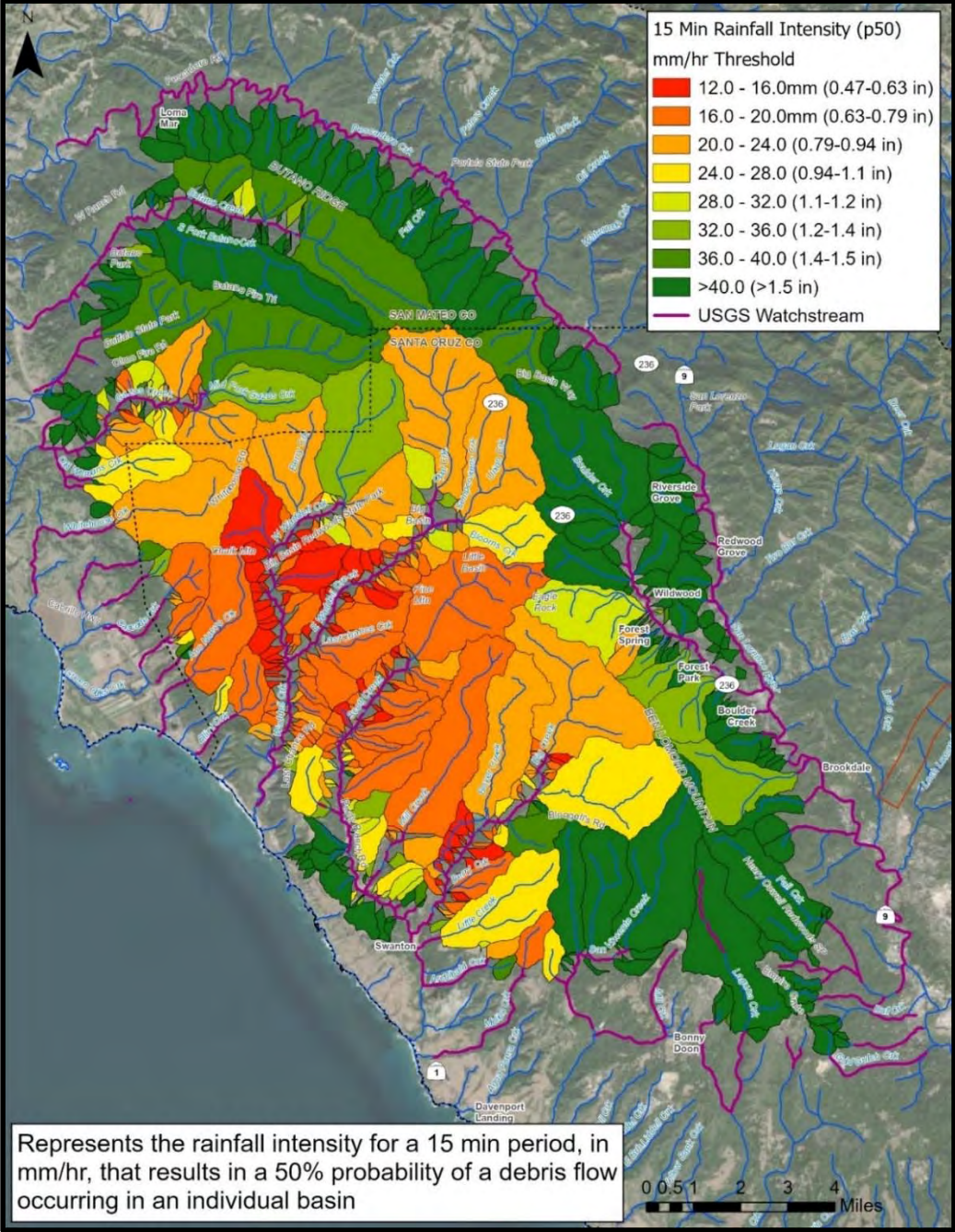


Figure 12. 15-minute rainfall intensity necessary to trigger a debris flow with a probability of 50 percent for the CZU Lightning Complex.

Post-Fire Surface Erosion

Surface erosion increases, often significantly, following wildfire due to loss of surface cover, canopy, and shallow soil damage due to fire heating. Soil burn severity generally indicates where increases may be most significant, topography and soil type also play significant roles in post-fire surface erosion.

Post-fire surface erosion was modeled using the Erosion Risk Management Tool (ERMiT) from the United State Forest Service's Rocky Mountain Research Station. The ERMiT model run calculated first year sediment production following a 2-year recurrence interval storm event. Figure 13 shows watershed averaged post-fire erosion rates for planning watersheds within the CZU Lightning Complex burned area. Modeling indicates that watershed averaged erosion rates are more than 10 tons per acre for the Waddell Creek, Scott Creek, and Big Creek watersheds. Butano Creek, Gazos Creek, Cascade Creek, Green Oaks Creek, Little Creek, and Boulder Creek have basin averaged erosion rates predicted to be in the range of 5 to 10 tons per acre. Figure 14 shows erosion rates as a percentage of the maximum rate for smaller basins (i.e., approximately 20 acres in size). It can be assumed that for the majority of the burned area, the post-fire erosion rates shown on Figures 13 and 14 are significantly higher than the pre-fire erosion rates. Overall, the firewide median erosion rate is predicted to be 8.6 to 9.4 tons per acre depending upon the scale of the model unit. ERMiT also suggest that the firewide median rate can be reduced by a factor of 5 if mulch is applied at a rate of 2 tons per acre.

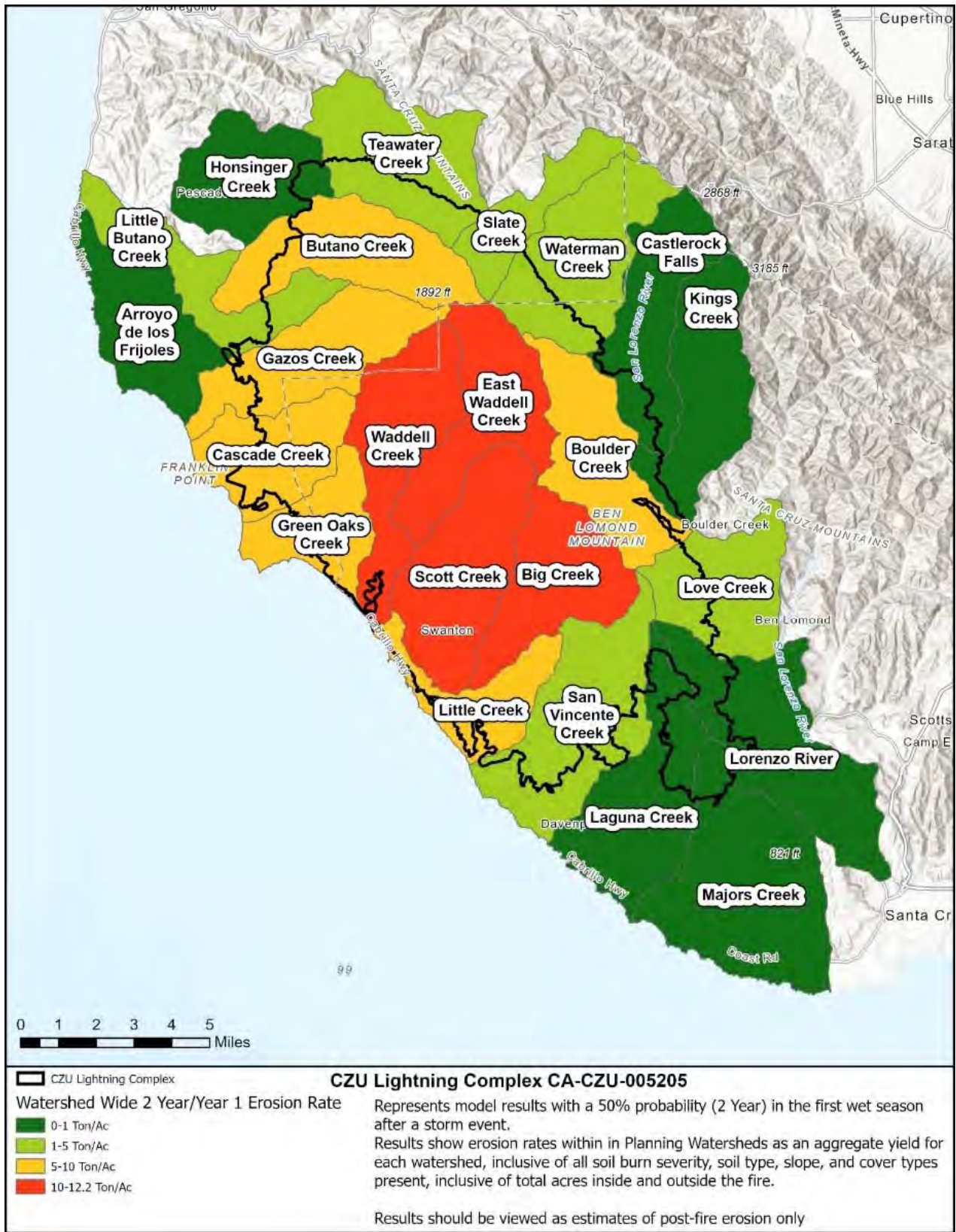


Figure 13. Watershed averaged erosion rates (tons per acre) on the CZU Lightning Complex for the first year 2-year storm event predicted using the Erosion Risk Management Tool (ERMIT).

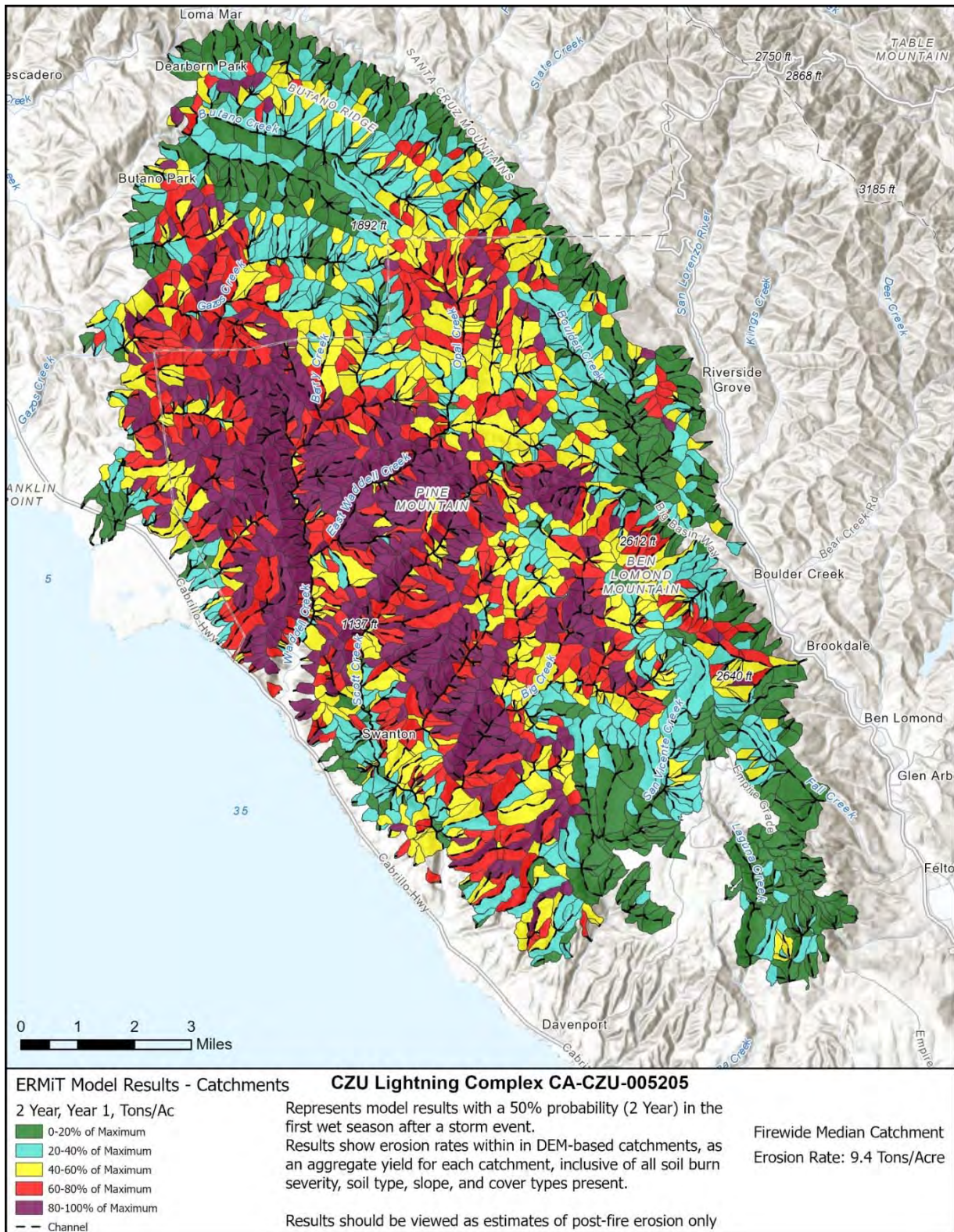


Figure 14. CZU Lightning Complex predicted surface erosion rates for the 2-year storm event using the Erosion Risk Management Tool (ERMiT).

Model Uncertainties

There has not been extensive validation of the USGS debris flow model outside of southern California, the intermountain west, the southwest United States and the Colorado Front Range. As such, there is considerable uncertainty regarding the hazard predictions for the CZU Lightning Complex. Data from Big Sur (Table 5) suggest that regional empirical data for rainfall intensities capable of triggering post-fire debris flows are within the range predicted by the model. Field observations and high resolution topographic imagery indicate that debris flows have previously occurred within and downstream of the burned area without the influence of wildfire. Given that 1-year rainfall intensities can exceed 1.7 in hr^{-1} for a 15-minute duration, it is unclear whether hillslopes are adjusted to these rainfall intensities and whether it will require potentially higher rainfall intensities to trigger post-fire debris flows than the models suggest. Staley et al. (2020) found that post-fire debris flows are generally triggered by the 1 to 2-year recurrence interval storm event. Assuming this relationship holds for the CZU Lightning Complex, this suggests the rainfall rates might have to be as high as 1.4 to 2.0 in hr^{-1} (approximately 35-50 mm hr^{-1}).

Recent studies have shown that the presence of fresh, loose rock and soil materials high in burned watershed basins (DiBase and Lamb, 2020) are a strong predictor of post-fire debris flow initiation. The low and very low/unburned soil burn severity mapped within some of the burned basins may not accurately reflect on-the-ground conditions because the redwood canopy was not consumed. The combination of loose materials and higher soil burn intensities in some of the watershed basins may not necessarily be reflected in the USGS modeling and calculated threshold rainfall rates.

4. VAR OBSERVATIONS AND RECOMMENDATIONS

Potential Values-at-Risk (VARs) are grouped into five areas defined by geographical communities. General observations and recommendations for each of these areas are provided below. More detailed observations are provided in the VAR summary table (Appendix B), VAR locations are displayed in Appendix C, and VAR site information is presented in Appendix D. **This evaluation is not intended to be comprehensive and/or conclusive, and additional VARs may be identified through more detailed evaluation by responsible agencies.** Several limitations include:

- FEMA, State and local flood hazard mapping was not complete or non-existent in several areas.
- Not all roadway culverts and bridges in and adjacent to the burned area were evaluated.
- Some potential VARs were not evaluated, or evaluated from a distance, because of the lack of access.
- Hazards on alluvial fans and other streamside areas could not be represented as single-points given the potential for avulsion and flow-path uncertainty. Alluvial fan

VARs are generally presented as polygons or included in FEMA and DWR flood and awareness zones.

- VAR evaluation was not conducted within all mapped flood hazard areas that are downstream of the burned area. Risk of flooding in these areas is preexisting and is anticipated to be increased by post-fire runoff. As such, local agencies should consider these mapped flood hazard areas in addition to the VARs identified in this report.

This report serves as a preliminary tool to assist emergency responding agencies (e.g., Santa Cruz County, San Mateo County, City of Santa Cruz, Town of Pescadero, California State Parks, local fire departments and water agencies, Caltrans, Office of Emergency Services, utility companies, and other responsible agencies) in the development of more detailed post-fire emergency response plans and assessments.

It is intended that responsible agencies will use the information presented in this report as a preliminary guide to complete their own more detailed evaluations and develop detailed emergency response plans and mitigations. These agencies may identify additional VARs through their more detailed evaluations.

General Discussion

Storm driven landsliding is quite prevalent in the area of the CZU Lightning Complex Fire. Post-fire effects such as loss of soil cover, vegetation, and canopy, as well as fire driven soil heating will exacerbate landslide hazards, in many cases significantly. Unstable slope conditions are apparent within burned areas upslope of residential/commercial developments within the Brookdale, Boulder Creek, Swanton, Whitehouse, Riverside Groove, Butano Canyon, and Wildwood communities, and facilities associated with Big Basin State Park. Team members observed post-fire dry ravel and existing areas of alluvial/colluvial deposits in steep drainages, along steep canyon headwalls, and on side slopes upstream of the residential and commercial areas.

While material observed near many of the canyon outlets near the upslope edge of the residential communities appears fine-grained, alluvial deposits of cobble- to boulder-sized rocks are present at the outlets of many drainages including but not limited to (1) Boulder Creek, (2) Jamison Creek, and (3) Big Creek. Alluvial fan deposits were observed along canyon outlets throughout the burned area, including within residential/commercial areas and Big Basin State Park. These observations suggest the presence of pre-existing flood, hyperconcentrated flow, and debris flow hazards. We observed recent small-scale shallow landslides and loose materials perched in steep headwalls and along steep streamside slopes that further confirm active slope instability within the burned area. These landslides also provide material to stream channels during heavy precipitation events that can be mobilized by subsequent flooding and debris flows. The slope morphology is visible on LiDAR-derived hillshade imagery of the burned area.

The northwest trending Ben Lomond fault roughly parallels the eastern boundary of the CZU Lightning Complex burned area and the active San Andreas Fault Zone is located approximately 8 miles to the east (Jennings and Bryant, 2010). Faults within the San Andreas Fault Zone are considered active by the State of California. In addition to storm events, landsliding and rockfall may also be triggered by strong ground shaking associated with

earthquakes on nearby faults, providing another source of material in channels to be mobilized during flood, hyperconcentrated flow, and debris flow events.

The drainage channels downslope of the CZU Lightning Complex burned area are heavily modified by infrastructure, including roads, bridges, and drainage structures in the communities of Pescadero, Butano Creek, Big Basin State Park, Swanton and the Highway 9 corridor. This report characterizes the potential Values-at-Risk observed within each of the communities and/or geographical areas adjacent to critical infrastructure.

Butano Creek

Observations

The area downslope of the CZU Lightning Complex burned area within Butano Creek is a source of potential hazards to residents, property, and infrastructure. Slopes within the fire area upstream of the developed areas are primarily burned at a low soil burn severity along north and south facing slopes. Butano Creek drains southwest through the Butano Canyon Conservation Association (BCCA), individual private residences, and agricultural land. Drainage infrastructure (culverts and bridges) observed within residential developments are discussed further below.

The BCCA (VARs 26 through 32) is located along Butano Creek, adjacent to the northwest portion of the CZU Lightning Complex burn perimeter and contains numerous residences, bridges, water tanks, and a water purification building within the FEMA floodplain. Based on discussions with residents, past flooding in the community in 1982 destroyed several of the bridges. Homes along the southeastern boundary of the community are located at the base of drainages and/or on moderate to steep slopes that appear susceptible to generating debris flows/slides. Other VARs within the drainage are located along the bottoms of steep canyons with the potential to generate debris flows (VAR 33). Butano Creek eventually drains to the ocean in the vicinity of Pescadero Creek Road. This area is subject to seasonal flooding that can be expected to be exacerbated for several years by excessive runoff from the CZU Lightning Complex burned area.

A total of eight VARs were found within the Butano Creek drainage, including a polygon encompassing a large portion of the BCCA. Generally, the VARs observed within and downslope of the northwestern burned area are determined to constitute a low/moderate risk to public safety and a moderate/high risk to property.

Recommendations

- Monitor and maintain bridges and other drainage structures prior to and during large rain events where they cross residential streets.
- Utilize existing early warning systems, linked to up-to-date storm information.
- Consider the use of appropriate professionals (State-Certified Professional Geologist (PG) and/or Professional Engineer (PE)) to review and design additional engineering mitigations not provided in this report.
- Provide Butano Creek residents with this VAR information so they may understand their proximity to hazard areas and take appropriate actions.

Pescadero Creek

Observations

The area downslope of the CZU Lightning Complex burned area within Pescadero Creek is a source of potential hazards to residences, property, and infrastructure. Slopes areas up gradient from developed areas are primarily burned at a low soil burn severity along north facing slopes. Pescadero Creek drains generally southwest through the community of Loma Mar and individual private residences before draining to the ocean in the vicinity of Pescadero. Drainage infrastructure (culverts and bridges) observed within residential developments are discussed further below.

Residences in the Pescadero Creek area, including the community of Loma Mar, are generally elevated above the watercourse and outside of the FEMA 100-year floodplain. Where evaluated, bridges along Pescadero Creek appear designed with freeboard to accommodate anticipated 100-year flood flows and debris.

One VAR polygon was found within the Pescadero Creek drainage. This area is determined to constitute a moderate risk to public safety and a moderate risk to property.

Recommendations

- Monitor and maintain drainage structures prior to and during large rain events where they cross residential streets.
- Utilize existing early warning systems, linked to up-to-date storm information.
- Consider the use of appropriate professionals (PE or PG) to review and design additional engineering mitigations not provided in this report.

Big Basin State Park and Waddell Drainage

Observations

The area downslope of the CZU Lightning Complex burned area within the Big Basin and Waddell Creek drainage is a source of potential hazards to downslope residences, property, and infrastructure. Slopes within the fire upstream of the developed areas are primarily burned at moderate to high soil burn severity along slopes that vary in aspect. Big Basin is drained primarily by Waddell Creek, which flows southwest to the ocean at Waddell Creek Beach. Drainage infrastructure (culverts and bridges) observed within residential developments and Big Basin State Park are discussed further below.

Regional geologic mapping (Brabb et al., 2000) characterizes the geologic units underlying the Big Basin/Waddell Creek drainage as primarily Eocene to Miocene/Oligocene-age sedimentary rock, including sandstone, shale, and mudstone, with Holocene-age alluvial deposits along valley bottoms.

Infrastructure within Big Basin State Park (VARs 1 through 13), including Semperviren Reservoir and the water treatment plant, are located downslope of drainages with a moderate to high potential for debris flows/slides. Culverts and cross drains along park roads could

potentially plug and impact access to critical infrastructure. One campground east of No Escape Road is located on a broad alluvial fan underlain by debris flow deposits, and others may be subject to flooding. Maintenance/equipment storage yards contain burned equipment, fuel tanks, and 55-gallon drums in close proximity to watercourses.

Downstream of Big Basin State Park, infrastructure and residences along Gazos Creek Road (VARs 15 and 16) and Canyon Road (VARs 20 through 22) are located within the FEMA 100-year floodplain. Several homes within the community of Whitehouse are built on alluvial fan deposits below areas mapped with a moderate to high potential for debris flows. Whitehouse Canyon Road may be impacted by debris flows and rockfall (VARs 23 through 25).

Access to the community of Last Chance was limited. Based on our review of hillshade imagery, residences in this area are primarily located near or along ridge tops. We did identify one VAR polygon that includes several homes located below drainages with a moderate to high potential for debris flows (VAR 18).

A total of 25 VARs including polygons and points were found within the Big Basin/Waddell Creek drainage. This area is determined to generally a low to moderate risk to public safety and a moderate risk to property.

Recommendations

- Monitor and maintain drainage structures prior to and during large rain events where they cross roads.
- Remove hazardous materials from State Park maintenance/equipment yards prior to the rainy season.
- Close Big Basin State Park facilities seasonally and do not allow camping during rain events.
- Close Whitehouse Canyon Road seasonally. Install signage warning about rockfall hazard.
- Perform infrastructure monitoring at critical infrastructure, including the water treatment plant and Semperviren Reservoir.
- Utilize existing early warning systems, linked to up-to-date storm information.
- Consider the use of appropriate professionals (PE or PG) to review and design additional engineering mitigations not provided in this report.
- Provide Canyon Road, Gazos Creek Road, Whitehouse Canyon Road, Pie Ranch and other residents with this VAR information so they may understand their proximity to hazard areas and take appropriate actions.

Swanton Area

Observations

The area downslope of the CZU Lightning Complex within the Swanton area is a source of potential hazards to residences, property, and infrastructure located in Mill Creek, Big Creek, Little Creek, and Scott Creek watersheds. Steeper slopes upstream of the developed areas and are primarily burned at a moderate to high soil burn severity. Drainage infrastructure

(culverts and bridges) observed within residential developments and along Swanton Road are discussed further below.

Infrastructure within the Swanton area (VARs 82 through 96) are located downslope of drainages with a moderate to high potential for debris flows and flooding. Bridges along Swanton Road could potentially plug and impact access to critical infrastructure. The CAL FIRE station (CZU Station #33 (Big Creek)) along Swanton Road (VAR 82) is located at the base of Winter Creek where it appears that if a culvert is plugged, flow would be directed towards the fire station and fuel vault (Figure 15).

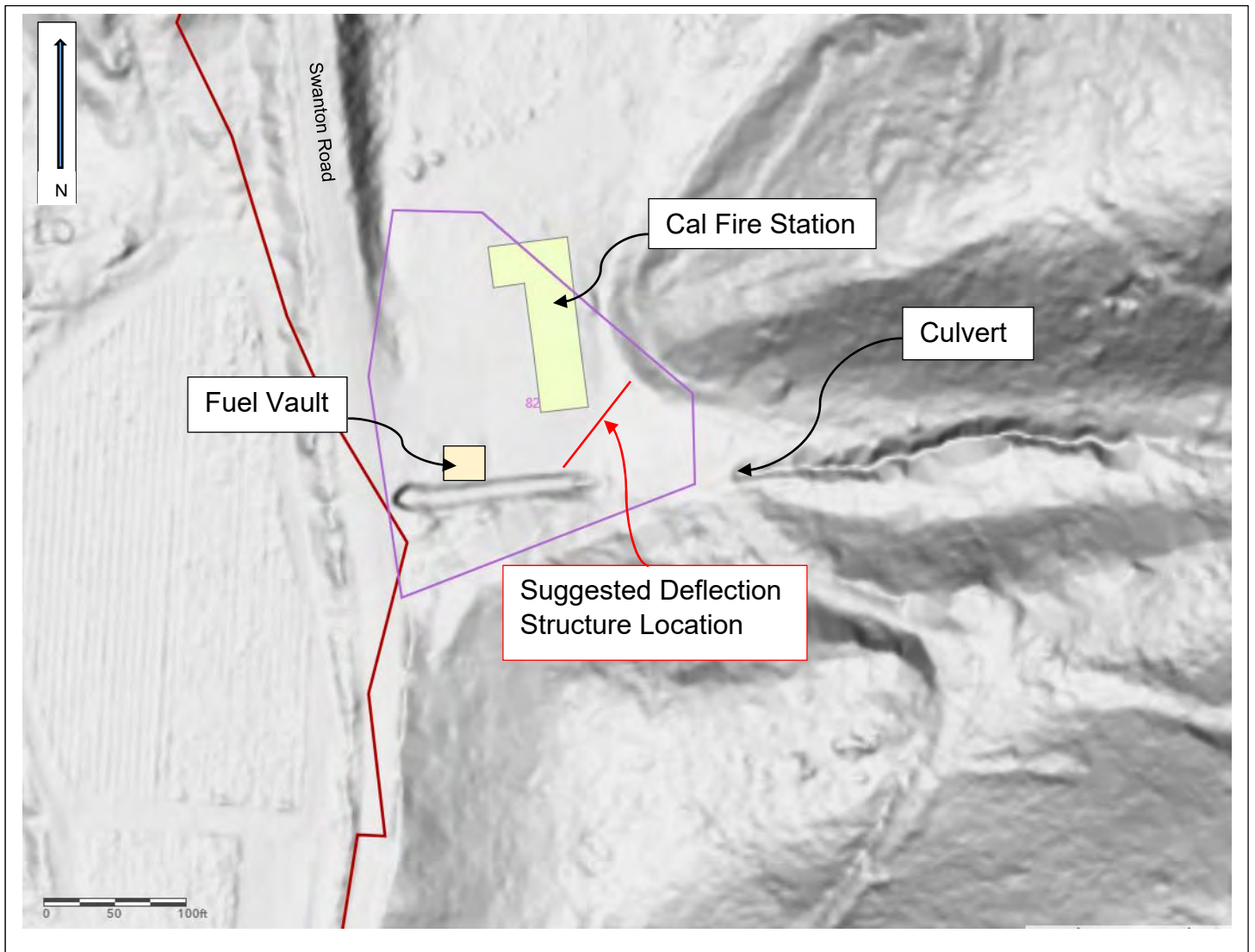


Figure 15. Site map of CAL FIRE station (VAR 82) showing the potential location of a properly designed deflection structure. The culvert denotes the location where debris could plug the structure and flow towards the station and fuel vault.

Several homes and a fish hatchery appear to be at risk from debris flows in the Big Creek watershed (VARs 84, 85, 89, and 90). VAR 92 consists of an existing unburned home located at the mouth of a drainage where it appears a deflection structure could help to limit the potential for flows impacting the home (Figure 16).

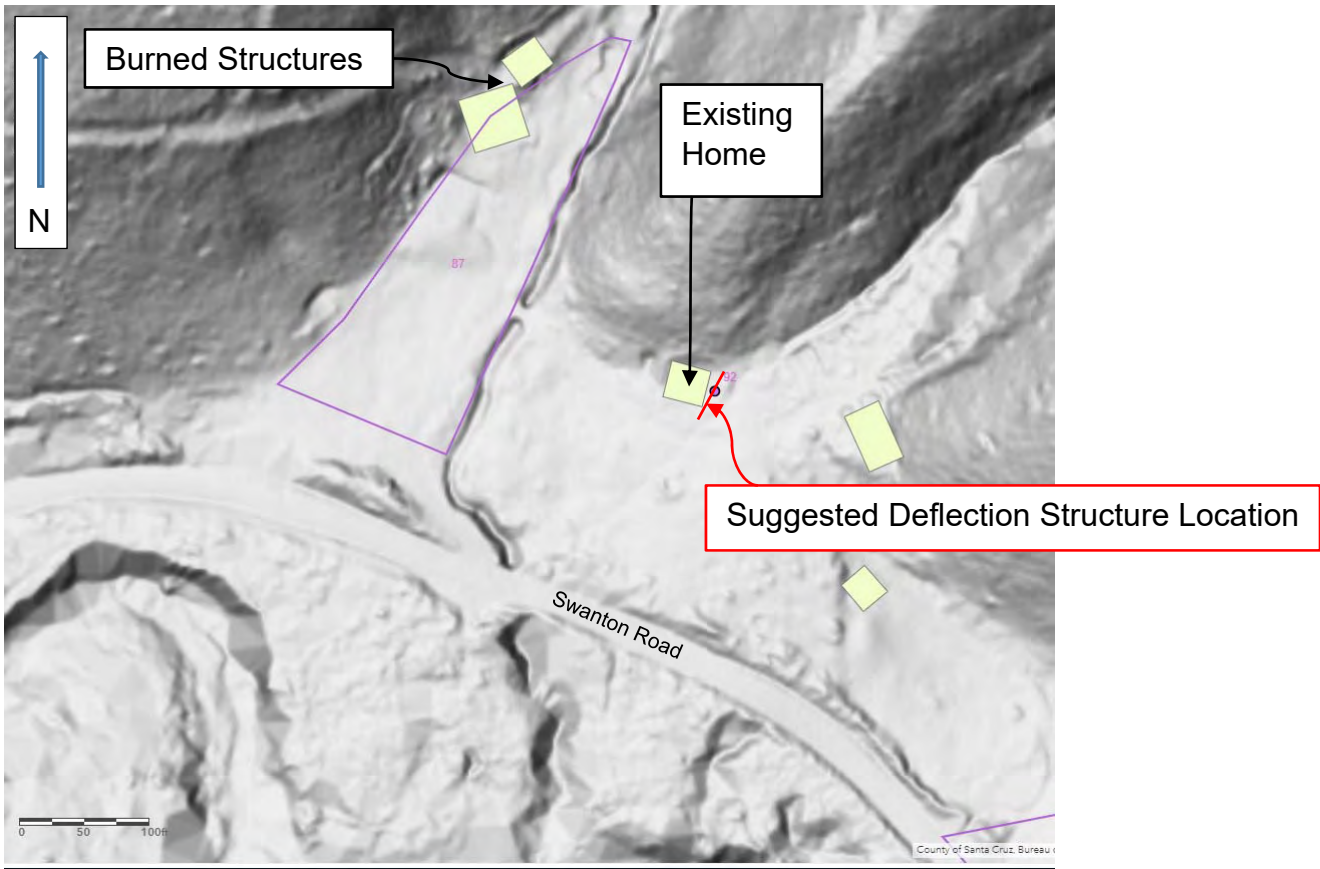


Figure 16. Site map of an existing home (VAR 92) showing the general location of a potential deflection structure. Any deflection structure would need to be properly designed for site conditions.

Homes located in the Purdy Ranch area appear to be at risk from debris flows (VAR 94) and flooding (VAR 96).

Recommendations

- Monitor and maintain drainage structures prior to and during large rain events where they cross park roads.
- Perform storm infrastructure monitoring at critical road infrastructure.
- Utilize existing early warning systems, linked to up-to-date storm information.
- Consider the use of appropriate professionals (PE or PG) to review and design additional engineering mitigations not provided in this report.
- Provide residents and businesses with this VAR information so they may understand their proximity to hazard areas and take appropriate actions.

San Vicente Redwoods Land Trust, Bonny Doon, and Felton areas

Observations

The area downslope of the CZU Lightning Complex within the San Vicente Redwoods Land Trust and Bonny Doon area in the southwestern portion of the burned area does not appear to contain significant threats to life-safety. This is primarily because most of San Vicente Redwoods does not contain developed infrastructure (e.g., homes). A water intake for the town of Davenport water supply (VAR 104) is located along San Vicente Creek, but the intake appears at low risk from sedimentation. Increases in dissolved organics, however should be anticipated. Similarly, water intakes for the City of Santa Cruz (VAR 106) located along the Smith Grade and within Felton (VAR 103) have a low risk of impact from debris flows but may experience increased suspended sediment and dissolved organics. The water intake in Felton is also located within a FEMA flood zone along the San Lorenzo River and may experience higher flows and flooding.

Residential development in the Bonny Doon area is located on a relatively flat ridgetop (Empire Grade) where the risk of impact from debris flows and flooding is very low. Felton is located outside of and east of the burned area. Burned slopes that drain to Felton were observed to contain low to very low soil burn severity and the USGS debris flow modeling indicates very low probability of debris flow occurrence within these slopes. Portions of Felton are located within FEMA flood zones along the San Lorenzo River. The potential for flooding in this area may be increased as a result of increased runoff from tributaries in the burned area that drain to the river.

Recommendations

- Monitor and maintain the intake drainage structures during and after large rain events.
- Clean out and maintain basins above the intakes.
- Prepare to treat water for increased dissolved organics.
- Develop an early warning system for potential flood events.

Highway 9 Corridor

Observations

The Highway 9 corridor encompasses the eastern border of the burned area along the San Lorenzo River and Boulder Creek from the town of Ben Lomond to the populated areas north of Boulder Creek.

The Highway 9 corridor is a moderately populated area with many neighborhoods constructed upon observed alluvial fans that have formed over geologic time at the base of steep hillsides (e.g., VARs 34 to 50, Figure 17). In addition, a considerable number of houses were observed within this area constructed adjacent to and/or within the channels of the San Lorenzo River, Boulder Creek, and their tributaries (e.g., VARs 52 and 59).

The Ben Lomond Fault is mapped west of Boulder Creek, along the approximate eastern perimeter of the burned area. The fault plane is near vertical and uplift along the fault has

resulted in steep slopes that are composed of fractured and shattered granitic bedrock (Kqd) upslope of the town of Boulder Creek (Stanley and McCaffrey, 1983).

Evidence of repeated past debris flow activity, including large granitic boulders, poorly-sorted debris flow deposits, and alluvial fan morphology was observed within several easterly flowing watercourses in the Boulder Creek area. Based on our field observations, it appears that there is a moderate to high potential for debris flow impacts to life safety and property within and adjacent to the following creeks and streams:

- Jamison Creek (VARs 34, 35, 37 through 39);
- Foreman Creek (VAR 48);
- Clear Creek (VARs 63-67 and 71-73);
- unnamed tributary upslope of downtown Boulder Creek (VAR 61);
- unnamed tributaries upslope of Acorn Drive (VARs 40, 41, and 42); and
- unnamed tributary to Hare Creek (VAR 36)

Based on our limited field reconnaissance a properly designed and located deflection structure may reduce the potential for avulsion from the current channel on an unnamed watercourse immediately upslope of Boulder Creek Elementary School and the adjoining residential neighborhood (VAR 61). A figure showing the location of the area is shown in Figure 17.

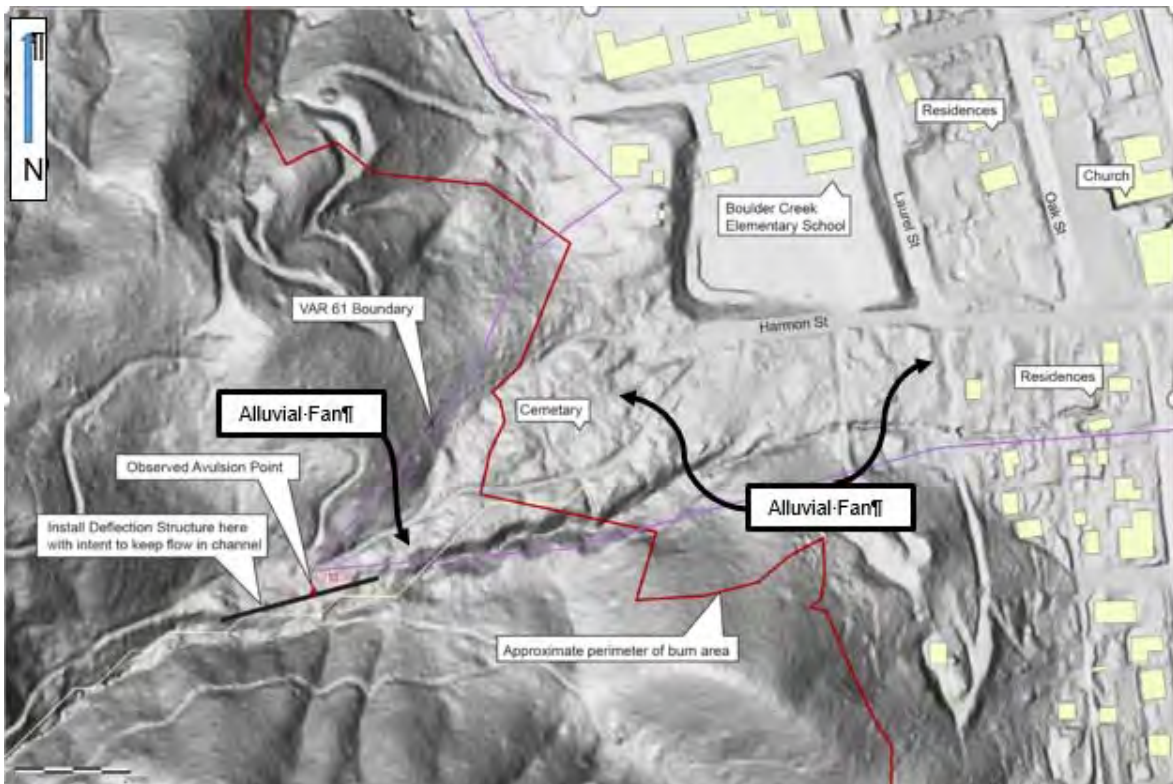


Figure 17. Site map of Boulder Creek (VAR 61) showing the potential location of a properly designed deflection structure to reduce the chance of avulsion from the current channel on an unnamed tributary southwest of the town. The red triangle denotes the location of the observed avulsion point.

Flow paths on alluvial fan surfaces can be unpredictable and are influenced by roads, buildings, and other man-made infrastructure (Figure 18). The actual debris flow pathways are highly uncertain and were difficult to predict during this rapid evaluation. Deflection structures may prove effective in reducing the chance for avulsion in other areas where the potential for post-fire debris flow and flooding impacts were observed. For these reasons, we recommend further observations and determinations be made by a State-Certified Professional Geologist (PG) and Professional Engineer (PE).

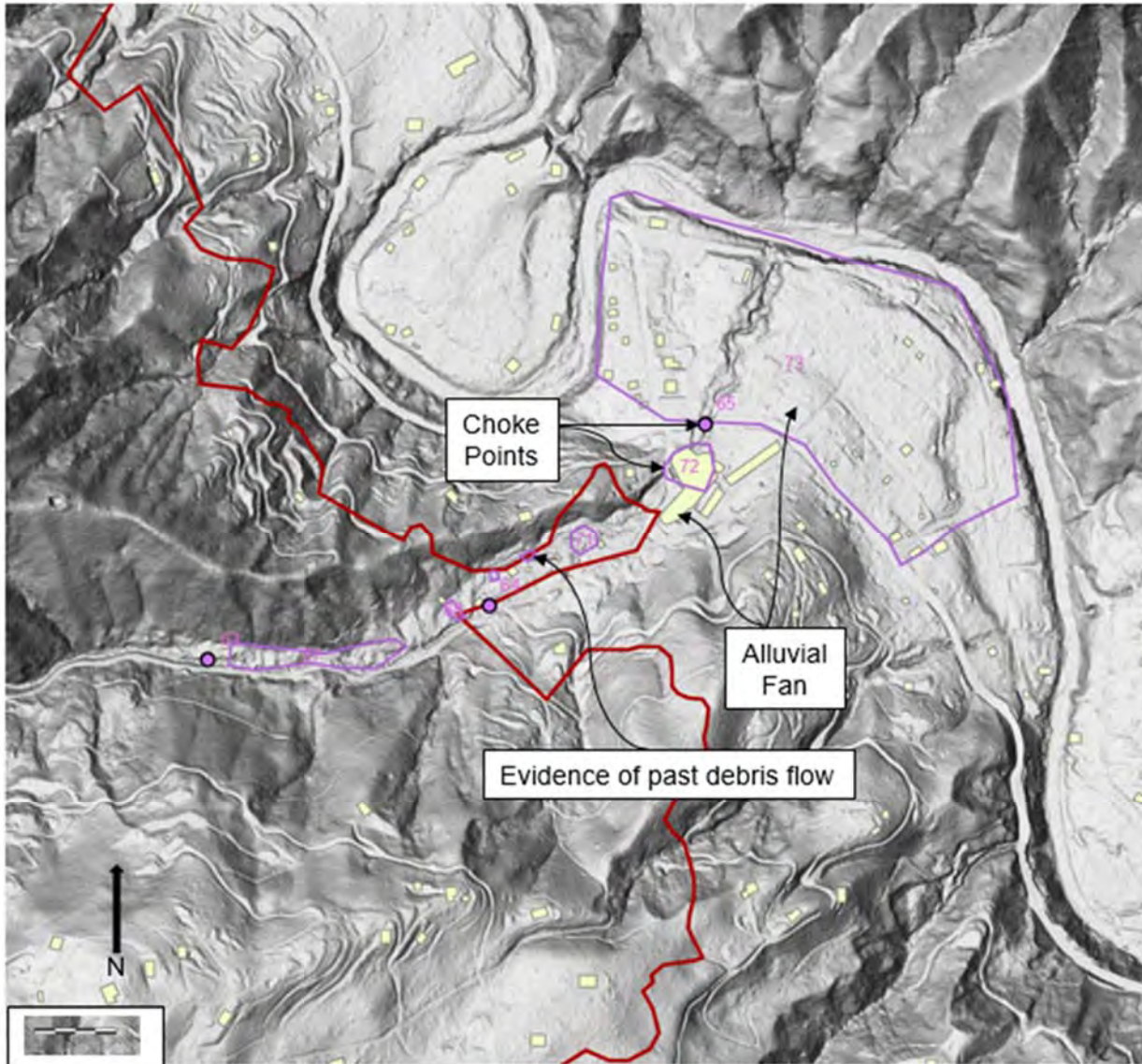


Figure 18. Site map of Clear Creek and Brookdale (VARs 65 – 73) showing potential locations of choke points (potential avulsion points) and alluvial fans. Past debris flow deposits were observed in the channel.

Recommendations

- Consider specific recommendations for VARs provided in Appendix B.
- Utilize early warning systems tied to prediction of incoming storm events.

- Educate the public about post-fire debris flows and how rapidly they move. The public should be informed to be out of the way of potential flow paths before a storm impacts the area.
- Areas along the Highway 9 corridor that are identified as post-fire hazard areas (VARs 34, 35-36, 37-39, 40-47, 48, 52, 61-67, and 71-73) should not be occupied during storm warnings.
- Provide Boulder Creek residents and commercial business owners with the information included in this report so they may understand their proximity to hazard areas and take appropriate actions.
- Perform storm patrols and monitor road drainage infrastructure.
- Consider vegetation and debris removal within channels, particularly at watercourse crossings.
- Utilize experts in civil, geotechnical, and hydrologic engineering, soil erosion, hydrology and engineering geology to develop site-specific recommendations and mitigation activities.
- Consider and evaluate the potential for installing stormwater control and deflection structures, including sand bags and/or concrete K-rails, along stream banks and around residences where high flood flows and debris flows are predicted along drainages.

China Grade/Upper Pescadero Creek

Observations

The China Grade/Upper Pescadero Creek area is located in the northeastern portion of the CZU Lightning Complex burned area. Northeast facing slopes within this portion of the burned area drain directly into Pescadero Creek. Land use in this area is comprised of recreational (County and State Parks) and industrial timberland.

Park facilities and infrastructure within this portion of the fire are located on the northeast side of Pescadero Creek, opposite of the burned area. Soil burn severity in the northeast portion of the fire was observed to be very low/unburned to low. For these reasons, no site-specific VARs were identified within the China Grade/Upper Pescadero Creek area.

Bedrock underlying this portion of the burned area is comprised of moderately folded and faulted sedimentary rocks (Tb, Tsr, and Tst), which may be prone to increased erosion due to the decrease in ground cover as a result of wildfire. It is likely that areas within the burned area that drain into Pescadero Creek may result in increased sediment bulking and flood impacts downstream to the communities of Loma Mar and Pescadero.

Recommendations

- Perform storm patrols and monitor road drainage infrastructure.
- Consider vegetation and debris removal within channels, particularly at watercourse crossings.

- Temporary closure of Pescadero Creek County Park, San Mateo County Memorial Park, and Portola Redwoods State Park facilities during the rainy season.

Community and Municipal Water Supply

Several community and municipal water supply systems are located within the CZU Lightning Complex (Table 9). The City of Santa Cruz has several water intakes at potential risk including (1) an intake in a tributary of the East Branch of Liddell Creek; (2) an intake on Laguna Creek off of Smith Grade (VAR 106); (3) an intake within the San Lorenzo River near Felton (VAR 103); and (4) an intake within the San Lorenzo River in the City of Santa Cruz (VAR 105). The water systems on the San Lorenzo River account for approximately 47 percent of the city’s water supply (<https://www.cityofsantacruz.com/government/city-departments/water/where-does-our-water-come-from>). The community of Davenport has a surface water intake (VAR 104) within San Vicente Creek that requires manual maintenance to clean intake screens and to shut off the intake structure. The San Lorenzo Valley Water District (SLVWD) has multiple surface water intakes in steep catchments near the communities of Brookdale and Boulder Creek (VARs 99, 101, 108-112). The SLVWD surface water intakes potentially affected by the fire account for approximately 50% of the water district’s water supply (SLVWD, personal communication, 2020).

Table 9. Post-fire watershed characteristics and the potential risk to water supply infrastructure.

Water Facility	Watershed Area	Percent Burned	Percent Burned at Moderate to High SBS	Potential for Water Quality Impact	Potential for Physical Damage
City of Santa Cruz					
Liddell Creek				Low	Low
Laguna Creek	3.5	61	6.6	Low/Mod	Low
San Lorenzo River at Felton	105.4	19	2.3	Low/Mod	Low
San Lorenzo River at Santa Cruz	114.6	18	2.1	Low/Mod	Low
Davenport					
San Vicente	5.8	100	12	Low/Mod	Mod
San Lorenzo Valley Water District					
Clear Creek infrastructure				High	High
Boulder Creek infrastructure				High	High

Post-fire conditions pose several threats to community and municipal water supply within and downstream of the CZU Lightning Complex. Physical damage can occur to water intake and conveyance structures, especially when infrastructure is situated in areas prone to debris flows and/or increased flood flows. Higher proportions of moderate and high soil burn

severity can increase sediment, nitrate and organic nitrogen concentrations, as well as total phosphorus (Rust et al., 2019). High turbidity and dissolved organic carbon (DOC) can affect treatment process performance (Hohner et al., 2019). Of special concern is the formation of toxic disinfection byproducts (DBP) during water treatment (Hohner et al., 2019).

The highest risk is for the San Lorenzo Valley Water District water intakes and water lines in the Boulder Creek and Brookdale areas. These water systems are at risk from physical damage from debris flows, flood flows, and rockfall. Impacts to water quality are also expected to be high for waters draining to these systems. The Liddell Creek intake for the City of Santa Cruz is expected to have little impact from the fire, given that the water source is primarily subsurface. We anticipate a low potential for physical damage to water supply infrastructure in the Laguna Creek and San Lorenzo River watersheds, although impacts to water quality can be expected.

General Recommendations

Early Warning Systems

Data from the Big Sur area indicate that early warning rainfall thresholds should be initially based on 0.2, 0.3, and 0.5 inches for 15, 30, and 60 minutes, respectively. The WERT strongly recommends that Santa Cruz/San Mateo County Department of Public Works, Santa Cruz/San Mateo County Office of Emergency Services (OES), the National Weather Service, CAL FIRE CZU San Mateo-Santa Cruz Unit, and other response agencies monitor rainfall intensities during and after storms, as well observe post-fire response following storm events. If the initial rainfall threshold is too conservative and little happens during storm events, data and observations should be used to adjust the threshold upward in a defensible manner.

Existing early warning systems should be used and improved such that residents can be alerted to incoming storms, allowing enough time to safely vacate hazard areas. In areas where cellular reception is poor or non-existent, methods should be developed to effectively contact residents. For example, installation of temporary mobile cellular towers should be considered. Early warning systems for the CZU Lightning Complex should take advantage of the following services:

National Weather Service Forecasting

Flash flood and debris flow warnings with practical lead times of several hours must come from a combination of weather forecasts, rainfall measurements of approaching storms, and knowledge of triggering thresholds. The following information is from the National Weather Service (NWS); they provide flash flood and post-fire debris flow “watch” and “warning” notifications for burned areas:

The NWS provides 24/7 information on watches, warnings and advisories for California. For additional information, see:

NWS – San Francisco Forecast Office: <https://www.weather.gov/mtr/>

NWS - Post-wildfire flash flood and debris flow guide

<http://www.wrh.noaa.gov/lox/hydrology/files/DebrisFlowSurvivalGuide.pdf>

CodeRED (Santa Cruz County)

The CodeRED notification system sends important messages to residents and businesses within Santa Cruz County in the event of emergency situations or critical community alerts. Examples of notifications include: evacuations, bio-terrorism alerts, missing person reports, and severe weather alerts.

<https://public.coderedweb.com/CNE/en-US/218A80E36F49>

SMC Alert (San Mateo County)

SMC ALERT is an alert notification system used to immediately contact people during urgent or emergency situations. Alerts can be set to send emergency and non-emergency text and voice messages to email accounts, cell phones, smartphones, tablets, and voice messages to landline phones.

Emergency notification sign-up:

<https://hsd.smcsheriff.com/smcalert>

Wireless Emergency Alerts (WEA)

WEA is an alert system originated by the NWS that can inform residents and businesses of flash flood warnings and other potential hazards. WEA alerts are emergency messages sent by authorized government alerting authorities through mobile carriers. Government partners include local and state public safety agencies, FEMA, the FCC, the Department of Homeland Security, and the National Weather Service. No signup is required, and alerts are automatically sent to enabled WEA-capable phones during an emergency. The emergency alert setting on WEA-capable phones must be turned on to enable this function.

<https://www.weather.gov/wrn/wea>

Emergency Alert System (EAS)

EAS is a national public warning system that may also be used by state and local authorities to delivery important emergency information, such as weather information, to targeted specific areas.

Integrated Public Alert and Warning System (IPAWS)

IPAWs is a FEMA-originated system that integrates federal, state, and local emergency warning systems (e.g., WEA, EAS) into a single interface.

<https://www.fema.gov/integrated-public-alert-warning-system>

Education for Residents and General Public

First and foremost, it is critical that residents heed evacuation warnings from local officials. In the absence of an official notice, residents should pay attention to evolving conditions around their homes.

Suzanne Perry, disaster scientist from the USGS, suggests the following:

- Be ready for debris flows for 2-5 years after a wildfire. Don't worry about every storm, as it takes more intense rain (typically about ½ inch per hour – like being in a thunderstorm) on a recently burned slope to trigger a debris flow.
- Follow all evacuation orders. Debris flows can destroy everything in their path.
- Pay attention to official weather forecasts. The National Weather Service will issue a Flash Flood “Watch” or “Warning” for your area when rainfall is anticipated to be intense. Also – and this is important - the rain back in the mountains can be different than where you are. It's the rain in the mountains that will start the debris flow.
- Don't rely on what you've seen in past floods and debris flows. Debris flows can hit new areas or return to previous areas; they might be smaller - or larger - the next time. Whatever happened before, the next time could be different.
- If you must shelter in place, choose your spot in advance and stay alert. Find the highest point nearby (such as a 2nd story or roof) and be ready to get there with a moment's notice. Listen and watch for rushing water, mud, unusual sounds. Survivors describe sounds of cracking, breaking, roaring, or a freight train.
- Never underestimate a debris flow. Unlike other landslides, debris flows can start in places they've never been before. They can leave stream channels and plow through neighborhoods. When a debris flow is small, people can control it with walls, K-rails, and sandbags. When a debris flow is big enough, nothing can stop it.
- Expect other flood dangers. Storms that can cause debris flows can also cause more common flooding dangers.
- Turn Around, Don't Drown!® Never drive, walk, or bicycle through a flooded road or path. Even a few inches of water can hide currents that can sweep you away. Also, the water level can rise before you finish crossing.

For an easy to understand summary of what a debris flow is see Geology.com, [What is a Debris Flow](#).

Increased Flood Flows, Erosion and Sedimentation

Surface runoff and erosion increases, often significantly, following wildfire due to loss of surface cover, canopy, and shallow soil damage due to fire heating. Post-fire erosion modeling predicts that erosion, and therefore sedimentation, rates will be high in many portions of the burned area. In many portions of the fire, flooding and sedimentation will greatly be increased. Therefore, emergency actions, maintenance, and storm response activities should be developed with these conditions in mind.

Debris Flow Runout

No tools are currently available to rapidly predict post-fire debris flow runout. WERT geologists rely partially on geomorphic evidence to estimate the downstream extent of debris flow inundation. However, many of the at-risk sites are within built environments where geomorphic evidence has been altered or destroyed through grading and/or construction. Also, geomorphic evidence may not be sufficient to predict the downstream extent of debris flows under these post-fire conditions. In areas below large, severely burned drainages (e.g., Waddell Creek, Scott Creek, Big Creek, Clear Creek, Boulder Creek, etc.), the areal extent of debris flow inundation is highly uncertain. The WERT strongly recommends more detailed analysis to further refine the identification downstream debris flow inundation areas.

Rockfall

Numerous rockfall hazards were identified during field evaluations. However, due to the rapid nature of the evaluation, a fully comprehensive evaluation of rockfall hazard was not possible. DeGraff and Gallegos (2012) provide an overview of rockfall hazard following wildfire, along with suggested approaches for identifying these hazards. The WERT strongly recommends more detailed analysis to further refine the identification of rockfall hazard areas. Signs should be posted in areas of rock fall hazard, for example along Whitehouse Canyon Road.

Road Drainage Systems, Storm Monitoring, and Storm Maintenance

The communities within and downstream of the burned area are serviced via a network of private and public roads and highways. Caltrans, Santa Cruz and San Mateo counties, and various cities and municipalities maintain numerous roads within and downstream of the burned area. Due to the relatively large proportion of moderate and high soil burn severity, increased flows on slopes and onto the road system and into storm drain systems can be expected. Loose and erodible soils that mantle the slopes could wash down, inundate, and plug these drainage systems. Flows could be diverted down roads and cause erosion and possible blockage, and/or loss of portions of the road infrastructure and structures along roads. The WERT did not evaluate the potential for rockfall, sedimentation, flooding, or debris flow hazards at all roads or watercourse crossings along federal, state, county, municipal or private road corridors. Existing road drainage systems should be inspected by the appropriate controlling agency to evaluate potential impacts from floods, hyperconcentrated floods, debris torrents, debris flows, and sedimentation resulting from storm events. Spatial data generated by the USGS and the WERT (e.g., USGS debris flow model, ERMiT model, and flood flow predictions) can be used to screen potential at-risk areas.

Storm Drains

Storm drains will be subject to increased flooding, sediment, and debris. In addition, flooding below debris flow prone areas is difficult, if not impossible to predict. It was beyond the scope of this evaluation to examine every storm drain. The WERT recommends further evaluation of the storm drain systems so that appropriate protective measures are put into place.

Signage

Place temporary signage in areas of potential post-fire rockfall, debris flow, and flooding hazards. Place signage along roads, bridges, and other types of crossings identified at risk of flooding, rockfalls, and debris flows. The WERT suggests responsible agencies consider installing gates, warning signs, or other measures to alert and keep people out of areas of identified risk.

Housing, Transitional, Temporary

When there is need for temporary housing or new building construction for residents displaced by the fire, site-specific evaluation of hazards for temporary housing should be conducted by a qualified professional and in accordance with the local lead agency. In addition to assessing the potential for increased flood hazards near watercourses, the following factors should be considered as part of the evaluation. On hillslopes above potential temporary housing and building sites:

- Could runoff from the hillslope concentrate in swales and small drainages and flow onto the site, and flood or otherwise damage the proposed structure, or present a life-safety hazard?
- Is the hillslope behind the structure steep and erodible, where rilling, gullying, or shallow failures could deliver a sufficient volume of sediment and debris to damage the proposed structure or pose a life-safety hazard?
- Are large rocks, boulders, or other material present on the slope that pose a rock or debris fall hazard that could impact the proposed structure, or present a life-safety hazard?
- Is there evidence of recent or impending erosion or mass wasting that could damage the proposed structure or pose a life-safety hazard (e.g., debris torrents/flows, deep-seated slides or slumps)? How about on hillslopes below potential temporary housing and building sites?
- Is there evidence of recent or impending fill slope landslide-type failures that indicate an elevated risk of building pad failure?
- Is the building pad located above a watercourse where normal or flood flows could potentially erode the toe of the slope and trigger failure? If any of these conditions are present, then mitigations need to be implemented, or alternative sites need to be identified and evaluated. Technical experts such as licensed engineers or geologists may be needed to support the evaluation.

Schools

The Boulder Creek Elementary School is situated in the community of Boulder Creek adjacent to State Route 9. The school is built on an alluvial fan which is potentially subject to combined debris flow and flood hazards following the CZU Lightning Complex. The school should be considered for closure during threshold storm events because of the potential for debris flows and/or flooding on the alluvial fan surface.

Parks, Campgrounds, Recreational Trails, Trailer Parks

Several parks and campgrounds are located within or downslope/downstream of the CZU Lightning Complex burned area, with some potentially being affected by post-fire flood and

geologic hazards. Campgrounds, day use, and trails should be closed in response to NWS flash flood watches and warnings. Signage should be placed in campgrounds, day use areas, at trailheads, and park entrances to warn users of post-fire watershed hazards.

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APPENDIX A: CZU LIGHTNING COMPLEX CONTACTS

Name	Title	Entity	Email	Phone Number
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Nate Armstrong	Deputy Chief	CAL FIRE CZU	Nate.Armstrong@fire.ca.gov	(831) 335-6701
Rich Sampson	Unit Forester	CAL FIRE CZU	Richard.Sampson@fire.ca.gov	(831) 335-6742
Mark Strudley	Division Manager	Santa Cruz DPW – Flood Control	Mark.Strudley@santacruzcounty.us	(831)-454-2160
Makena Wong	Associate Project Manager	San Mateo County Flood	mwong@oneshoreline.org	(650) 272-7684
Chris Spohrer	District Superintendent	CA State Parks	Chris.Spohrer@parks.ca.gov	(831) 335-6390
Michael Bennett	Deputy IC	Santa Cruz County OES		(831) 239-1499
Whit Garaguchi	District Conservationist	NRCS	Whitney.Haraguchi@usda.gov	(831) 227-22901

Shaded rows = polygons
 White rows = points

CZU Lightning Complex Fire Values-at-Risk Table

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
1	Big Basin State Park	37.16529	-122.22489	Scour along eastern abutment. Landslides visible on hillshade along upstream slopes.	debris flow / flood	Bridge	other	low	low	Monitor and maintain
2	Big Basin State Park	37.16463	-122.22852	Moderate to steep slopes above with moderate burn severity, potential for shallow debris slides to impact facility	debris flow	Infrastructure	utilities	low	moderate	Early Warning, monitor and maintain
3	Big Basin State Park	37.18971	-122.20865	Flooding and debris flows could impact dam. Slopes upstream with moderate to high burn severity and visible landslides on hillshade imagery. Existing 12" diameter drainage pipe along east side of embankment is damaged. Spillway outlet prone to plugging.	debris flow / flood	Dam, domestic water supply.	utilities	low	moderate	Monitor and maintain
4	Big Basin State Park	37.18583	-122.20923	90 degree turn in creek observed approximately 80ft upstream of the tank. Potential for water and debris to leave the main channel and flow towards tank.	debris flow / flood	Infrastructure	utilities	low	moderate	Monitor and maintain, deflection structure
6	Big Basin State Park	37.16842	-122.21352	Choke point, 10-foot diameter arched culvert appears to be chokepoint for upstream watershed. Potential to plug with woody debris, overtop and washout road prism.	debris flow / flood	Road	drainage structure	low	moderate	Monitor and maintain
7	Big Basin State Park	37.16780	-122.19682	36-inch concrete box culvert has potential to overtop and washout road prism. Crossing located downstream of steep slopes with high potential for debris flows. Watercourse contains large amount of woody debris.	debris flow / flood	Road	drainage structure	low	moderate	Monitor and maintain
8	Big Basin State Park			Debris flow/slide. Campgrounds located on alluvial fan deposits visible of hillshade imagery. Moderate to steep slopes above.	debris flow	Campgrounds	recreational	moderate	low	Early Warning, temporary closure

Shaded rows = polygons

White rows = points

CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
9	Big Basin State Park			Loss of access, numerous culverts along road prone to plugging and blowing out. Waterline from dam runs within road prism. Watercourse contains significant amount of woody debris	debris flow / flood	Reservoir access	multiple	low	moderate	Monitor and maintain
10	Big Basin State Park			Debris flow, structures built on alluvial fan deposits. Fuel tanks and 55-gallon drums have potential to spill into watercourse.	debris flow	Fuel tanks	utilities	low	high	Site cleanup
11	Big Basin State Park			Campground located on floodplain upstream of choke point along highway 236	debris flow / flood	Infrastructure	recreational	moderate	low	Early Warning, temporary closure
12	Big Basin State Park	37.15634	-122.20095	Culvert along Little Basin Road has potential plug and washout. Drainage contains moderate to steep slopes, with a moderate to high debris flow potential. Rockfall also observed along the road in the vicinity of the crossing.	debris flow	Infrastructure	drainage structure	high	low	Monitor and maintain, signage
13	Big Basin State Park	37.19429	-122.21229	Approximately 150 feet of retaining wall is damaged	other	retaining wall	other	low	moderate	Further evaluation should be made by a PE or PG
14	Big Basin State Park	37.16654	-122.20021	Retention pond along paved access road has potential to overtop and divert towards residence. Moderate to steep slopes upstream, with a moderate to high potential for debris flows.	debris flow	Residence, access road	drainage structure	moderate	moderate	Monitor and maintain
15	Big Basin State Park	37.16680	-122.35924	House within floodplain, large portion of upstream watershed located within burn area.	flood	Residence	home	moderate	moderate	Early Warning, sandbags
16	Big Basin State Park	37.16932	-122.35675	Well house and associated equipment within floodplain. Large portion of upstream watershed located in burn area.	flood	Pump house/well	utilities	low	moderate	Early Warning, sandbags

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
17	Big Basin State Park	37.18585	-122.33963	Flooding/debris jam has potential to overtop bridge. Bridge founded on sill logs located immediately above channel slope along northern abutment.	flood	Bridge	drainage structure	low	moderate	Early Warning, monitor and maintain
18	Big Basin State Park			Unable to access property. Homes located at the bottom of two drainages with a high potential for debris flows. Addition determinations and observations should be made by a PG or PE.	debris flow	Residences	home	moderate	moderate	Early Warning, deflection structure
19	Big Basin State Park	37.13481	-122.31221	Upstream watercourse mapped as a moderate to high potential for debris flows. Watercourse contains large amounts of debris. Classroom buildings within lower portion of the property are located adjacent to watercourse.	debris flow	Residence	home	low	moderate	Early Warning, deflection structure, temporary closure
20	Big Basin State Park	37.10856	-122.27299	Flooding could impact the bridge, large watershed upstream.	flood	Bridge	other	low	moderate	Monitor and maintain
21	Big Basin State Park	37.10334	-122.27702	Flooding could impact the bridge, large watershed upstream.	flood	Bridge	other	low	moderate	Monitor and maintain
22	Big Basin State Park			Flooding could impact several homes within floodplain.	flood	Residences	home	low	moderate	Early Warning
23	Whitehouse Creek			Adjacent slopes are steep and appear prone to debris slides/flows. Rockfall hazard also present.	rock fall	Residential access	other	high	moderate	Early Warning, signage
24	Big Basin State Park			Debris flow, homes located on alluvial fan deposits visible on hillshade imagery. Additional determination and observations should be made by a PG or PE.	debris flow	Residences	home	moderate	moderate	Early Warning, signage

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 White rows = points

CZU Lightning Complex Fire Values-at-Risk Table

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
25	Big Basin State Park			Debris flow, homes located on alluvial fan deposits visible on hillshade imagery. Additional determination and observations should be made by a PG or PE.	debris flow	Six Residences	home	moderate	moderate	Early Warning, signage
26	Butano Creek	37.23994	-122.31711	Flooding could impact bridge. Large portion of upstream watershed located in burn area.	flood	Bridge	other	low	moderate	Monitor and maintain
27	Butano Creek	37.24017	-122.31766	Flooding could impact bridge. Large portion of upstream watershed located in burn area.	flood	Bridge	other	low	moderate	Monitor and maintain
28	Butano Creek	37.24028	-122.31828	Community water tanks, pump house and purification system within floodplain	flood	Community water supply	utilities	low	moderate	Monitor and maintain, sandbags
29	Butano Creek	37.23488	-122.32345	Flooding could impact bridge. Scour observed along abutments.	flood	Residential access	other	low	moderate	Monitor and maintain
30	Butano Creek	37.23110	-122.32600	Flooding could impact bridge. Large portion of upstream watershed located in burn area.	flood	Residential access	other	low	moderate	Monitor and maintain
31	Butano Creek	37.23065	-122.32739	Flooding could impact bridge. Vertically stacked log abutments functioning as retaining wall along eastern abutment.	flood	Residential access	other	low	moderate	Monitor and maintain
32	Butano Creek			Numerous residences within floodplain. Homes along southern side are adjacent to moderate to steep slopes with potential for debris flows.	debris flow / flood	Residences.	home	moderate	high	Early Warning
33	Butano Creek	37.22146	-122.33489	Debris flow has potential to impact structures and pump house for campground.	debris flow	Camp structures	recreational	moderate	moderate	Early Warning, deflection structure, temporary closure
34	Highway 9 Corridor	37.14987	-122.16747	House located along tributary to Jamison Creek. Evidence of past debris flow activity, including large boulders within channel and adjacent to structure.	debris flow	House	home	high	high	Early Warning

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
35	Highway 9 Corridor	37.14603	-122.15844	CALFIRE Jamison Creek Station located along Jameson Creek. Within alluvial fan at bottom of creek. Box culvert at highway 236 is SW of building.	debris flow / flood	CALFIRE station.	other	moderate	moderate	Early Warning
36	Highway 9 Corridor	37.15667	-122.17591	House located on fan at base of steep watercourse. Multiple debris slides mapped upstream.	debris flow	House	home	moderate	moderate	Early Warning
37	Highway 9 Corridor			Multiple residential properties along Jamison Creek. High potential for debris flow. About 2 sq km drainage above, addition determinations and observations should be made by a PG or PE.	debris flow / flood	Residential properties	home	high	high	Early Warning, sandbags
38	Highway 9 Corridor			Multiple residential properties along Jamison Creek. High potential for debris flow. About 4 sq km drainage above, addition determinations and observations should be made by a PG or PE.	debris flow / flood	Residential properties	home	high	high	Early Warning
39	Highway 9 Corridor			Multiple residential properties alluvial fan at bottom Jamison Creek. About 4 sq km drainage above, addition determinations and observations should be made by a PG or PE.	debris flow / flood	Residential properties	home	moderate	moderate	Early Warning, sandbags
40	Boulder Creek			Neighborhood constructed on alluvial fan. Avulsion point observed at top of development. Several foundations constructed over and/or immediately adjacent to watercourse channel. Also impacts to State Highway 236. Evidence of historic debris flow activit	debris flow	Multiple houses and foundations. SR 236.	home	high	high	Early Warning

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
41	Highway 9 Corridor			Three houses east of SR236 located at mouth of fan deposit. Undersized culvert crosses highway and proceeds under house.	debris flow / flood	3 houses and highway.	home	low	moderate	Early Warning, clear and maintain culvert
42	Highway 9 Corridor			Neighborhood constructed on alluvial fan. Several foundations constructed over and/or immediately adjacent to watercourse channel. No obvious channel observed within the deposit fan. Also impacts to State Highway 236.	debris flow	Multiple houses and foundations. SR 236.	home	moderate	high	Early Warning
43	Highway 9 Corridor			Houses located along Boulder Creek in flood plain. Also immediately downslope of debris slide slopes.	debris flow / flood	Homes on downslope side of Brook Lane	home	low	moderate	Early Warning
44	Highway 9 Corridor			Three burned PVC water tanks, one redwood water tank, 1 burned house, and one unburned house located within debris flow channel	debris flow	Water tanks, house pad, and house	home	moderate	moderate	Early Warning
45	Highway 9 Corridor			Three burned house plus one house adjacent to channel. About a dozen houses further downslope on apparent fan deposit. No drainage facilities were observed downstream of swale. Upstream drainage area below debris model threshold.	debris flow	18 houses	home	moderate	moderate	Early Warning
46	Highway 9 Corridor			Houses adjacent to and downstream of channel. Additional houses downstream of apparent fan deposit. One storm drainage inlet located in swale above Ridge Road. Storm drain on Ridge Road. Upstream drainage area below model threshold.	debris flow	About 30 houses	home	moderate	moderate	Early Warning

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
47	Highway 9 Corridor			One house adjacent debris flow channel. About 18 houses further downslope on apparent fan deposit. Park Road appears to be preferential pathway. Upstream drainage area below debris model threshold.	debris flow	About 20 houses	home	moderate	moderate	Early Warning
48	Highway 9 Corridor			Residential homes adjacent and in Foreman Creek. High potential for debris flow. Debris flow deposits and boulders in channel. Debris flow levee observed within channel. About 2 sq km drainage above, addition determinations should be made by PG or PE	debris flow / flood	Residential properties	home	high	high	Early Warning
49	Highway 9 Corridor			Two Houses located along watch stream/ debris flow segment. Existing concrete retaining walls at base of house along creek to protect house foundations.	debris flow / flood	House	home	low	moderate	Early Warning
50	Highway 9 Corridor			Several houses located on fan deposits	debris flow / flood	10 houses	home	moderate	moderate	Early Warning
51	Highway 9 Corridor			At bend in Peavine Creek. Model indicates moderate to high potential upstream. Watershed extends to top of Ben Lomand Mountain.	debris flow / flood	5 houses	home	low	moderate	Early Warning
52	Highway 9 Corridor			Three Houses located along Boulder Creek. Foundation supports within the 1-year flood plain. Some foundation elements are rotated. Evidence of ongoing scour and foundation problems.	debris flow / flood	Homes downslope of roads	home	moderate	high	Early Warning

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
53	Highway 9 Corridor			Three houses built on watercourse channel. Evidence of creep and foundation issues. Existing structural weakness could be exacerbated with increased post-fire sediment and runoff.	debris flow / flood	Three houses	home	low	moderate	Early Warning
54	Highway 9 Corridor	37.16503	-122.16429	House and deck located immediately adjacent to Boulder Creek. Deck post rotated.	flood	House	home	low	moderate	Early Warning
55	Highway 9 Corridor	37.16359	-122.16279	Potential for flooding impacts to temporary housing site. Apparent former structure and shipping container located within bank full flood plain of Boulder Creek. Also, rail car bridge.	flood	Burned structure and rail car bridge.	home	low	moderate	Early Warning
56	Highway 9 Corridor	37.15813	-122.15587	House located adjacent to small channel. Channel mapped as low debris flow probability.	debris flow	House and outbuildings	home	low	moderate	Early Warning
57	Boulder Creek	37.12655	-122.13423	Well box located in Creek. Creek identified as low probability debris flow.	debris flow	Well box	utilities	low	moderate	Monitor and maintain
58	Boulder Creek	37.12420	-122.12994	House located adjacent to modeled debris flow channel segment. Model shows low potential. Possible small avulsion upstream of house. Homeowner constructed berm to channel flow away from house	debris flow	House	home	low	moderate	Early Warning
59	Highway 9 Corridor			About a dozen houses located immediately adjacent to watch stream. Pool located within channel. Gabion walls and retaining structures observed along channel adjacent houses.	flood	Houses located within channel.	home	moderate	moderate	Early Warning

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
60	Highway 9 Corridor			Houses on apparent old alluvial fan. Channel mapped as low probability. Channel is minor about 2 feet wide by 18 inches depth. Potential for minor avulsion. And flood debris impacts.	debris flow / flood	Houses	home	low	moderate	Early Warning, sandbags
61	Highway 9 Corridor			Large alluvial fan observed town of Boulder Creek. Elementary school and cemetery at fan apex. Avulsion pathway highly uncertain. Potential avulsion point observed ~500ft SW of cemetery. Additional determinations and observations should be made by a PG/PE	debris flow / flood	School, cemetery, homes, and businesses	other	moderate	moderate	Early Warning, deflection structure
62	Highway 9 Corridor			Neighborhood built on fan deposit. Resident at top of street reports existing drainage has handled surface drainage within the past 9 years. Additional determinations and observations should be made by a PG or PE	debris flow / flood	About twenty houses	home	low	moderate	Early Warning, clear and maintain culvert
63	Highway 9 Corridor	37.10501	-122.11633	Existing house and driveway bridge	debris flow	House and access bridge	home	high	high	Early Warning, signage
64	Highway 9 Corridor	37.10565	-122.11219	Existing house	debris flow	House	home	high	high	Early Warning, signage
65	Highway 9 Corridor	37.10778	-122.10901	Highway 9 bridge	debris flow / flood	Bridge	other	low	moderate	Monitor and maintain
66	Highway 9 Corridor			Potential for debris flow to impact temporary housing site. Existing structures destroyed.	debris flow	House	other	high	moderate	Early Warning
67	Highway 9 Corridor			Burned homes pads that can be used as temp housing. Additional determination and observations should be made by a PG or PE.	debris flow	Temp housing	other	high	moderate	Early Warning, signage
68	Highway 9 Corridor			Existing house	debris flow	House	home	high	high	Early Warning, signage

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
69	Highway 9 Corridor			Existing house	debris flow	House	home	high	high	Early Warning, signage
70	Highway 9 Corridor			Existing house	debris flow	House	home	high	high	Early Warning, signage
71	Highway 9 Corridor			Existing house	debris flow	House	home	high	high	Early Warning, signage
72	Highway 9 Corridor			Existing structure old building part of Brookdale lodge, the creek runs under the structure. Additional determination and observations should be made by a PG and PE.	debris flow	Structure lodge	business	high	high	Early Warning, signage
73	Highway 9 Corridor			Residential community on alluvial fan. Additional determination should be made by a PG or PE	debris flow / flood	multiple homes and businesses	multiple	high	high	Early Warning, signage, 3.8 sq km drainage area above, uncertain where avulsion would flow, additional determinations and observations should be made by professional geologist/engineer
74	Highway 9 Corridor	37.17506	-122.14376	House located adjacent to watercourse. Stream is channelized through property. Potential for clogging and flooding.	flood	House and shed	home	low	moderate	Early Warning, sandbags
75	Highway 9 Corridor	37.16777	-122.14390	House located at mouth of canyon.	debris flow	House	home	moderate	moderate	Early Warning
76	Highway 9 Corridor			YMCA camp located along San Lorenzo River. Low debris flow potential on tributaries to San Lorenzo. Possible flooding on structures adjacent to San Lorenzo.	debris flow / flood	Camp buildings and pool	recreational	low	moderate	Early Warning, sandbags, close camp during winter
77	Highway 9 Corridor			Low debris flow potential on tributary to San Lorenzo. Possible debris flow impacts to residential structures adjacent to San Lorenzo. Channel is deeply incised, near vertical side channels. Potential choke point at culvert crossing on Wildwood Road	debris flow / flood	homes	home	moderate	moderate	Early Warning

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
78	Highway 9 Corridor	37.15346	-122.14167	Potential for debris flow to impact temporary housing site. Burned house located immediately adjacent to watercourse with a low probability for debris flow.	debris flow	Burned house	home	moderate	low	Early Warning, early warning
79	Highway 9 Corridor	37.15297	-122.14053	Potential for debris flow to impact temporary housing site. Burned house located immediately adjacent to watercourse with a low probability for debris flow.	debris flow	Burned house	home	moderate	low	Early Warning, early warning
80	Highway 9 Corridor	37.14840	-122.14038	Potential for debris flow to impact temporary housing site. Burned house located immediately adjacent to watercourse with a low probability for debris flow.	debris flow	Burned house	home	moderate	moderate	Early Warning, early warning
81	Highway 9 Corridor	37.17457	-122.13964	House located above bend in San Lorenzo River. Existing channel scour is endangering house.	flood	House	home	moderate	moderate	Early Warning
82	Swanton			Impact to CAL FIRE station including fuel tank. Plugging at culvert just upstream (east) of station, may direct flows towards structure and/gas vault.	debris flow / flood	CAL FIRE station	other	moderate	moderate	Deflection structure, debris barrier, clear and maintain basin
83	Swanton			Potential for flooding to impact temporary housing site. Existing structures destroyed.	flood	Temporary housing	other	moderate	moderate	Early Warning
84	Swanton			Potential for flooding to impact temporary housing site. Existing structures destroyed.	debris flow / flood	House	home	moderate	moderate	Early Warning
85	Swanton			Potential for flooding to impact temporary housing site. Existing structures destroyed.	debris flow / flood	Temp house pad	home	moderate	moderate	Early Warning
86	Swanton			Potential for flooding to impact temporary housing site. Existing structures destroyed.	debris flow	Temp housing	other	low	low	Clear and maintain culvert, early warning
87	Swanton			Potential for flooding to impact temporary housing site. Existing structures destroyed.	debris flow	Temp house	other	moderate	moderate	Early Warning

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CZU Lightning Complex Fire Values-at-Risk Table

Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
88	Swanton	37.06378	-122.22690	Bridge appears to be choke point for debris and sediment. Woody debris could block bridge	debris flow / flood	Bridge	drainage structure	low	moderate	Clear and maintain basin, monitor and maintain
89	Swanton	37.07465	-122.22118	Flooding impact to fish hatchery and structures	flood	Fish hatchery buildings and ponds	utilities	moderate	high	Early Warning
90	Swanton	37.07420	-122.22218	Potential for flooding to impact temporary housing site. Existing structures destroyed.	flood	temporary housing	other	moderate	moderate	Early Warning
91	Swanton	37.06709	-122.22902	Bridge within floodplain. Large watershed upstream with a mapped moderate to high potential for debris flows. Numerous landslides visible adjacent to watercourse and tributaries on LiDAR imagery.	debris flow / flood	Bridge on swanton road	drainage structure	low	moderate	Clear and maintain basin, early warning
92	Swanton	37.07459	-122.23583	House in potential debris flow / flood path.	debris flow	House	home	high	high	Deflection structure, early warning, debris barrier, K rail
93	Swanton	37.07983	-122.24705	Flooding could impact bridge, large watershed upstream.	flood	Bridge	other	low	moderate	Monitor and maintain
95	Swanton			Homes within floodplain	flood	Residential homes	home	low	moderate	Early Warning
96	Swanton			Homes within floodplain	flood	Residences	home	low	moderate	Early Warning
97	Water District Intakes			Domestic water company located on a tributary to Jamison Creek. Large boulders observed in channel indicate past debris flow activity and potential for avulsion.	debris flow / flood	Big Basin Water Company Facilities.	utilities	low	moderate	Early Warning, deflection structure, prepare for increased organics
98	Water District Intakes	37.13735	-122.15206	Local water district pump house and intake lines. Intake pipe observed extending upstream. Pipe located within active debris flow channel.	debris flow / flood	Big Basin Water Company Facilities	utilities	low	high	Monitor and maintain, prepare for increased organics
99	Water District Intakes	37.10550	-122.13102	Impacts to intake, water quality	debris flow	SLV Water District Intake	utilities	low	high	Monitor and maintain, monitor and maintain, prepare for increased organics
101	Brookdale, Clear Creek	37.10745	-122.13285	impacts to San Lorenzo Valley water intake	debris flow	water intake	utilities	low	high	Clear and maintain basin, monitor and maintain, prepare for increased dissolved organics

Shaded rows = polygons
 White rows = points

CZU Lightning Complex Fire Values-at-Risk Table

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
103	Water District Intakes	37.04566	-122.07222	Post-fire runoff could result in excessive organic that would impair water treatment.	other	San Lorenzo River at Felton Intake	utilities	low	moderate	Monitor and maintain, prepare for increased organics
104	San Vincent Creek, Davenport water intake	37.05524	-122.18163	Potential for sedimentation, possible impacts to water quality	flood	Municipal water intake	utilities	low	low	Clear and maintain culvert, prepare for increased organics
105	Water District Intakes	36.98989	-122.02983	Post-fire runoff could result in excessive organic that would impair water treatment.	debris flow / flood	San Lorenzo River at Santa Cruz intake	utilities	low	moderate	Monitor and maintain, prepare for increased organics
106	Water District Intakes	37.02423	-122.13111	Impacts to water quality at City of Santa Cruz water intake	other	City of Santa Cruz water intake	utilities	moderate	low	Clear and maintain basin, monitor and maintain, prepare for increased organics
107	Brookdale, Clear Creek			Impacts to intake, water quality	debris flow / flood	Water intake	utilities	low	high	Monitor and maintain, prepare for increased organics
108	Brookdale, Clear Creek	37.10470	-122.12901	Impacts to San Lorenzo Valley water intake	debris flow	water intake	utilities	low	high	Clear and maintain basin, monitor and maintain, prepare for increased dissolved organics
109	Brookdale, Clear Creek	37.09868	-122.12789	impacts to San Lorenzo Valley water intake	debris flow	Water intake	utilities	low	high	Clear and maintain basin, monitor and maintain, prepare for increased dissolved organics
110	Foreman Creek	37.12461	-122.14264	impacts to San Lorenzo Valley water intake	debris flow	water intake	utilities	low	high	Clear and maintain basin, monitor and maintain, prepare for increased dissolved organics
111	Silver Creek	37.12971	-122.14631	impacts to San Lorenzo Valley water intake	debris flow	water intake	utilities	low	high	Clear and maintain basin, monitor and maintain, prepare for increased dissolved organics
112	Peavine Creek	37.13236	-122.15088	impacts to San Lorenzo Valley water intake	debris flow	water intake	utilities	low	high	Clear and maintain basin, monitor and maintain, prepare for increased dissolved organics

Shaded rows = polygons

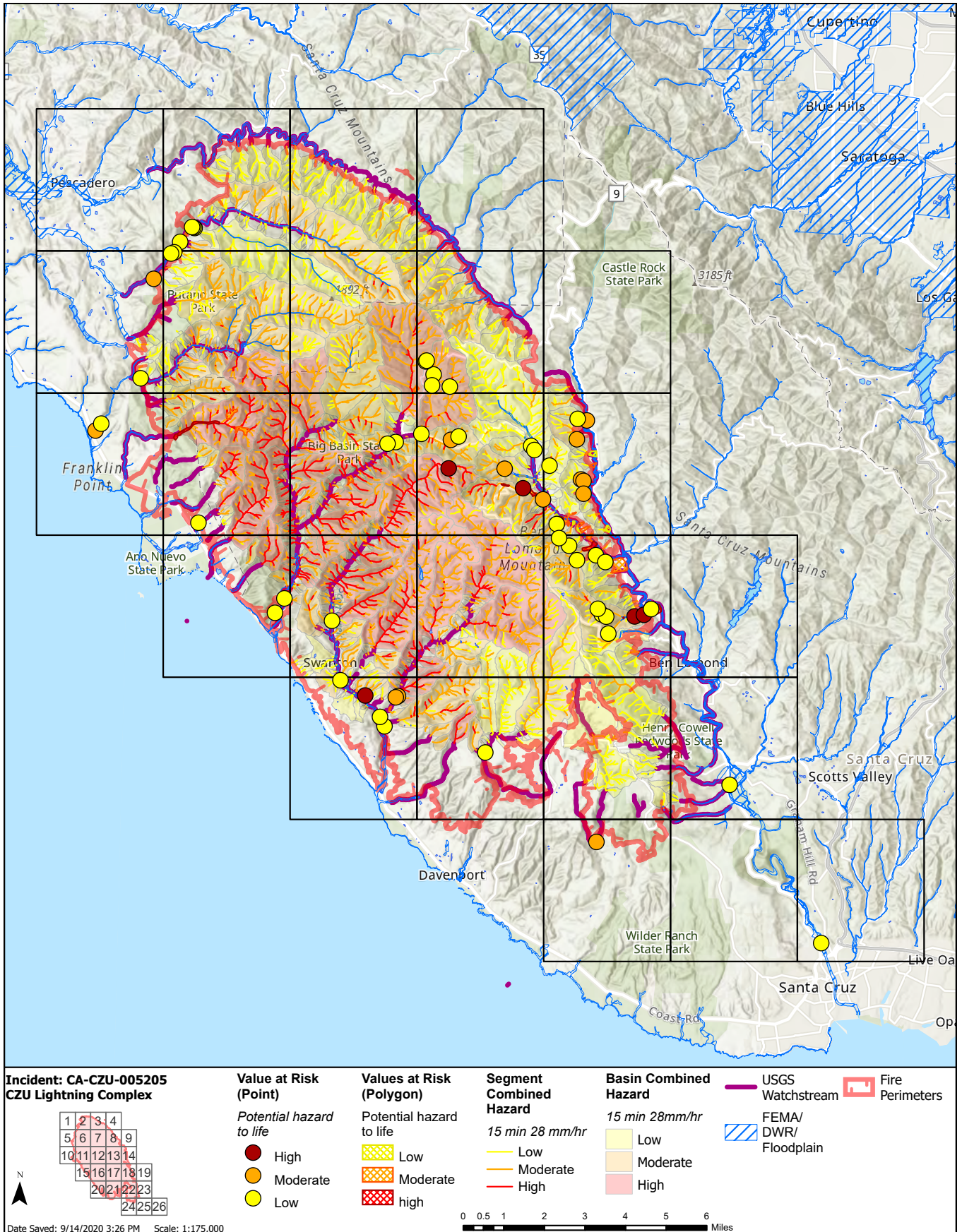
White rows = points

CZU Lightning Complex Fire Values-at-Risk Table

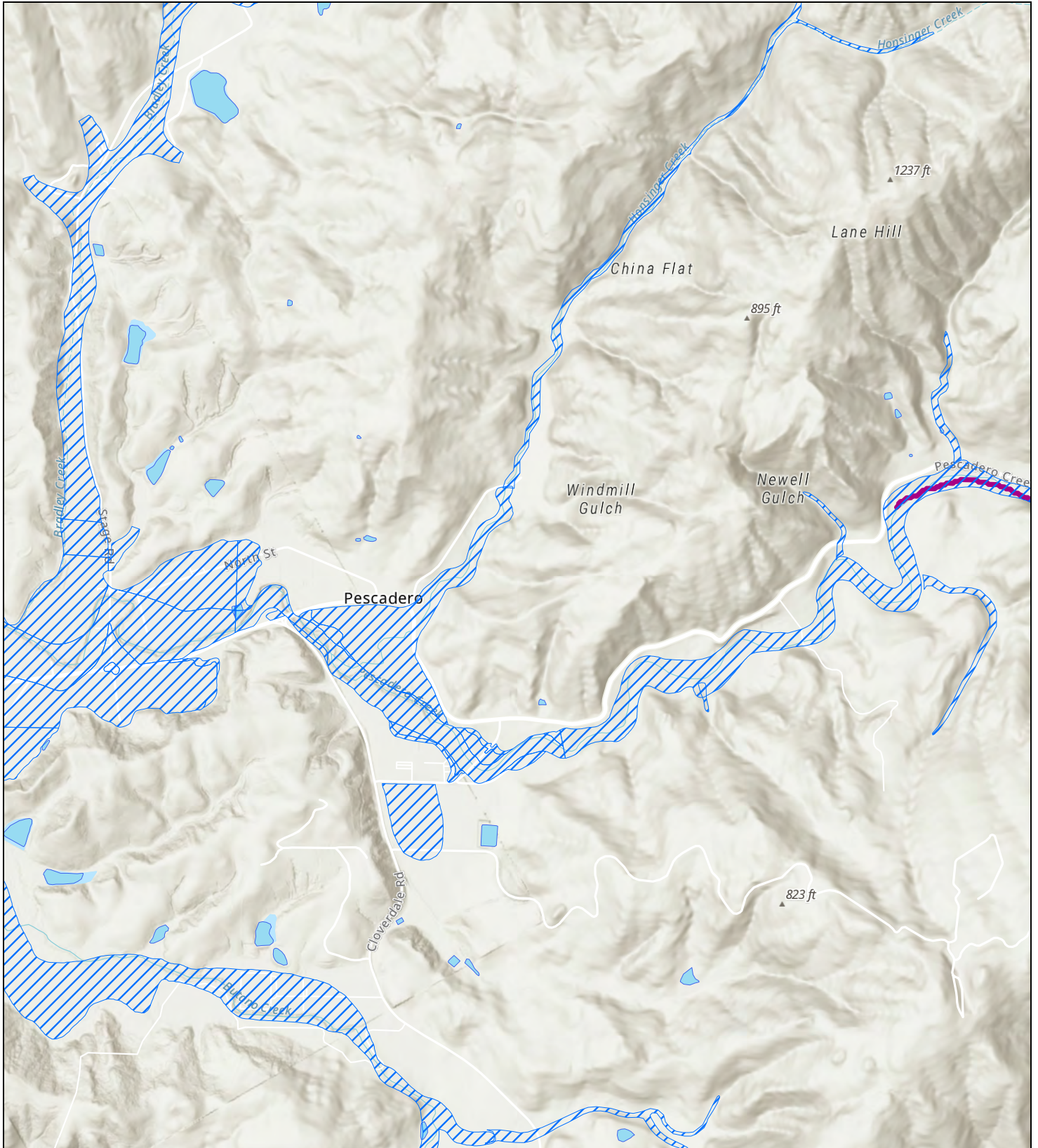
Appendix B

Site	Community / Local area	Latitude	Longitude	Potential hazard / Field observation	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life	Potential hazard to property	Preliminary EMP
C21	Big Basin State Park	37.18553	-122.20127	Flooding/Debris Flow could impact the crossing. Culvert undersized, large amount of fill (>20 feet). Inlet is highly corroded. Landslides visible on LiDAR images along upstream slopes. Recommend culvert be replaced and sized appropriately.	debris flow / flood	Road	drainage structure	low	moderate	Monitor and maintain
C28	Last Chance	37.10097	-122.25147	Potential for debris flow to leave channel and impact residence. Steep slopes upstream with moderate to high potential for debris flows	debris flow	Residence	home	low	low	Early Warning
C35	Big Basin State Park	37.19461	-122.21192	Approximately 150 feet of retaining wall damaged.	other	Road	other	low	moderate	Monitor and maintain

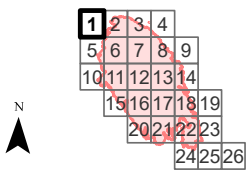
Appendix C



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

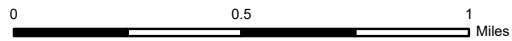
Segment Combined Hazard

- Low
- Moderate
- High

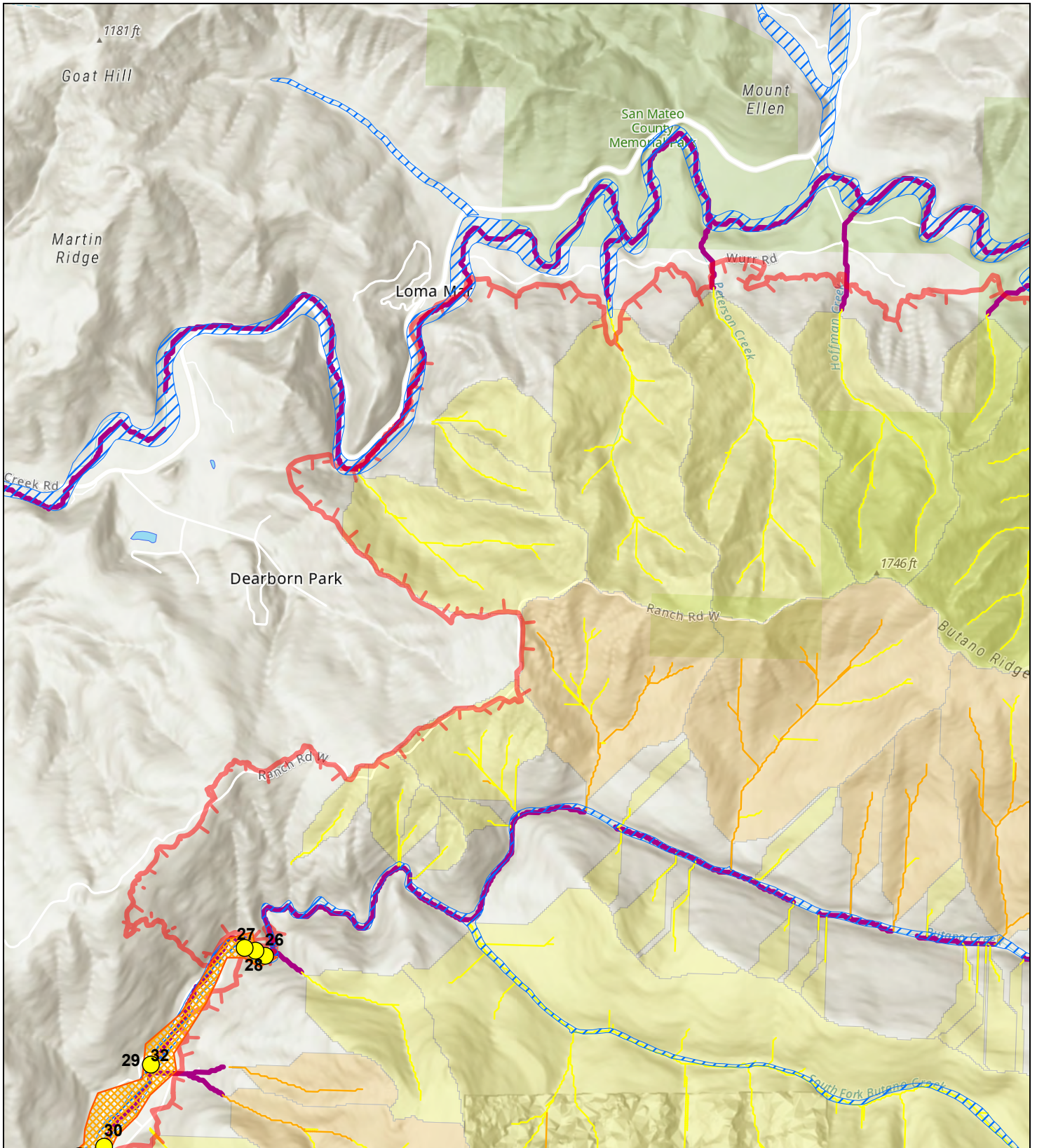
Basin Combined Hazard

- 15 min 28mm/hr Low
- Moderate
- High

- USGS Watchstream
- Fire Perimeters
- FEMA/DWR/Floodplain



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

- Low
- Moderate
- High

Basin Combined Hazard

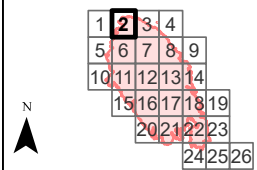
15 min 28mm/hr

- Low
- Moderate
- High

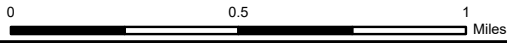
— USGS Watchstream

FEMA/DWR/Floodplain

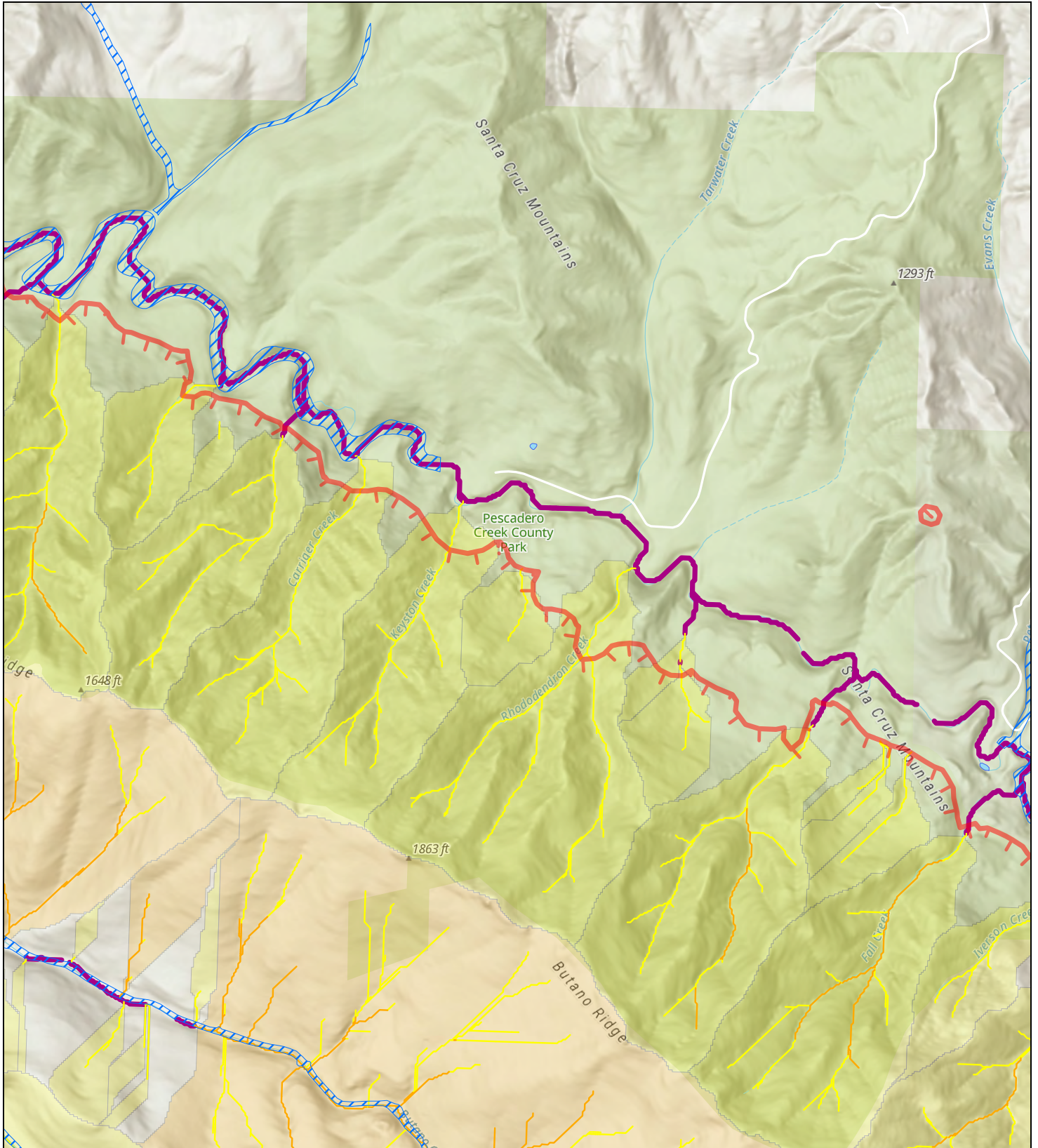
Fire Perimeters



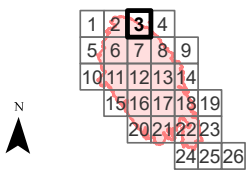
Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

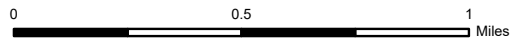
- 15 min 28 mm/hr
- Low
 - Moderate
 - High

Basin Combined Hazard

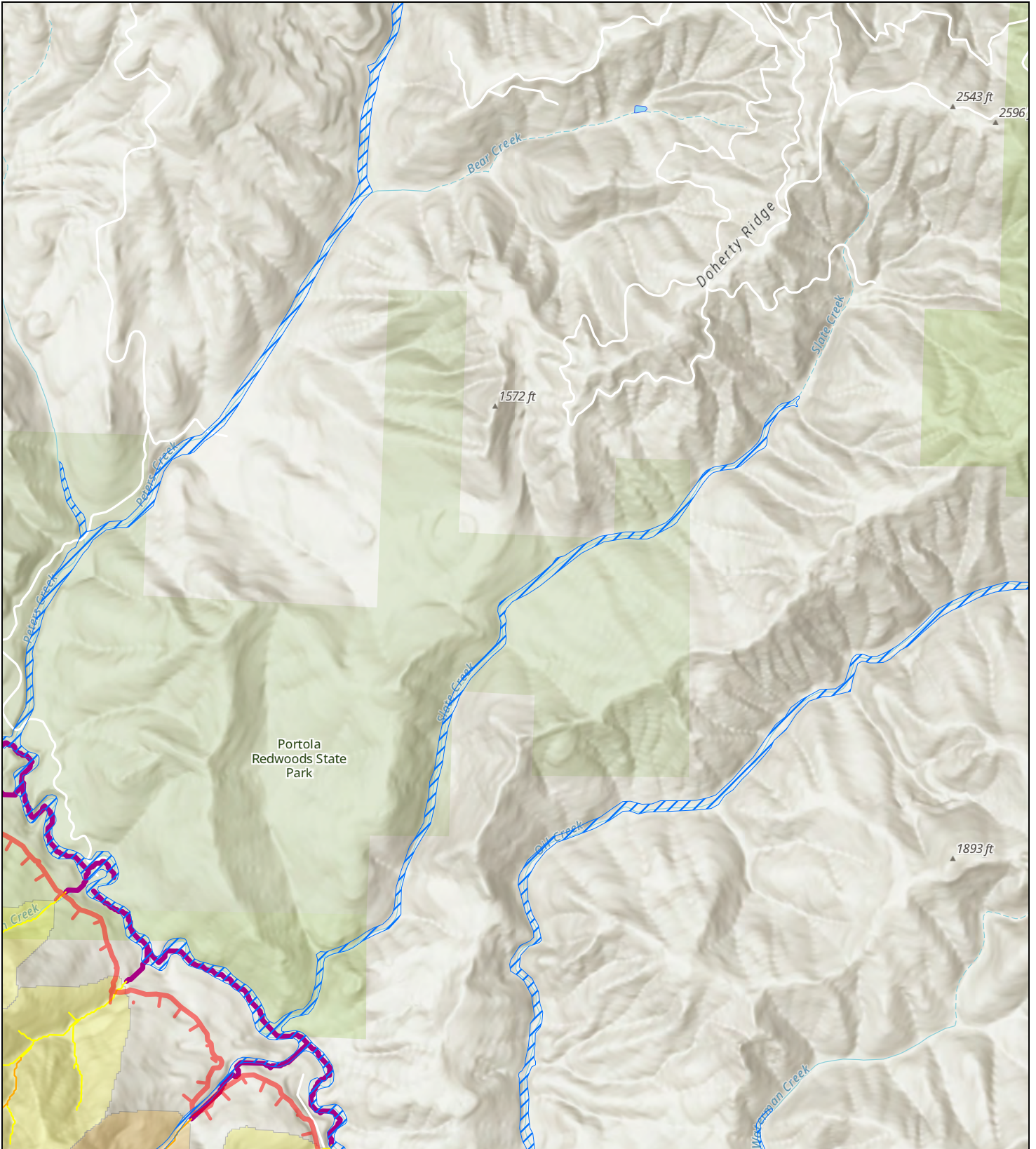
- 15 min 28mm/hr
- Low
 - Moderate
 - High

- USGS Watchstream
- FEMA/DWR/ Floodplain

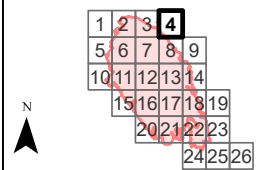
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

- Low
- Moderate
- High

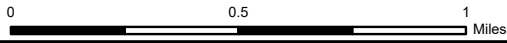
Basin Combined Hazard

15 min 28mm/hr

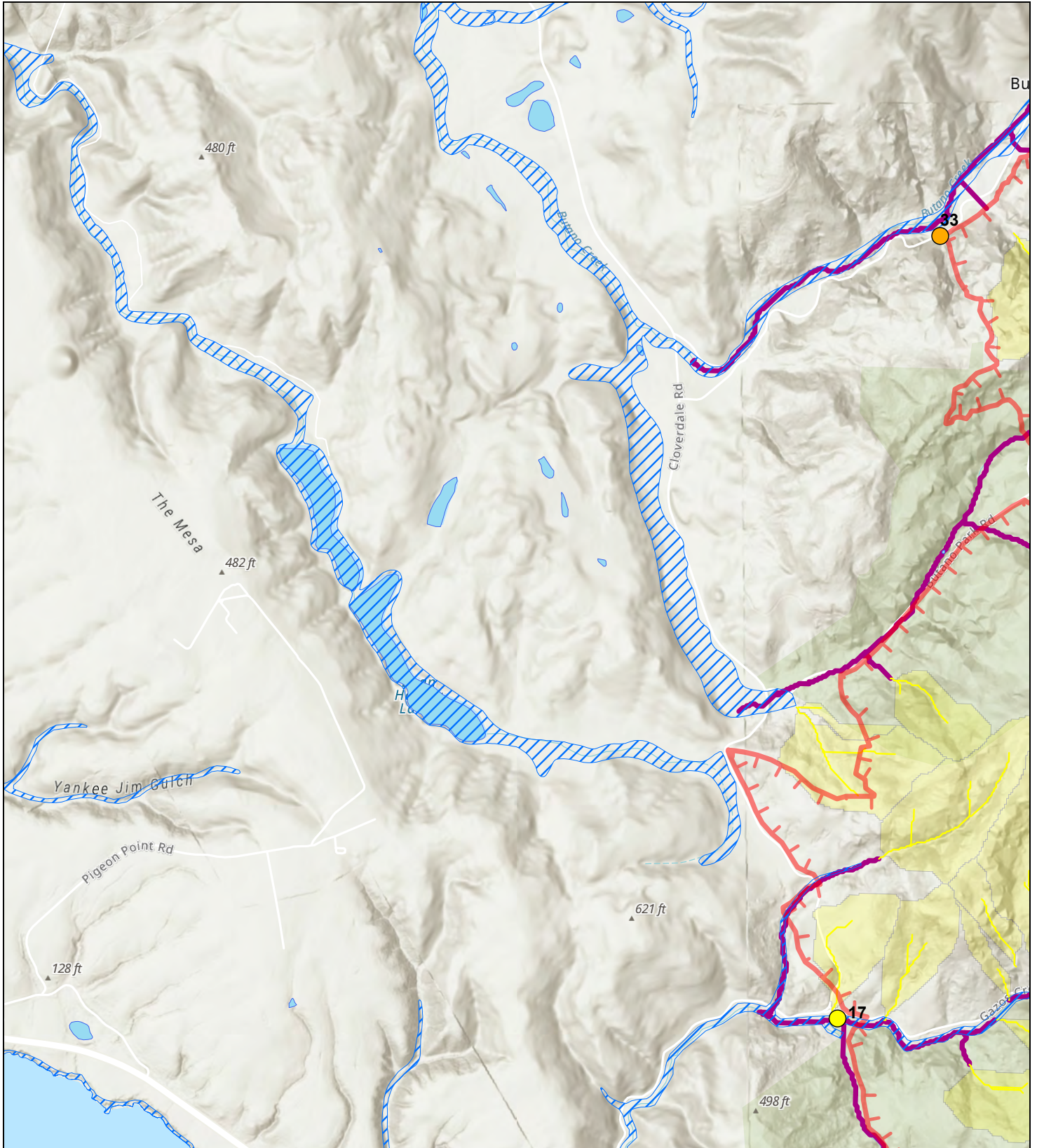
- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/Floodplain

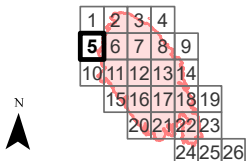
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

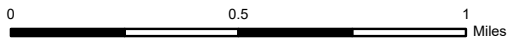
Segment Combined Hazard
 15 min 28 mm/hr

- Low
- Moderate
- High

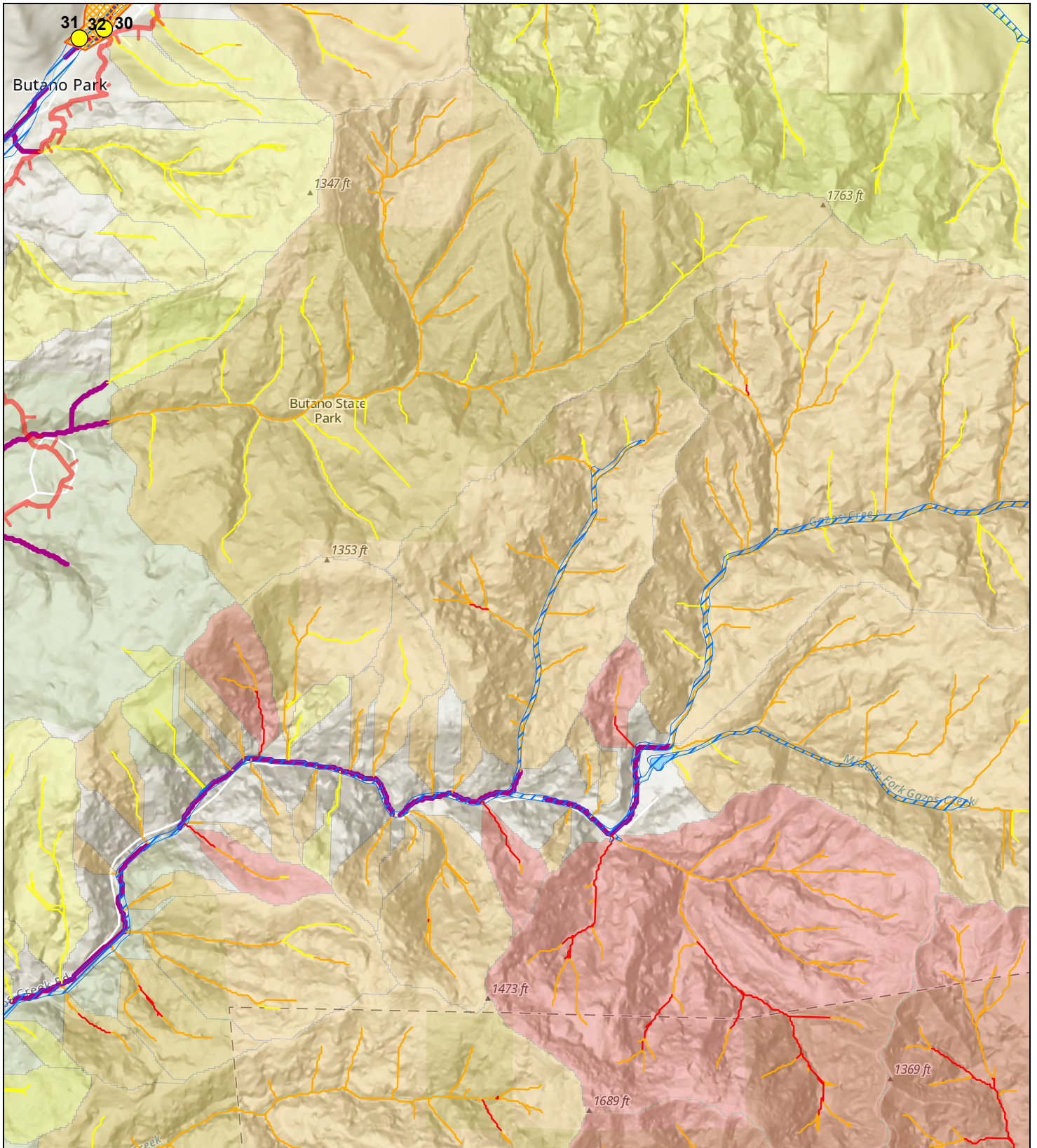
Basin Combined Hazard
 15 min 28mm/hr

- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/Floodplain
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex

Value at Risk (Point)

Potential hazard to life

- High
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- Low

Values at Risk (Polygon)

Potential hazard to life

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- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

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- High

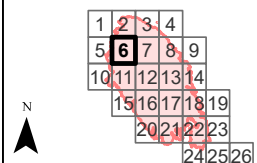
Basin Combined Hazard

15 min 28mm/hr

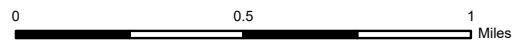
- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/ Floodplain

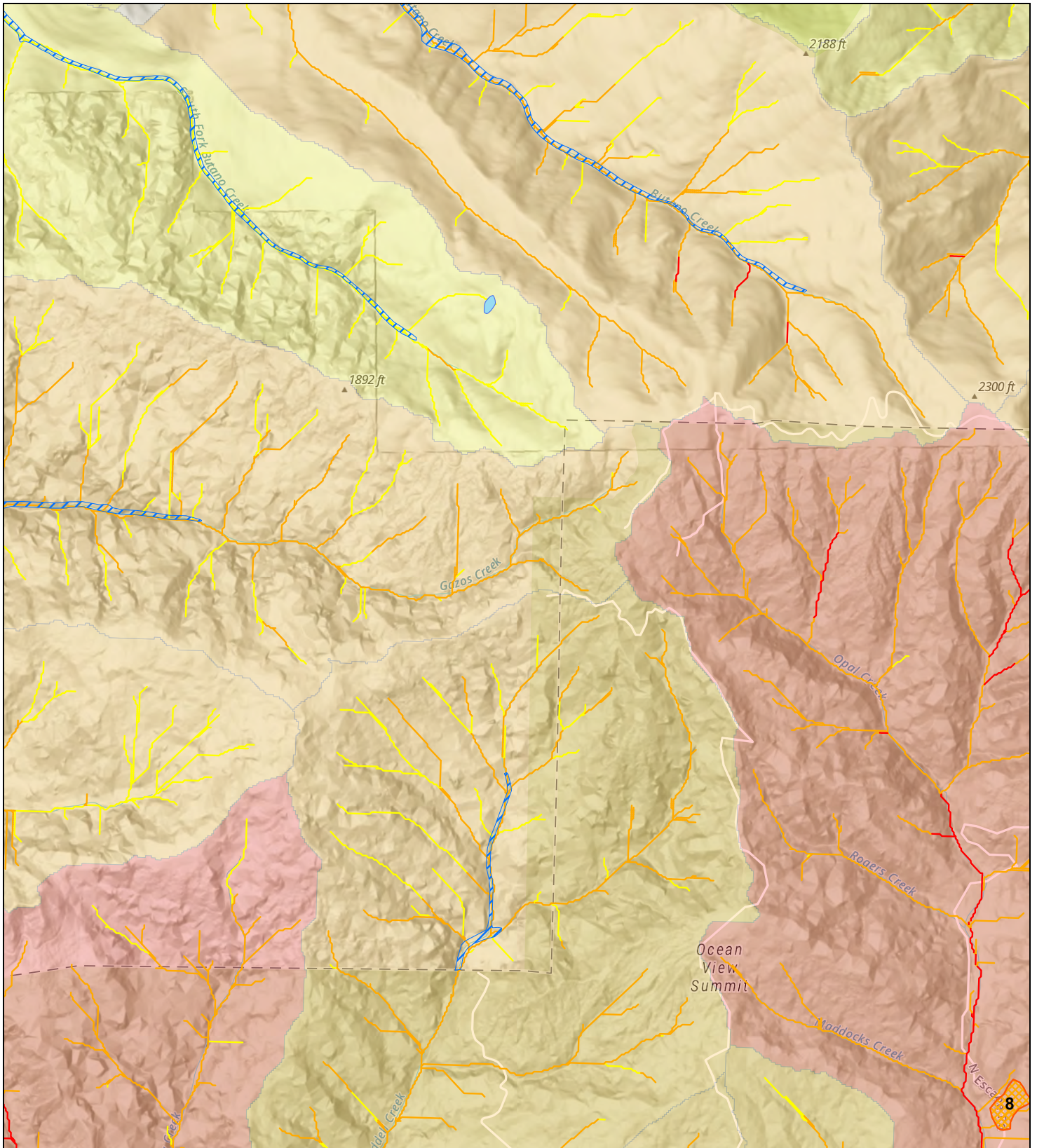
- Fire Perimeters



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard
 15 min 28 mm/hr

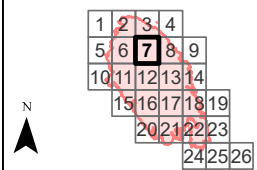
- Low
- Moderate
- High

Basin Combined Hazard
 15 min 28mm/hr

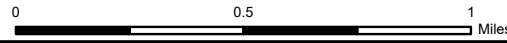
- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/ Floodplain

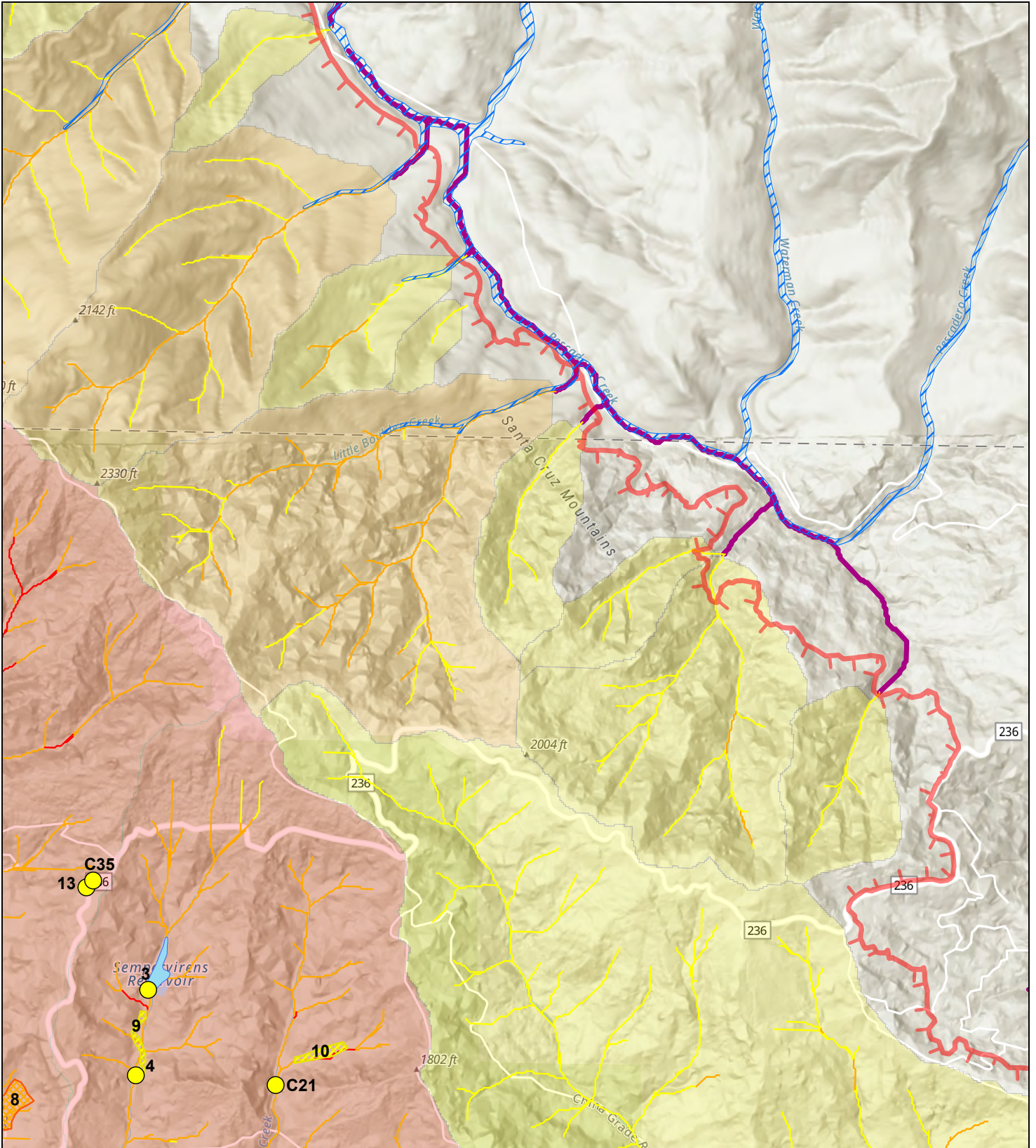
Fire Perimeters



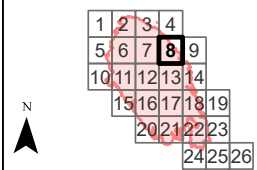
Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
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Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

- Low
- Moderate
- High

Basin Combined Hazard

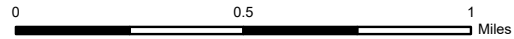
15 min 28mm/hr

- Low
- Moderate
- High

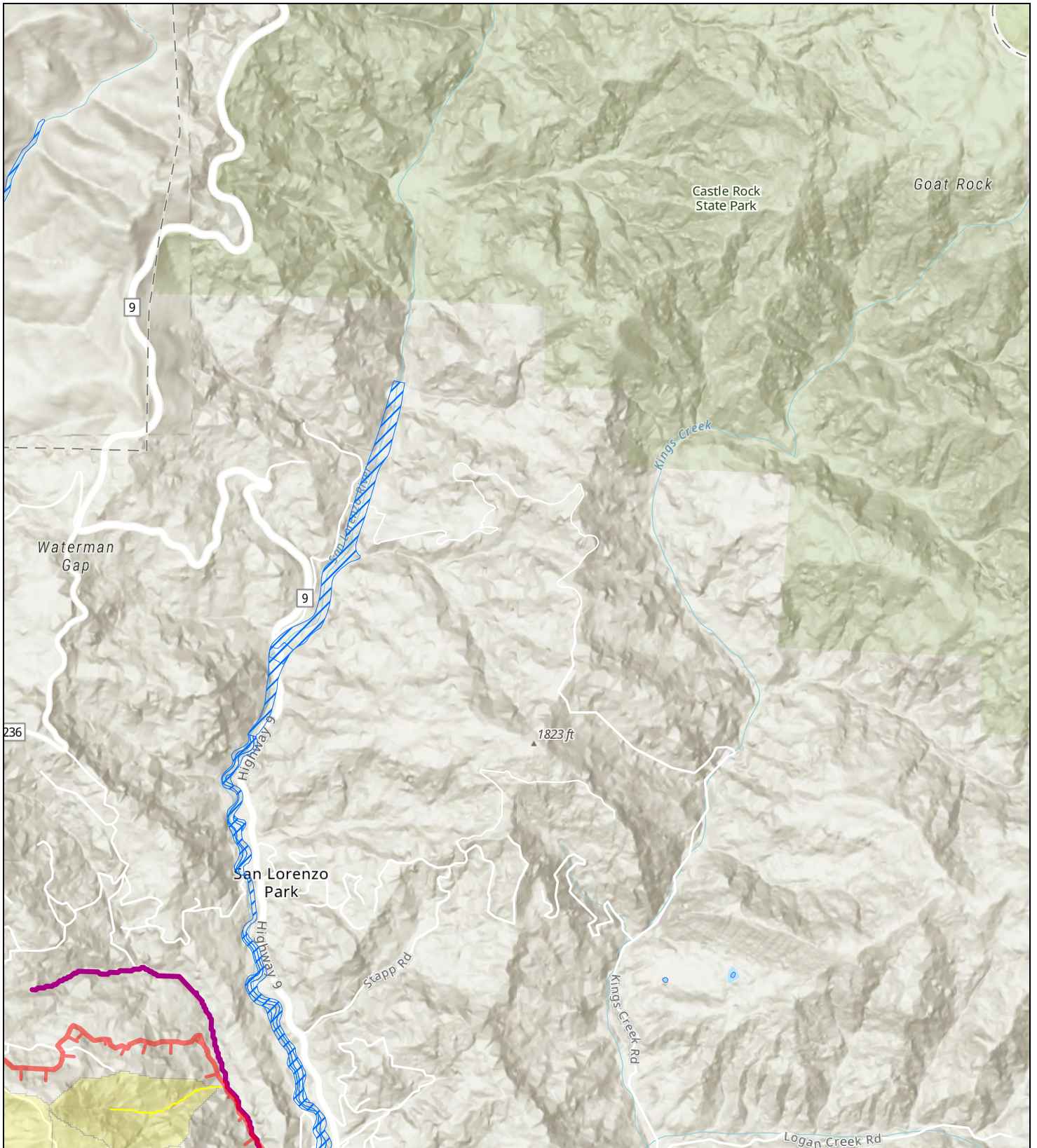
USGS Watchstream

FEMA/DWR/ Floodplain

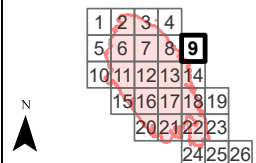
Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
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Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

- Low
- Moderate
- High

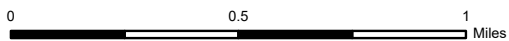
Basin Combined Hazard

15 min 28mm/hr

- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/ Floodplain

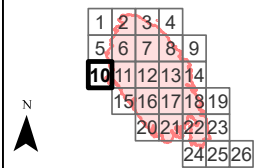
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

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- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

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- Moderate
- high

Segment Combined Hazard

15 min 28 mm/hr

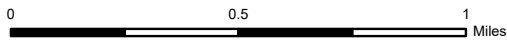
- Low
- Moderate
- High

Basin Combined Hazard

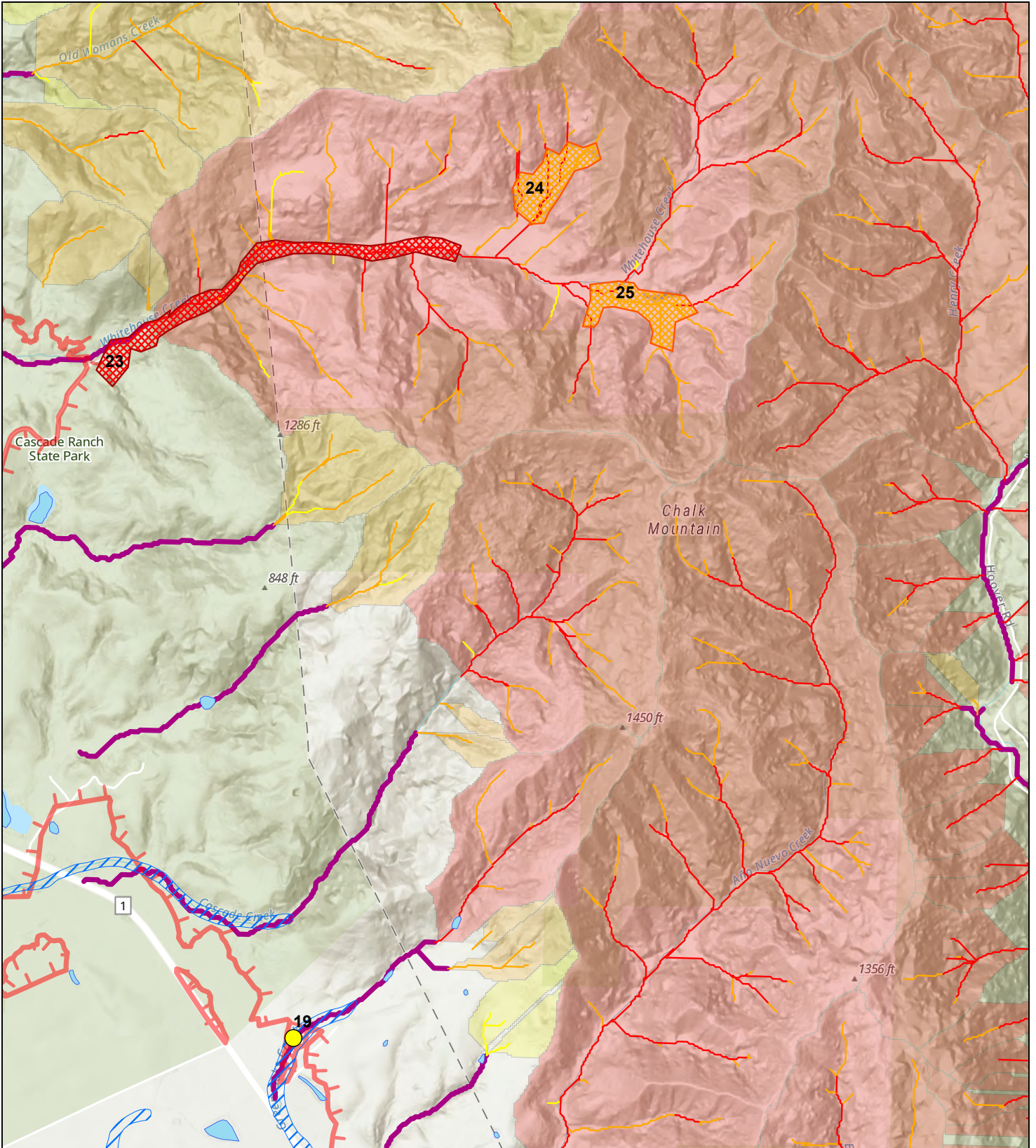
15 min 28mm/hr

- Low
- Moderate
- High

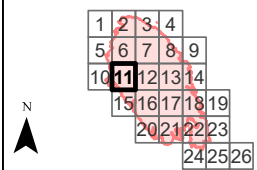
- USGS Watchstream
- Fire Perimeters
- FEMA/DWR Floodplain



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

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Values at Risk (Polygon)

Potential hazard to life

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- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

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- Moderate
- High

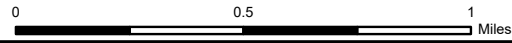
Basin Combined Hazard

15 min 28mm/hr

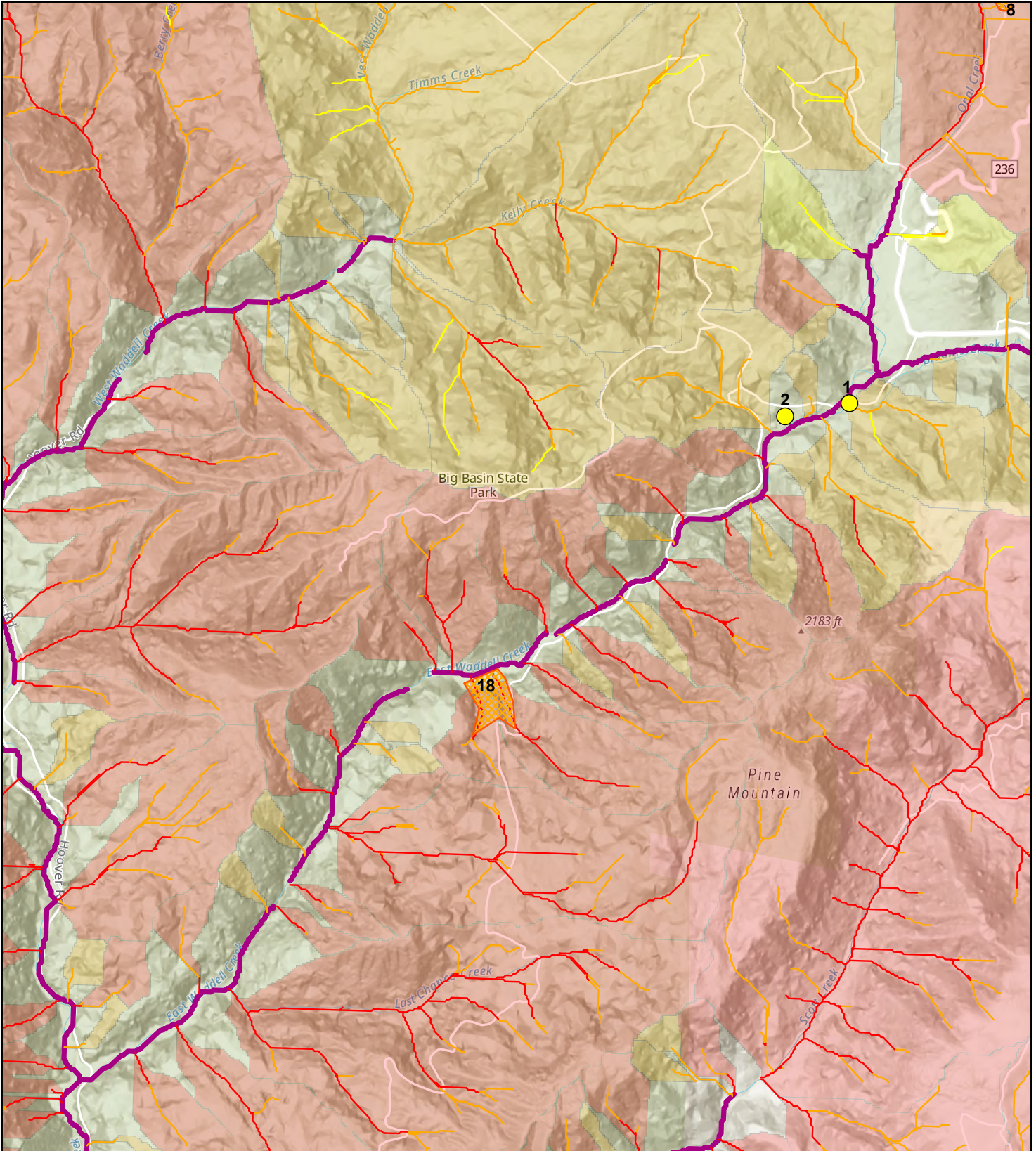
- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/ Floodplain

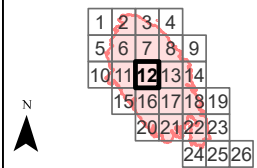
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

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- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

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Segment Combined Hazard

15 min 28 mm/hr

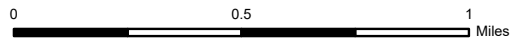
- Low
- Moderate
- High

Basin Combined Hazard

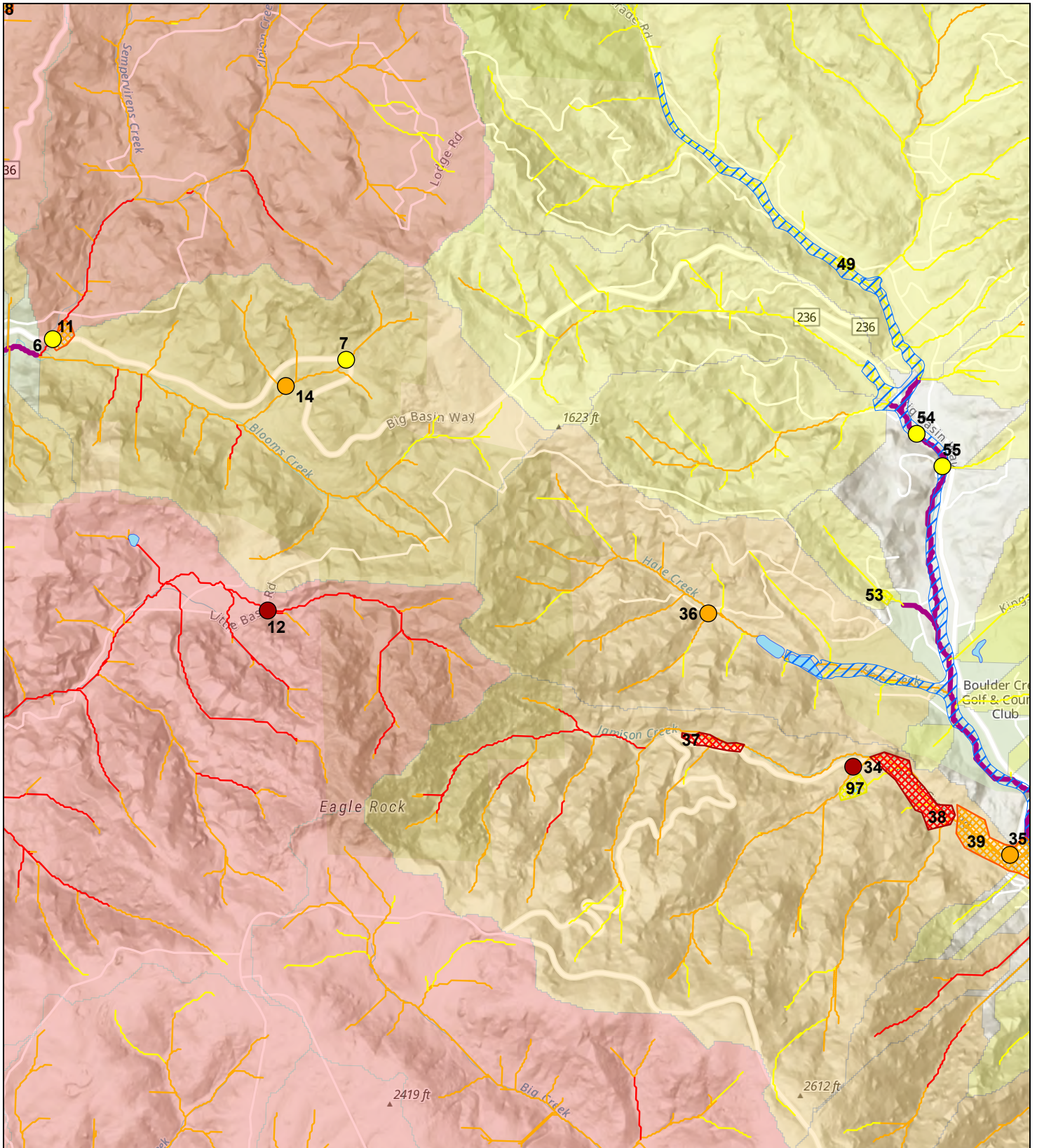
15 min 28mm/hr

- Low
- Moderate
- High

- USGS Watchstream
- Fire Perimeters
- FEMA/DWR/ Floodplain



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex

Value at Risk (Point)

Potential hazard to life

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Values at Risk (Polygon)

Potential hazard to life

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- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

- Low
- Moderate
- High

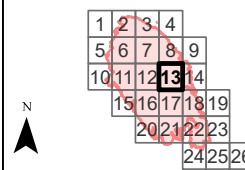
Basin Combined Hazard

15 min 28mm/hr

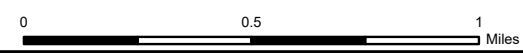
- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/Floodplain

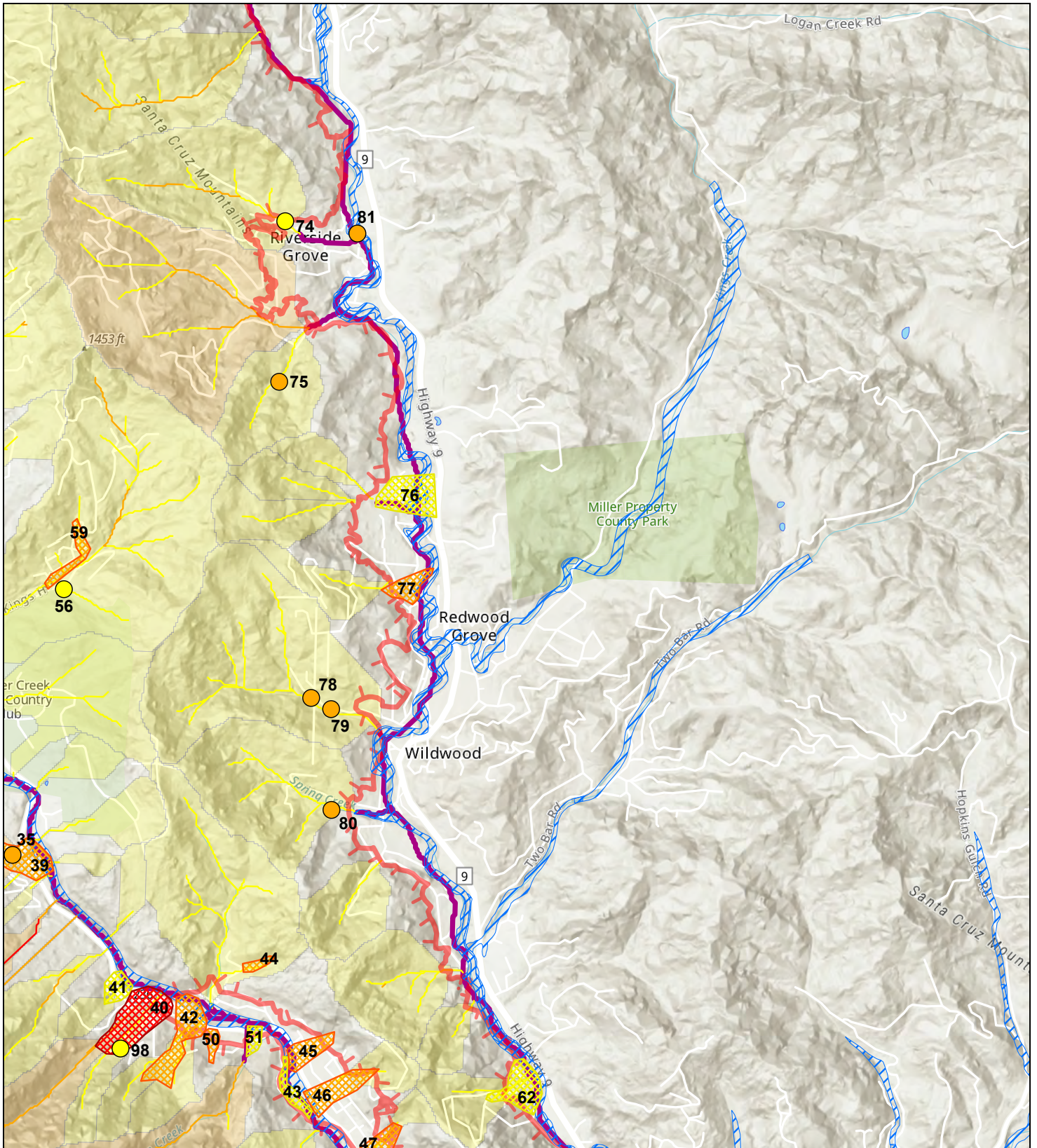
- Fire Perimeters



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



**Incident: CA-CZU-005205
CZU Lightning Complex**

Value at Risk (Point)

- Potential hazard to life
- High
 - Moderate
 - Low

Values at Risk (Polygon)

- Potential hazard to life
- Low
 - Moderate
 - High

Segment Combined Hazard

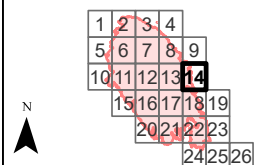
- 15 min 28 mm/hr
- Low
 - Moderate
 - High

Basin Combined Hazard

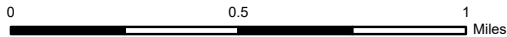
- 15 min 28mm/hr
- Low
 - Moderate
 - High

- USGS Watchstream
- FEMA/DWR/Floodplain

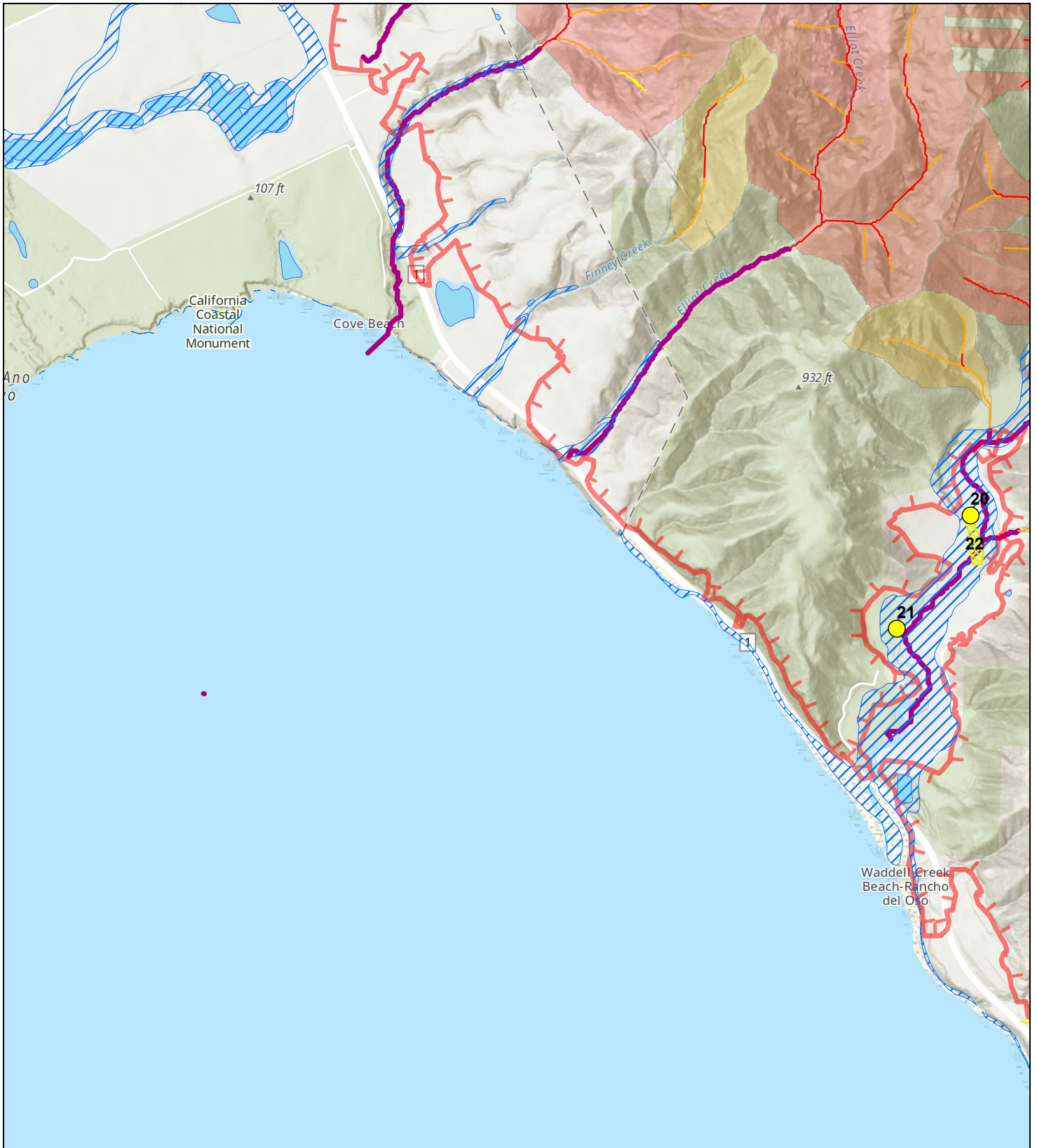
Fire Perimeters



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
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Values at Risk (Polygon)

Potential hazard to life

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Segment Combined Hazard
 15 min 28 mm/hr

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- Moderate
- High

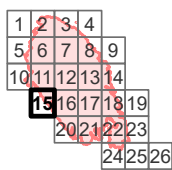
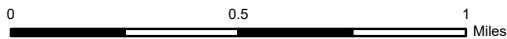
Basin Combined Hazard
 15 min 28mm/hr

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- Moderate
- High

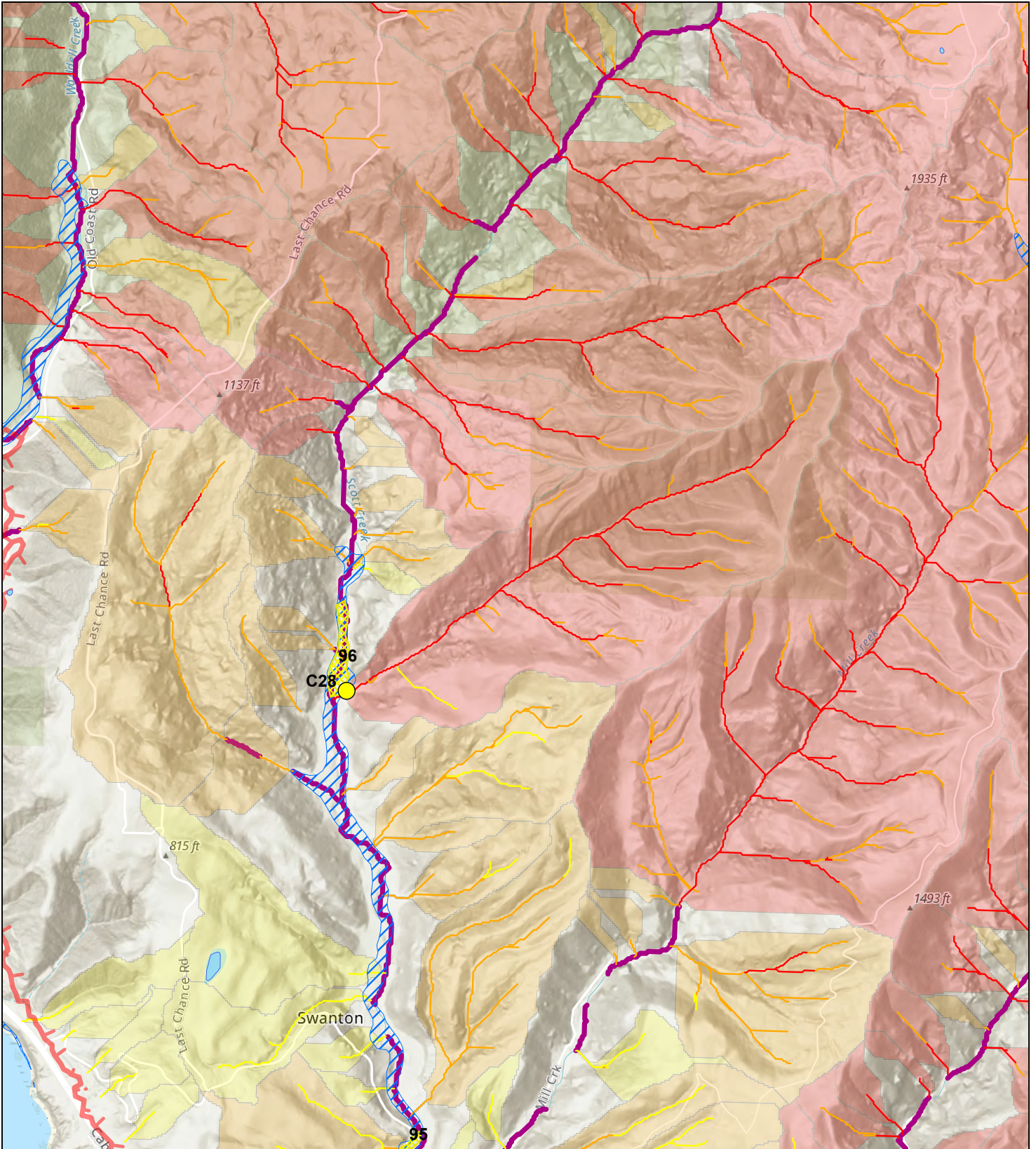
- USGS Watchstream
- Fire Perimeters
- FEMA/DWR/Floodplain



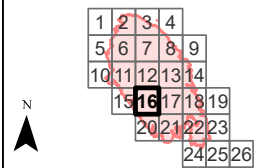
Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

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15 min 28 mm/hr

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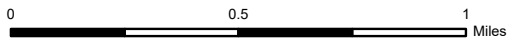
Basin Combined Hazard

15 min 28mm/hr

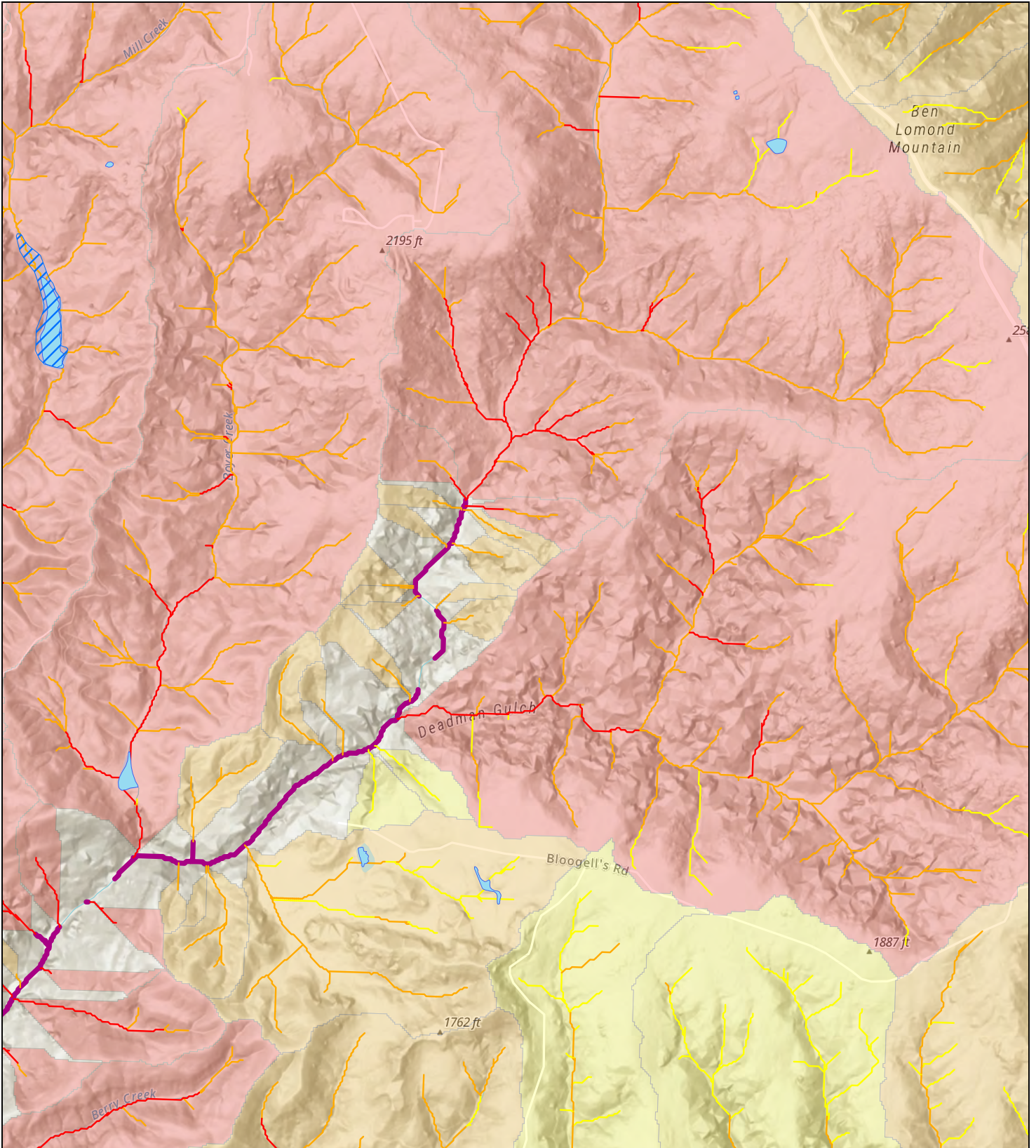
- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/Floodplain

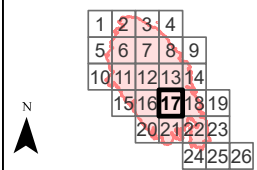
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

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- Moderate
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Values at Risk (Polygon)

Potential hazard to life

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15 min 28 mm/hr

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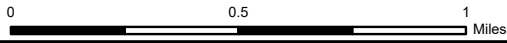
Basin Combined Hazard

15 min 28mm/hr

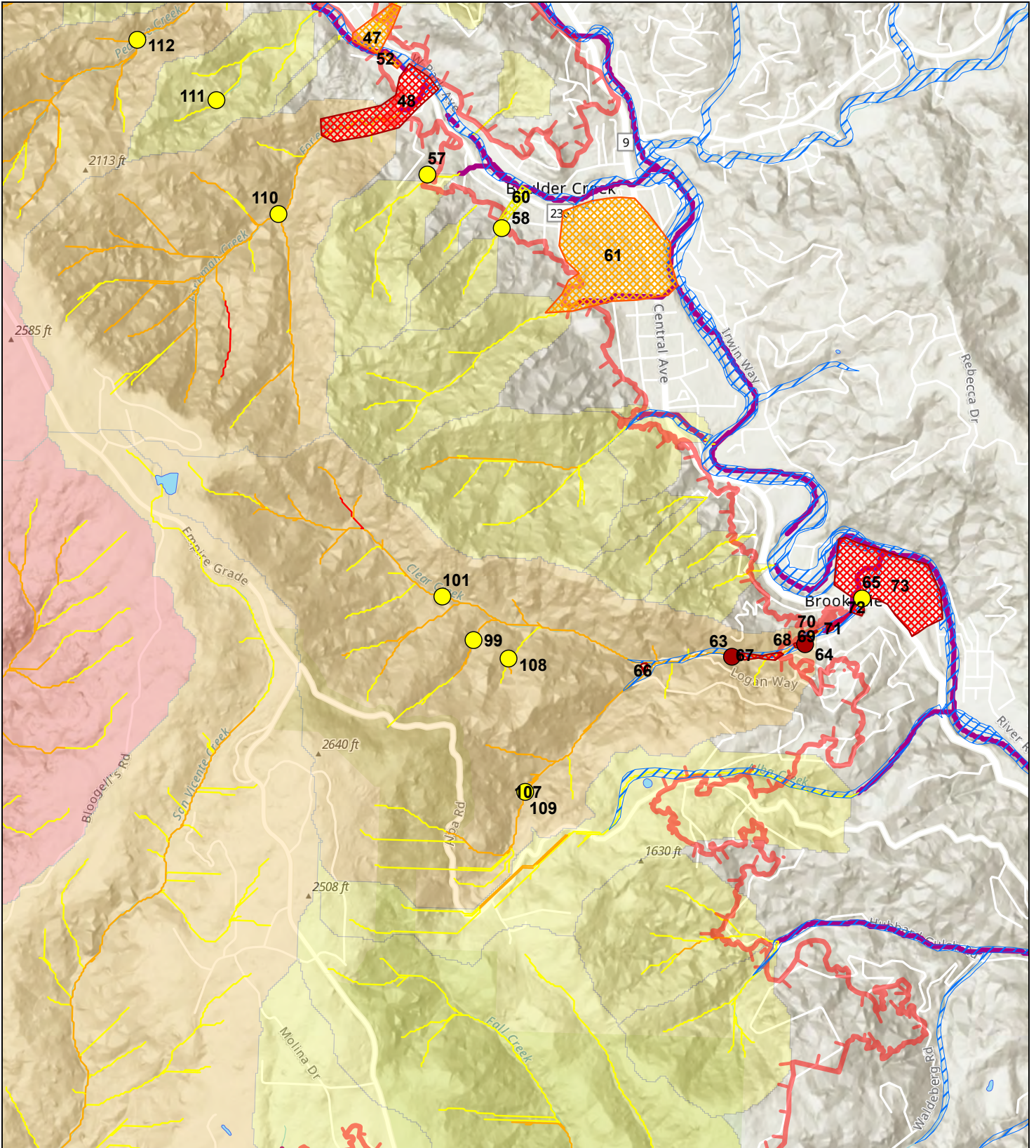
- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/ Floodplain

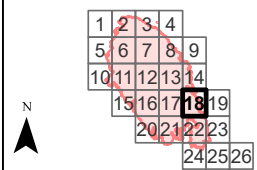
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

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- Moderate
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Values at Risk (Polygon)

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Segment Combined Hazard

15 min 28 mm/hr

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Basin Combined Hazard

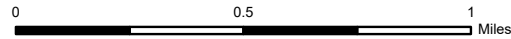
15 min 28mm/hr

- Low
- Moderate
- High

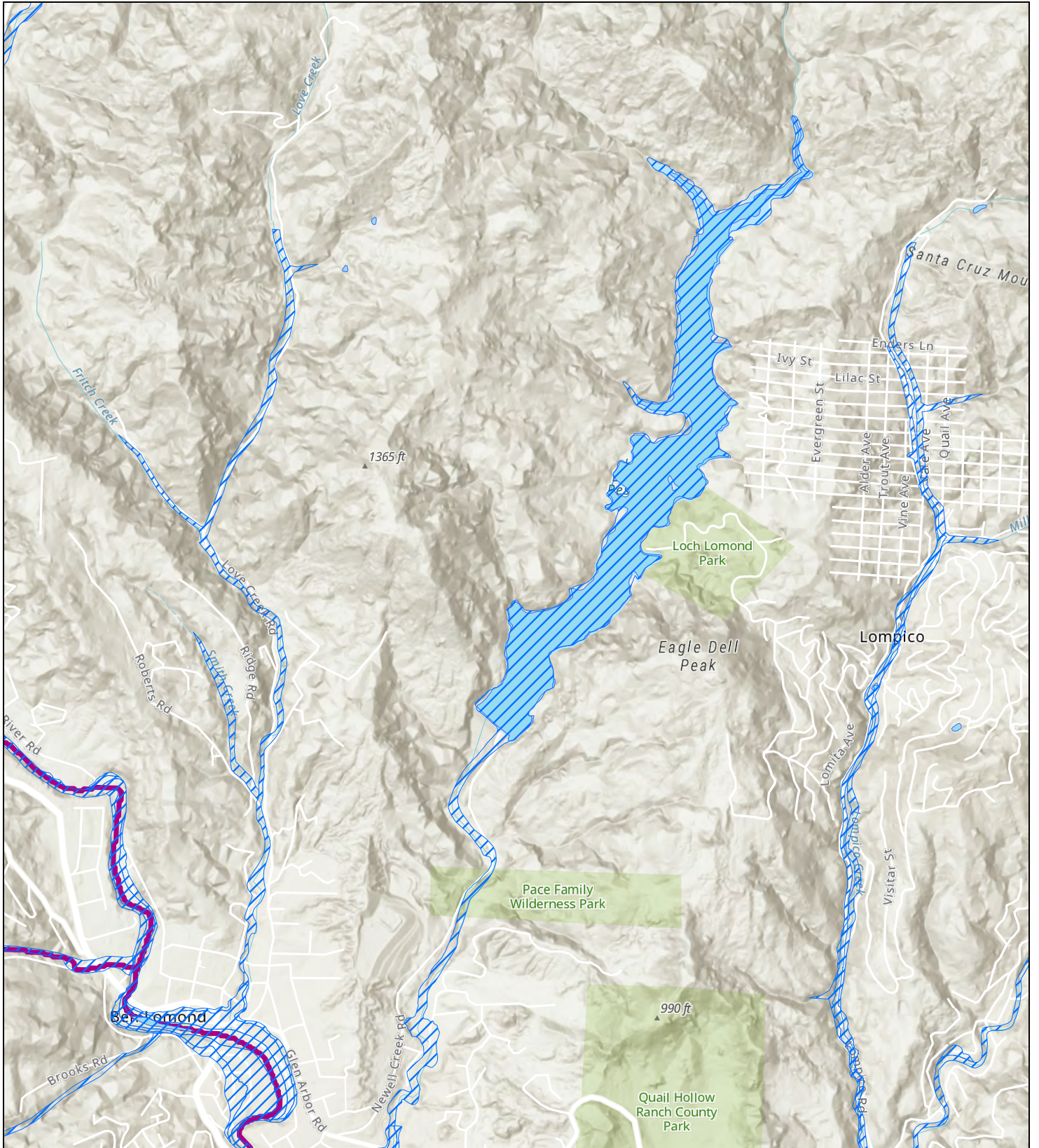
USGS Watchstream

FEMA/DWR/ Floodplain

Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- ▣ Low
- ▣ Moderate
- ▣ High

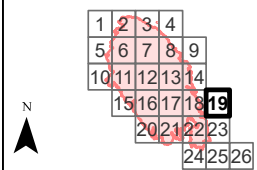
Segment Combined Hazard

- Low
- Moderate
- High

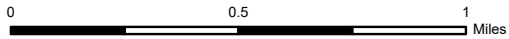
Basin Combined Hazard

- Low
- Moderate
- High

- USGS Watchstream
- Fire Perimeters
- FEMA/DWR/ Floodplain



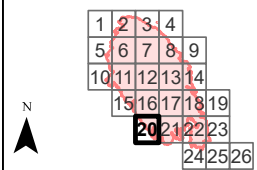
Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
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Values at Risk (Polygon)

Potential hazard to life

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Segment Combined Hazard

15 min 28 mm/hr

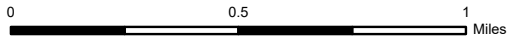
- Low
- Moderate
- High

Basin Combined Hazard

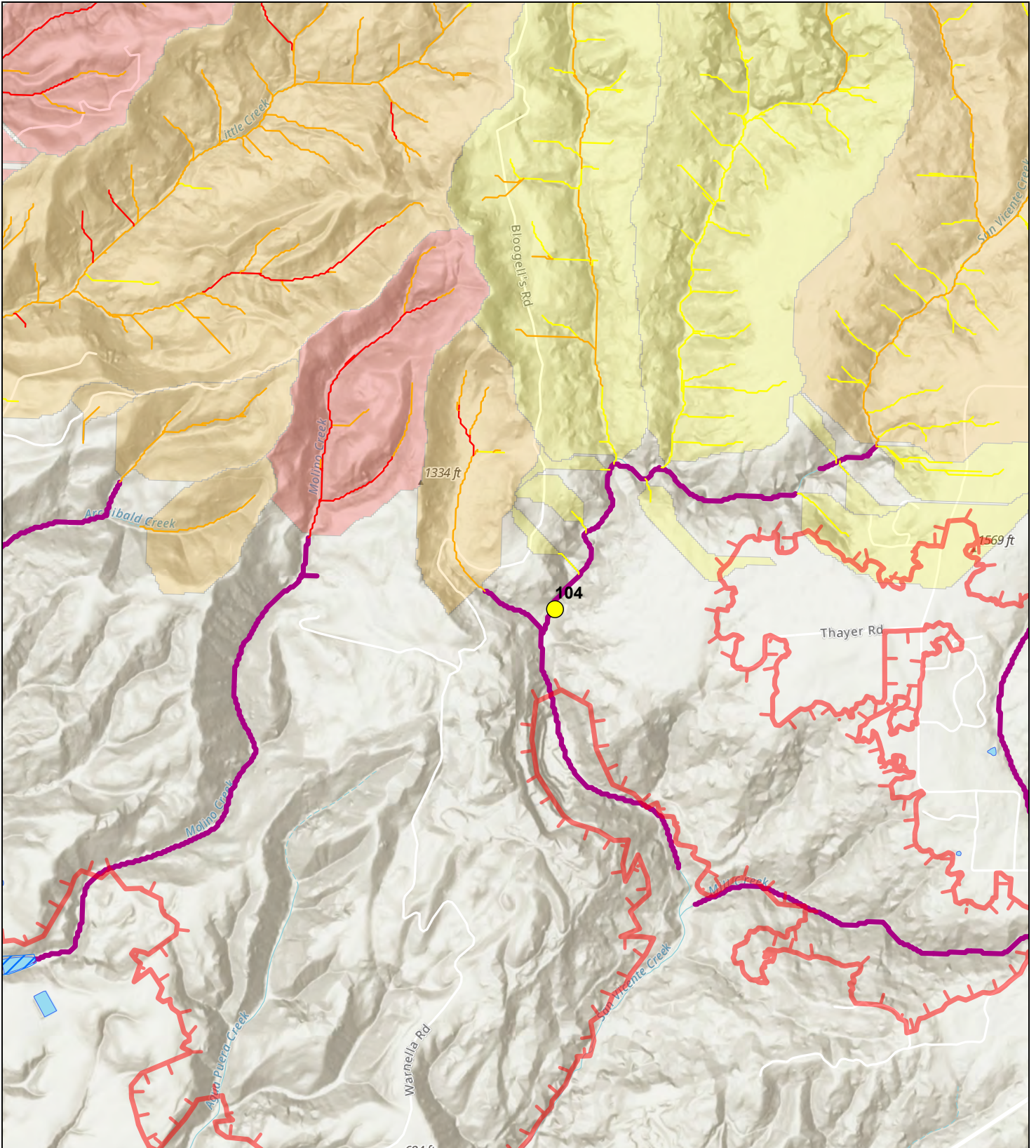
15 min 28mm/hr

- Low
- Moderate
- High

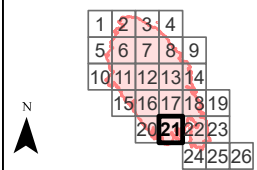
- USGS Watchstream
- Fire Perimeters
- FEMA/DWR/ Floodplain



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

- Potential hazard to life
- High
 - Moderate
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Values at Risk (Polygon)

- Potential hazard to life
- Low
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Segment Combined Hazard

- 15 min 28 mm/hr
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 - Moderate
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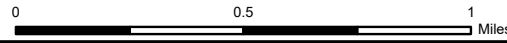
Basin Combined Hazard

- 15 min 28mm/hr
- Low
 - Moderate
 - High

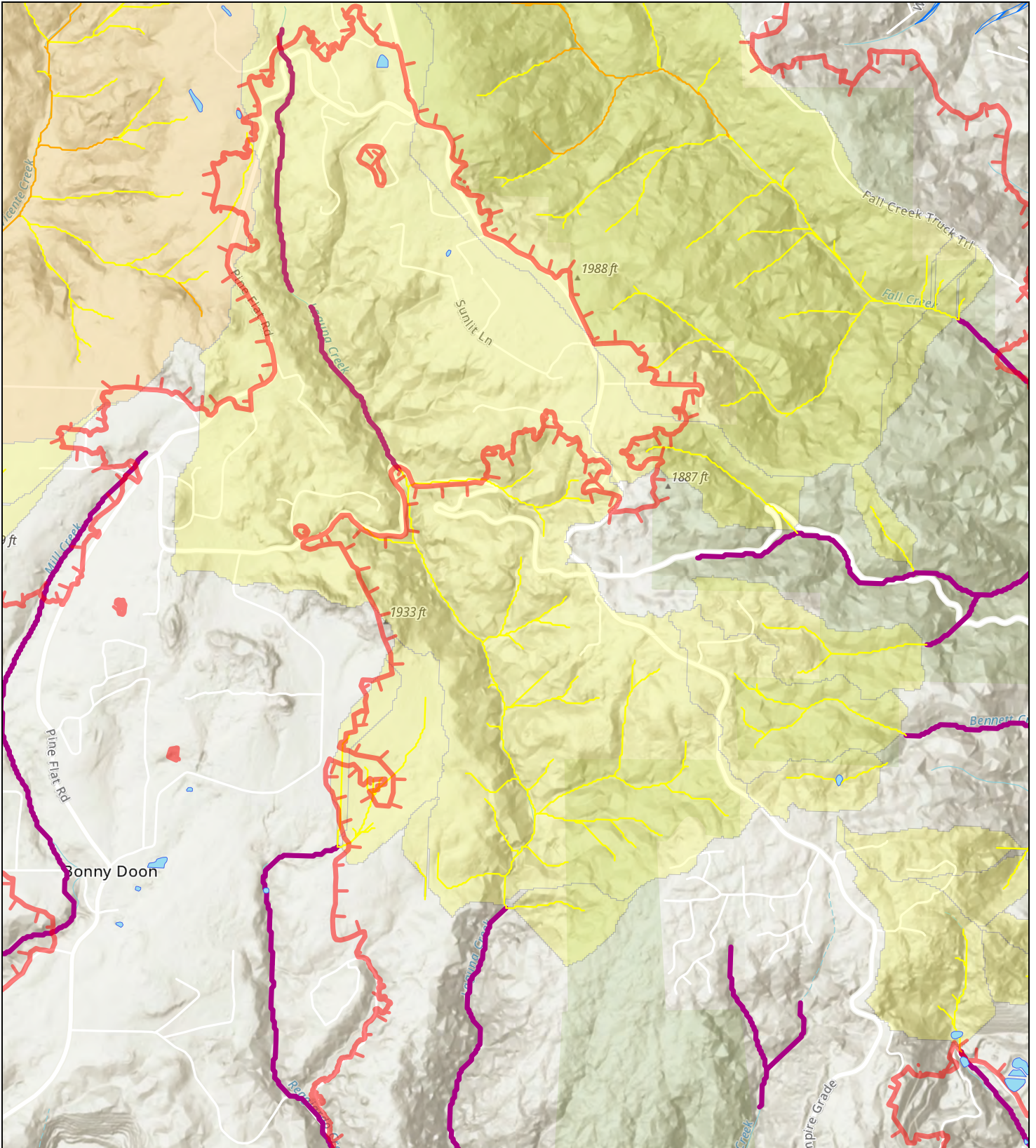
— USGS Watchstream

 FEMA/DWR/Floodplain

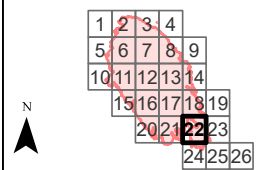
Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

- Low
- Moderate
- High

Basin Combined Hazard

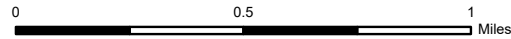
15 min 28mm/hr

- Low
- Moderate
- High

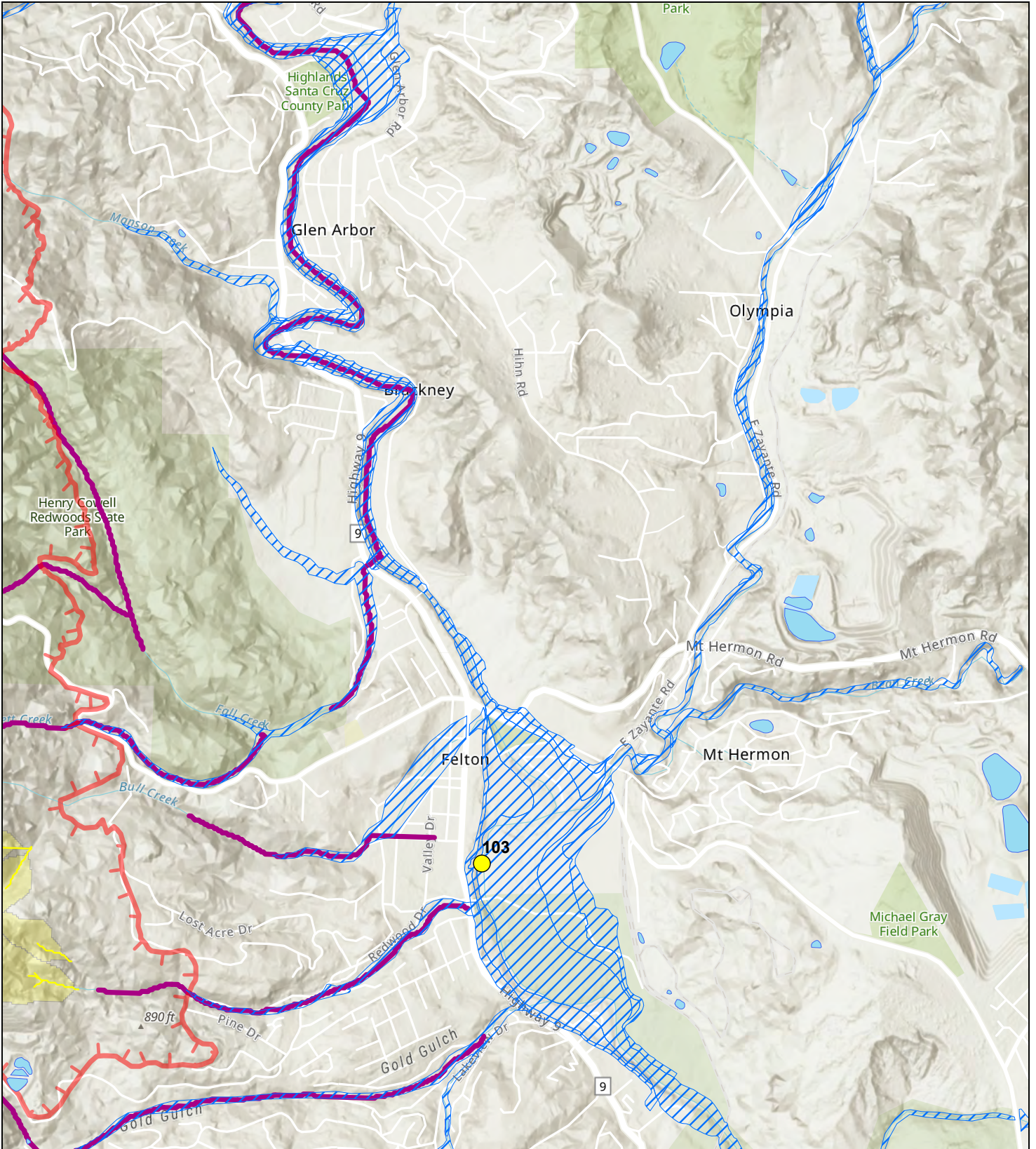
— USGS Watchstream

FEMA/DWR/ Floodplain

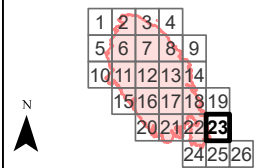
Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- ▣ Low
- ▣ Moderate
- ▣ High

Segment Combined Hazard

15 min 28 mm/hr

- ▬ Low
- ▬ Moderate
- ▬ High

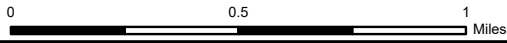
Basin Combined Hazard

15 min 28mm/hr

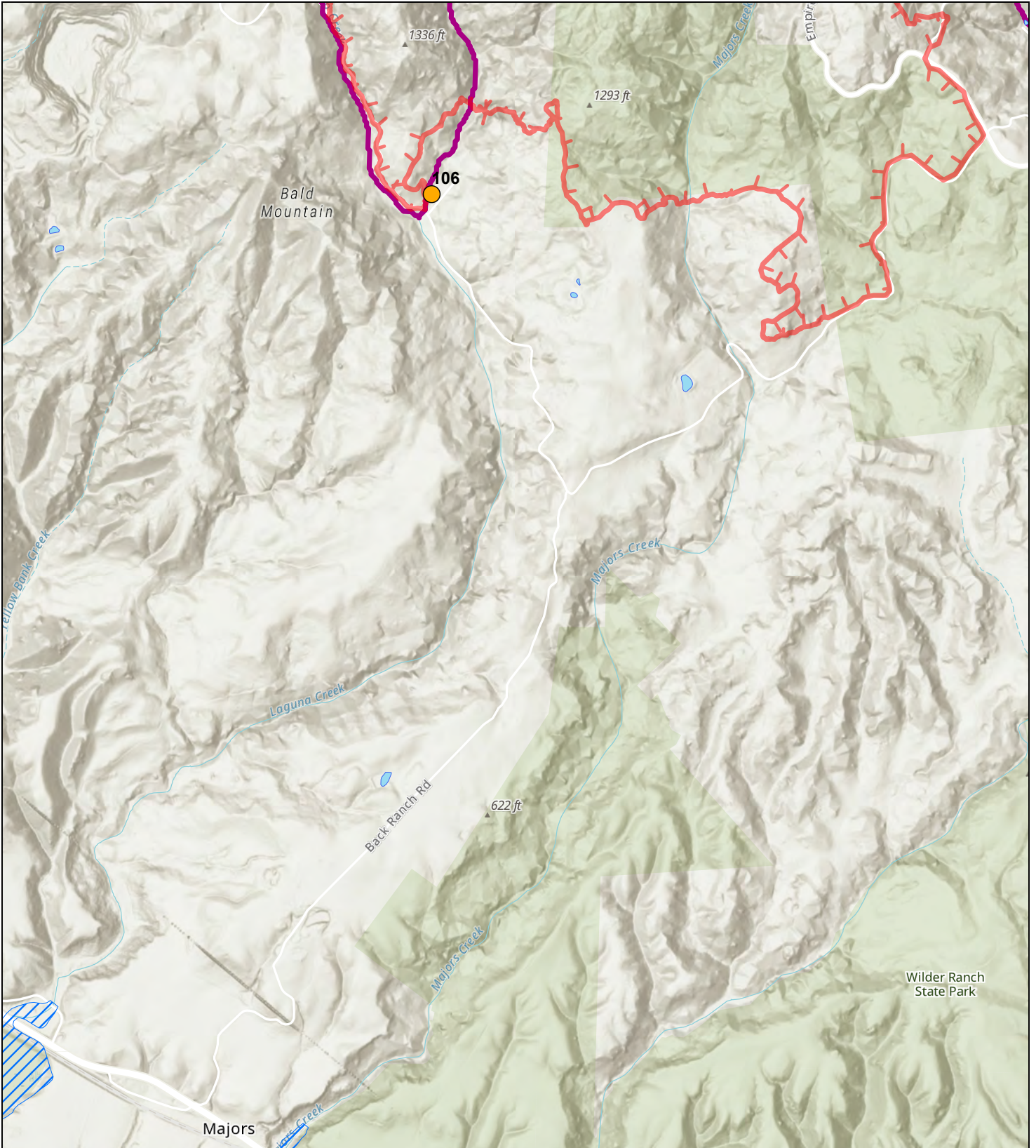
- ▣ Low
- ▣ Moderate
- ▣ High

- ▬ USGS Watchstream
- ▬ FEMA/DWR/Floodplain

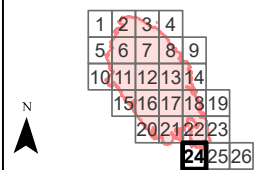
- ▣ Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

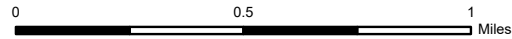
- Low
- Moderate
- High

Basin Combined Hazard

15 min 28mm/hr

- Low
- Moderate
- High

- USGS Watchstream
- FEMA/DWR/Floodplain
- Fire Perimeters



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex

Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

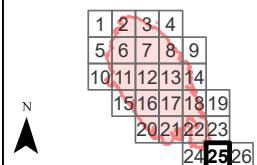
- Low
- Moderate
- High

Basin Combined Hazard

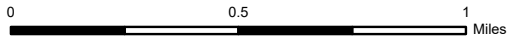
15 min 28mm/hr

- Low
- Moderate
- High

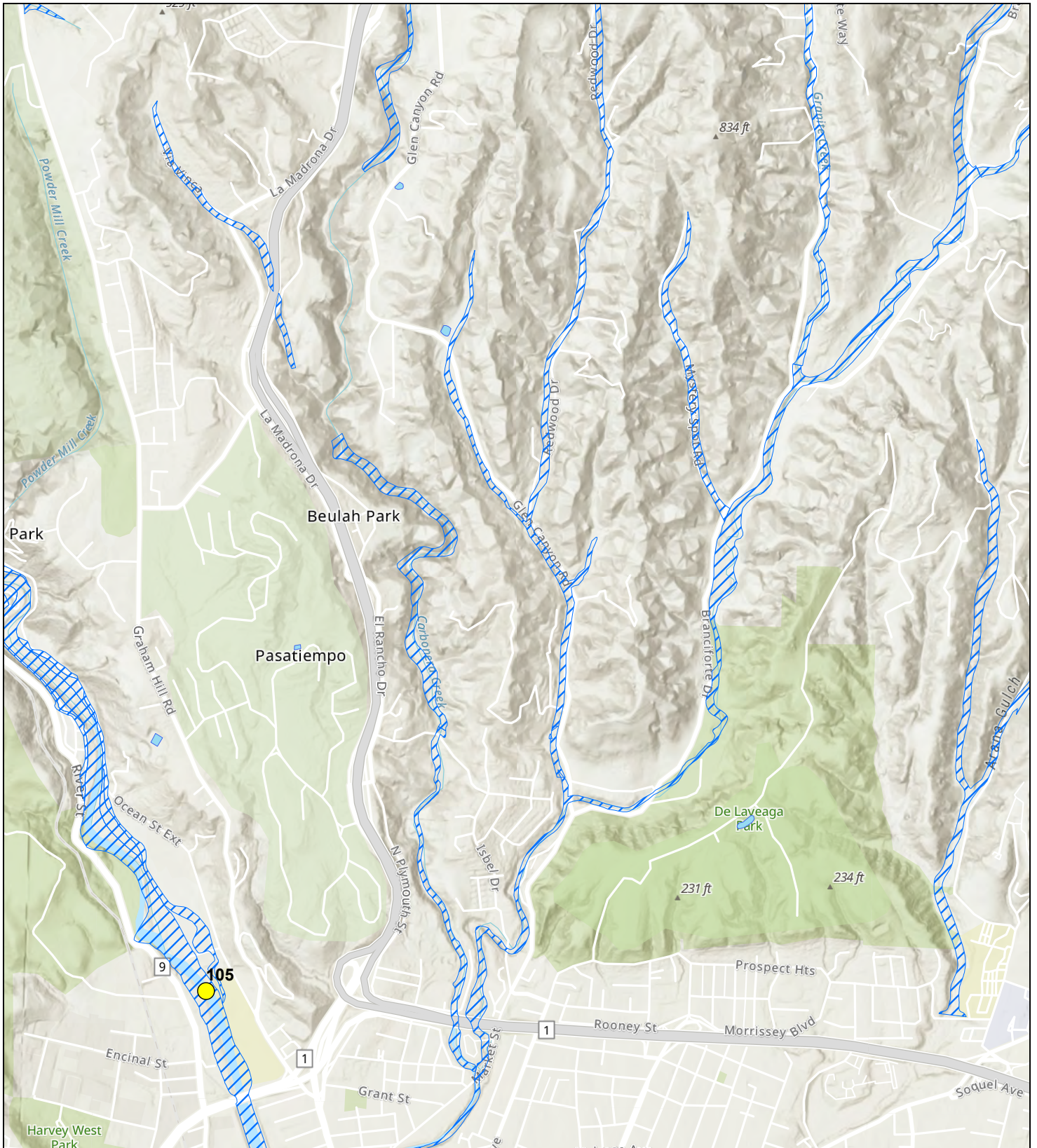
- USGS Watchstream
- Fire Perimeters
- FEMA/DWR/ Floodplain



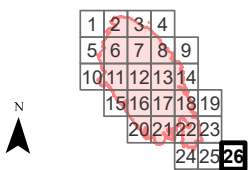
Date Saved: 9/14/2020 3:26 PM Scale: 1:24,000



Appendix C



Incident: CA-CZU-005205
CZU Lightning Complex



Value at Risk (Point)

Potential hazard to life

- High
- Moderate
- Low

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Segment Combined Hazard

15 min 28 mm/hr

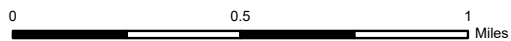
- Low
- Moderate
- High

Basin Combined Hazard

15 min 28mm/hr

- Low
- Moderate
- High

- USGS Watchstream
- Fire Perimeters
- FEMA/DWR/Floodplain



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Last Chance**

Site Number: **C28**

Feature: **Residence**

Feature Category: **home**

Field Observation or Potential Hazard: Potential for debris flow to leave channel and impact residence. Steep slopes upstream with moderate to high potential for debris flows

Potential Hazard to Life: **low**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures (1): **Early Warning**

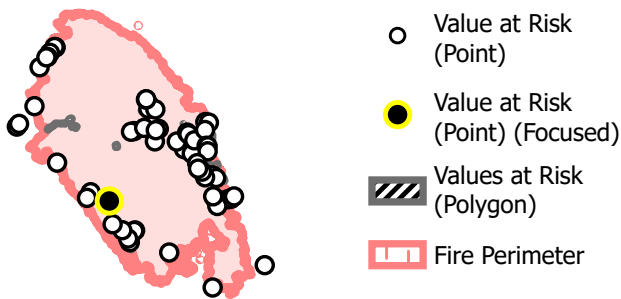
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: **NA**

LOCATION AND PHOTO



Latitude: 37.10097

Longitude: -122.25147



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **C35**

Feature: **Road**

Feature Category: **other**

Field Observation or Potential Hazard: Approximately 150' of retaining wall damaged.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

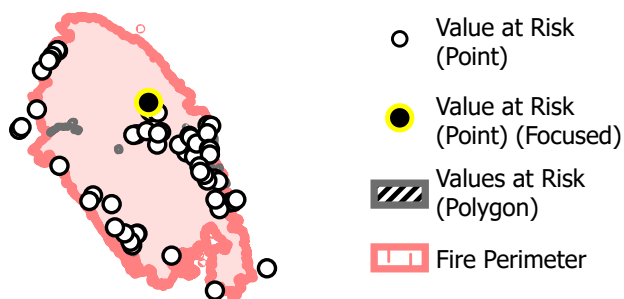
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

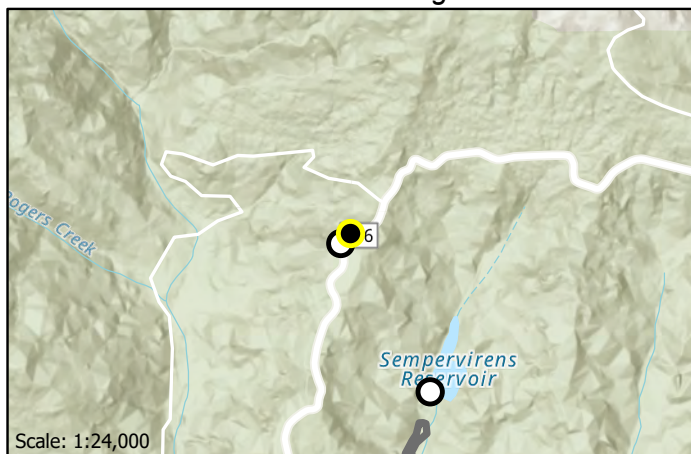
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.19461

Longitude: -122.21192



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **1**

Feature: **Bridge**

Feature Category: **other**

Field Observation Scour along eastern abutment. Landslides visible on hillshade along upstream or Potential Hazard: slopes.

Potential Hazard to Life: **low**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

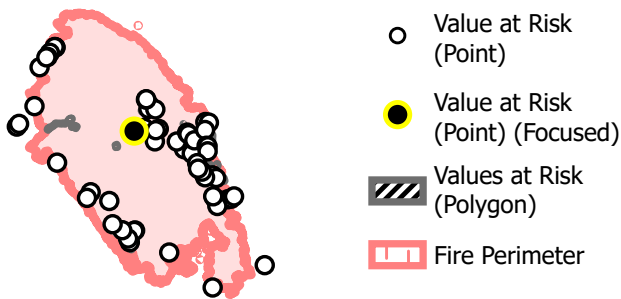
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

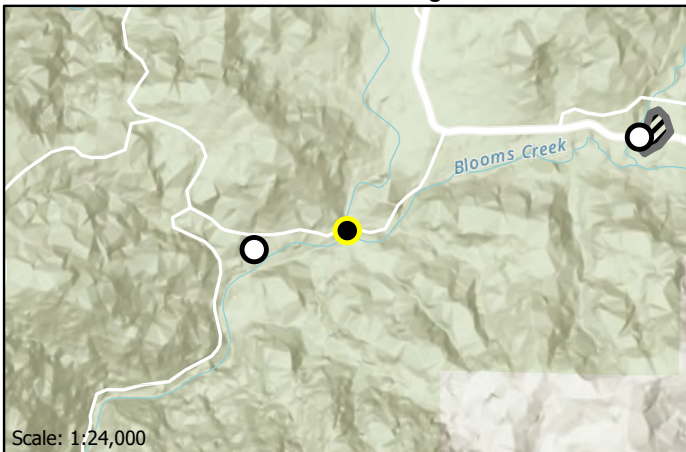
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.16529

Longitude: -122.22489



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Brookdale, Clear Creek**

Site Number: **101**

Feature: **water intake**

Feature Category: **utilities**

Field Observation impacts to San Lorenzo Valley water intake
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

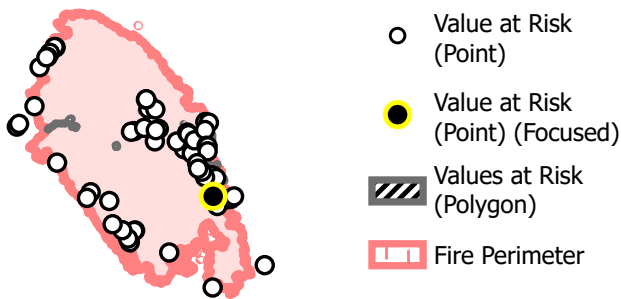
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

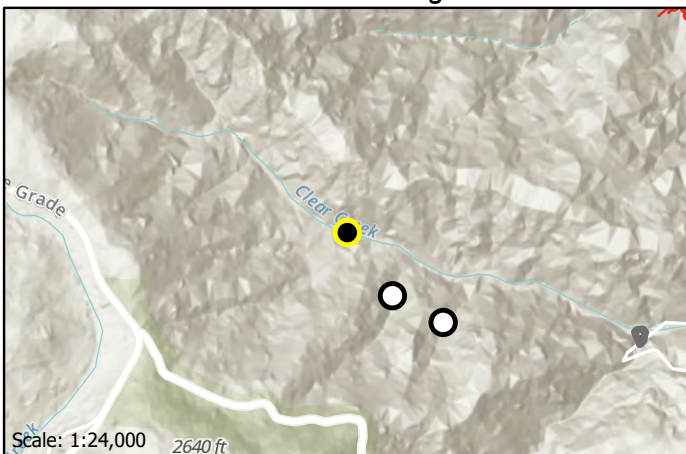
Description: prepare for increased dissolved organics

LOCATION AND PHOTO



Latitude: 37.10745

Longitude: -122.13285



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Water District Intakes**

Site Number: **103**

Feature: **San Lorenzo River at Felton Intake**

Feature Category: **utilities**

Field Observation Post-fire runoff could result in excessive organic that would impair water or Potential Hazard: treatment.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

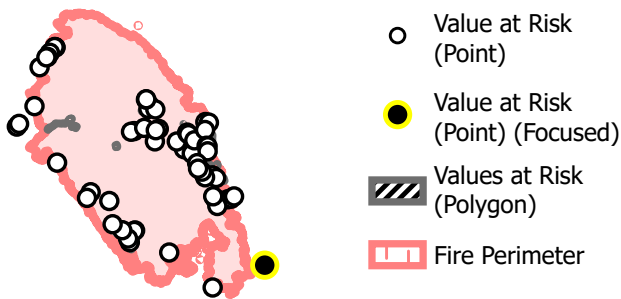
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

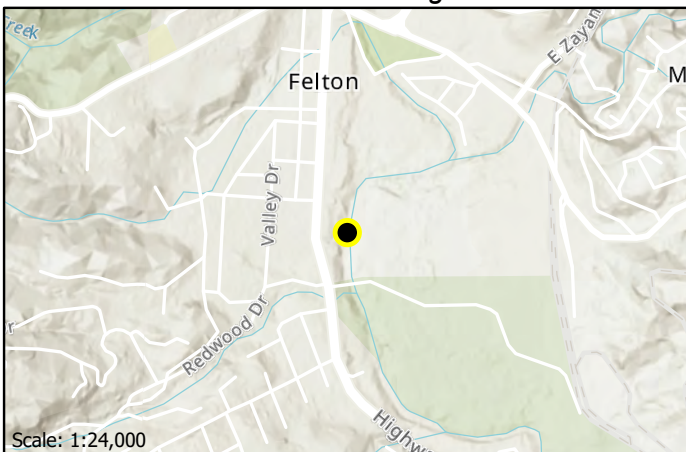
Description: Prepare for increased organics

LOCATION AND PHOTO



Latitude: 37.04566

Longitude: -122.07222



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: San Vincent Creek, Davenport water intake

Site Number: 104

Feature: Municipal water intake

Feature Category: utilities

Field Observation or Potential Hazard: Potential for sedimentation, possible impacts to water quality

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures (1): Clear and maintain culvert

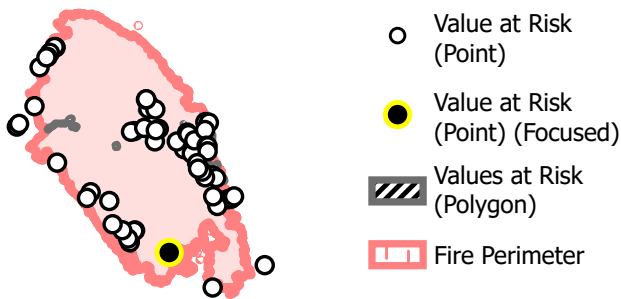
Preliminary Emergency Protective Measures (2): NA

Preliminary Emergency Protective Measures (3): NA

Preliminary Emergency Protective Measures (4): NA

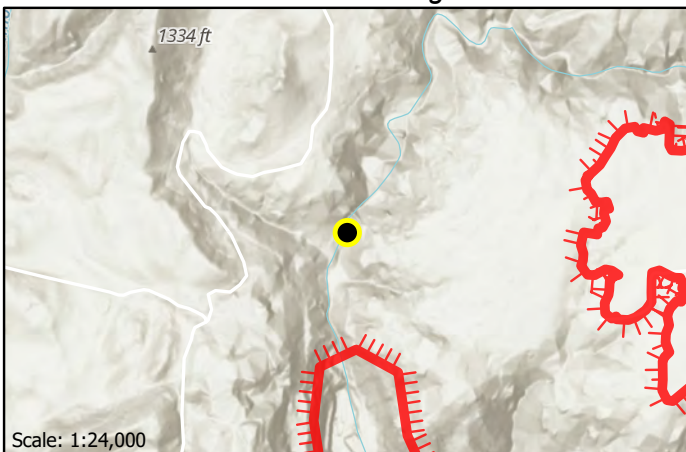
Description: Prepare for increased organics

LOCATION AND PHOTO



Latitude: 37.05524

Longitude: -122.18163



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Water District Intakes**

Site Number: **105**

Feature: **San Lorenzo River at Santa Cruz intake**

Feature Category: **utilities**

Field Observation Post-fire runoff could result in excessive organic that would impair water or Potential Hazard: treatment.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

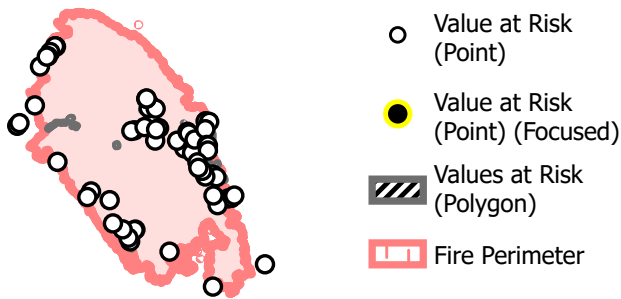
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

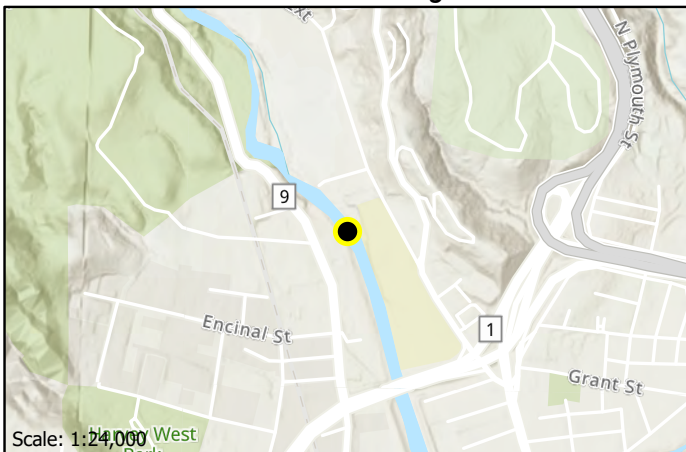
Description: Prepare for increased organics

LOCATION AND PHOTO



Latitude: 36.98989

Longitude: -122.02983



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Water District Intakes**

Site Number: **106**

Feature: **City of Santa Cruz water intake**

Feature Category: **utilities**

Field Observation or Potential Hazard: Impacts to water quality at City of Santa Cruz water intake

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

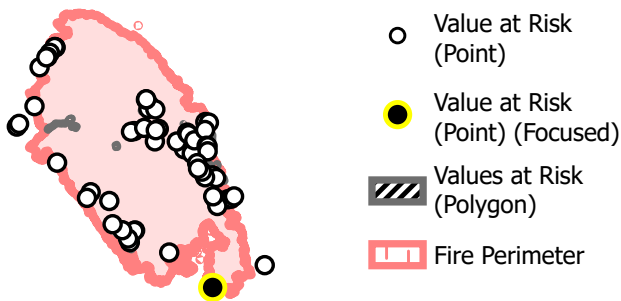
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **Monitor and maintain**

Preliminary Emergency Protective Measures (4): **NA**

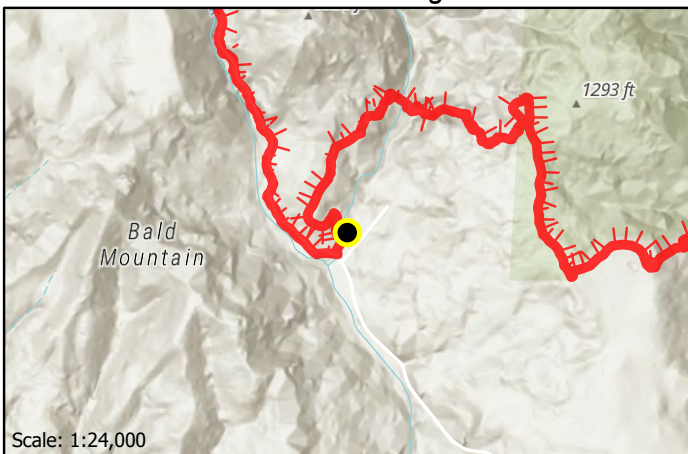
Description: Prepare for increased organics

LOCATION AND PHOTO



Latitude: 37.02423

Longitude: -122.13111



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Brookdale, Clear Creek**

Site Number: **108**

Feature: **water intake**

Feature Category: **utilities**

Field Observation Imapcts to San Lorenzo Valley water intake
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

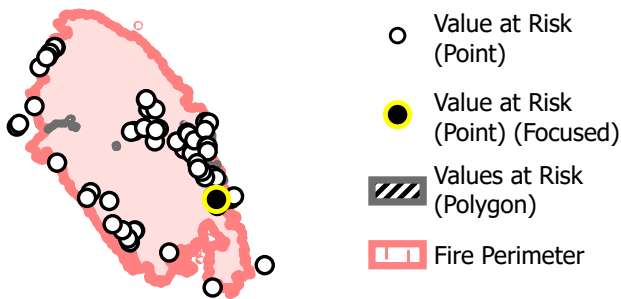
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

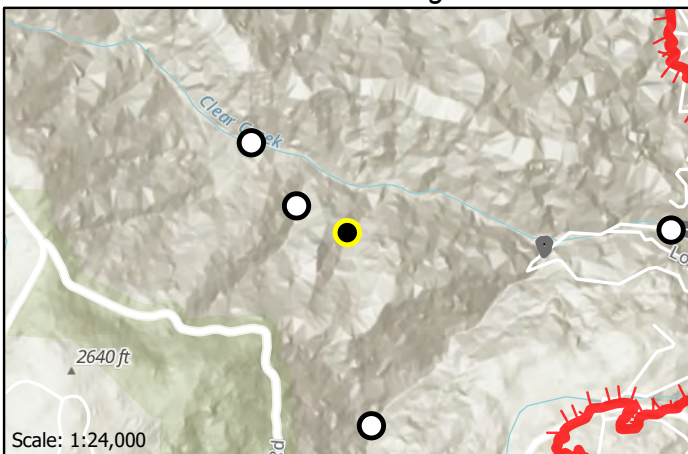
Description: prepare for increased dissolve organics

LOCATION AND PHOTO



Latitude: 37.10470

Longitude: -122.12901



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Brookdale, Clear Creek**

Site Number: **109**

Feature: **Water intake**

Feature Category: **utilities**

Field Observation impacts to San Lorenzo Valley water intake
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

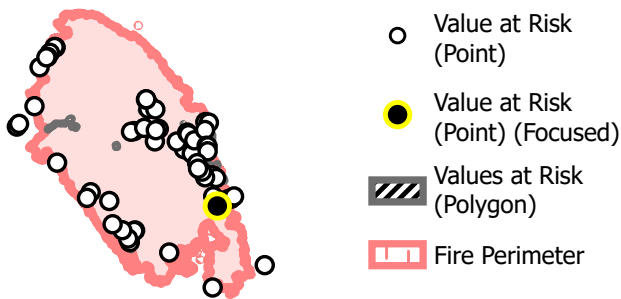
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

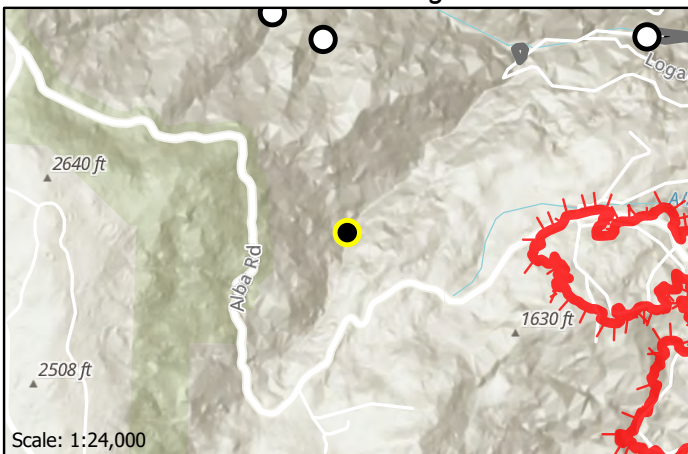
Description: Prepare for increased dissolved organics

LOCATION AND PHOTO



Latitude: 37.09868

Longitude: -122.12789



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Foreman Creek**

Site Number: **110**

Feature: **water intake**

Feature Category: **utilities**

Field Observation impacts to San Lorenzo Valley water intake
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

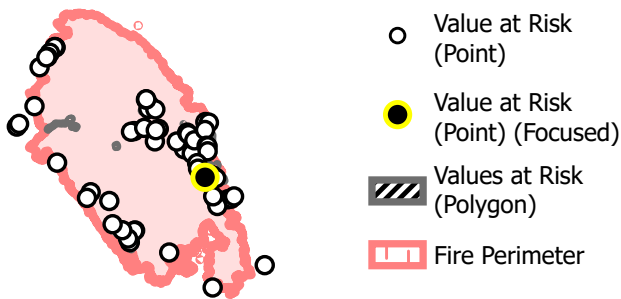
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

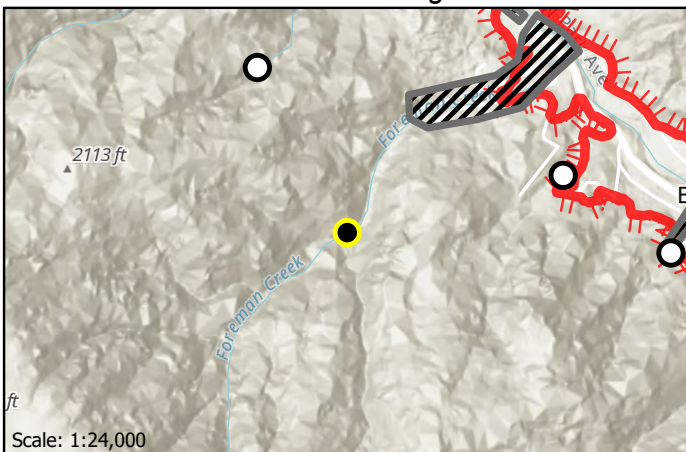
Description: prepare for increased dissolved organics

LOCATION AND PHOTO



Latitude: 37.12461

Longitude: -122.14264



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Silver Creek**

Site Number: **111**

Feature: **water intake**

Feature Category: **utilities**

Field Observation impacts to San Lorenzo Valley water intake
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

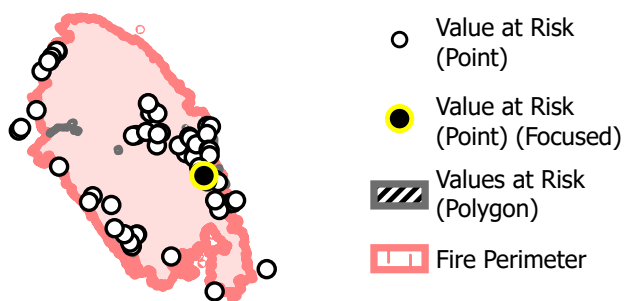
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

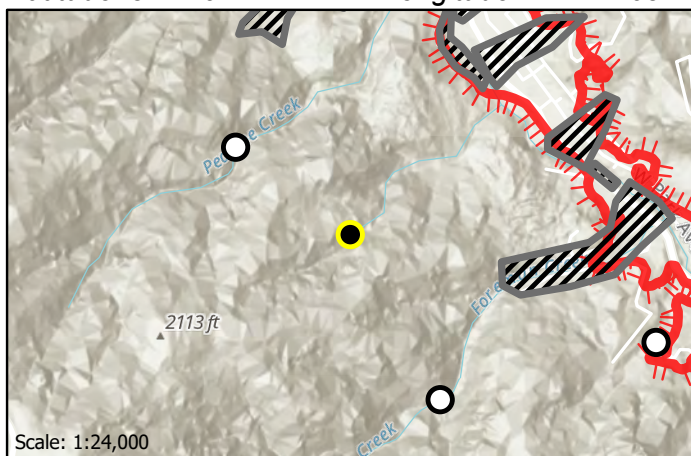
Description: prepare for increased dissolved organics

LOCATION AND PHOTO



Latitude: 37.12971

Longitude: -122.14631



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Peavine Creek**

Site Number: **112**

Feature: **water intake**

Feature Category: **utilities**

Field Observation impacts to San Lorenzo Valley water intake
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

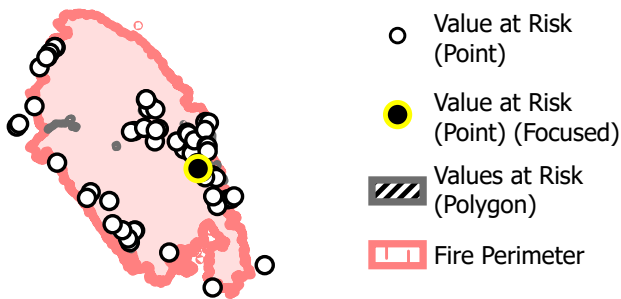
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

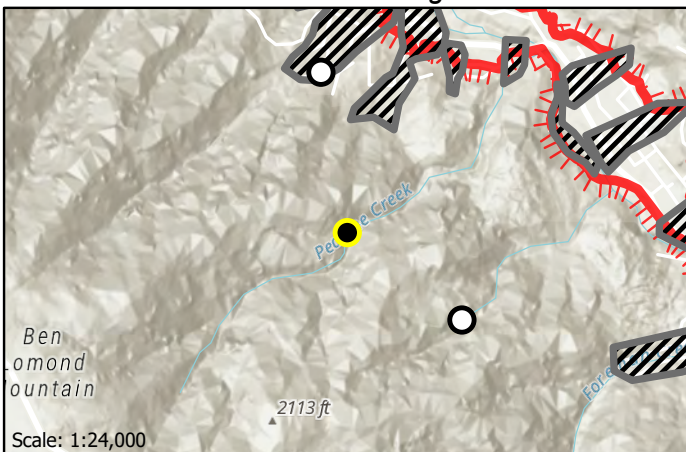
Description: prepare for increased dissolved organics

LOCATION AND PHOTO



Latitude: 37.13236

Longitude: -122.15088



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **12**

Feature: **Infrastructure**

Feature Category: **drainage structure**

Field Observation or Potential Hazard: Culvert along Little Basin Road has potential plug and washout. Drainage contains moderate to steep slopes, with a moderate to high debris flow potential. Rockfall also observed along the road in the vicinity of the crossing.

Potential Hazard to Life: **high**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

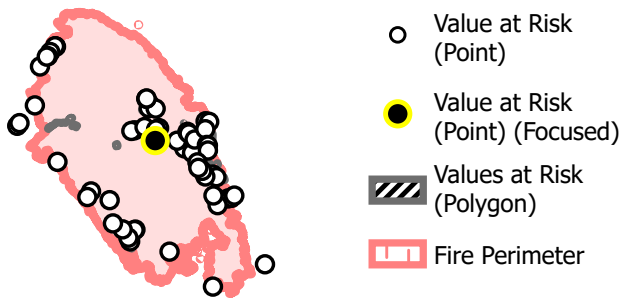
Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: NA

LOCATION AND PHOTO



Latitude: 37.15634

Longitude: -122.20095



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **13**

Feature: **retaining wall**

Feature Category: **other**

Field Observation Approximately 150 feet of retaining wall is damaged
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **NA**

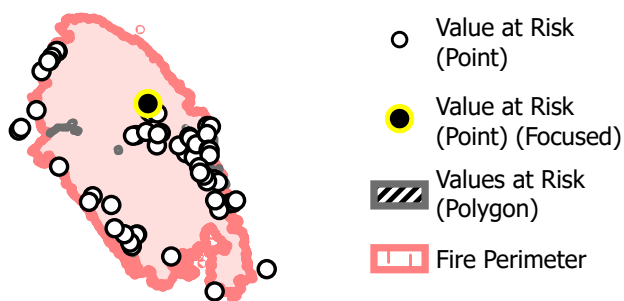
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

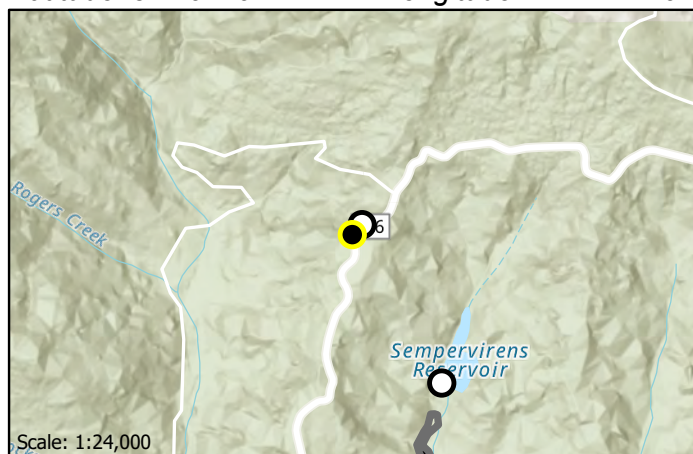
Description: Further evaluation should be made by a PE or PG

LOCATION AND PHOTO



Latitude: 37.19429

Longitude: -122.21229



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **14**

Feature: **Residence, access road**

Feature Category: **drainage structure**

Field Observation or Potential Hazard: Retention pond along paved access road has potential to overtop and divert towards residence. Moderate to steep slopes upstream, with a moderate to high potential for debris flows.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

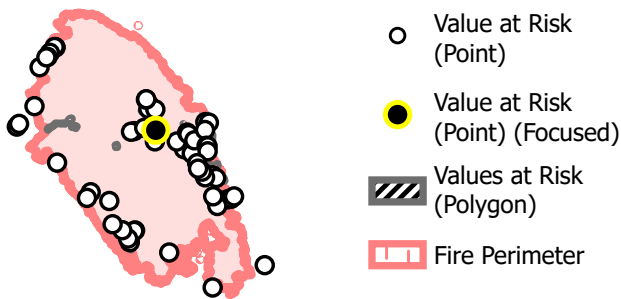
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

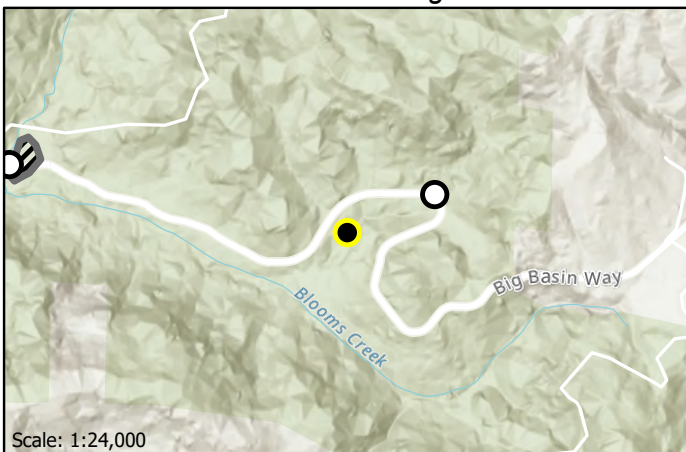
Description: NA

LOCATION AND PHOTO



Latitude: 37.16654

Longitude: -122.20021



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **15**

Feature: **Residence**

Feature Category: **home**

Field Observation or Potential Hazard: House within floodplain, large portion of upstream watershed located within burn area.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

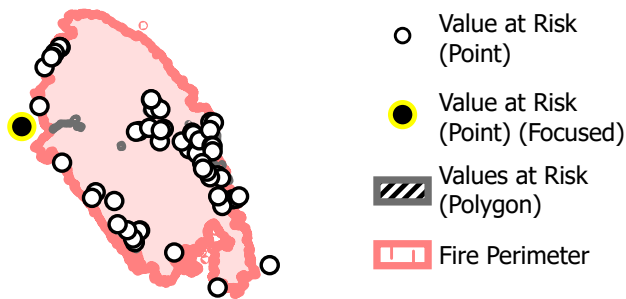
Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

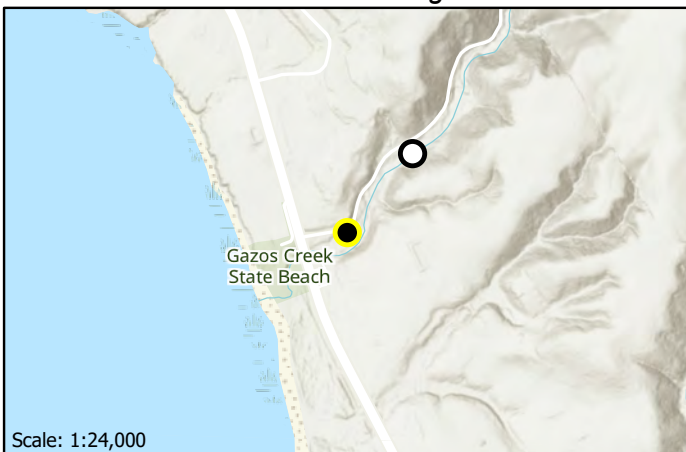
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.16680

Longitude: -122.35924



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **16**

Feature: **Pump house/well**

Feature Category: **utilities**

Field Observation Well house and associated equipment within floodplain. Large portion of
or Potential Hazard: upstream watershed located in burn area.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

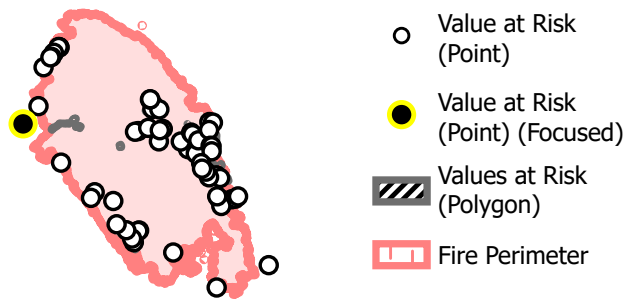
Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: **NA**

LOCATION AND PHOTO



Latitude: 37.16932

Longitude: -122.35675



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **17**

Feature: **Bridge**

Feature Category: **drainage structure**

Field Observation Flooding/debris jam has potential to overtop bridge. Bridge founded on sill logs or *Potential Hazard:* located immediately above channel slope along northern abutment.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

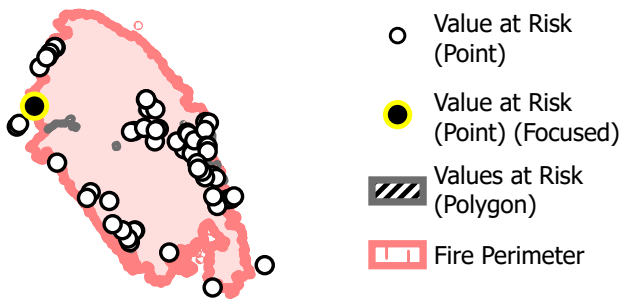
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: NA

LOCATION AND PHOTO



Latitude: 37.18585

Longitude: -122.33963



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **19**

Feature: **Residence**

Feature Category: **home**

Field Observation Upstream watercourse mapped as a moderate to high potential for debris flows.
or Potential Hazard: Watercourse contains large amounts of debris. Classroom buildings within lower portion of the property are located adjacent to watercourse.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

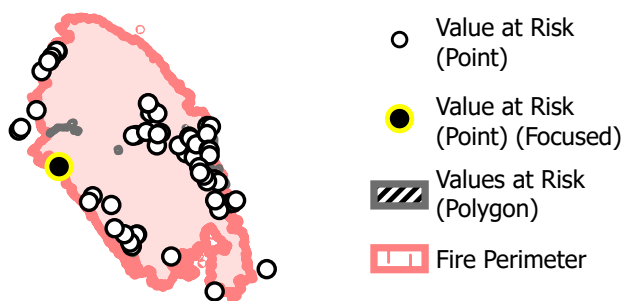
Preliminary Emergency Protective Measures (2): **Deflection structure**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

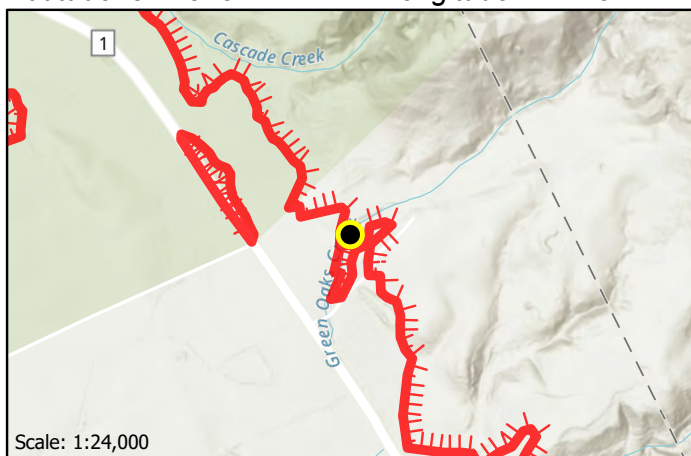
Description: Temporary Closure

LOCATION AND PHOTO



Latitude: 37.13481

Longitude: -122.31221



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **2**

Feature: **Infrastructure**

Feature Category: **utilities**

Field Observation Moderate to steep slopes above with moderate burn severity, potential for
or Potential Hazard: shallow debris slides to impact facility

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

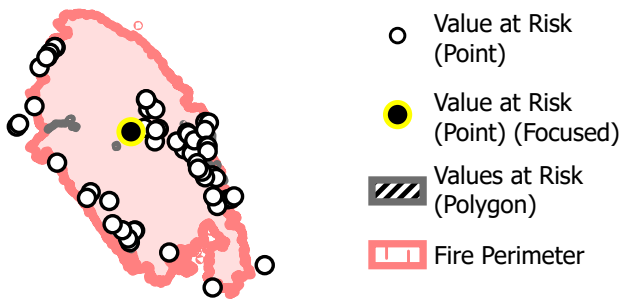
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

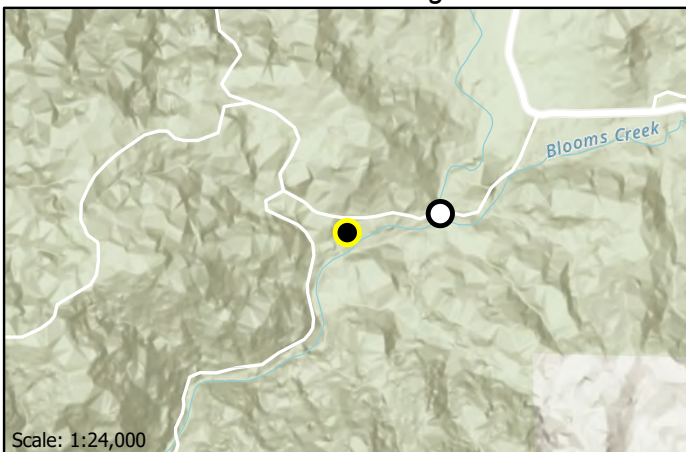
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.16463

Longitude: -122.22852



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **20**

Feature: **Bridge**

Feature Category: **other**

Field Observation Flooding could impact the bridge, large watershed upstream.
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

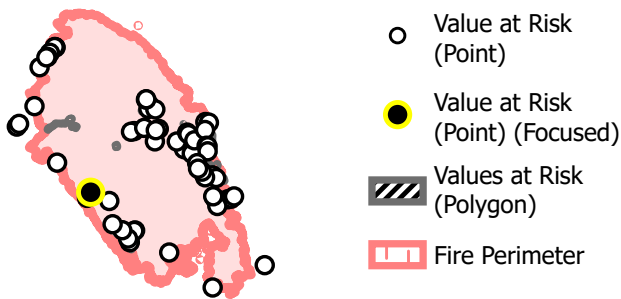
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

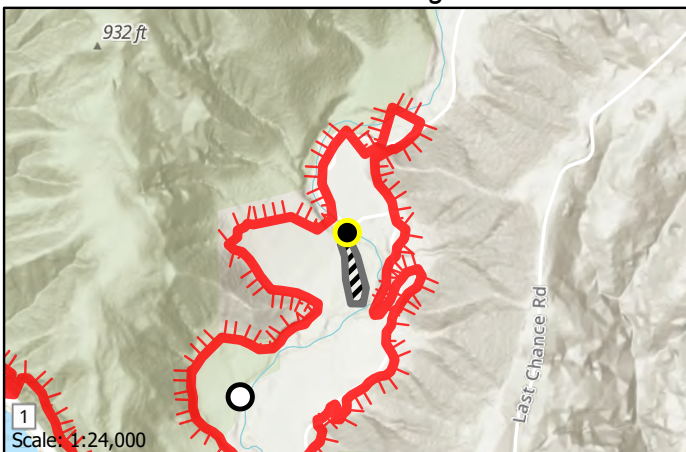
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.10856

Longitude: -122.27299



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **21**

Feature: **Bridge**

Feature Category: **other**

Field Observation or Potential Hazard: Flooding could impact the bridge, large watershed upstream.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

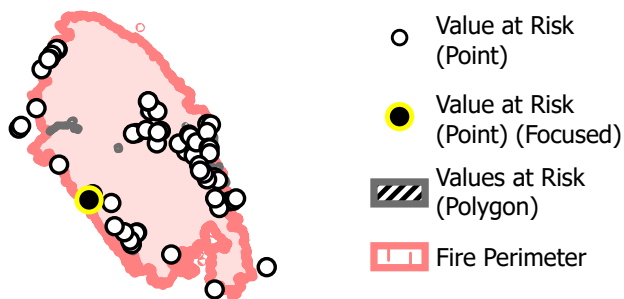
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

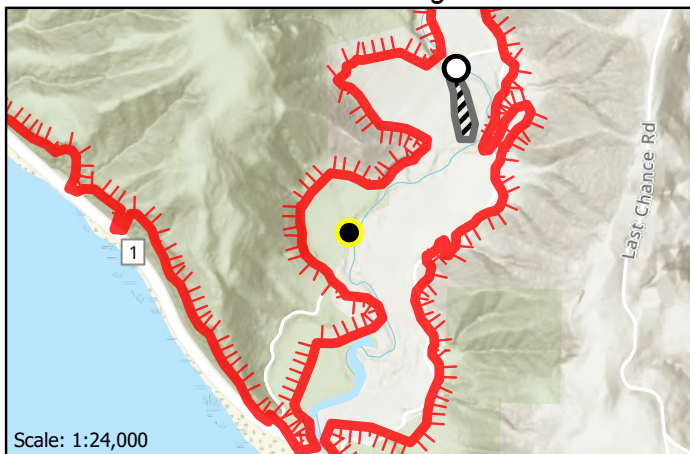
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.10334

Longitude: -122.27702



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **26**

Feature: **Bridge**

Feature Category: **other**

Field Observation Flooding could impact bridge. Large portion of upstream watershed located in
Potential Hazard: burn area.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

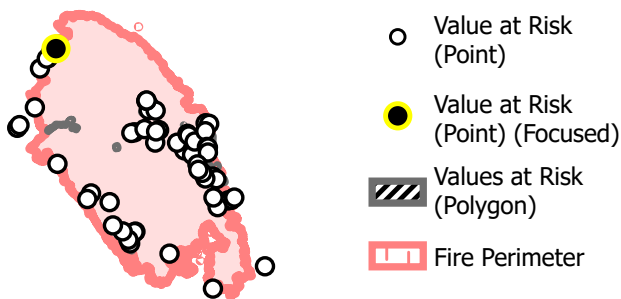
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

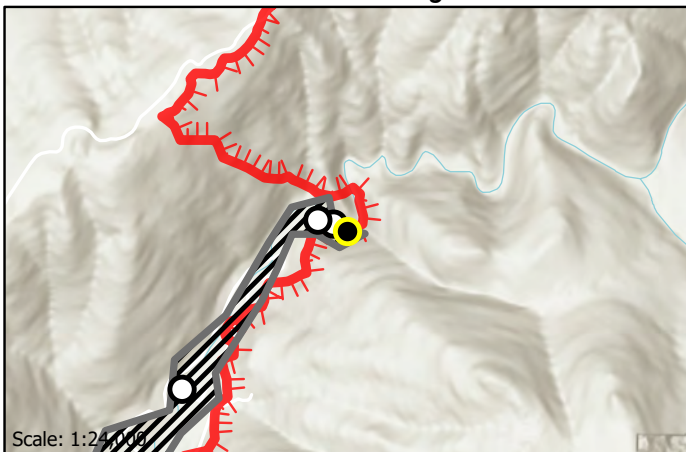
Description: NA

LOCATION AND PHOTO



Latitude: 37.23994

Longitude: -122.31711



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **27**

Feature: **Bridge**

Feature Category: **other**

Field Observation Flooding could impact bridge. Large portion of upstream watershed located in
Potential Hazard: burn area.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

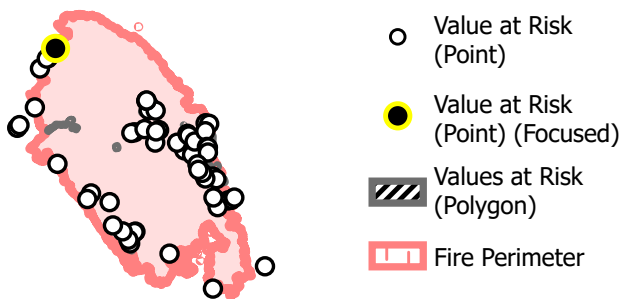
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

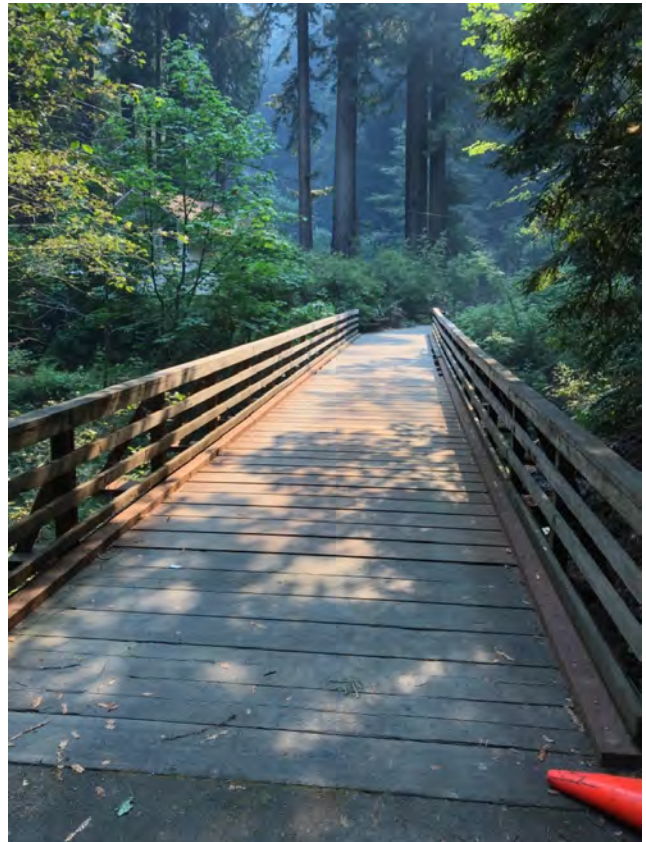
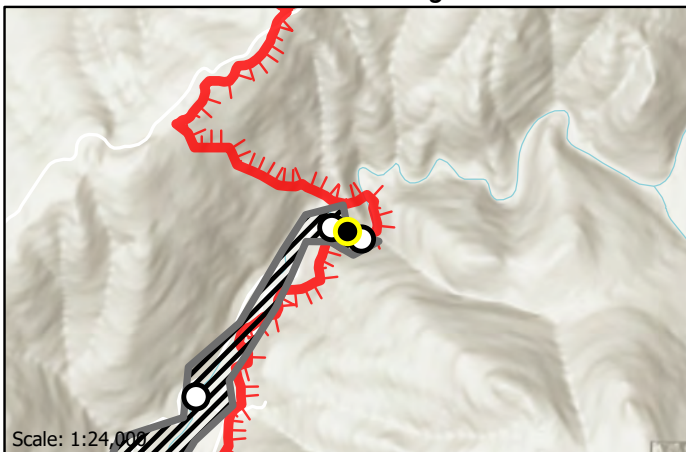
Description: NA

LOCATION AND PHOTO



Latitude: 37.24017

Longitude: -122.31766



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **28**

Feature: **Community water supply**

Feature Category: **utilities**

Field Observation Community water tanks, pump house and purification system within floodplain
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

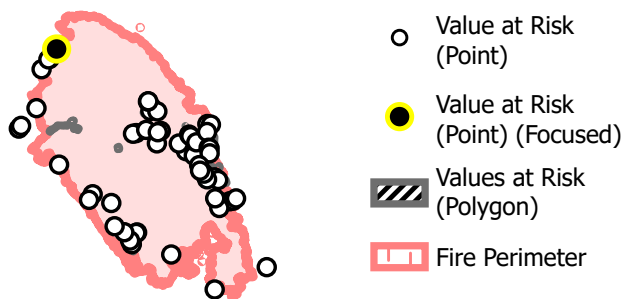
Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

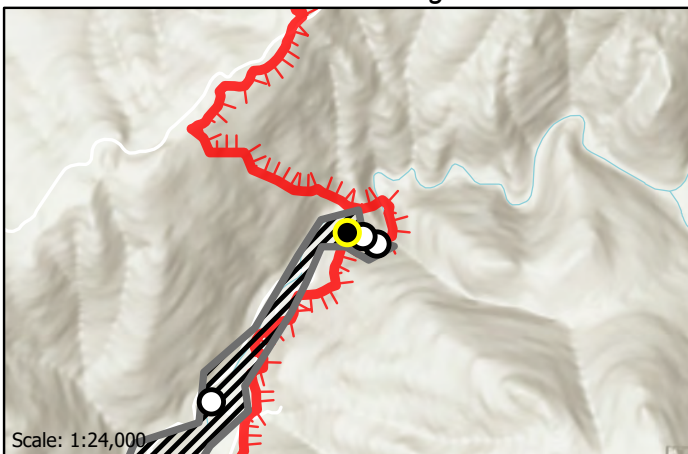
Description: NA

LOCATION AND PHOTO



Latitude: 37.24028

Longitude: -122.31828



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **29**

Feature: **Residential access**

Feature Category: **other**

Field Observation or Potential Hazard: Flooding could impact bridge. Scour observed along abutments.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

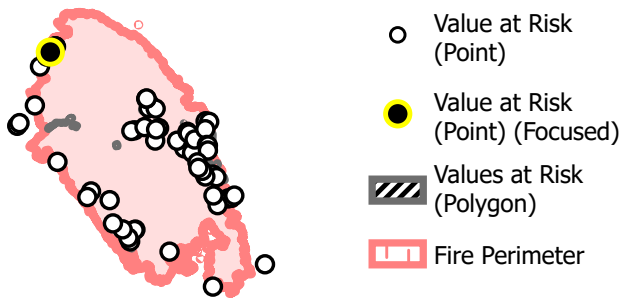
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

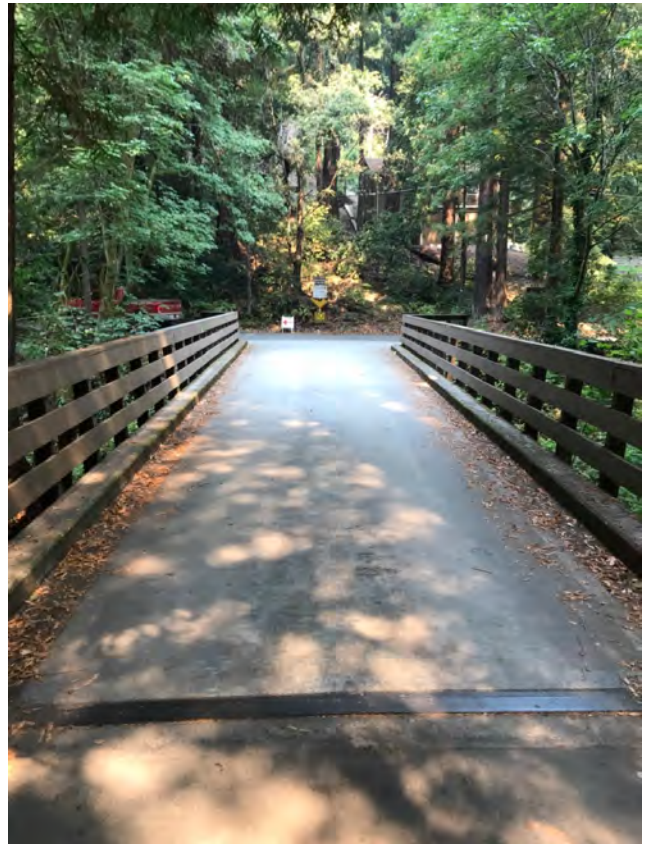
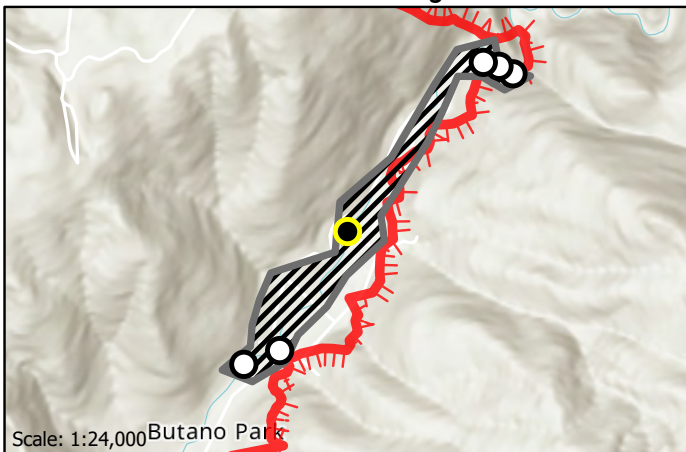
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.23488

Longitude: -122.32345



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **3**

Feature: **Dam, domestic water supply.**

Feature Category: **utilities**

Field Observation Flooding and debris flows could impact dam. Slopes upstream with moderate to high burn severity and visible landslides on hillshade imagery. Existing 12" diameter drainage pipe along east side of embankment is damaged. Spillway outlet prone to plugging.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

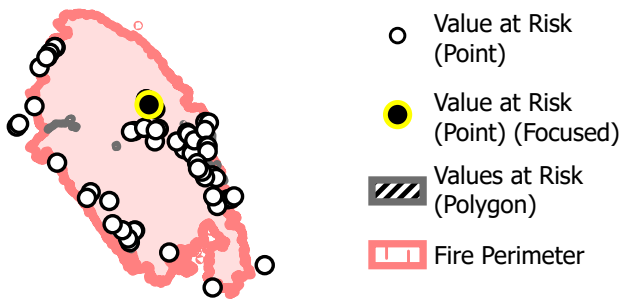
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

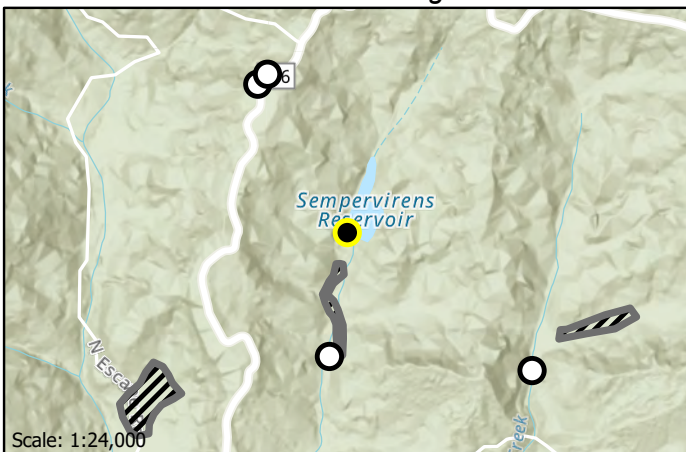
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.18971

Longitude: -122.20865



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **30**

Feature: **Residential access**

Feature Category: **other**

Field Observation: Flooding could impact bridge. Large portion of upstream watershed located in
or Potential Hazard: burn area.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

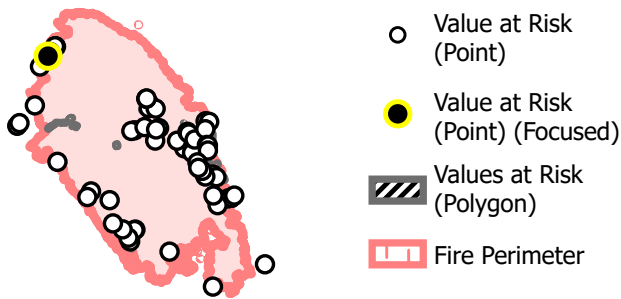
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

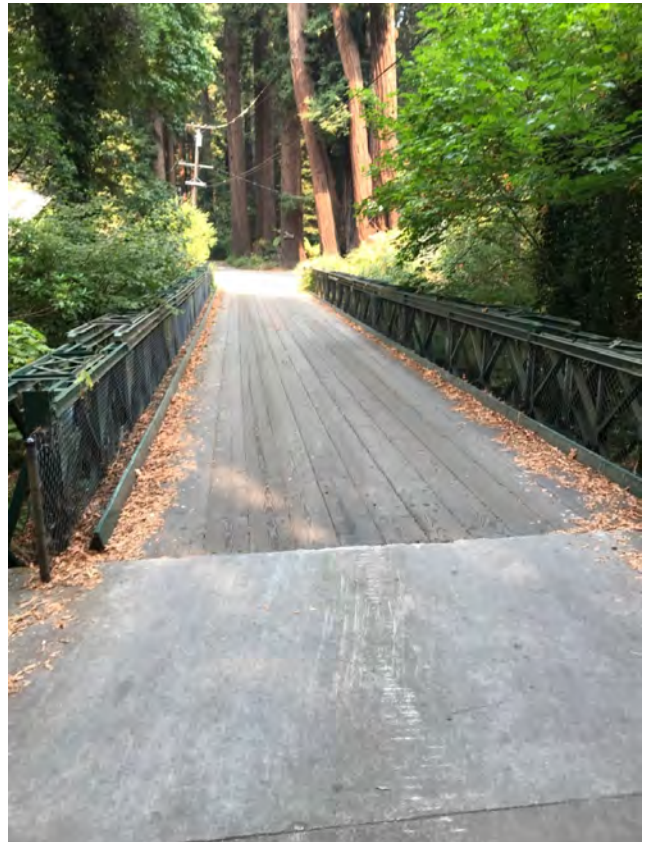
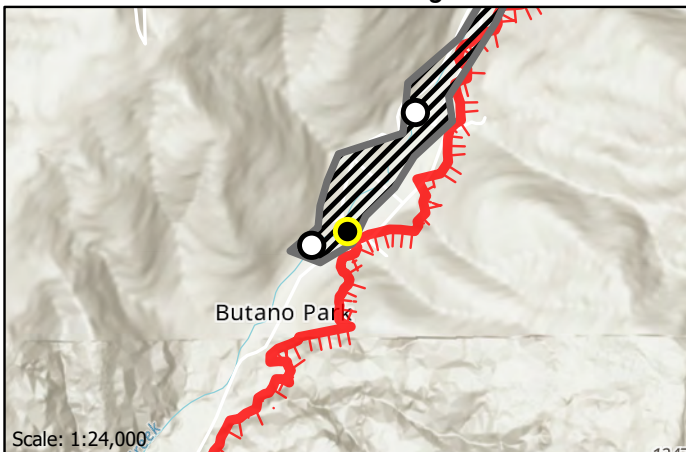
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.23110

Longitude: -122.32600



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **31**

Feature: **Residential access**

Feature Category: **other**

Field Observation Flooding could impact bridge. Vertically stacked log abutments functioning as
Potential Hazard: retaining wall along eastern abutment.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

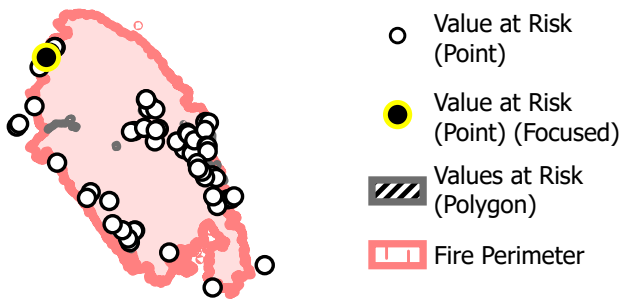
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

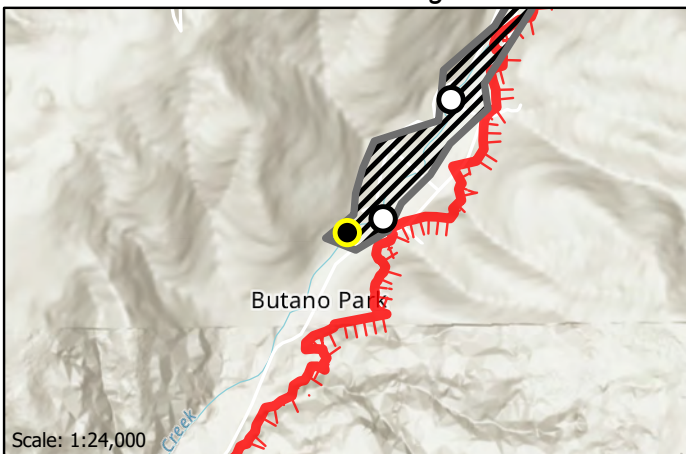
Description: NA

LOCATION AND PHOTO



Latitude: 37.23065

Longitude: -122.32739



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **33**

Feature: **Camp structures**

Feature Category: **recreational**

Field Observation Debris flow has potential to impact structures and pump house for campground.
or Potential Hazard:

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

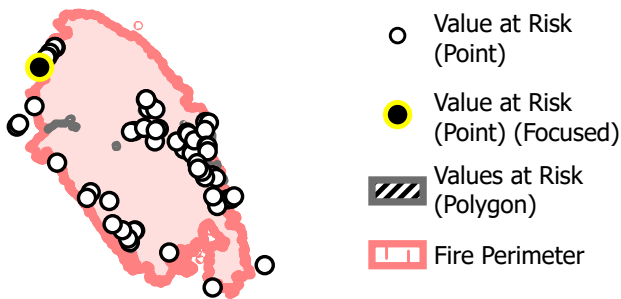
Preliminary Emergency Protective Measures (2): **Deflection structure**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

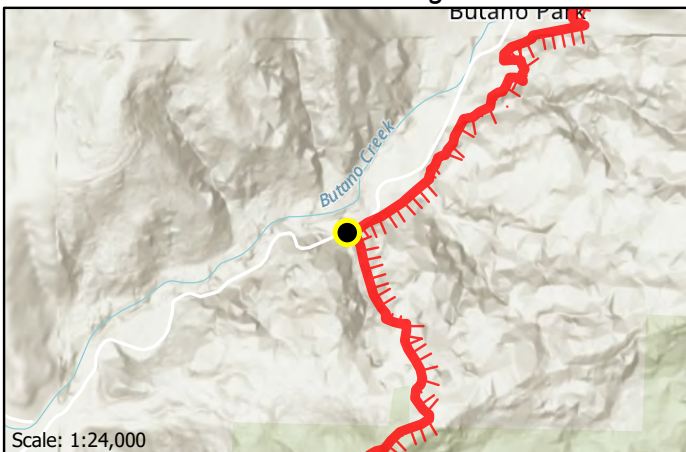
Description: Temporary Closure

LOCATION AND PHOTO



Latitude: 37.22146

Longitude: -122.33489



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **34**

Feature: **House**

Feature Category: **home**

Field Observation House located along tributary to Jamison Creek. Evidence of past debris flow or *Potential Hazard*: activity, including large boulders within channel and adjacent to structure.

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

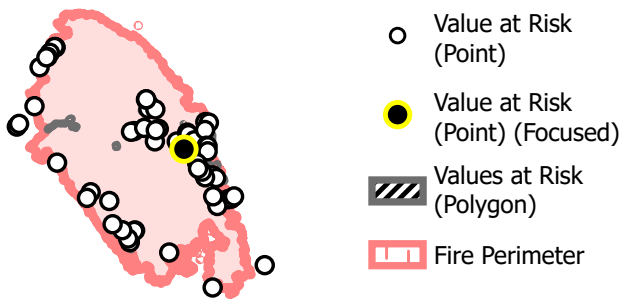
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

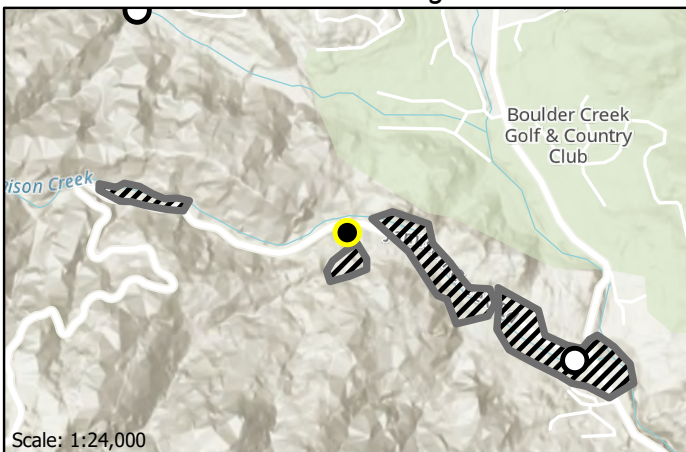
Description: NA

LOCATION AND PHOTO



Latitude: 37.14987

Longitude: -122.16747



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **35**

Feature: **CALFIRE station.**

Feature Category: **other**

Field Observation CALFIRE Jamison Creek Station located along Jameson Creek. Within alluvial
or Potential Hazard: fan at bottom of creek. Box culvert at highway 236 is SW of building.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

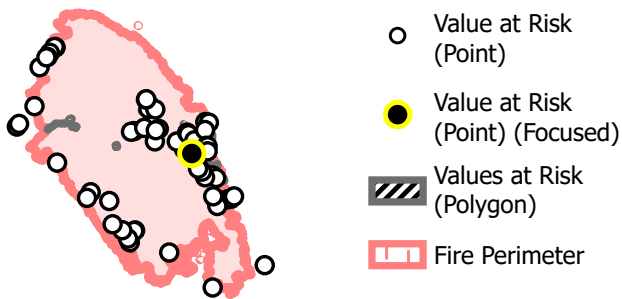
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

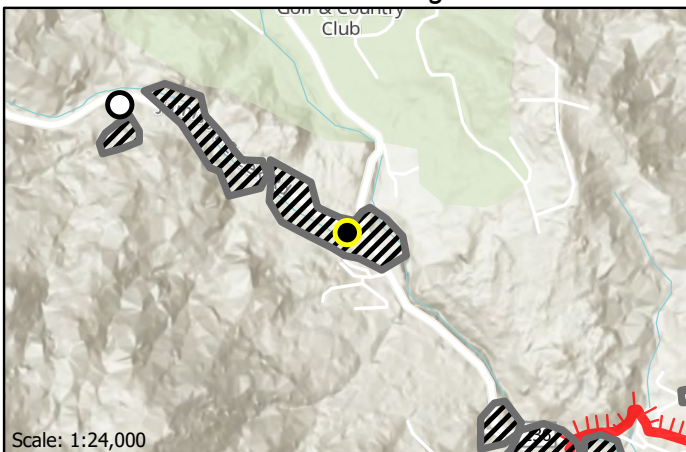
Description: NA

LOCATION AND PHOTO



Latitude: 37.14603

Longitude: -122.15844



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **36**

Feature: **House**

Feature Category: **home**

Field Observation House located on fan at base of steep watercourse. Multiple debris slides or *Potential Hazard*: mapped upstream.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

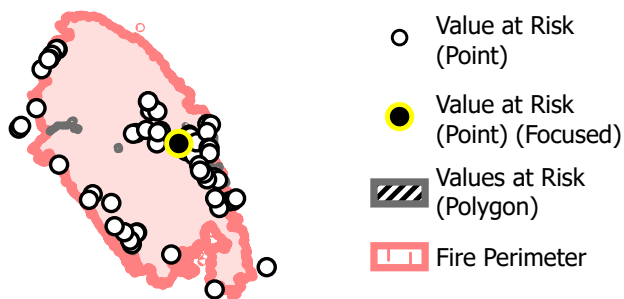
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: NA

LOCATION AND PHOTO



Latitude: 37.15667

Longitude: -122.17591



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **4**

Feature: **Infrastructure**

Feature Category: **utilities**

Field Observation 90 degree turn in creek observed approximately 80' upstream of the tank.
or Potential Hazard: Potential for water and debris to leave the main channel and flow towards tank.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

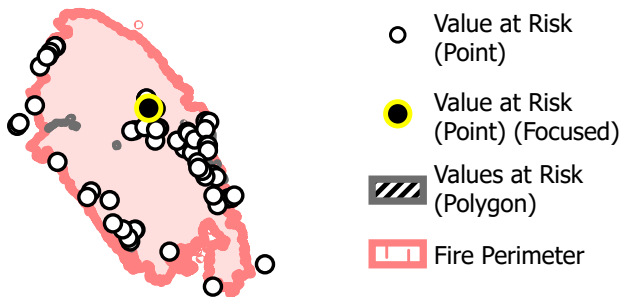
Preliminary Emergency Protective Measures (2): **Deflection structure**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

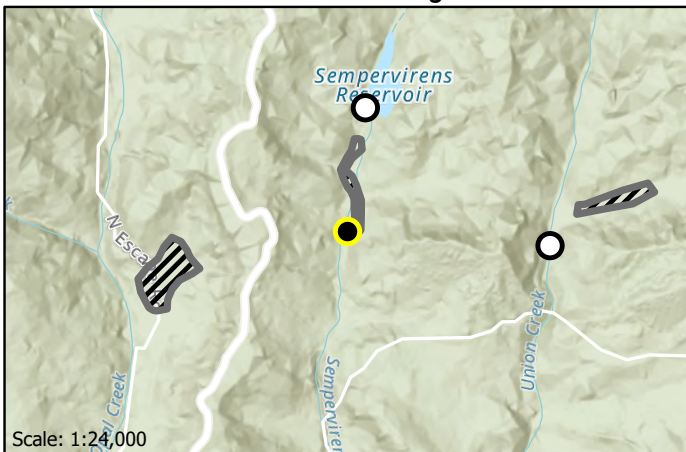
Description: NA

LOCATION AND PHOTO



Latitude: 37.18583

Longitude: -122.20923



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **54**

Feature: **House**

Feature Category: **home**

Field Observation House and deck located immediately adjacent to Boulder Creek. Deck post or Potential Hazard: rotated.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

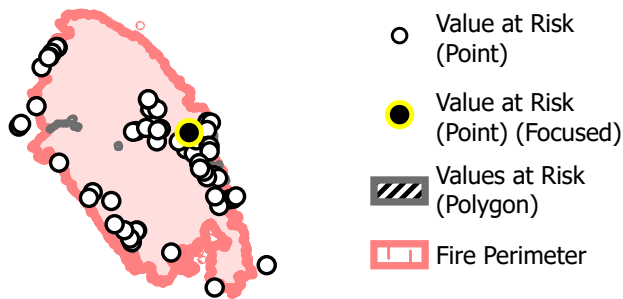
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

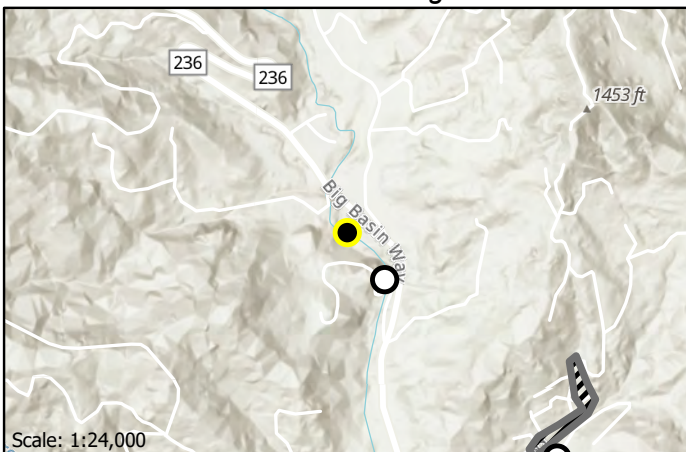
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.16503

Longitude: -122.16429



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **55**

Feature: **Burned structure and rail car bridge.**

Feature Category: **home**

Field Observation or Potential Hazard: Potential for flooding impacts to temporary housing site. Apparent former structure and shipping container located within bank full flood plain of Boulder Creek. Also, rail car bridge.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

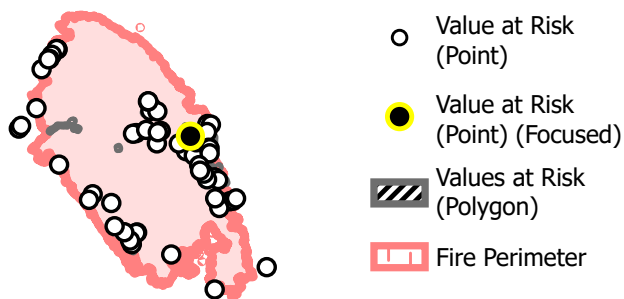
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

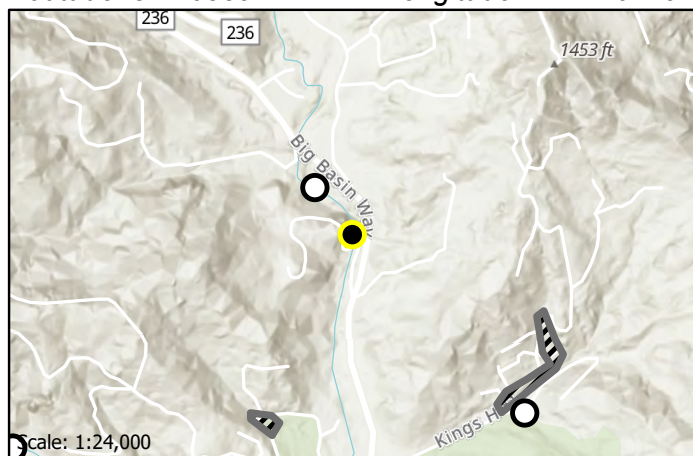
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.16359

Longitude: -122.16279



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **56**

Feature: **House and outbuildings**

Feature Category: **home**

Field Observation or Potential Hazard: House located adjacent to small channel. Channel mapped as low debris flow probability.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

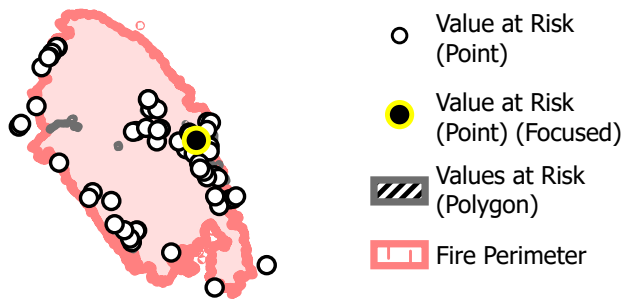
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

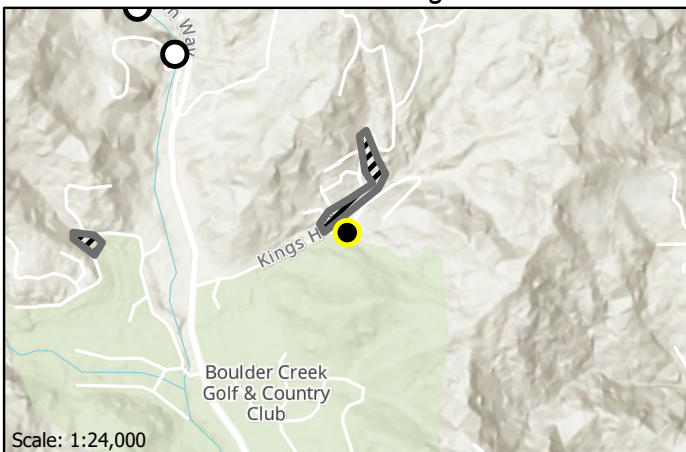
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.15813

Longitude: -122.15587



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Boulder Creek**

Site Number: **57**

Feature: **Well box**

Feature Category: **utilities**

Field Observation Well box located in Creek. Creek identified as low probability debris flow.
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

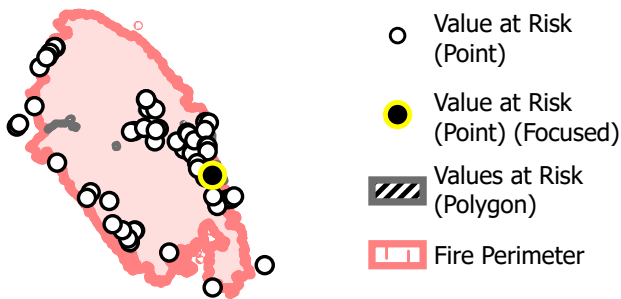
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

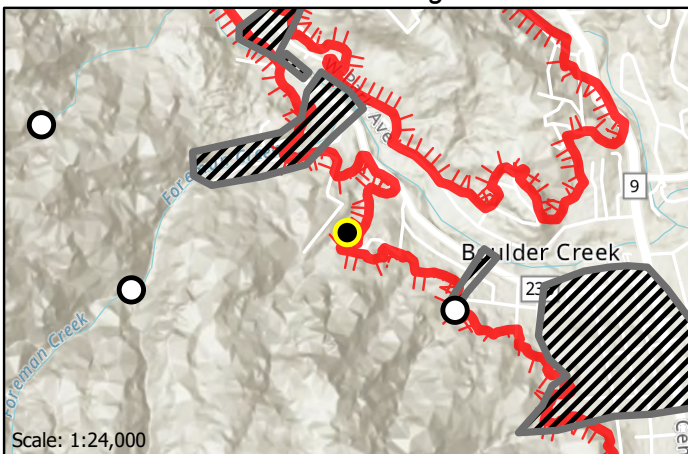
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.12655

Longitude: -122.13423



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Boulder Creek**

Site Number: **58**

Feature: **House**

Feature Category: **home**

Field Observation or Potential Hazard: House located adjacent to modeled debris flow channel segment. Model shows low potential. Possible small avulsion upstream of house. Homeowner constructed berm to channel flow away from house

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

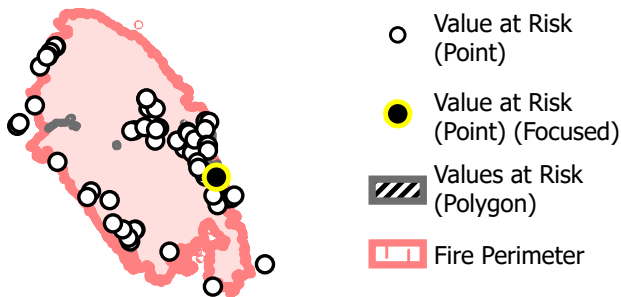
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

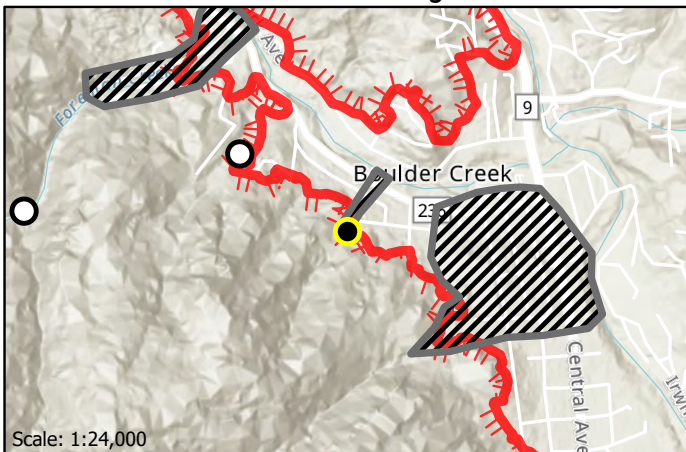
Description: NA

LOCATION AND PHOTO



Latitude: 37.12420

Longitude: -122.12994



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **6**

Feature: **Road**

Feature Category: **drainage structure**

Field Observation Choke point, 10-foot diameter arched culvert appears to be chokepoint for
or Potential Hazard: upstream watershed. Potential to plug with woody debris, overtop and washout road prism.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

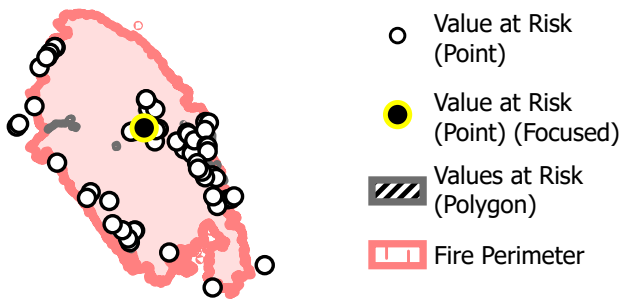
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

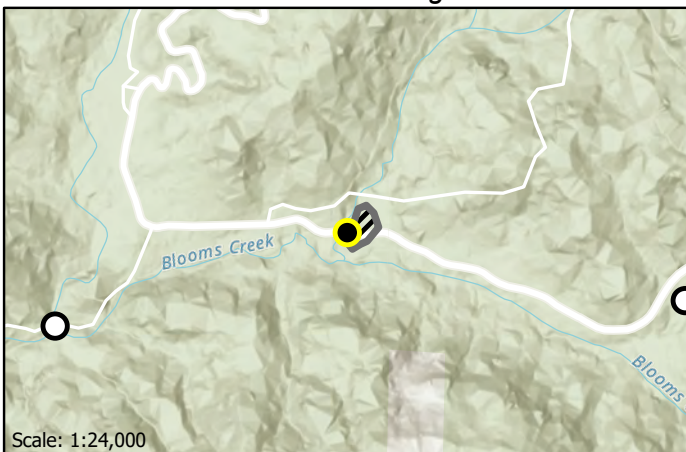
Description: NA

LOCATION AND PHOTO



Latitude: 37.16842

Longitude: -122.21352



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **63**

Feature: **House and access bridge**

Feature Category: **home**

Field Observation or Potential Hazard: Existing house and driveway bridge

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

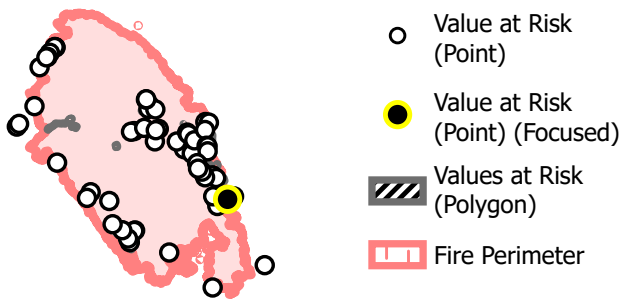
Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

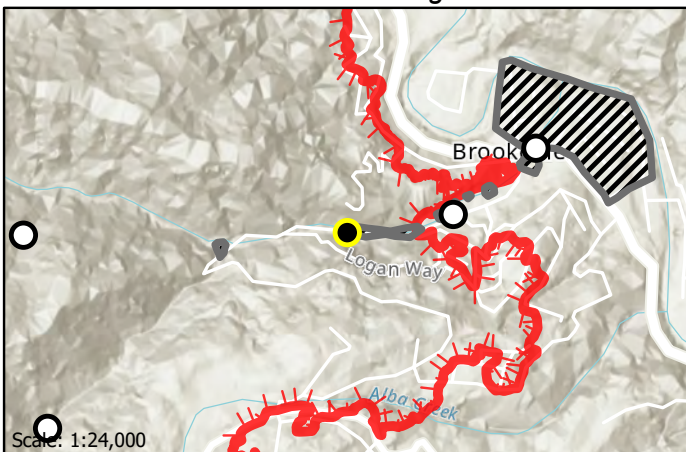
Description: NA

LOCATION AND PHOTO



Latitude: 37.10501

Longitude: -122.11633



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **64**

Feature: **House**

Feature Category: **home**

Field Observation Existing house
or Potential Hazard:

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

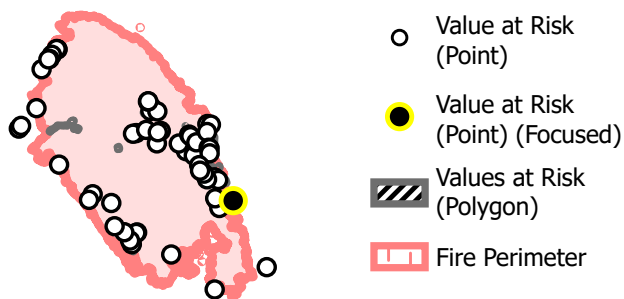
Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

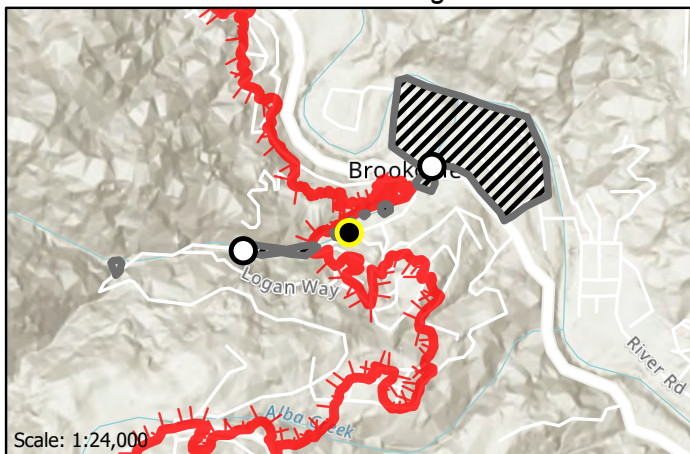
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.10565

Longitude: -122.11219



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **65**

Feature: **Bridge**

Feature Category: **other**

Field Observation or Potential Hazard: Highway 9 bridge

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

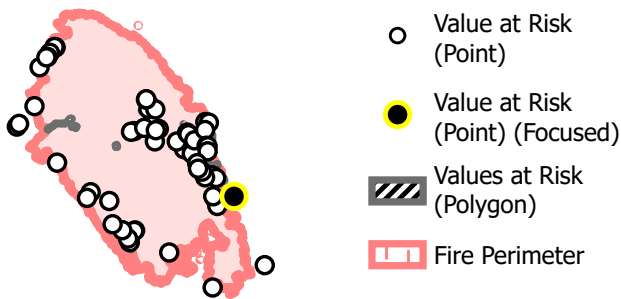
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

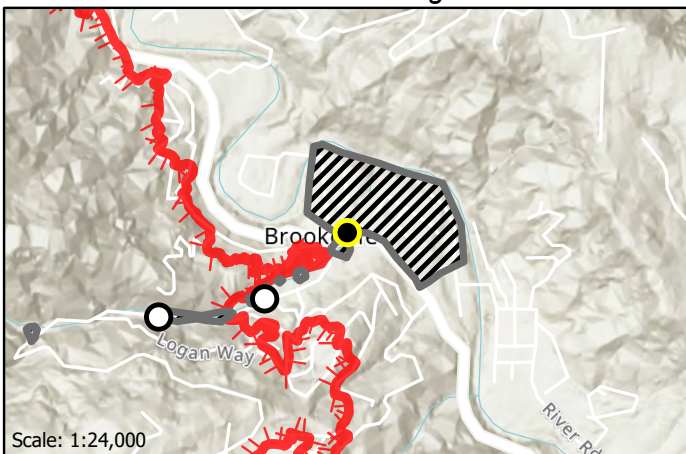
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.10778

Longitude: -122.10901



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **7**

Feature: **Road**

Feature Category: **drainage structure**

Field Observation 36-inch concrete box culvert has potential to overtop and washout road prism.
or Potential Hazard: Crossing located downstream of steep slopes with high potential for debris flows. Watercourse contains large amount of woody debris.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

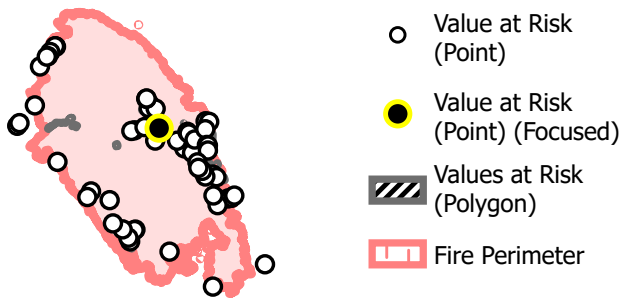
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

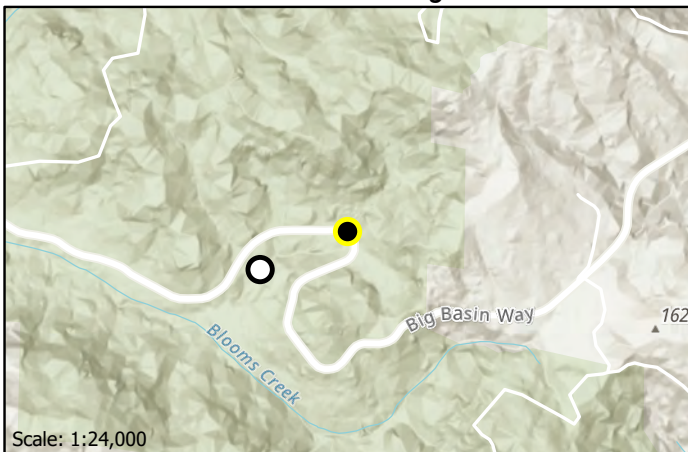
Description: NA

LOCATION AND PHOTO



Latitude: 37.16780

Longitude: -122.19682



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **74**

Feature: **House and shed**

Feature Category: **home**

Field Observation or Potential Hazard: House located adjacent to watercourse. Stream is channelized through property. Potential for clogging and flooding.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

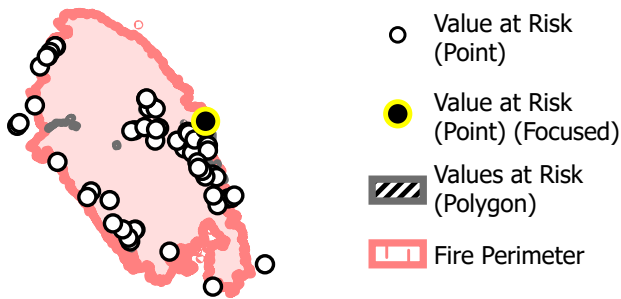
Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

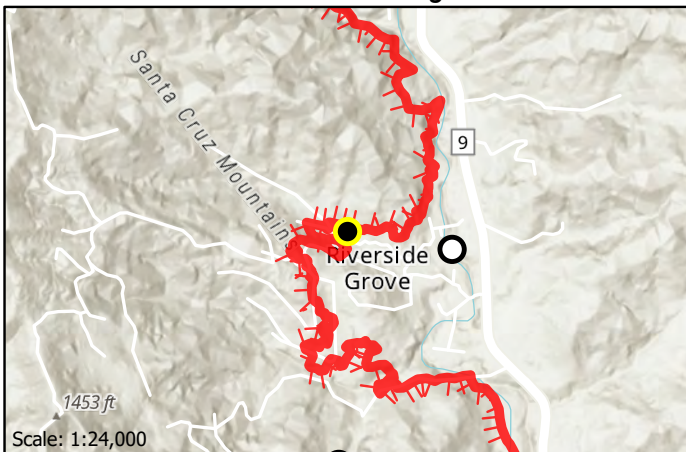
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.17506

Longitude: -122.14376



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **75**

Feature: **House**

Feature Category: **home**

Field Observation or Potential Hazard: House located at mouth of canyon.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

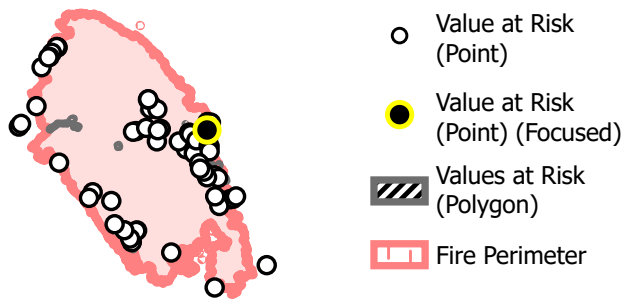
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: **NA**

LOCATION AND PHOTO



Latitude: 37.16777

Longitude: -122.14390



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **78**

Feature: **Burned house**

Feature Category: **home**

Field Observation Potential for debris flow to impact temporary housing site. Burned house
or Potential Hazard: located immediately adjacent to watercourse with a low probability for debris flow.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures (1): **Early Warning**

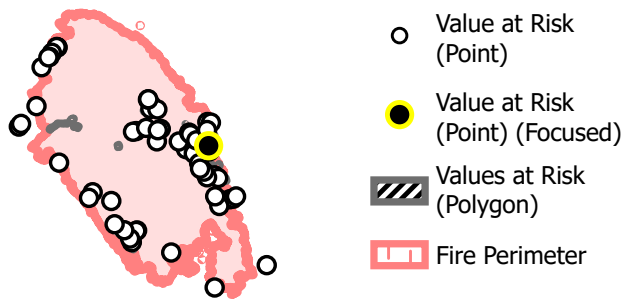
Preliminary Emergency Protective Measures (2): **Early Warning**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: NA

LOCATION AND PHOTO



Latitude: 37.15346

Longitude: -122.14167



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **79**

Feature: **Burned house**

Feature Category: **home**

Field Observation Potential for debris flow to impact temporary housing site. Burned house
or Potential Hazard: located immediately adjacent to watercourse with a low probability for debris flow.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures (1): **Early Warning**

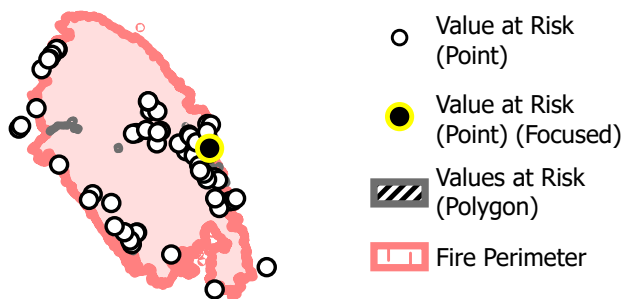
Preliminary Emergency Protective Measures (2): **Early Warning**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

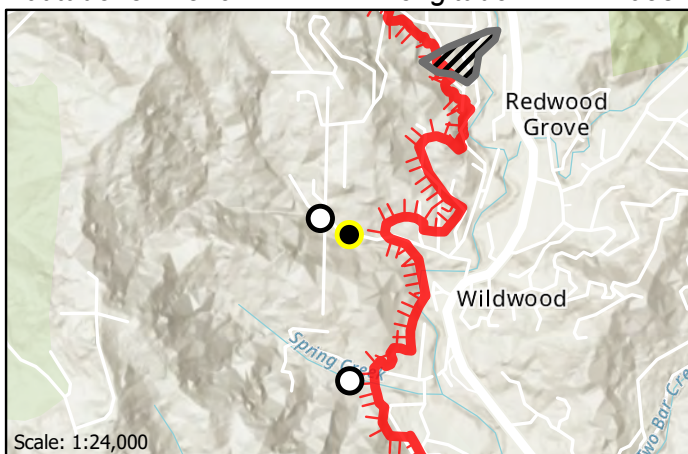
Description: NA

LOCATION AND PHOTO



Latitude: 37.15297

Longitude: -122.14053



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **80**

Feature: **Burned house**

Feature Category: **home**

Field Observation Potential for debris flow to impact temporary housing site. Burned house
or Potential Hazard: located immediately adjacent to watercourse with a low probability for debris flow.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

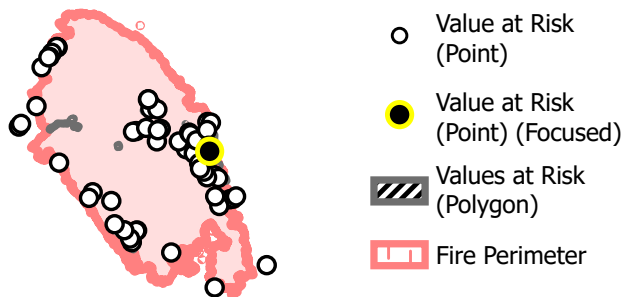
Preliminary Emergency Protective Measures (2): **Early Warning**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

Description: NA

LOCATION AND PHOTO



Latitude: 37.14840

Longitude: -122.14038



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **81**

Feature: **House**

Feature Category: **home**

Field Observation or Potential Hazard: House located above bend in San Lorenzo River. Existing channel scour is endangering house.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

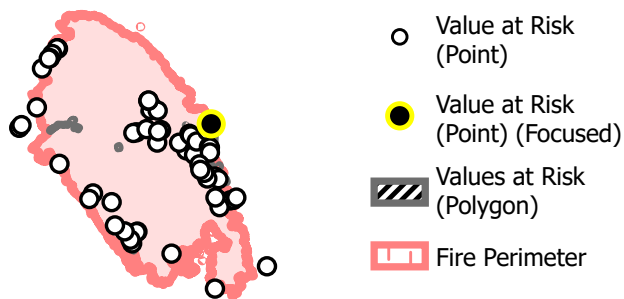
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

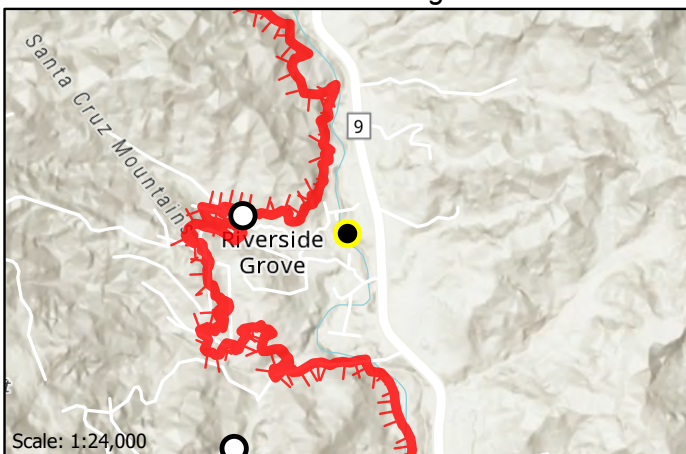
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.17457

Longitude: -122.13964



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **88**

Feature: **Bridge**

Feature Category: **drainage structure**

Field Observation Bridge appears to be choke point for debris and sediment. Woody debris could
Potential Hazard: block bridge

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

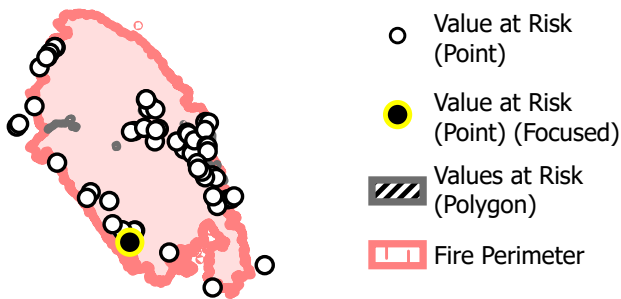
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

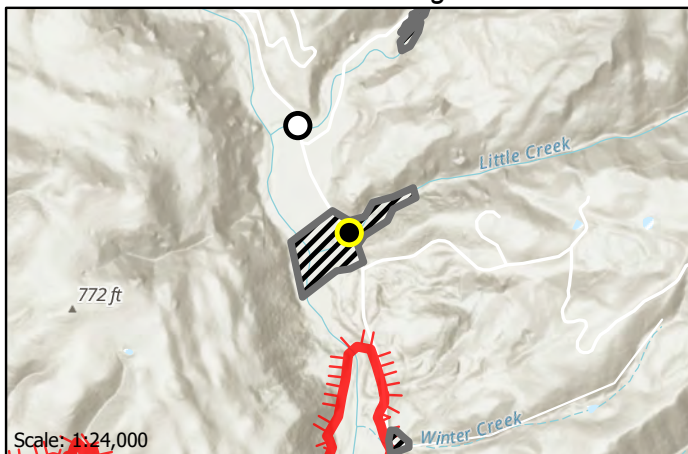
Description: NA

LOCATION AND PHOTO



Latitude: 37.06378

Longitude: -122.22690



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **89**

Feature: **Fish hatchery buildings and ponds**

Feature Category: **utilities**

Field Observation or Potential Hazard: **Flooding impact to fish hatchery and structures**

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

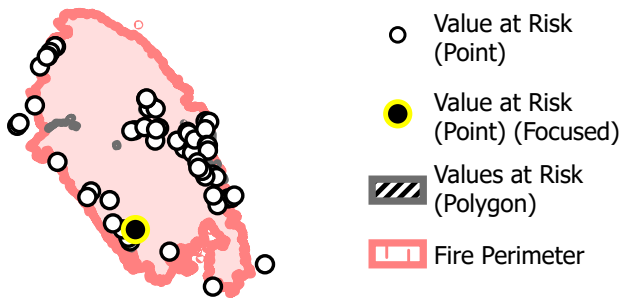
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

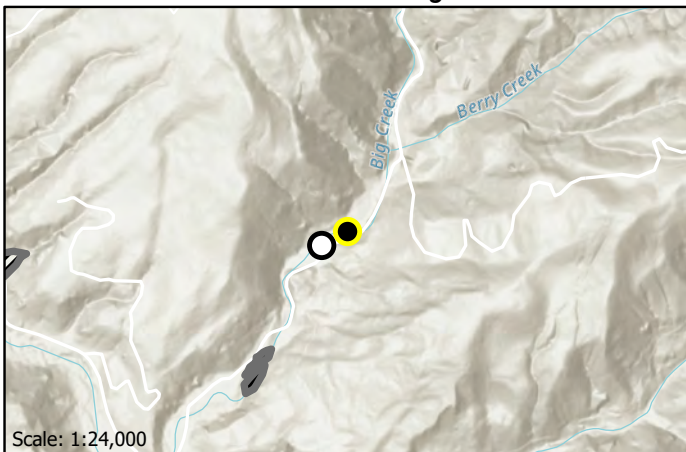
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.07465

Longitude: -122.22118



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **90**

Feature: **temporary housing**

Feature Category: **other**

Field Observation Potential for flooding to impact temporary housing site. Existing structures or Potential Hazard: destroyed.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

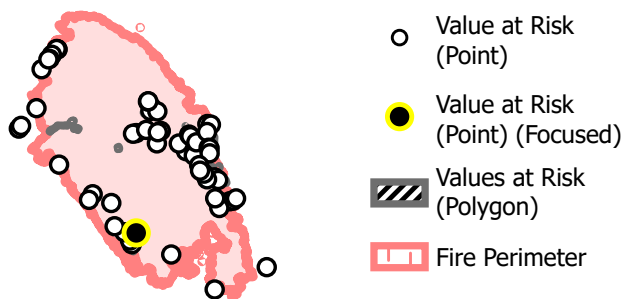
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

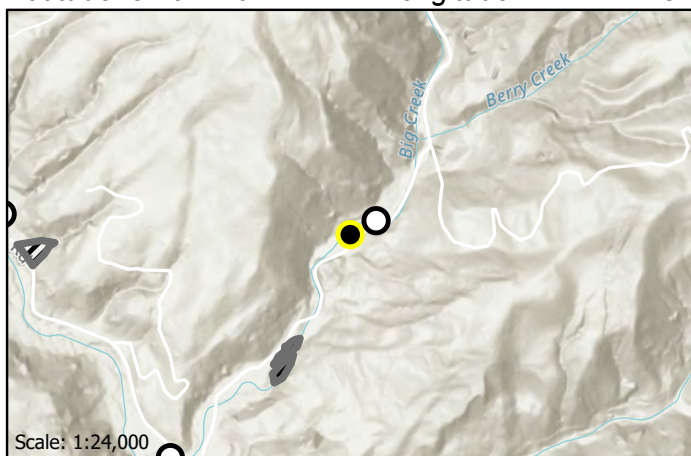
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.07420

Longitude: -122.22218



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **91**

Feature: **Bridge on swanton road**

Feature Category: **drainage structure**

Field Observation Bridge within floodplain. Large watershed upstream with a mapped moderate to
or Potential Hazard: high potential for debris flows. Numerous landslides visible adjacent to
watercourse and tributaries on LiDAR imagery.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Clear and maintain basin**

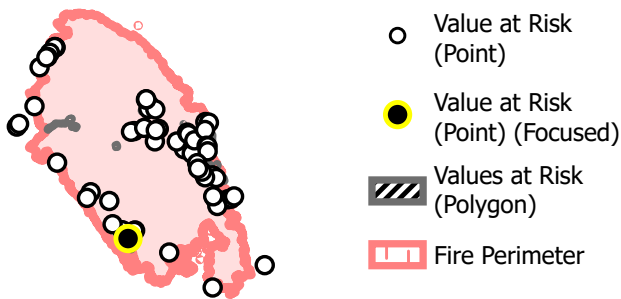
Preliminary Emergency Protective Measures (2): **Early Warning**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

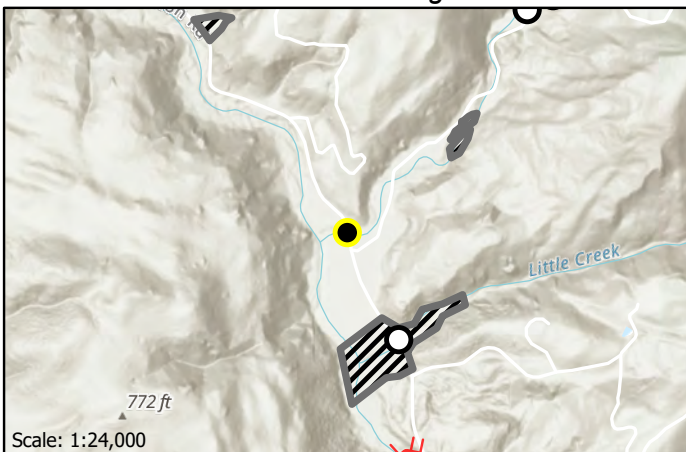
Description: NA

LOCATION AND PHOTO



Latitude: 37.06709

Longitude: -122.22902



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **92**

Feature: **House**

Feature Category: **home**

Field Observation House in potential debris flow / flood path.
or Potential Hazard:

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Deflection structure**

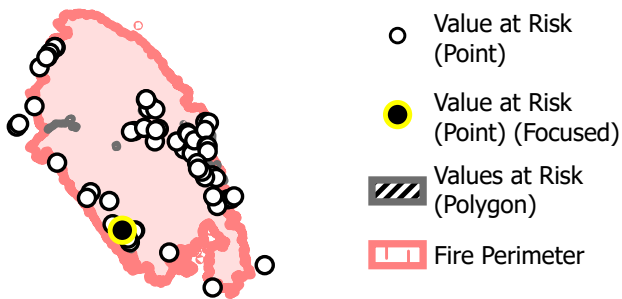
Preliminary Emergency Protective Measures (2): **Early Warning**

Preliminary Emergency Protective Measures (3): **Debris barrier**

Preliminary Emergency Protective Measures (4): **NA**

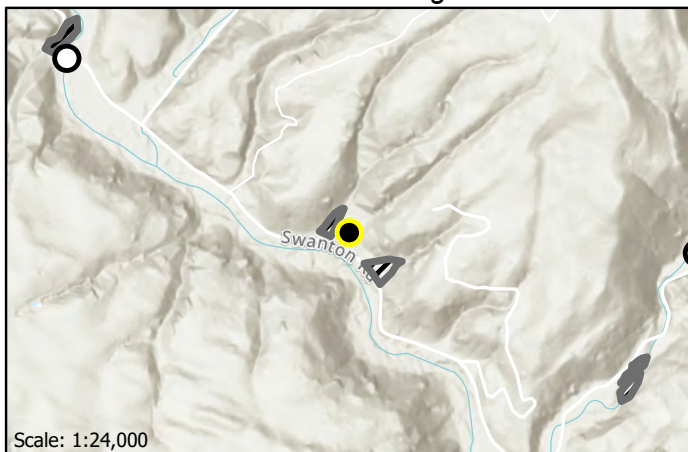
Description: K rail

LOCATION AND PHOTO



Latitude: 37.07459

Longitude: -122.23583



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **93**

Feature: **Bridge**

Feature Category: **other**

Field Observation or Potential Hazard: Flooding could impact bridge, large watershed upstream.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

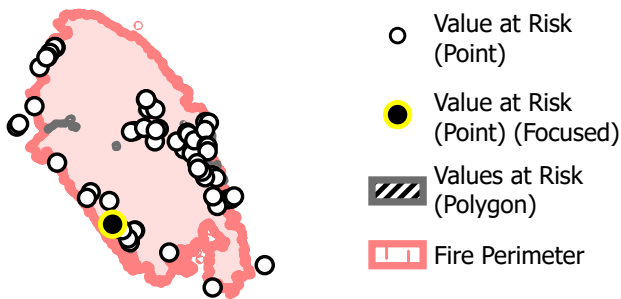
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

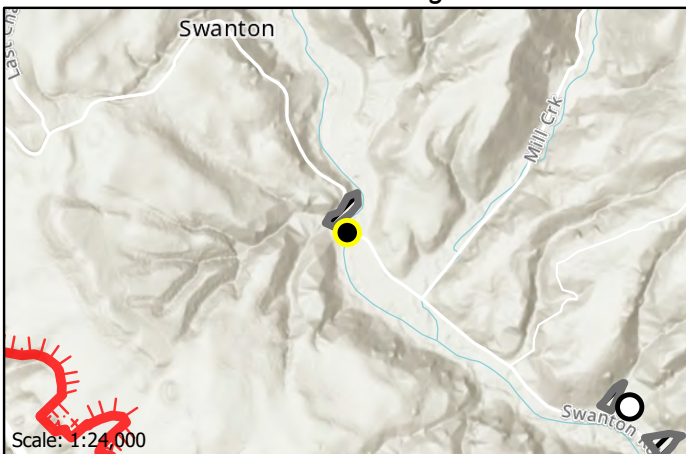
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.07983

Longitude: -122.24705



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Water District Intakes**

Site Number: **98**

Feature: **Big Basin Water Company Facilities**

Feature Category: **utilities**

Field Observation or Potential Hazard: Local water district pump house and intake lines. Intake pipe observed extending upstream. Pipe located within active debris flow channel.

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

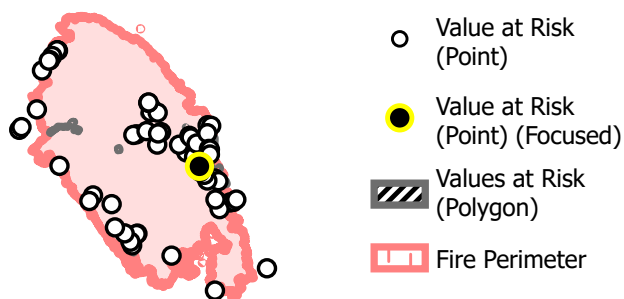
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

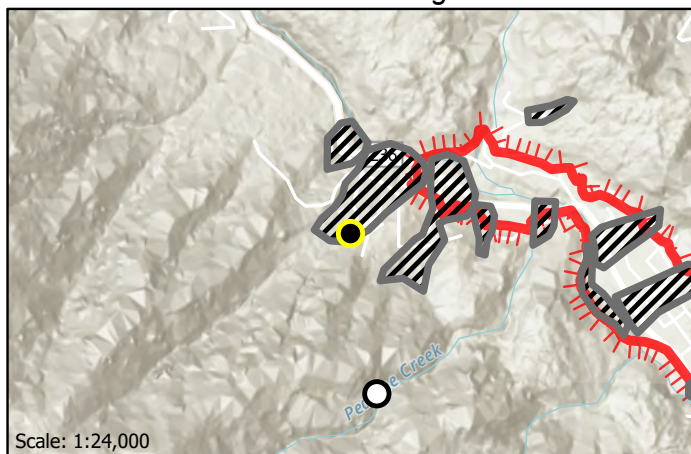
Description: Prepare for increased organics

LOCATION AND PHOTO



Latitude: 37.13735

Longitude: -122.15206



VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Water District Intakes**

Site Number: **99**

Feature: **SLV Water District Intake**

Feature Category: **utilities**

Field Observation or Potential Hazard: Impacts to intake, water quality

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

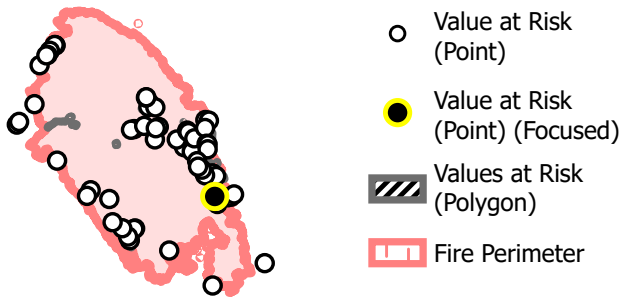
Preliminary Emergency Protective Measures (2): **Monitor and maintain**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

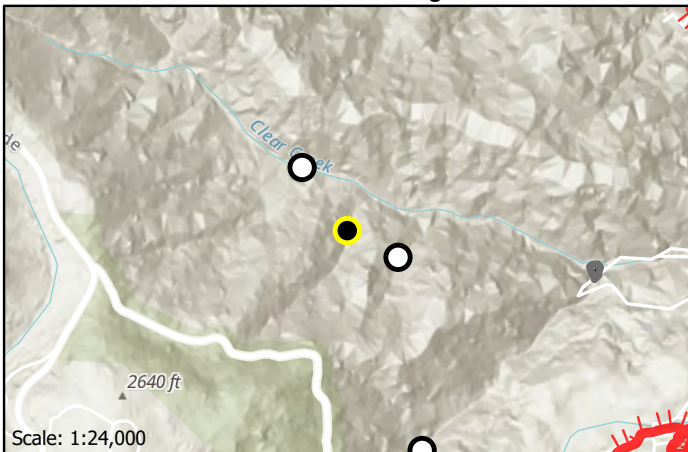
Description: Prepare for increased organics

LOCATION AND PHOTO



Latitude: 37.10550

Longitude: -122.13102



Appendix D
VALUE AT RISK DETAIL

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **C21**

Feature: **Road**

Feature Category: **drainage structure**

Field Observation or Potential Hazard: Flooding/Debris Flow could impact the crossing. Culvert undersized, large amount of fill (>20 feet). Inlet is highly corroded. Landslides visible on LiDAR images along upstream slopes. Recommend culvert be replaced and sized appropriately.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

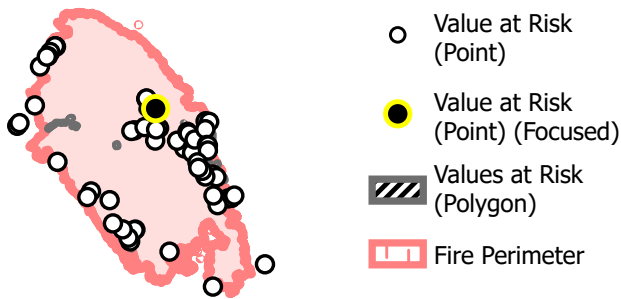
Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Preliminary Emergency Protective Measures (4): **NA**

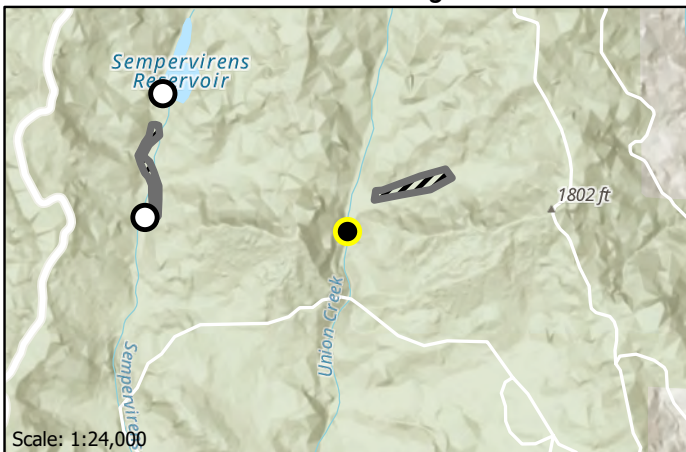
Description: **NA**

LOCATION AND PHOTO



Latitude: 37.18553

Longitude: -122.20127



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **10**

Feature: **Fuel tanks**

Feature Category: **utilities**

Field Observation Debris flow, structures built on alluvial fan deposits. Fuel tanks and 55-gallon or *Potential Hazard:* drums have potential to spill into watercourse.

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **NA**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: Site Cleanup

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:4,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Brookdale, Clear Creek**

Site Number: **107**

Feature: **Water intake**

Feature Category: **utilities**

Field Observation Impacts to intake, water quality
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: Prepare for increased organics

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:1,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **11**

Feature: **Infrastructure**

Feature Category: **recreational**

Field Observation Campground located on floodplain upstream of choke point along highway 236
or Potential Hazard:

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **low**

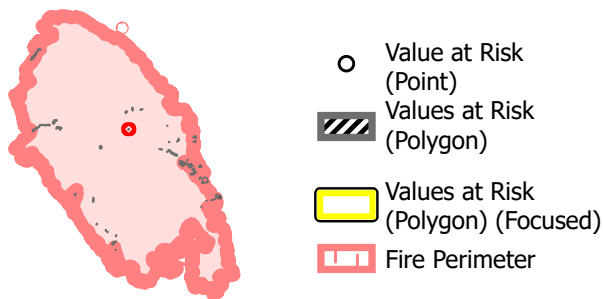
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: Temporary Closure

LOCATION AND PHOTO



Scale: 1:3,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **18**

Feature: **Residences**

Feature Category: **home**

Field Observation Unable to access property. Homes located at the bottom of two drainages with
or Potential Hazard: a high potential for debris flows. Addition determinations and observations should be made by a PG or PE.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

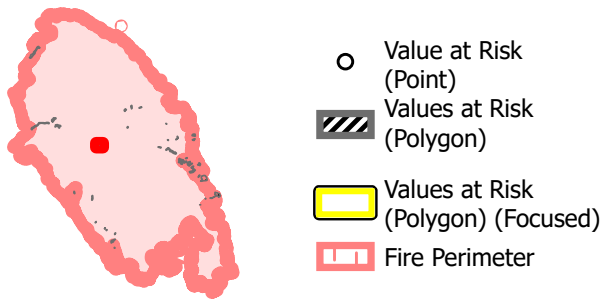
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Deflection structure**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:7,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **22**

Feature: **Residences**

Feature Category: **home**

Field Observation Flooding could impact several homes within floodplain.
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

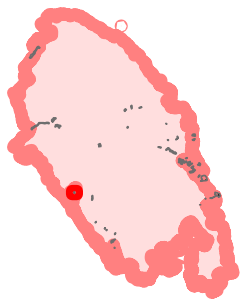
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:5,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Whitehouse Creek**

Site Number: **23**

Feature: **Residential access**

Feature Category: **other**

Field Observation Adjacent slopes are steep and appear prone to debris slides/flows. Rockfall or Potential Hazard: hazard also present.

Potential Hazard to Life: **high**

Potential Hazard to Property: **moderate**

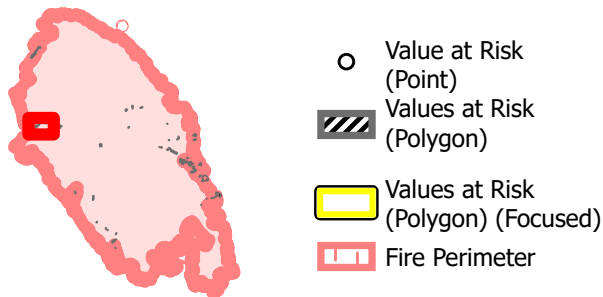
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Signage**

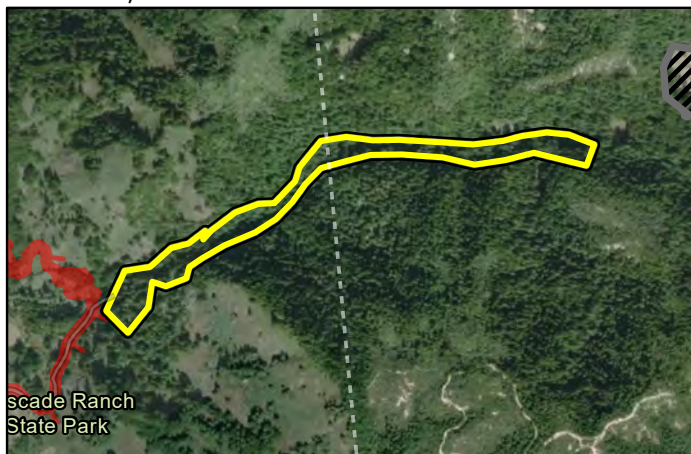
Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:26,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **24**

Feature: **Residences**

Feature Category: **home**

Field Observation Debris flow, homes located on alluvial fan deposits visible on hillshade imagery.
or Potential Hazard: Additional determination and observations should be made by a PG or PE.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

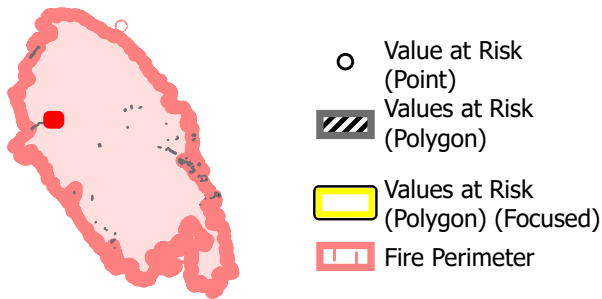
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:9,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **25**

Feature: **Six Residences**

Feature Category: **home**

Field Observation Debris flow, homes located on alluvial fan deposits visible on hillshade imagery.
or Potential Hazard: Additional determination and observations should be made by a PG or PE.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:8,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Butano Creek**

Site Number: **32**

Feature: **Residences.**

Feature Category: **home**

Field Observation Numerous residences within floodplain. Homes along southern side are
or Potential Hazard: adjacent to moderate to steep slopes with potential for debris flows.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:26,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **37**

Feature: **Residential properties**

Feature Category: **home**

Field Observation Multiple residential properties along Jamison Creek. High potential for debris or *Potential Hazard:* flow. About 2 sq km drainage above, addition determinations and observations should be made by a PG or PE.

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:4,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **38**

Feature: **Residential properties**

Feature Category: **home**

Field Observation Multiple residential properties along Jamison Creek. High potential for debris or *Potential Hazard:* flow. About 4 sq km drainage above, addition determinations and observations should be made by a PG or PE.

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

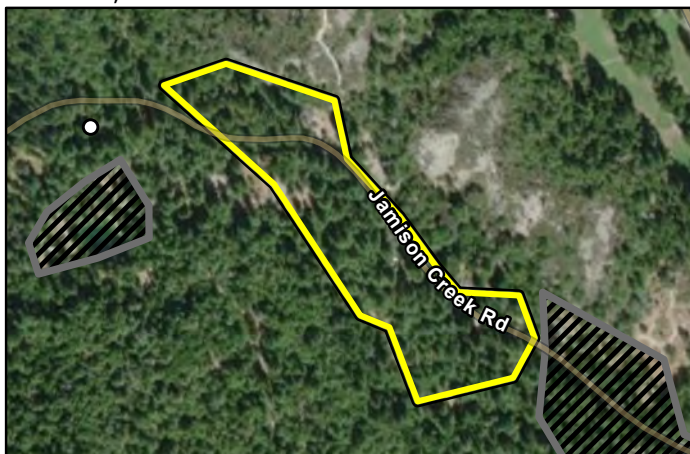
Description: NA

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:8,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **39**

Feature: **Residential properties**

Feature Category: **home**

Field Observation Multiple residential properties alluvial fan at bottom Jamison Creek. About 4 sq
or Potential Hazard: km drainage above, addition determinations and observations should be made
by a PG or PE.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

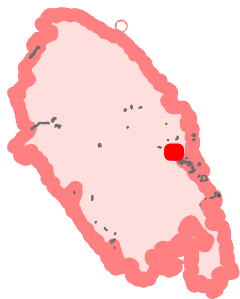
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▨ Fire Perimeter

Scale: 1:8,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Boulder Creek**

Site Number: **40**

Feature: **Multiple houses and foundations. SR 236.**

Feature Category: **home**

Field Observation Neighborhood constructed on alluvial fan. Avulsion point observed at top of
or Potential Hazard: development. Several foundations constructed over and/or immediately adjacent to watercourse channel. Also impacts to State Highway 236. Evidence of historic debris flow activity

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

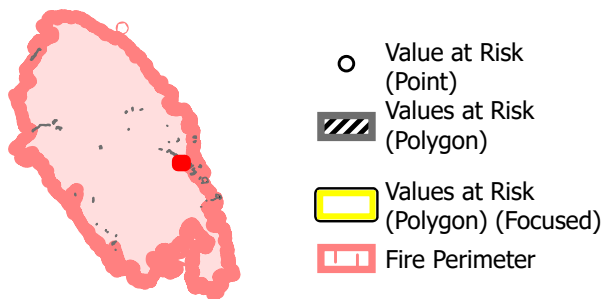
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

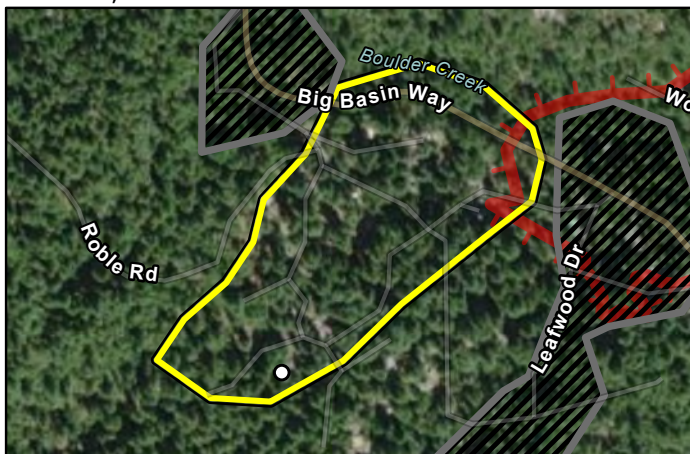
Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:7,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **41**

Feature: **3 houses and highway.**

Feature Category: **home**

Field Observation Three houses east of SR236 located at mouth of fan deposit. Undersized or *Potential Hazard*: culvert crosses highway and proceeds under house.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

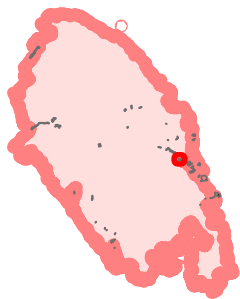
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Clear and maintain culvert**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:4,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **42**

Feature: **Multiple houses and foundations. SR 236.**

Feature Category: **home**

Field Observation Neighborhood constructed on alluvial fan. Several foundations constructed or *Potential Hazard:* over and/or immediately adjacent to watercourse channel. No obvious channel observed within the deposit fan. Also impacts to State Highway 236.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **high**

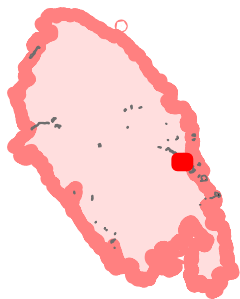
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

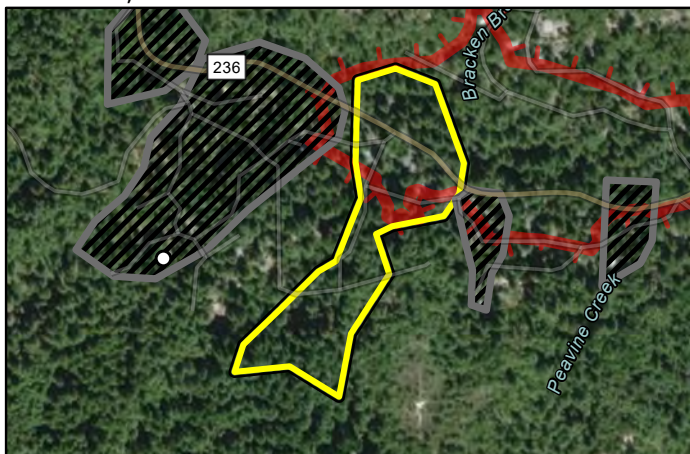
Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:10,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **43**

Feature: **Homes on downslope side of Brook Lane**

Feature Category: **home**

Field Observation Houses located along Boulder Creek in flood plain. Also immediately or Potential Hazard: downslope of debris slide slopes.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

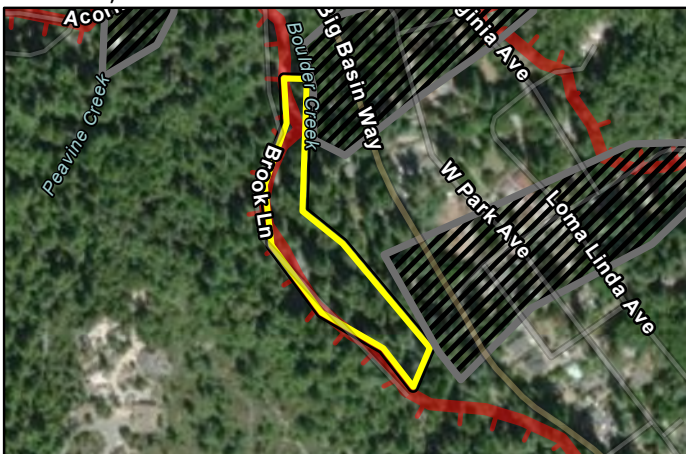
Description: **NA**

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:7,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **44**

Feature: **Water tanks, house pad, and house**

Feature Category: **home**

Field Observation Three burned PVC water tanks, one redwood water tank, 1 burned house, and
or Potential Hazard: one unburned house located within debris flow channel

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

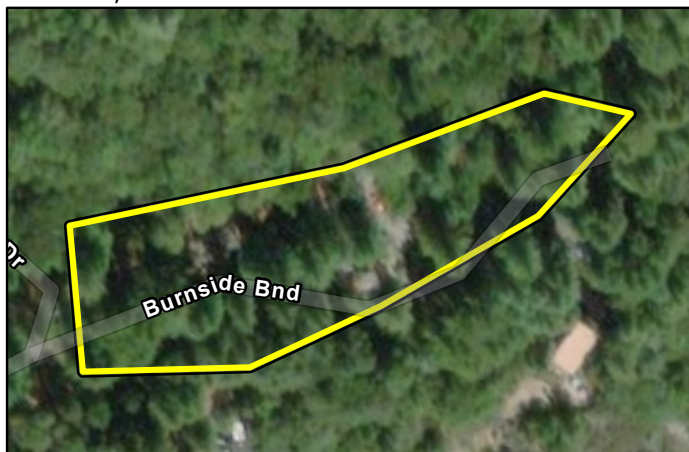
Description: **NA**

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **45**

Feature: **18 houses**

Feature Category: **home**

Field Observation Three burned house plus one house adjacent to channel. About a dozen
or Potential Hazard: houses further downslope on apparent fan deposit. No drainage facilities were observed downstream of swale. Upstream drainage area below debris model threshold.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

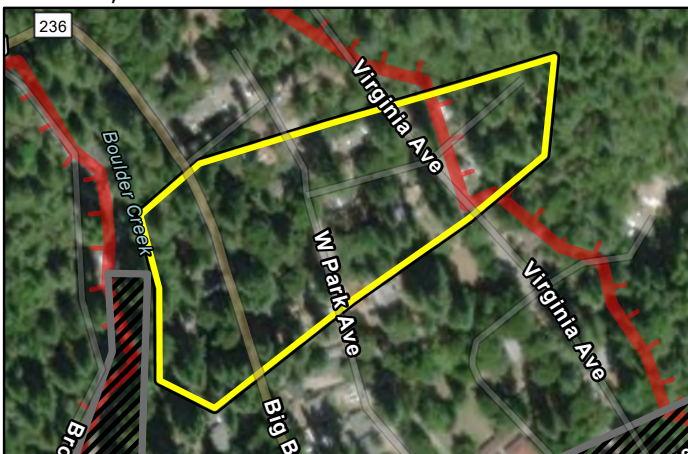
Description: **NA**

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▨ Fire Perimeter

Scale: 1:4,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **46**

Feature: **About 30 houses**

Feature Category: **home**

Field Observation Houses adjacent to and downstream of channel. Additional houses downstream
or Potential Hazard: of apparent fan deposit. One storm drainage inlet located in swale above Ridge Road. Storm drain on Ridge Road. Upstream drainage area below model threshold.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures (1): Early Warning

Preliminary Emergency Protective Measures (2): NA

Preliminary Emergency Protective Measures (3): NA

Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:5,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **47**

Feature: **About 20 houses**

Feature Category: **home**

Field Observation One house adjacent debris flow channel. About 18 houses further downslope
or Potential Hazard: on apparent fan deposit. Park Road appears to be preferential pathway.
 Upstream drainage area below debris model threshold.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

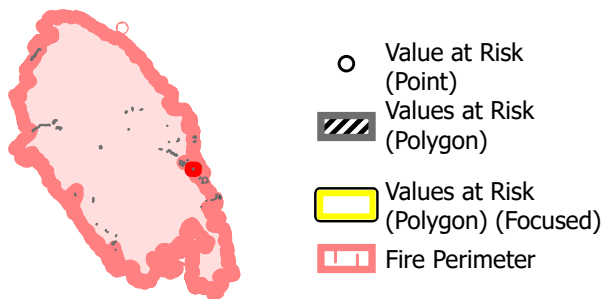
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

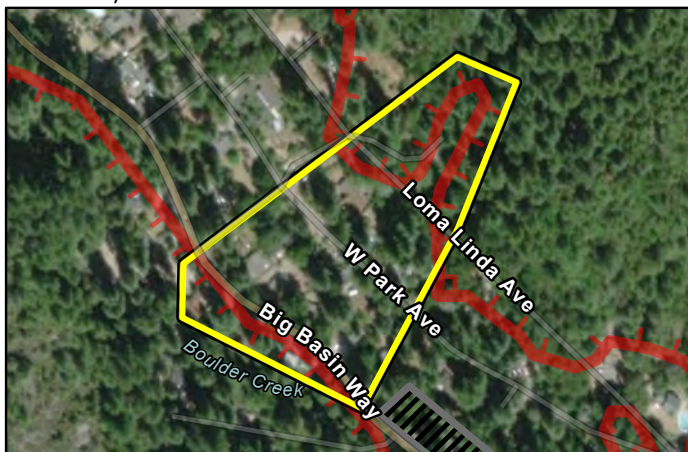
Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:5,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **48**

Feature: **Residential properties**

Feature Category: **home**

Field Observation Residential homes adjacent and in Foreman Creek. High potential for debris or *Potential Hazard:* flow. Debris flow deposits and boulders in channel. Debris flow levee observed within channel. About 2 sq km drainage above, addition determinations should be made by PG or PE

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

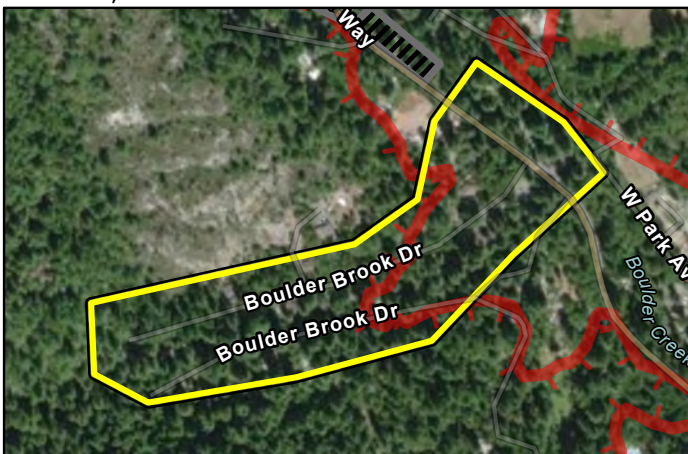
Description: **NA**

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:8,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **49**

Feature: **House**

Feature Category: **home**

Field Observation Two Houses located along watch stream/ debris flow segment. Existing
or Potential Hazard: concrete retaining walls at base of house along creek to protect house foundations.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

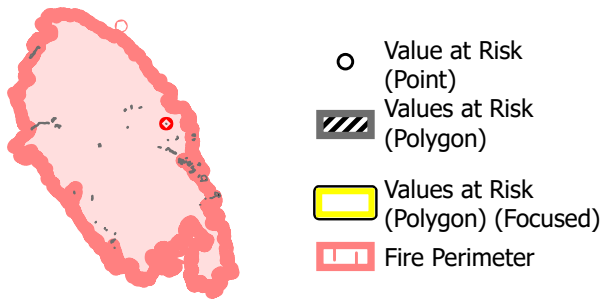
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **50**

Feature: **10 houses**

Feature Category: **home**

Field Observation Several houses located on fan deposits
or Potential Hazard:

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

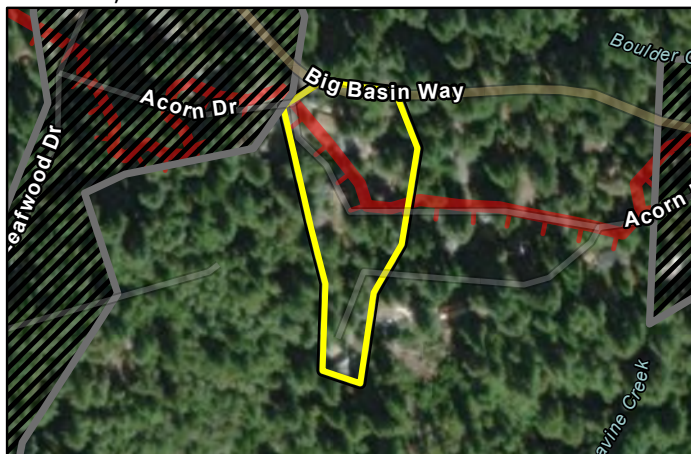
Description: **NA**

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▨ Fire Perimeter

Scale: 1:4,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **51**

Feature: **5 houses**

Feature Category: **home**

Field Observation At bend in Peavine Creek. Model indicates moderate to high potential or *Potential Hazard*: upstream. Watershed extends to top of Ben Lomand Mountain.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

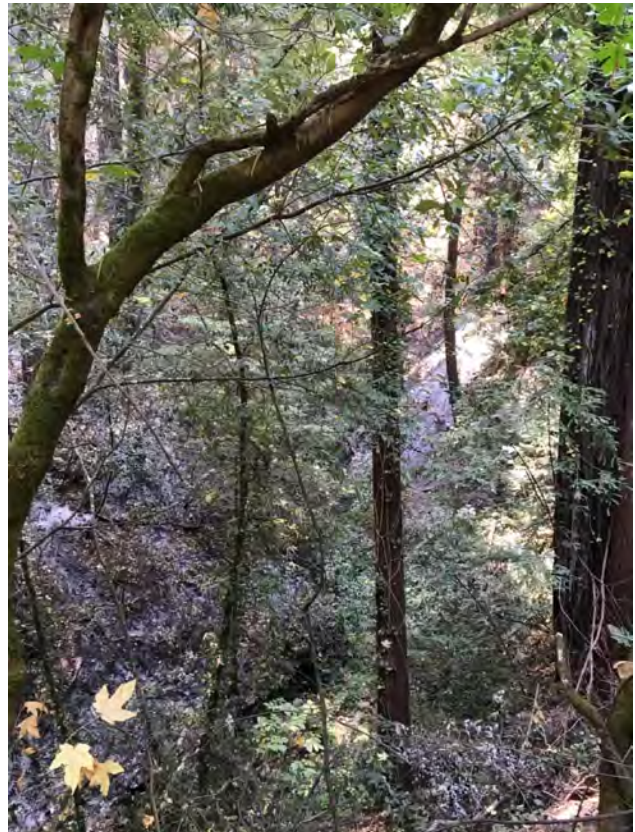
Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:3,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **52**

Feature: **Homes downslope of roads**

Feature Category: **home**

Field Observation Three Houses located along Boulder Creek. Foundation supports within the 1-
or Potential Hazard: year flood plain. Some foundation elements are rotated. Evidence of ongoing
scour and foundation problems.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **53**

Feature: **Three houses**

Feature Category: **home**

Field Observation Three houses built on watercourse channel. Evidence of creep and foundation or *Potential Hazard*: issues. Existing structural weakness could be exacerbated with increased post-fire sediment and runoff.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

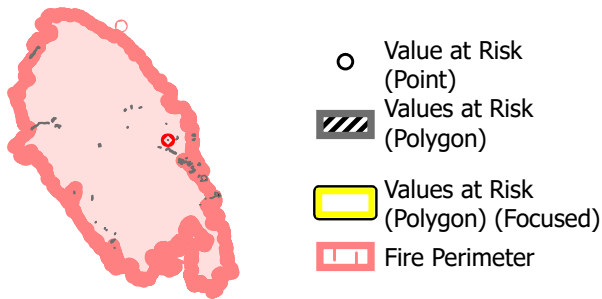
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **59**

Feature: **Houses located within channel.**

Feature Category: **home**

Field Observation About a dozen houses located immediately adjacent to watch stream. Pool or *Potential Hazard*: located within channel. Gabion walls and retaining structures observed along channel adjacent houses.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

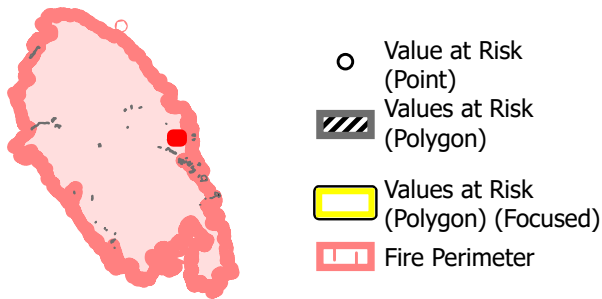
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:8,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **60**

Feature: **Houses**

Feature Category: **home**

Field Observation Houses on apparent old alluvial fan. Channel mapped as low probability.
or Potential Hazard: Channel is minor about 2 feet wide by 18" depth. Potential for minor avulsion. And flood debris impacts.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

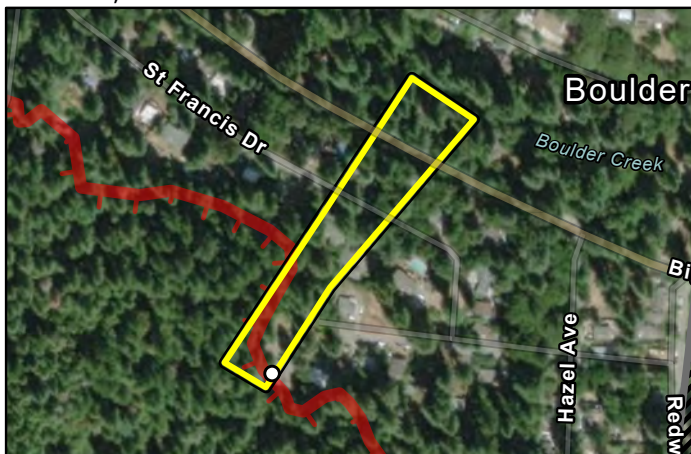
Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▨ Fire Perimeter

Scale: 1:5,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **61**

Feature: **School, cemetery, homes, and businesses**

Feature Category: **other**

Field Observation or Potential Hazard: Large alluvial fan observed town of Boulder Creek. Elementary school and cemetery at fan apex. Avulsion pathway highly uncertain. Potential avulsion point observed ~500ft SW of cemetery. Addition determinations and observations should be made by a PG/PE

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Deflection structure**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:12,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **62**

Feature: **About twenty houses**

Feature Category: **home**

Field Observation Neighborhood built on fan deposit. Resident at top of street reports existing or *Potential Hazard*: drainage has handled surface drainage within the past 9 years. Additional determinations and observations should be made by a PG or PE

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Clear and maintain culvert**

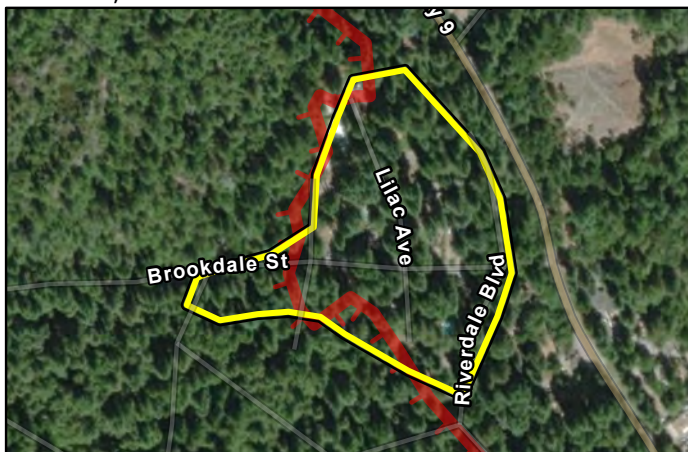
Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:6,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **66**

Feature: **House**

Feature Category: **other**

Field Observation Potential for debris flow to impact temporary housing site. Existing structures or Potential Hazard: destroyed.

Potential Hazard to Life: **high**

Potential Hazard to Property: **moderate**

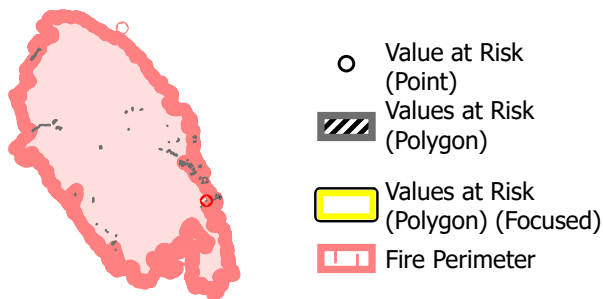
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **67**

Feature: **Temp housing**

Feature Category: **other**

Field Observation Burned homes pads that can be used as temp housing. Additional or Potential Hazard: determination and observations should be made by a PG or PE.

Potential Hazard to Life: **high**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:3,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **68**

Feature: **House**

Feature Category: **home**

Field Observation Existing house
or Potential Hazard:

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:1,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **69**

Feature: **House**

Feature Category: **home**

Field Observation Existing house
or Potential Hazard:

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:1,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **70**

Feature: **House**

Feature Category: **home**

Field Observation Existing house
or Potential Hazard:

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:1,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **71**

Feature: **House**

Feature Category: **home**

Field Observation Existing house
or Potential Hazard:

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

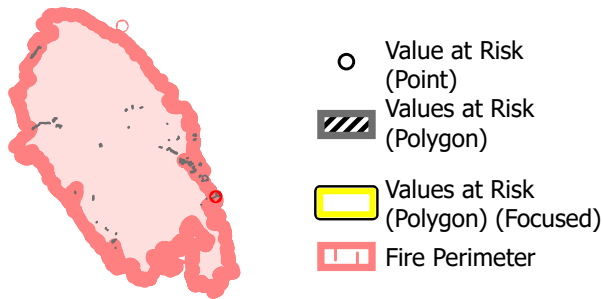
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **72**

Feature: **Structure lodge**

Feature Category: **business**

Field Observation Existing structure old building part of Brookdale lodge, the creek runs under the
or Potential Hazard: structure. Additional determination and observations should be made by a PG and PE.

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Signage**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:1,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **73**

Feature: **multiple homes and businesses**

Feature Category: **multiple**

Field Observation Residential community on alluvial fan. Additional determination should be made or Potential Hazard: by a PG or PE

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

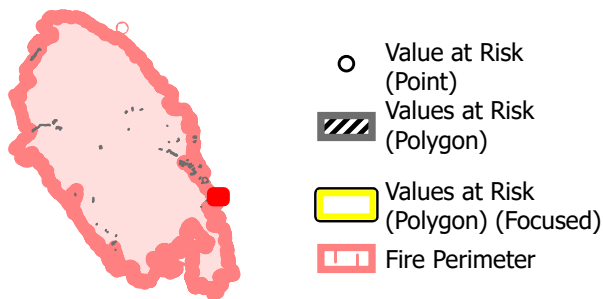
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **Signage**

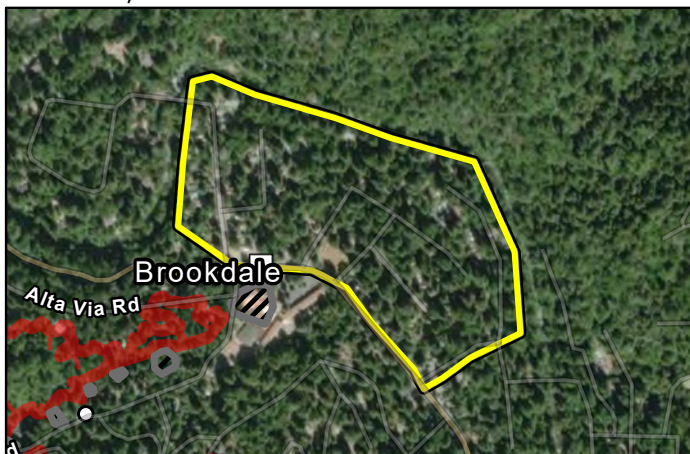
Preliminary Emergency Protective Measures (3): **NA**

Description: 3.8 sq km drainage area above, uncertain where avulsion would flow, additional determinations and observations should be made by Professional Geologist/Engineer.

LOCATION AND PHOTO



Scale: 1:11,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **76**

Feature: **Camp buildings and pool**

Feature Category: **recreational**

Field Observation or Potential Hazard: YMCA camp located along San Lorenzo River. Low debris flow potential on tributaries to San Lorenzo. Possible flooding on structures adjacent to San Lorenzo.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**





Preliminary Emergency Protective Measures (2): **Sandbags**

Preliminary Emergency Protective Measures (3): **NA**

Description: Close camp during winter

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:5,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Highway 9 Corridor**

Site Number: **77**

Feature: **homes**

Feature Category: **home**

Field Observation or Potential Hazard: Low debris flow potential on tributary to San Lorenzo. Possible debris flow impacts to residential structures adjacent to San Lorenzo. Channel is deeply incised, near vertical side channels. Potential choke point at culvert crossing on Wildwood Road

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

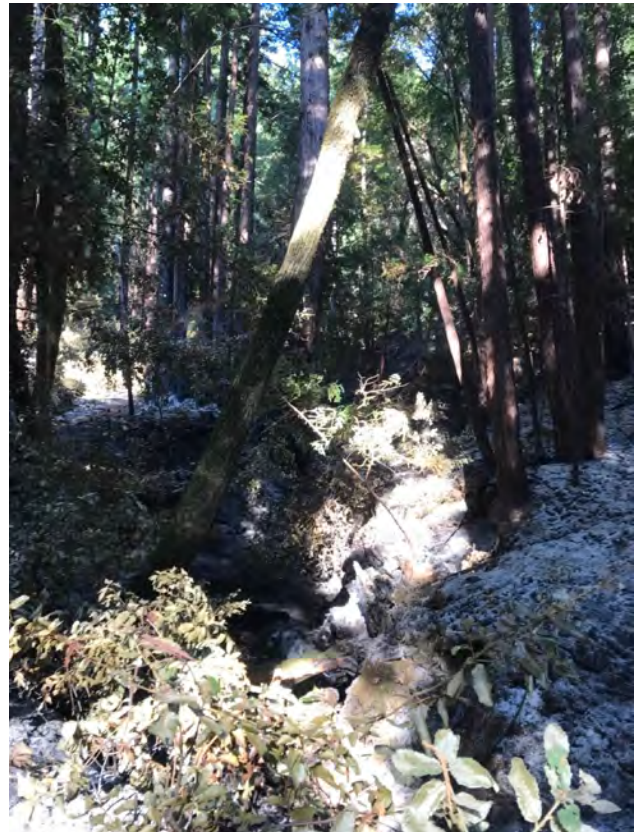
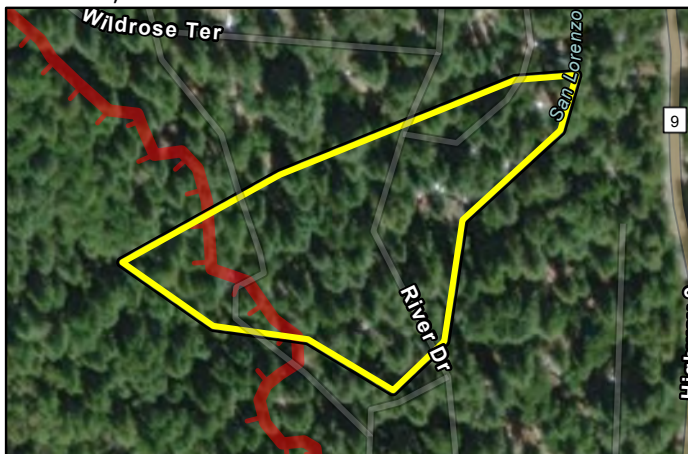
Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:4,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **8**

Feature: **Campgrounds**

Feature Category: **recreational**

Field Observation Debris flow/slide. Campgrounds located on alluvial fan deposits visible of or Potential Hazard: hillshade imagery. Moderate to steep slopes above.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: Temporary Closure

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:5,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **82**

Feature: **CAL FIRE station**

Feature Category: **other**

Field Observation Impact to CAL FIRE station including fuel tank. Plugging at culvert just
or Potential Hazard: upstream (east) of station, may direct flows towards structure and/gas vault.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

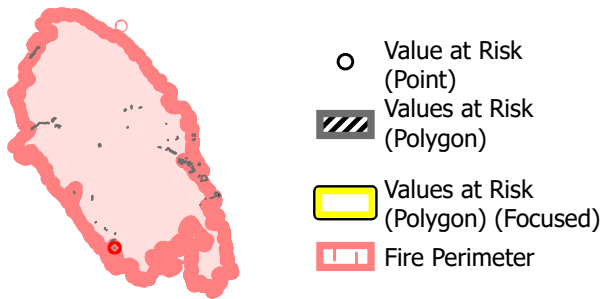
Preliminary Emergency Protective Measures (1): **Deflection structure**

Preliminary Emergency Protective Measures (2): **Debris barrier**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **83**

Feature: **Temporary housing**

Feature Category: **other**

Field Observation Potential for flooding to impact temporary housing site. Existing structures or Potential Hazard: destroyed.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

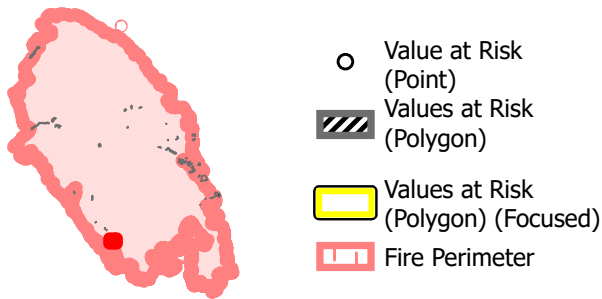
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:8,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **84**

Feature: **House**

Feature Category: **home**

Field Observation Potential for flooding to impact temporary housing site. Existing structures or Potential Hazard: destroyed.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

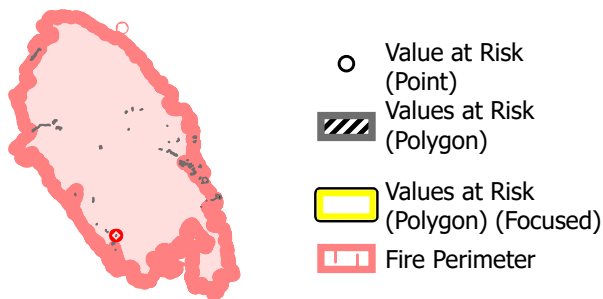
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **85**

Feature: **Temp house pad**

Feature Category: **home**

Field Observation Potential for flooding to impact temporary housing site. Existing structures or Potential Hazard: destroyed.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

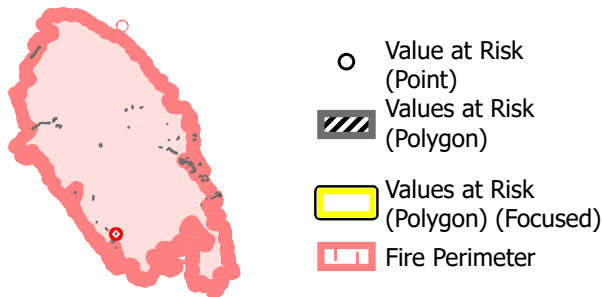
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **86**

Feature: **Temp housing**

Feature Category: **other**

Field Observation Potential for flooding to impact temporary housing site. Existing structures or Potential Hazard: destroyed.

Potential Hazard to Life: **low**

Potential Hazard to Property: **low**

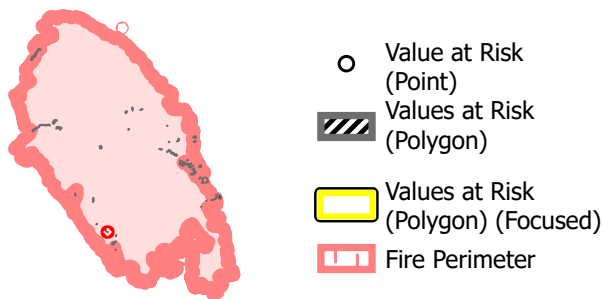
Preliminary Emergency Protective Measures (1): **Clear and maintain culvert**

Preliminary Emergency Protective Measures (2): **Early Warning**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **87**

Feature: **Temp house**

Feature Category: **other**

Field Observation Potential for flooding to impact temporary housing site. Existing structures or Potential Hazard: destroyed.

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

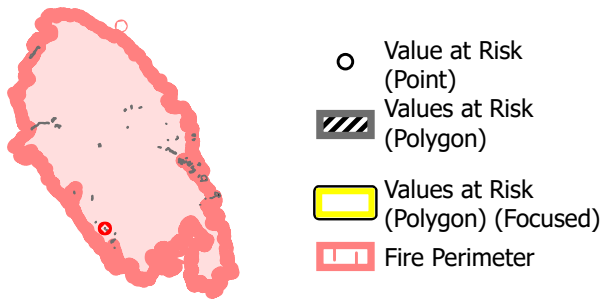
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Big Basin State Park**

Site Number: **9**

Feature: **Reservoir access**

Feature Category: **multiple**

Field Observation Loss of access, numerous culverts along road prone to plugging and blowing
or Potential Hazard: out. Waterline from dam runs within road prism. Watercourse contains significant amount of woody debris

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures (1): **Monitor and maintain**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: NA

LOCATION AND PHOTO



- Value at Risk (Point)
- ▨ Values at Risk (Polygon)
- ▭ Values at Risk (Polygon) (Focused)
- ▭ Fire Perimeter

Scale: 1:7,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **95**

Feature: **Residential homes**

Feature Category: **home**

Field Observation Homes within floodplain
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

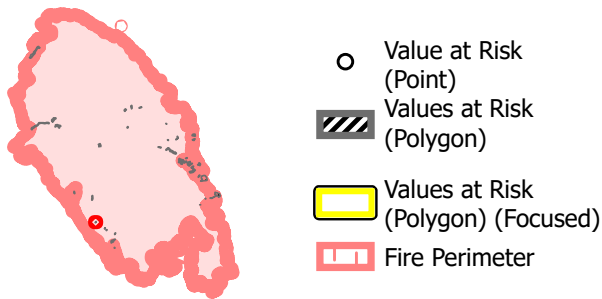
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:3,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: **Swanton**

Site Number: **96**

Feature: **Residences**

Feature Category: **home**

Field Observation Homes within floodplain
or Potential Hazard:

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

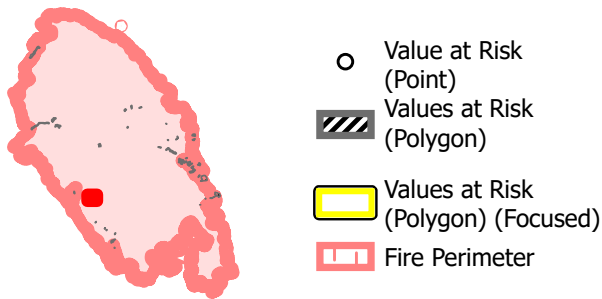
Preliminary Emergency Protective Measures (1): **Early Warning**

Preliminary Emergency Protective Measures (2): **NA**

Preliminary Emergency Protective Measures (3): **NA**

Description: **NA**

LOCATION AND PHOTO



Scale: 1:10,000



VALUE AT RISK DETAIL - Polygons

Incident: CZU Lightning Complex

Incident Number: CA-CZU-005205

Community: Water District Intakes

Site Number: 97

Feature: Big Basin Water Company Facilities.

Feature Category: utilities

Field Observation or Potential Hazard: Domestic water company located on a tributary to Jamison Creek. Large boulders observed in channel indicate past debris flow activity and potential for avulsion.

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures (1): Early Warning





Preliminary Emergency Protective Measures (2): Deflection structure

Preliminary Emergency Protective Measures (3): NA

Description: Prepare for increased organics

LOCATION AND PHOTO



-  Value at Risk (Point)
-  Values at Risk (Polygon)
-  Values at Risk (Polygon) (Focused)
-  Fire Perimeter

Scale: 1:3,000

