

Watershed Emergency Response Team (WERT) 2024 Bridge Fire



CA-ANF-243334

October 24, 2024



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WERT REPORT AUTHORSHIP AND PROFESSIONAL REGISTRATION

REPORT TITLE: Watershed Emergency Response Team (WERT) Evaluation – 2024 Bridge Fire

LIMITATIONS: This report presents the results of a rapid assessment to help communities prepare after wildfire by documenting and communicating postfire risks to life, property, and infrastructure 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 responsible jurisdictions and agencies in the development of more detailed postfire emergency response plans.

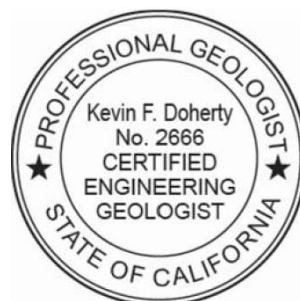
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Bridge Fire – WERT REPORT EXECUTIVE SUMMARY

CA-ANF-243334 - WERT Evaluation

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

It should be noted that 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 Los Angeles County Office of Emergency Management and San Bernardino County Office of Emergency Services, Los Angeles and San Bernardino County Fire, CAL FIRE, local first responders, Los Angeles and San Bernardino County Sheriff's Offices, Los Angeles and San Bernardino County Public Works and Flood Control, California Department of Transportation, the California Governor's Office of Emergency Services, the United States Department of Agriculture Natural Resources Conservation Service, the United States Forest Service, utility companies, and other responsible agencies and entities in the development of more detailed postfire 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 Bridge Fire started on 8 September 2024, in the San Gabriel Mountains National Monument in the East Fork area by Cattle Canyon Bridge along Camp Bonita Road, in Los Angeles County. The large size of the fire (i.e., 86 mi², 54,878 acres on 3 October 2024 at 98% containment), occurrence of widespread moderate to high soil burn severity on steep, upland slopes means that parts of the Bridge Fire and downstream area will be subject to postfire hazards such as sediment-laden flooding, debris flows, and increased erosion. The burn area has a long history of recorded debris flow and flood events prior to the Bridge Fire, particularly within the area of East Fork San Gabriel River, and developed areas around Wrightwood and Mt. Baldy Village. Most recently, sediment laden floods and debris flows were recorded within Sheep Canyon (Wrightwood, 2023) and Bear Canyon (2014) drainages that closed access roads and adversely impacted property, infrastructure, and public safety, including a fatality in Bear Canyon in 2014. These runoff events were triggered by large, relatively uncommon storm events associated with tropical storm Hillary (Wrightwood, 2023) and isolated thunderstorms (Bear Canyon 2014) under unburned conditions. Similar runoff events may occur under postfire conditions, but triggered by more commonly occurring storm events.

Due to the potential for increased postfire runoff hazards and proximity of the Bridge Fire perimeter to residential areas and critical infrastructure, the burn area was assessed by an interagency WERT. The WERT rapidly evaluated postfire watershed conditions, identified potential **Values-at-Risk (VARs)** related to human life-safety and property, and evaluated the

potential for increased postfire hazards. The WERT also recommends 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 and sediment generation, and the occurrence of postfire watershed hazards (e.g., debris flows and flooding). Moderate and high soil burn severities typically create the most impacts.
- The Bridge Fire produced more than 50-percent moderate and high soil burn severity. Bridge Fire area soil burn severity: Unburned to Very Low (9%), Low (36%), Moderate (41%), High (13%).
- The WERT identified 60 VARs within and downslope/downstream of the fire. Thirty-eight (38) VARs are shown as polygons which encompass multiple individual sites subject to similar hazard and risk. The remaining twenty-two (22) VARs are points, which are associated with discrete sites such as homes and road crossing structures.
- Twenty (20) are exigent VARs, which present a more urgent threat to life, safety, and/or property.
- Four (4) of the VARs have a high risk to life, safety, and property, which is the highest potential level of risk assessed by the WERT. Three of the VARs are in the community of Mt. Baldy (MB_01, MB_06, and MB-08), and one is in the community of Wrightwood (WW_18). The VARs in the community of Mt. Baldy can potentially affect dozens of residential structures.
- The road network within and downstream of the Bridge Fire perimeter will be subject to increased potential for storm damage for the next two to five years. Specific crossing structures that provide ingress and egress to homes and communities, or along publicly-maintained roads were addressed as VARs.
- State Hwy 2, Mt. Baldy Road, Glendora Ridge Road, E Fork Road, and Camp Bonita Road have several crossing structures subject to potential blockage and overtopping.
- Rockfall hazards exist on and adjacent to steep slopes within and downslope of the burned areas due to postfire effects, particularly in the Mt. Baldy Village and East Fork San Gabriel River areas.
- Some homes and structures are at risk of flooding or debris flows. These structures primarily exist within the Government Canyon, Flume Canyon, Acorn Canyon, and Swarthout Valley areas of Wrightwood, within and downstream of the Bear Canyon area of Mt. Baldy Village, and within the lower reach of the San Gabriel River watershed within and downstream of Coldwater Canyon.
- Model results are presented for postfire debris flow hazard and postfire flooding. The debris flow model results show a significant increase in postfire debris flow potential in steep, convergent slopes that are burned at moderate to high severity. **The hydrologic model results indicate areas of moderate to high flood hazards within the San Gabriel River watershed and portions of the Swarthout Valley and its tributary canyons including Government Canyon, Buford Canyon, Flume Canyon and to a lesser extent Acorn and Heath Canyon. Very high debris flood and debris flow hazards exist in the community of Mt. Baldy, particularly within and downslope of an unnamed swale above Shaw Avenue, referred to locally as Goat Rock, and within and downslope of the Bear Canyon drainage.**

- Residents subject to postfire hazards need to have a clear understanding of the hazards and mitigation strategies (e.g., evacuation, deflection structures, culvert improvements) to effectively reduce risk to life, safety, and property.
- **To trigger the National Weather Service early warning system, the WERT suggests fire-wide rainfall/duration thresholds of 0.2 inches in 15 minutes, 0.3 inches in 30 minutes, and 0.5 inches in 60 minutes.**
- Close coordination between the Los Angeles County Fire Department and San Bernardino County Fire Protection District, Los Angeles and San Bernardino County Office of Emergency Management/Emergency Services, the National Weather Service, local first responders, and Los Angeles and San Bernardino County Public Works will be necessary to effectively develop and implement a response plan that will minimize risk. WERT information provides critical intelligence for response planning and implementation.

Introduction

Background

The Bridge Fire started on 8 September 2024 in the San Gabriel Mountains National Monument in the East Fork area by Cattle Canyon Bridge along Camp Bonita Road, Los Angeles County, California. The official cause of the fire is still under investigation. The fire grew rapidly through dense grass, brush, and timber in steep and complex terrain in some areas that had seen limited to no wildfire activity in modern history. The fire area is located within two jurisdictional zones, with most of the burned area falling under USFS jurisdiction within the Angeles National Forest. Several in-holdings and areas downstream of the burned area, including the areas around Wrightwood and Mt. Baldy Village, are located outside of the Angeles National Forest and are within state and local jurisdiction. Governor Newsom declared a State of Emergency for Los Angeles and San Bernardino Counties due to the fire on September 11, 2024. As of 3 October 2024, the fire was 54,878 acres in size (86 square miles) and 98% contained. The incident had no fatalities and 8 firefighter and/or civilian injuries. The fire destroyed 81 structures and damaged 17 structures.

CAL FIRE San Bernardino/Inyo/Mono Unit Chief, Shane Littlefield, requested a prescreen of the burned area to assess potential postfire hazards. The prescreen was completed on 19 September 2024 by the California Geological Survey (CGS) and recommended the deployment of a Type-1 or Type-2 Watershed Emergency Response Team (WERT). Primary concerns for burned watersheds are the increased potential for damaging sediment and debris flood flows, increased potential for debris flow occurrence, rockfall from steep slopes, and hillslope erosion resulting in excessive sedimentation due to storm runoff for several years following the fire. See footnote for definitions of different postfire runoff types¹. The Bridge Fire is unique in that several large watersheds, including East Fork San Gabriel River, San Antonio Creek, and Swarthout Valley, had a high proportion of their drainage areas affected by fire, and these watersheds drain towards populated areas of Los Angeles and San Bernardino counties. During periods of thunderstorm activity, and as the wet season approaches (typically October through May) and during summer monsoons (mid-July through September), it is critical that people who live in hazard areas within and downstream of the Bridge Fire implement emergency protection measures (EPMs) where appropriate, check weather conditions and forecasts, stay alert to National Weather Service (NWS) flash flood watches and warnings, and monitor local county resources for guidance on evacuations.

This report presents the results of a rapid evaluation of postfire geologic and hydrologic hazards to life-safety and property (i.e., collectively known as “Values-at-Risk” or “VARs”) for private lands affected by the Bridge Fire. Figure 1 shows the acreage and percentage of the burned

¹ Definitions of different flow types applied in this document are as follows (after Pierson (2005) and Hungr et al. (2001)):

Floods – closely resemble normal streamflow with sediment concentrations less than 20% by volume, bedload transport composed of sands to cobbles, and more predictable Newtonian fluid behavior.

Debris floods – rapid, surging flow that is heavily charged with debris and sediment. Suspended sediment composed of sand-sized particles is common with bedload transport composed of cobbles to boulders. Approximately Newtonian flow behavior with 20% to 60% sediment concentration by volume. Transient debris dams of boulders and woody material are common. Highly erosive.

Debris flows – rapid, surging flow composed of a slurry of sediment and water with suspended gravels and boulders. Less predictable non-Newtonian flow behavior with sediment concentrations of >50% by volume. Can cause catastrophic damage from burial and impact that can infill and divert streams, and destroy automobiles, buildings, and infrastructure.

area by ownership for the fire. Approximately 5.4 percent of the burned area is in private ownership, 94.5 percent is in federal ownership, and less than 1 percent is designated as special district lands. The Bridge Fire WERT conducted field assessments from 23 to 27 September 2024. WERT representatives met with Los Angeles and San Bernardino County personnel and other stakeholders during the WERT assessment (see Appendix A for a list of key contacts). A preliminary copy of the potential VAR locations and hazard descriptions was delivered to Los Angeles and San Bernardino Counties on 1 October 2024. A community meeting with local government, WERT, and federal BAER representatives was held with the Mount Baldy community online on 1 October 2024 and in the field on 3 October 2024.

Team members for the Bridge Fire WERT are listed in Table 1.

Table 1. Bridge Fire WERT members.

Name	Position	Agency	Expertise-Position
Don Lindsay; PG 7489; CEG 2323; PE 76899; GE 3097	Team Leader	CGS	Engineering Geology; Civil Engineering
Kevin Doherty; PG 7824; CEG 2666	Team Co-Leader	CGS	Engineering Geology
Derek Magnuson; PG 9181; CEG 2653	Team Member	CGS	Engineering Geology
Drew Coe; RPF	Team Member	CAL FIRE	Liaison
David Ahmadi; RPF	Team Member	CAL FIRE	Forestry
Peter Smith, RPF	Team Member	CAL FIRE	Forestry
Adjunct Team			
David Cavagnaro	Adjunct Member	CGS	GIS
Meerea Kang	Adjunct Member	CGS	GIS
Deshawn Brown	Adjunct Member	CGS	GIS
Michael Falsetto	Adjunct Member	CGS	GIS

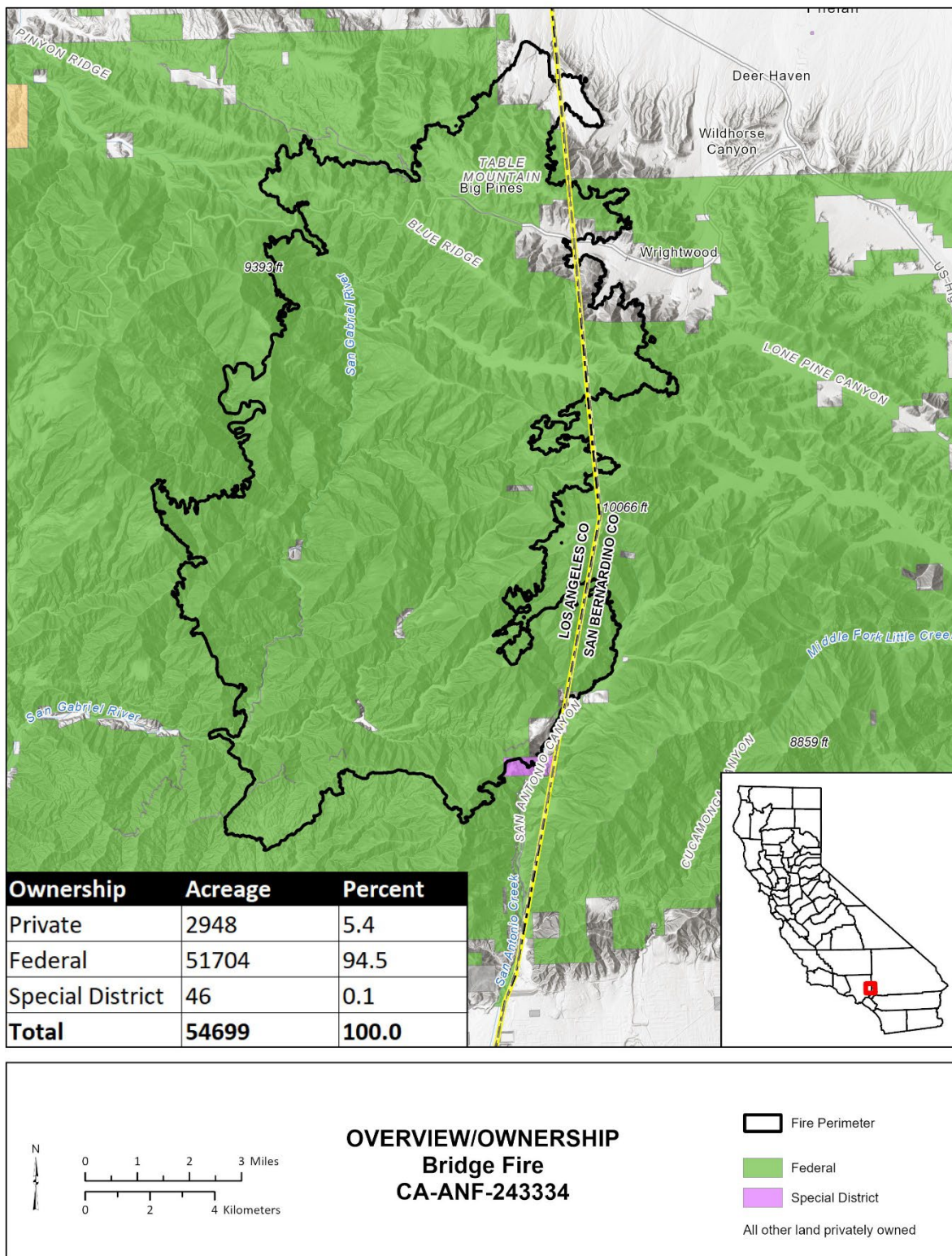


Figure 1. Ownership map of the Bridge Fire burned area.

Objectives and Scope

Primary objectives for the WERT are to conduct a rapid preliminary assessment that include the following components.

- Identify types and locations of on-site and downstream threats to life-safety, property, and critical infrastructure (i.e., Values-at-Risk or VARs) from postfire flooding, debris flows, rockfall, erosion, and other hazards that are elevated due to postfire conditions.
- Rapidly determine relative postfire risk to these values, using a combination of state-of-the-art analytical tools (e.g., USGS postfire debris-flow likelihood model) and the best professional judgement of licensed geohazard professionals (i.e., Professional Geologists; Certified Engineering Geologists; Professional Civil Engineers).
- Develop preliminary emergency protection measures (EPMs) needed to avoid or minimize threats to life-safety and property.
- Communicate findings to responsible entities and affected parties so that the information and intelligence collected by the WERT can be used in response planning to reduce risk from postfire watershed hazards.
- It is important to emphasize that the WERT performs a rapid evaluation of postfire hazards and risk. A complete characterization of postfire 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.
- This document summarizes downslope/downstream VARs and makes specific and general recommendations to reduce exposure to postfire, life-safety and property hazards on county and private lands. **While the report can provide useful information to emergency planners and first responders, the GIS data, in the form of a geodatabase, produced by the WERT is the most important source of information for postfire response planning. 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.**

Physical Setting

Topography and Climate

The Bridge Fire burned primarily in the San Gabriel Mountain range upslope of the San Gabriel Reservoir and the communities of Mt. Baldy and Wrightwood, and largely within land designated as the Angeles National Forest. The topography within the fire area is predominantly moderately steep to very steep. Elevations range from approximately 1,600 feet at the lowermost point along the San Gabriel River in the southwestern side of the burned area to approximately 9,600 feet on the western flank of Mount San Antonio on the eastern side of the burned area. HUC-12 watersheds within the fire perimeter include Rock Creek, Grandview Canyon, Mescal Creek, Jesus Canyon, Le Montaine Creek, Sheep Creek, Iron Fork of San Gabriel River, Fish Fork of San Gabriel River, North Fork Lytle Creek, San Antonio Canyon, and San Dimas Wash.

The burned area spans the northern and southern slopes of the San Gabriel Mountains. This area has a Mediterranean climate with mild to cold, wet winters and warm to hot, dry summers. Most of the annual precipitation in this region occurs from November through March. Annual precipitation ranges from approximately 15 inches on the north side of the burn area in the lee

of the San Gabriel Mountains to 65 inches in the higher elevation slopes of the range (PRISM Climate Group 2024). Annual precipitation totals in the burned area are highly variable from year to year; the presence of El Niño conditions can result in wetter-than-average annual precipitation. Thunderstorms occur in the summer and fall months, typically associated with the North American Monsoon or decaying tropical systems. These thunderstorms can generate localized heavy rainfall and runoff. In the winter season, seasonal snowpack forms in the upper elevations (typically above 6000 feet in elevation) and can be influenced by postfire effects. Seasonal snow depths can increase following fire due to reductions in interception and evaporation/sublimation and decrease following fire due to changes in albedo caused by ash and dust mixing with the snow and wind scour. A shallow, ephemeral snowpack may develop at lower elevations and can readily melt in rain-on-snow events, resulting in enhanced runoff.

Hydrology and Flood History

Alluvial fans observed downstream of the mouths of steep confined drainages of high relief and denuded headwall swales suggest ongoing surface erosion and mass wasting occurring within mountainous areas of the Bridge Fire burned area. Relic channels and observed matrix-supported debris deposits across fan surfaces in some areas indicate a history of debris flows, independent of postfire conditions. Flooding and debris flow events within the Wrightwood area in 1941, 1969, and 1978, and most recently in 2023 following tropical storm Hilary were not associated with wildfire (Morton and Campbell, 1974; Caltrans District 8, 2023). In addition, flooding and debris flow activity occurred in Mt Baldy Village following a convective thunderstorm that resulted in 4.7 inches of rain over 2.5 hours (<https://www.usgs.gov/news/debris-flow-reconnaissance>).

There have been no confirmed, documented postfire debris flows within or adjacent to the Bridge Fire perimeter in recent history (since 2000). However, these types of debris flows commonly occur throughout the San Gabriel and San Bernardino Mountains and may have occurred without documentation since 2000 in more remote areas of the fire perimeter. The closest confirmed, recent postfire debris flow was documented within the 2003 Grand Prix - Old Complex Fire. This fire experienced at least 74 debris flows where 68 of these occurred 2 months after fire ignition on 25 December 2003 (Cannon et al., 2008). The December debris flows killed at least 16 people, damaged or destroyed 52 homes, severely damaged a campground, and caused an estimated \$38 million in damages (Oakley et al., 2017). A second debris flow event within the 2003 Grand Prix burned area occurred 10 months later on 20 October 2004 with unknown effects (Cannon et al., 2008). Both events were triggered by cool season weather systems.

Other recent fires with documented postfire debris flows (PFDF) further from the Bridge Fire, but within the San Gabriel Mountains, include: 2008 Santa Anita Fire (1 PFDF), 2009 Station Fire (>109 PFDFs), and 2016 Fish Fire (7 PFDFs) (Staley et al., 2016; Oakley et al., 2017). In addition, the 2020 Bobcat Fire had a reported debris flood that impacted Monrovia Canyon Park. The environmental settings of these fires are very similar to that of the Bridge Fire, therefore similar responses are likely.

Older debris flow events have also been documented near the Bridge fire. In 1969, intense storms triggered debris flows from recently burned slopes above the City of Glendora. More than a million cubic yards of sediment and debris was deposited within the city. These debris

flows damaged or destroyed at least 175 homes and caused at least \$2,500,000 (1969 value) in damages (Cannon et al., 2004).

Vegetation and Fire History

Vegetation within the Bridge Fire is characterized by a mixture of chaparral, oak woodland, and mixed conifer forest. In general, the majority of the burned area is occupied by chaparral vegetation, with higher elevations consisting of oak woodland and mixed conifer forest (Cal Fire, 2024).

Previous fire history can influence the magnitude of postfire response. The Bridge Fire footprint occupies portions of several recently burned areas, the largest of which were the Williams Fire (2002, 38,094 acres), Curve Fire (2002, 20,565 acres), and the Narrows Fire (1997, 18,248 acres). Other small to moderate-size fires also affected portions of the Bridge Fire area in the past 25 years, including the Bighorn (2008), Shoemaker (2014), Nowhere (2006), Sheep (2011), and Pines (2015) Fires. Records of older fires within the Bridge Fire boundary indicate that the San Gabriel River watershed burned several times between the early 1900's and 1980's. Figure 2 provides a map of known fires within and adjacent to the Bridge Fire perimeter.

Some areas, such as portions of Coldwater Canyon and the slopes above Wrightwood and Big Pines in the Angeles National Forest, have not experienced wildfire activity in modern history. Areas with less recent fire activity or no recorded fire history might have a higher potential for postfire response due to higher fuel loading which might lead to more severely damaged soil. Also, since these areas have not been subjected to recent postfire erosional processes, they may have a more abundant supply of sediment that can be entrained by amplified postfire runoff.

Geology and Landslides

The Bridge Fire occurred within the San Gabriel Mountains that comprise a portion of the Transverse Ranges Geomorphic Province. The Transverse Ranges Geomorphic Province is a series of steep, east-west trending mountain ranges and valleys extending from the San Bernardino Mountains in the east to the Santa Ynez Range in the west. The Transverse Ranges are oriented oblique to the generally north-south trending California coastline and delineate a significant westward step of the coastline northward across the province. The San Andreas fault zone makes a large left bend across the Transverse Ranges and causes a zone of compression resulting in significant uplift within the range. The San Gabriel Mountains are roughly bounded to the north by the San Andreas fault where it passes through the Wrightwood area and bounded to the south by the Sierra Madre fault zone that forms along the foothills separating the mountains from the Los Angeles basin.

As shown in Figure 3, the bedrock units exposed in the burn area include: 1) Precambrian igneous and metamorphic rocks, including gneissic rocks and quartz diorite; 2) Paleozoic igneous and metamorphic rocks including schist, gneiss, and quartz diorite; 3) Mesozoic igneous rocks including granite, granodiorite, diorite, and quartz diorite; 4) very minor areas of Tertiary marine and nonmarine sedimentary rocks, including shale and conglomerate; and 5) Quaternary nonmarine deposits including recent alluvium, terrace deposits, older alluvial gravel and sand, and alluvial fan gravel.

The basement igneous and metamorphic rocks are generally dense and incompressible, readily form steep slopes, and are prone to rockfall, talus slope formation, and shallow and deep-seated landslide processes. Bedrock is generally fractured in outcrop and combined with strong ground shaking generated on nearby active faults, deep-seated rockslides are common. One exception to the dense older rocks in the burn area is the Pelona Schist (a Paleozoic metamorphic rock) that is mapped in a large portion of the burn area south and west of the Wrightwood area (Dibblee, 2002). The Pelona Schist is a known rock unit with slope stability problems because of the platy structure and compressibility. The Pelona Schist is also known for generating hyperconcentrated flows (Morton and Sadler, 1989; CDMG, 1979). Rapid uplift and highly fractured rock within the San Gabriel Mountains result in steep, highly-erodible slopes that generate some of the highest sediment yield rates in California (Minear and Kondolf, 2009).

Published landslide mapping and field observations in the burn area indicate a variety of landslide processes occur in the region (Dibblee 2002a, 2002b, 2002c, 2002d; Morton and Streitz, 1966). Postfire hydrological changes and loss of vegetation could contribute to the reactivation of prior landslides, although it is unlikely in most cases. Hazards specifically from debris flows and hyperconcentrated flows are present in and downslope of the burned area as evidenced by historical records, alluvial fan landforms, and debris flow deposits observed in exposure. A history of debris flow activity within and near the limits of the Bridge Fire is presented in the Hydrology and Flood History section of this report.

Mineral Hazards and Wells

Fire can increase exposure to mineral hazards. Figure 4 shows the locations of metallic and non-metallic mines, natural oil and gas seeps, and prospecting sites within and near the burned area. An evaluation of aerial imagery at these locations did not indicate signs of recent use, associated structures, or human activity, so they were not assessed for postfire hazards in the field. A majority of the mapped metallic mines are related to historic gold mining operations in the Mount Baldy Mining District, in which both lode and placer mining for gold and silver has occurred. The placer mining was predominantly focused along lower segments of the East Fork of the San Gabriel River, while the lode mines were distributed higher up in the watershed of the river (Higgins and Churchill, 2012). These mining operations may still contain mine tailings and mine waste that may contain potentially harmful concentrations of heavy minerals. The use of mercury was common practice to enhance gold recovery in all the various types of mining operations since 1850.

Figure 4 also shows areas of potential mineralogical concern within the burn area shaded in red, orange, and yellow. Small areas of red shading on Figure 4 west of Prairie Fork Creek within the burn area are generally consistent with geologic mapping of the Punchbowl Fault, and the area is considered as having a high potential for mineralogical concern for heavy metals, manganese, radioactive elements, and naturally occurring asbestos (NOA) (Higgins and Churchill, 2017). Asbestos is classified as a known human carcinogen by state, federal and international agencies and is regulated under Title 8 Section 1529 of the California Code of Regulations. State and federal health officials consider all types of asbestos to be hazardous. Orange shading on Figure 4 within the burn area is generally consistent with geologic mapping

of the Pelona Schist and Sheep Creek alluvial fan material derived from the Pelona Schist, which is known to contain small bodies of serpentinite and ultramafic rock with the potential for NOA. Yellow shading on Figure 4 within the burn area generally corresponds to potential landslide deposits generated from the Pelona Schist with the potential for NOA.

Following fire, exposed soils are more prevalent and can be mobilized through wind, runoff, and anthropogenic activities increasing human exposure to hazardous minerals. For information on hazardous minerals, please refer to <https://www.conservation.ca.gov/cgs/minerals/mineral-hazards>, <https://oehha.ca.gov/chemicals/> or <https://pubs.usgs.gov/fs/2005/3014/>.

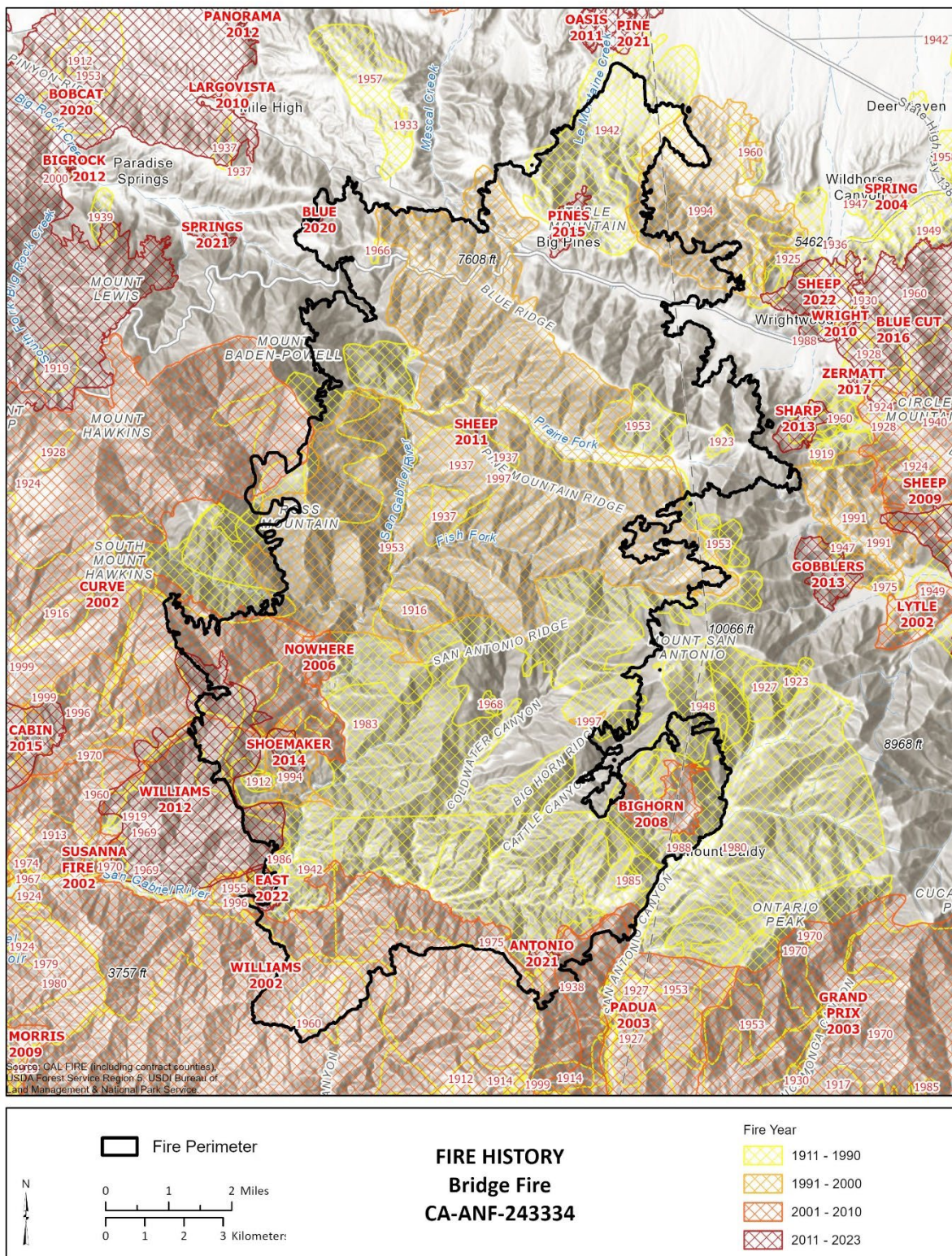


Figure 2. Fire history for the Bridge Fire. Note: Areas that haven't burned for many decades have a potentially higher erosional response than areas that have been subject to recent fire.

Geologic Map Units - Bridge Fire

CENOZOIC

Quaternary

Qal	Recent Alluvium
Qal-Qc	Recent Alluvium And Pleistocene Nonmarine Sedimentary Deposits
Qt	Quaternary Nonmarine Terrace Deposits
Qc	Pleistocene Nonmarine Sedimentary Deposits
Qco	Pleistocene Nonmarine Sedimentary Deposits, Older

Tertiary

Pc	Undivided Pliocene Nonmarine Sedimentary Rocks
Mc	Undivided Miocene Nonmarine Sedimentary Rocks
Ep	Paleocene Marine Sedimentary Rocks
Tr	Tertiary Intrusive (Hypabassal) Rocks- Undifferentiated
Tr	Tertiary Intrusive (Hypabassal) Rocks- Rhyolitic

MESOZOIC

Cretaceous to Jurassic

gr	Mesozoic Granitic Rocks- Undifferentiated
gr(Pm*)	Permian-Triassic Granitic Rocks-Undifferentiated
gr ¹	Mesozoic Granitic Rocks- Granite And Adamellite (Quartz Monzonite)
gr ^g	Mesozoic Granitic Rocks- Granodiorite
gr	Mesozoic Granitic Rocks- Tonalite (Quartz Diorite) And Diorite

PALEOZOIC

Undivided Paleozoic

gr-m	Pre-Cenozoic Granitic And Metamorphic Rocks
ms	Pre-Cretaceous Metasedimentary Rocks
m	Pre-Cretaceous Metamorphic Rocks- Undifferentiated
ms	Pre-Cretaceous Metamorphic Rocks- Limestone And/Or Dolomite

Pre-Cambrian

p_c	Precambrian Igneous And Metamorphic Rock Complex
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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

Figure 3b. Legend for geologic map in Figure 3a for the Bridge Fire.

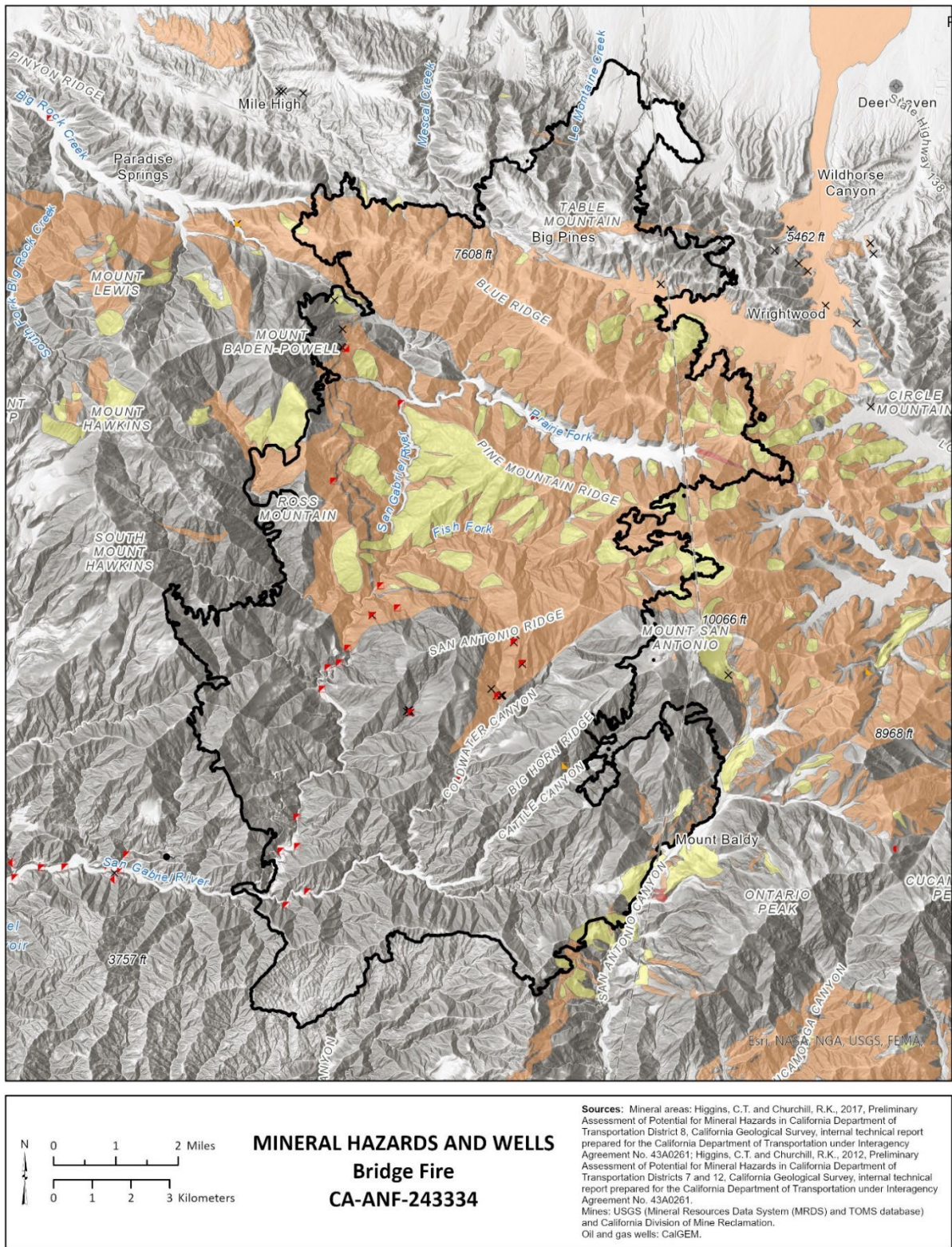


Figure 4a. Mineral Hazards map for the Bridge Fire.

Areas of Potential Mineralogical Concern (APMC)



Areas of serpentinite/ultramafic or silica/carbonate rocks. These have potential for locally elevated concentrations of the following:

- Asbestos, Chromium, Cobalt, Copper, Manganese, Mercury, Nickel



Areas of various metamorphic/igneous rocks and associated sedimentary deposits. They have potential for locally elevated concentrations of the following:

- Asbestos, Beryllium, Chromium, Cobalt, Copper, Lead, Manganese, Molybdenum, Nickel, Silver, Vanadium, Zinc



Areas of landslide deposits that may include debris from adjoining APMC rock units. These have potential for locally elevated concentrations of the following:

- Asbestos and/or various metals, depending on the sources of the debris.
- The potential for asbestos and metals in the landslide deposits will likely be the same or similar to that of the APMC rock units that adjoin these deposits.

Mines and Prospects

CAM17 and Related Metals

- | | |
|--|--|
| <ul style="list-style-type: none"> ◀ Barium (Barite) ◀ Copper ◀ Gold ◀ Gold + Other Metals | <ul style="list-style-type: none"> ◀ Lead + Other Metals ◀ Molybdenum ◀ Silver ◀ Zinc + Other Metals |
|--|--|

Other Potentially Hazardous Commodities

- ◀ Tungsten

Other Mines

- × Non-metallic mine or mine feature (TOMS database)

Wells and Other Features

Oil and Gas Wells

Well Status

- Idle
- Plugged

Well Type

- ⊕ Dry hole
- Oil and gas

Other Features

- ◻ Fire perimeter
- Oil or natural gas seep

Figure 4b. Legend for Mineral Hazards map in Figure 4a for the Bridge Fire.

Modeling Postfire Response

Soil Burn Severity

The initial field assessment by the WERT was conducted using a Burned Area Reflectance Classification (BARC) map that was field validated and edited in collaboration with soil scientists from the USFS Bridge Fire BAER team to create a Soil Burn Severity (SBS) map of the burn area (Figure 5).

Within the Bridge Fire footprint, 36 percent of the area was burned at low, 41 percent at moderate, 13 percent at high and 9 percent as very low/unburned soil burn severity. Just under 1 percent of the burned area produced no data. Some of the highest proportions of moderate and high soil burn severity are located within mountainous terrain within the southern and western portions of the burned area within the San Gabriel River and San Antonio Canyon drainages.

Postfire Debris Flow: Predicted Thresholds and Hazards

The USGS postfire debris flow hazard model (Staley et al., 2016) was run using the SBS map for the Bridge Fire to assist in the WERT's assessment of locations where hazards to life, property, and infrastructure may exist. The combined hazard model results reflect the potential likelihood of a debris flow occurring as well as the volumetric yield of the debris flow. These results are combined into an overall categorical ranking that range from low to high.

Figure 6 shows the combined debris flow hazard for the 15-minute, 24 mm/hr (0.94 in/hr) intensity storm. Figure 6 indicates that the combined debris flow hazard is moderate to high within the central and southern portions of the burned area, while the combined debris flow hazard within the northern and northeastern portions of the burned area ranges from low to moderate. The western and southern portions of the San Gabriel River drainage, particularly portions of Prairie Fork, Fish Fork, Coldwater Canyon, and Cattle Canyon, have many steep basins with high debris flow likelihood and high combined hazard.

Figure 7 illustrates 15-minute rainfall intensities required to generate a 50 percent likelihood of debris flows for each basin across the burned area. The fire wide basin average 15-minute rainfall intensity threshold at a 50 percent probability is 22 mm/h (0.87 in/hr). Basins with high debris flow hazard rankings are typically in remote areas, except for the Bear Canyon drainage within the southeastern corner of the Bridge Fire burned area. These debris flows should have minimal immediate downstream impacts in most areas, but they may supply large quantities of sediment and debris to mainstream channels (e.g., Coldwater Canyon) that may be transported to downstream reaches and eventually impact infrastructure. The community of Mt. Baldy Village is the primary area with homes and structures that may directly be impacted by debris flows. Within and downstream of Bear Canyon, there are multiple homes and commercial structures along channels with a combined hazard ranking of high. Additionally, there are residential and commercial structures within the community of Wrightwood, particularly downstream of Government and Flume Canyons, and along the northern slopes of Swarthout Valley, with a combined hazard ranking of moderate. Damage to stream crossings and bridges along State Highway 2 and Upper Monroe Road is also possible.

Debris Flow Model Accuracy and Limitations

For basins burned in the Bridge Fire, the results of the USGS debris flow model (Staley et al., 2016) give an indication of potential postfire watershed response but may not accurately predict debris-flow likelihood or volume for a given design storm. However, a very high proportion of data used for the model development come from the San Gabriel Mountains, suggesting that the model can provide reasonable predictions for the Bridge Fire area.

The USGS model results do not constitute a site-specific analysis of debris-flow hazards. Additional on-the-ground evaluation should be conducted by qualified and licensed professionals where necessary and appropriate, rather than taking the model results at face value. The model results are also limited in that they do not show hazards for basins that are less than approximately 5 acres in area, and do not specifically identify hazards in areas where one or more tributaries may contribute flood and debris flows (drainage areas approximately greater than 2,000 acres). For areas not shown as having a debris flow hazard along a segment that is associated with a drainage network, a hazard may still be present yet undefined because the segment model results are limited based on the resolution of the input digital elevation model (DEM). Additionally, other hillslope processes such as rockfalls, debris slides, and deep-seated slides are not included in the model results.

It should also be noted that the debris-flow model does not predict runout and inundation areas beyond the modeled source basin and does not consider potential increased hazards from multiple storm events that may load channels with sediment that could be entrained in future debris flows.

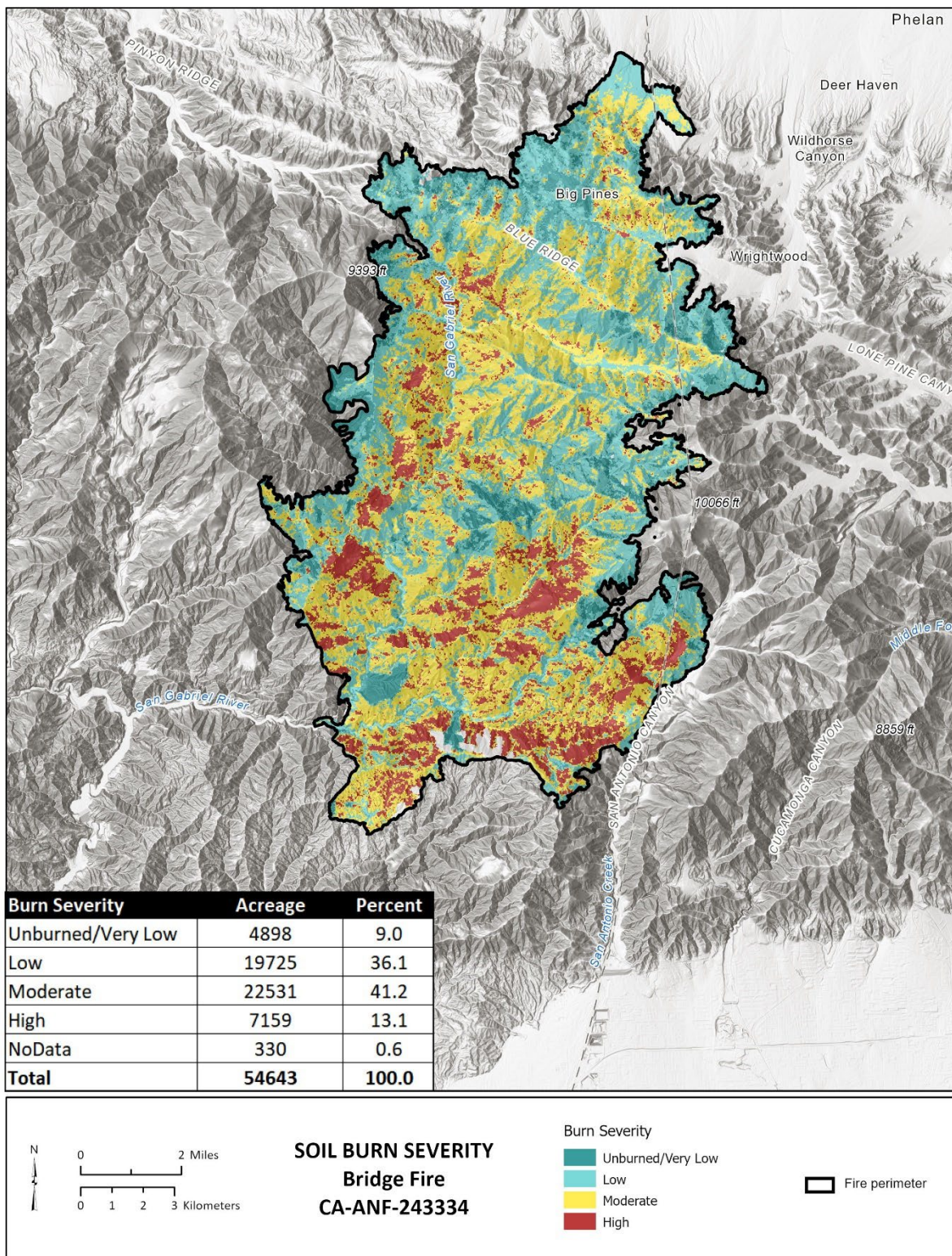


Figure 5. Soil Burn Severity map for the Bridge Fire.

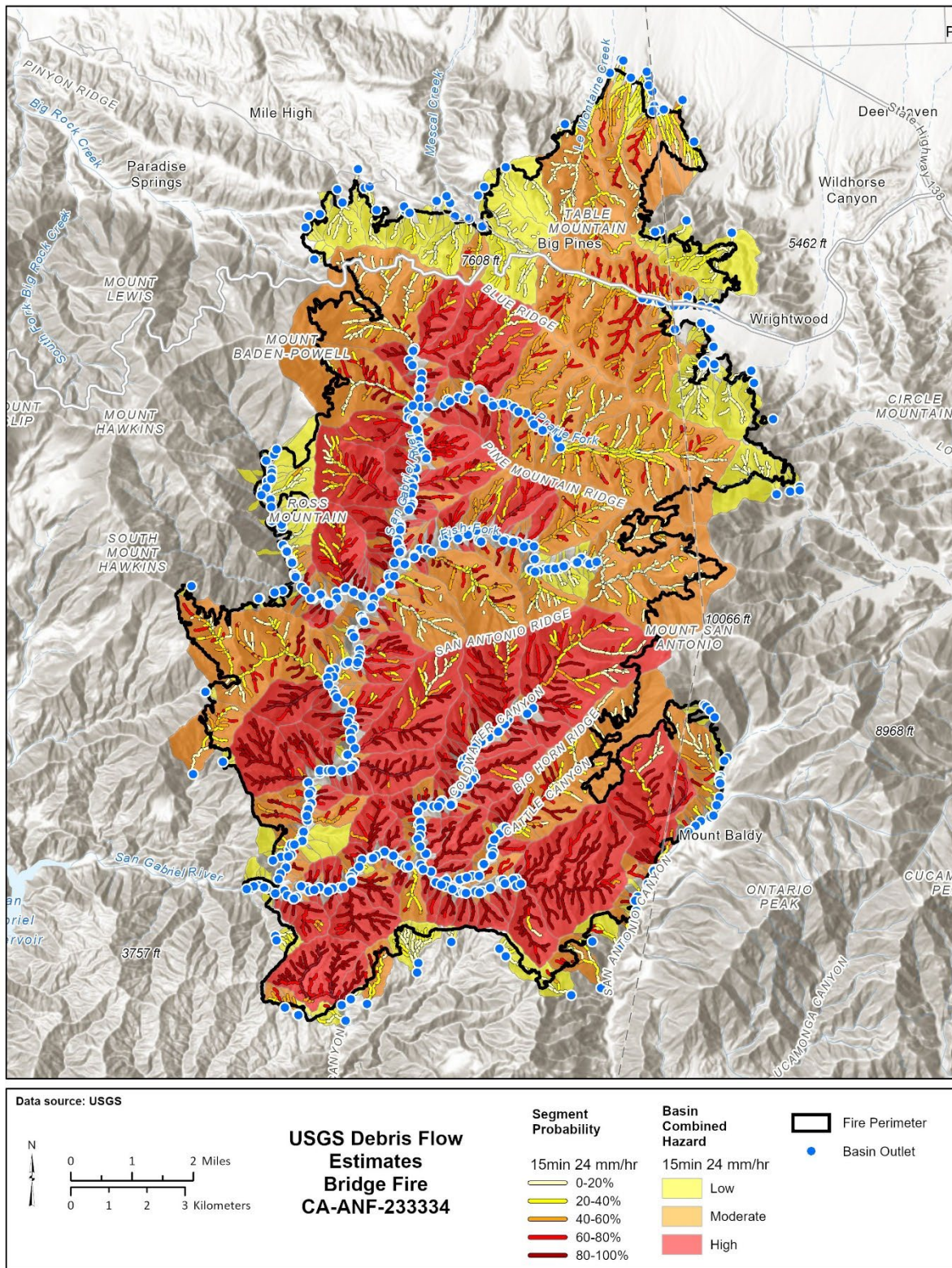


Figure 6. Combined debris flow hazard on the Bridge Fire for the 24 mm/hr (0.94 in/hr) 15-minute storm event.

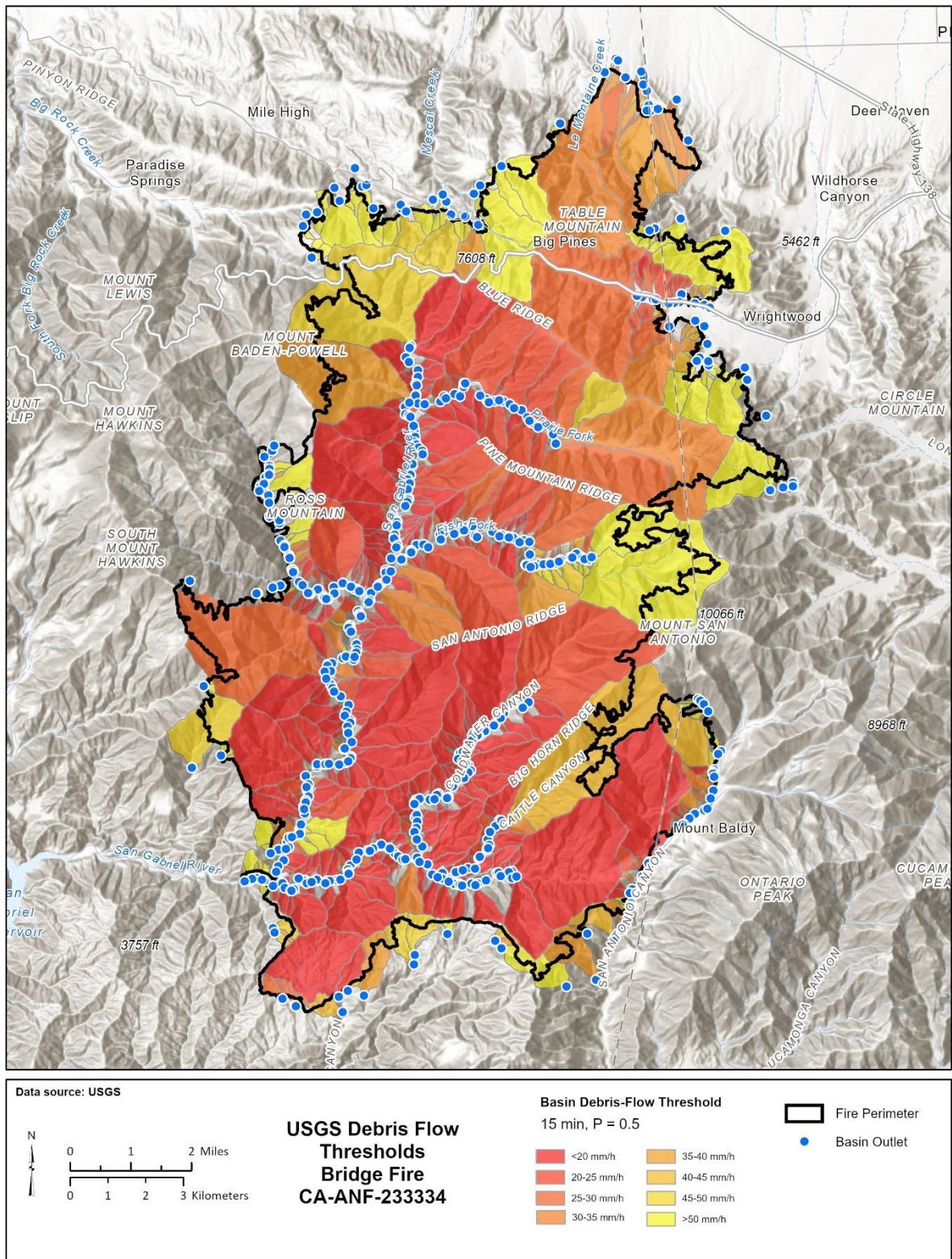


Figure 7. Predicted 15-minute rainfall intensity with a 50 percent likelihood of triggering a debris flow for the Bridge Fire.

Postfire Hydrology

Peak flows increase following wildfire due to reduced vegetation, surface cover, infiltration rates, and the formation of water repellent soils. The largest peak flows occur during intense, short duration rainfall events on watersheds with steep slopes (Neary et al., 2005). Research conducted in southern California indicates that postfire peak flows can increase as much as 30-fold for moderate storms (0.1- to 5-year RI) and approximately 2- to 3-fold for large magnitude storms (5- to 100-year RI) (Rowe et al., 1949; Moody and Martin, 2001). Kinoshita et al. (2014) reported that commonly used flood flow prediction methods have lower confidence with larger recurrence interval events (25- and 50-year); therefore, we analyzed pre- and postfire flows assuming a 2-year storm event.

The WERT selected eight watersheds, or “pour points”, to estimate potential postfire peak flow increases to VARs from debris flood to debris flow hazards. Figure 9 shows the eight pour point locations, four of which are within the Wrightwood area, three are in the Mount Baldy area, and one is along the East Fork San Gabriel River near the western perimeter of the burn area. These pour points represent elevated flood and debris flow hazards to private and public roads and residential structures. Pour points located close to the fire perimeter and burned at moderate and high soil burn severity (SBS) yield larger postfire flow increases than those far below the fire perimeter and those burned at lower severity.

Prefire peak flow estimates were first produced for the eight pour point watersheds using the South Coast, Region 5 (Pour Points 1-4), and Desert, Region 6 (Pour Points 5-8), USGS regional regression equations for a 2-year recurrence interval discharge (USGS StreamStats, 2024; Gotvald et al., 2012).

Changes in postfire peak flows were estimated using two methods based on the basin size and anticipated flow type at each pour point ranging from debris flood to debris flow. Flow type was determined based on existing slope and channel morphology, as well as historic account of postfire runoff events, either reported in public documents reviewed as part of our assessment or through personnel accounts shared by local residences.

To estimate postfire peak discharge for flood and debris floods, we followed procedures outlined by USFS BAER teams (unpublished), referred to here as the BAER method. The BAER method uses the proportions of the watershed that are unburned and burned at low, moderate, and high SBS to account for postfire runoff increases. For this analysis, the postfire 2-year recurrence interval flow is estimated by assuming areas that are unburned or have very low SBS undergo no change in runoff (Q2); runoff from low SBS areas are assumed to respond similarly to a 5-year recurrence interval discharge (Q5); runoff from moderate SBS areas are assumed to respond similarly to a 10-year recurrence interval discharge (Q10); and runoff from high SBS areas are assumed to respond similarly to a 25-year recurrence interval discharge (Q25). Applicable USGS regression equations for the Q2, Q5, Q10, and Q25 flows are applied to each category (USGS StreamStats, 2024; Gotvald et al., 2012). The area-weighted flow estimates by soil burn severity class are then summed to derive the runoff response that would typically generate a 2-year peak flow.

The BAER method is intended to predict peak discharge for postfire floods and debris floods with sediment concentrations less than about 40%, however, it may underpredict peak discharge of debris flows that often form dilated surge fronts composed of segregated boulders and woody debris. Short-lived amplification in stage and instantaneous discharge caused by debris flow surge fronts can be 10 to 100 times larger than normal stream flow (Rickenmann, 2016; Kean et al., 2016) and can lead to flow avulsion (i.e., rapid shifting of the stream), property damage, and sometimes fatalities (Kean et al., 2016; 2019). To demonstrate the potential amplification in postfire peak debris flow resulting from dilated surge fronts, we applied a simple empirical model by Kean et al., 2016, that estimates the mean peak discharge of postfire, runoff-induced debris flows in small (<345 acres) basins burned at over 43% moderate and high SBS:

$$Qp = 5.7 * I30 * Ab$$

Where:

Qp – Peak Discharge

I30 – 30 minute Peak Rainfall Intensity

Ab – Basin area

The one basin that fit the criteria necessary to apply the Kean et al. 2016 model is PP-6 (Goat Rock) above the community of Mount Baldy. This basin was the source area of a 2014 debris flow that impacted the community following an early August convective thunderstorm.

Table 2 provides a summary of basin information as well as pre-fire post-fire flood flow estimates based on a 2-year recurrence interval flow. Results indicate that postfire runoff events for a 2-year recurrence interval storm can result in floods and debris floods that are about 6 to 11 times larger than normal streamflow. The largest change occurs within the PP-6 basin above Shaw Avenue in Mount Baldy where postfire debris flow hazards are high and the flow multiplier is estimated to be 36. This large increase in clearwater equivalent peak discharge illustrates the significance of dilated surge fronts for debris flows and better frames the potential hazards to life and property in debris-flow-prone basins. Additional basins believed to represent an elevated threat of mobilizing sediment and debris to form dilated surge fronts include, in descending order of perceived threat, Bear Canyon (PP-5) and Flume Canyon (PP-2).

These flow estimates are intended for emergency response planning purposes only and are not to be used for design. Moreover, they are most appropriately applied to flows within the first year following the fire or until ground cover within the burned area is well established. As knowledge is obtained through monitoring the runoff response of stressing storms in the first wet season after fire or as the slopes in the watersheds become revegetated, these flow multipliers may be adjusted to decrease predicted postfire flows and reduce conservatism.

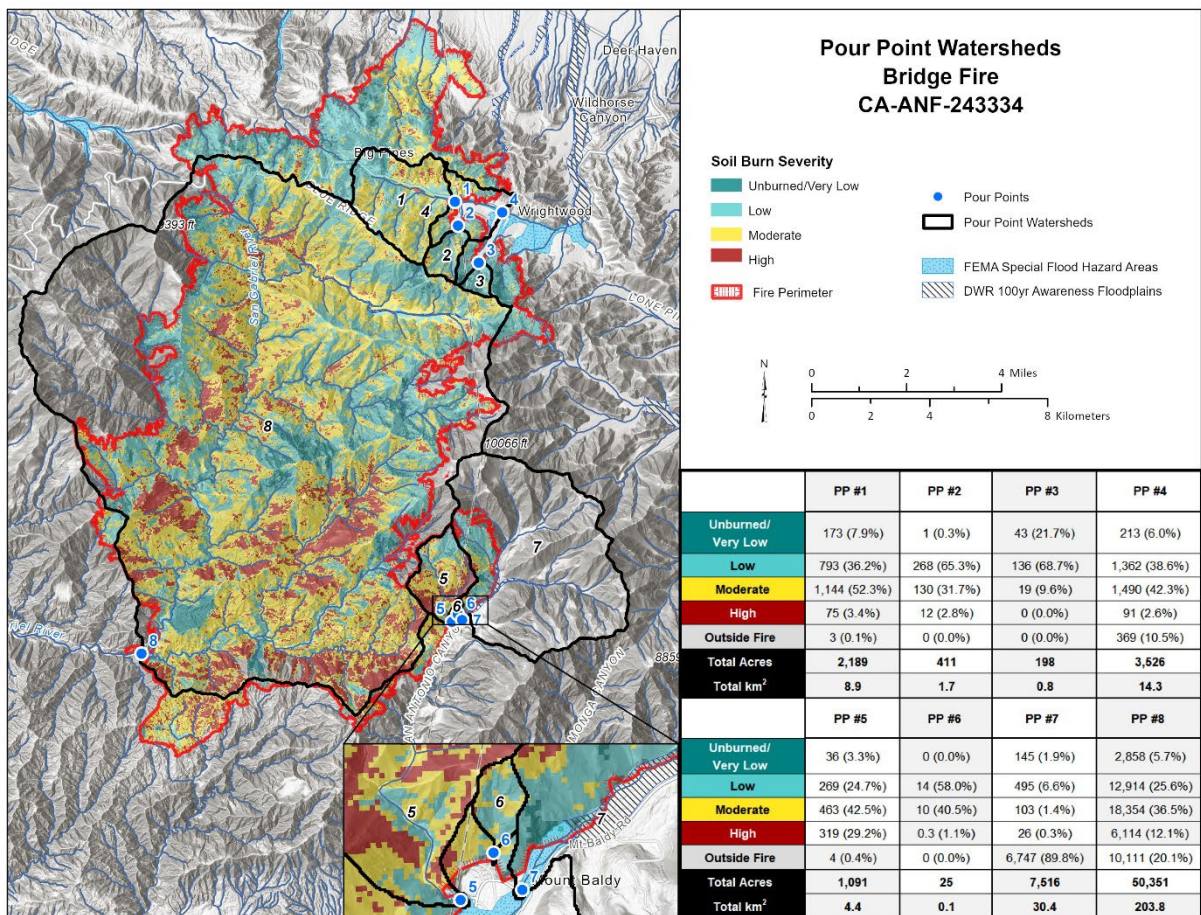


Figure 7. Pour Point locations within and downstream of the Bridge Fire.

Table 2. Basin metrics, pre- and postfire Q2 flow estimates, and prefire Q2 flow multipliers used to estimate increased relative runoff response for eight watersheds assessed for flood, debris flood, and debris flow hazards (i.e., “pour points”).

Pour Point #	Description	Anticipated flow type based on channel morphology and historic record	Basin Area (mi ²)	Relief (feet)	Mean Basin Elevation (feet)	% Unburned/very low	% Low SBS	% Moderate SBS	% High SBS
PP-1	West Wrightwood	Debris Flood	3.4	2337	7154	8	36	52	3
PP-2	Flume Canyon	Debris Flood/Flow	0.6	2110	7550	0	65	32	3
PP-3	Acom Canyon	Flood	0.3	1608	7501	22	69	10	0
PP-4	Hwy 2 crossing - Wrightwood	Debris Flood	5.5	2548	7011	17	39	42	3
PP-5	Bear Canyon	Debris Flood/Flow	1.7	4112	6166	4	25	42	29
PP-6	Goat Rock - Mt Baldy	Debris Flow	0.04	1287	5096	0	58	41	1
PP-7	San Antonio Canyon/Mt Baldy Rd	Flood	11.7	5779	7091	92	7	1	0
PP-8	San Gabriel River	Debris Flood	78.7	8264	5583	26	26	36	12
Pour Point #	Description	Q2 prefire flow (CFS) ¹	Q2 post-fire flow (CFS) following BAER ²	Q2 post-fire flow (CFS) following Kean ³ for small basins (0.005 - 0.5 sq. miles) with expected high debris flow potential	Q2 prefire to postfire flow multiplier (Postfire Q2/Q2) for Flood/Debris Flood/Debris Flow	Interpreted Postfire Response ⁴			
PP-1	West Wrightwood	19	215	--	11	High			
PP-2	Flume Canyon	8	79	--	10	High			
PP-3	Acom Canyon	6	32	--	6	Moderate			
PP-4	Hwy 2 crossing - Wrightwood	24	235	--	10	High			
PP-5	Bear Canyon	81	553	--	7	Very High			
PP-6	Goat Rock - Mt Baldy	6	20	227	36	Very High			
PP-7	San Antonio Canyon/Mt Baldy Rd	322	429	--	1	Low			
PP-8	San Gabriel River	1001	7131	--	7	High			

¹2-yr Recurrence Interval (Q2) flow estimated using USGS regional regression equations (Gotvald, 2012)

²Postfire, 2-yr Recurrence Interval (Q2) flow (clearwater) following BAER protocol based on Soil Burn Severity: non&verylow = Q2; low = Q5; moderate = Q10; High =Q25. See report text for explanation.

³Postfire peak debris flow discharge (Kean et al, 2016). See report text for explanation.

⁴Localized flooding in excess of the postfire reponses presented may occur immediately downslope of basins burned at a high severity, at tributary confluence, and at crossing structures if high volumes of woody debris and large boulders are transported.

Postfire Hydrologic and Hydraulic Models

The peak flow estimates and flow multipliers summarized in Table 2 are best used to evaluate the relative magnitude of change from prefire to postfire runoff. However, because the methods applied only allow for peak flow to be estimated, they do not provide a complete runoff hydrograph needed to conduct unsteady 2D and 1D hydraulic modelling to inform flow conveyance and inundation extent within and downslope of burnt areas. Consequently, the WERT recognizes that Los Angeles County and San Bernardino County public works may wish to conduct detailed hydrologic and hydraulic modelling to better account for increased runoff and potential flow path uncertainty using available models such as the Hydrologic Engineering Center’s Hydrologic Modeling System (HEC-HMS) and River Analysis System (HEC-RAS) (HEC, 2024). Upon request, the WERT can provide general guidance to help parameterize

basic hydrologic and hydraulic models based on experience from burn scars in similar geoclimatic conditions with known postfire response.

VAR Observations and Discussion

This evaluation is not intended to be comprehensive and/or conclusive, and additional VARs may be identified through more detailed evaluation by responsible agencies. This includes more detailed site investigation for the development and design of appropriate mitigation measures. Several limitations are summarized below.

- 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 burn area were evaluated.
- Some potential VARs were not evaluated, or evaluated from a distance, because of the lack of access.
- Hazards on alluvial fans could not be represented as single-points given the potential for avulsion (i.e., rapid channel shifting) 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 burn perimeter. Risk of flooding in these areas is preexisting and is anticipated to be increased by postfire runoff and/or blockage of drainage structures (e.g., culverts and bridges) by postfire debris. As such, local agencies should consider these previously mapped hazard areas in addition to the VARs identified in this report.

Specific Values-at-Risk (VARs) are contained within the geodatabase (VAR point and polygon feature classes) created by WERT, and these comprise the best product for use in response planning because they provide spatial location along with attribute data captured in the field. Detailed observations and potential mitigations are provided in the geodatabase (VAR point and polygon feature classes), VAR summary table (Appendix B) and VAR site information sheets (Appendix C and D). A summary of VARs by relative risk to life-safety and property are shown in Table 3.

Table 3. Values-at-Risk (VARs) classified by risk to life-safety and property.

		Risk to Life-Safety		
		Low	Moderate	High
Risk to Property	Low	EF_04, EF_05, MB_03, MB_12, WW_02, WW_07, WW_11, WW_13, WW_14, WW_15, WW_19, WW_20, WW_21, WW_22, WW_24, WW_25, WW_26, WW_30, WW_33, WW_34, WW_35	Jub_01	
	Moderate	EF_03, EF_06, GRR_01, MB_02, MB_07, MB_10, MB_13, MB_14, MB_15, WW_01, WW_04, WW_06, WW_09, WW_12, WW_17, WW_23, WW_28, WW_31	EF_01, MB_04, MB_11, WW_08, WW_10, WW_16, WW_18b, WW_27, WW_29, WW_32,	
	High	WW_05	EF_02, EF_07, MB_05, MB_09, WW_03	MB_01, MB_06, MB_08, WW_18

Exigent Values-at-Risk

Exigent VARs represent moderate or higher risk to both life-safety and property and should receive priority attention for pre-planning and emergency protection measure implementation. Twenty (20) exigent VARs were identified within or downslope of the Bridge Fire burned area (Table 3). These VARs are discussed below, along with associated VARs that include many residential structures that face potential flood risks in areas of known flood hazard and key road crossings that present a moderate hazard to either life-safety or property.

Mt. Baldy Village (MB_01, MB_04, MB_05, MB_06, MB_08, MB_09, MB_11): Burned residential structures and access roads within Bear Canyon are susceptible to debris flows, flooding, and rock fall (**MB_05**). Downed logs were noted along the steep (approximately 50 to 70+/-percent) slopes above the Bear Canyon drainage that will likely move into the channel. Low water crossings may act as avulsion points during high flows, diverting flows onto Bear Canyon Road. What appears to be a gravity sewer line at **MB_02** was observed elevated approximately 4 to 5 feet above Bear Canyon channel and may be at risk of damage. The Bear Canyon drainage downstream of the Bridge Fire boundary is laterally constrained by residential structures and channel improvements, is partially infilled with sediment and debris, and is encroached by vegetation, all of which reduce the conveyance capacity of the channel to pass

bulk postfire debris and flood flows. Adjacent structures are at risk of impacts from flooding and debris flows overtopping the channel (**MB_01, MB_06, MB_09**). Excessive runoff triggered by a thunderstorm in August 2014 plugged a culvert along Mt. Baldy Road at **MB_07** and overtopped the road. The road and adjacent structures were inundated with water and debris, resulting in the death of one person. The same storm triggered a debris flow that impacted residential structures along Shaw and Hill Avenues (**MB_04, MB_08**). Per conversations with residents, approximately 3 to 4 feet deep mud and debris impacted the residential structures. Structures and infrastructure along the Mt. Baldy Road, Oak Drive, Alder Drive, and Bear Drive (**MB_01, MB_11**) are at risk of flooding and debris flow activity emanating from steep, upslope slopes and swales that were burned at moderate to high severity. Clearing vegetation and downed logs from the channel within and downstream of Bear Canyon should increase the channel capacity and decrease the potential for crossings to become plugged and overtopped. In the event of overtopping flows, deflection structures should be considered to direct flow away from VARs. Lastly, residences area advised to evacuate the area when high-intensity storms are forecast and the National Weather Service issues a watch or warning.

East Fork San Gabriel River (EF_01, EF_02): A low-lying bridge (**EF_02**) crosses East Fork San Gabriel River to access the Julius Klein Conservation Camp #19 (**EF_01**). The bridge has a history of being overtopped and directing flows towards Camp #19, which sits on top of an elevated terrace southwest of the crossing. Potential flooding of the camp may impact camp structures and other infrastructure and restrict access. A large portion of the upstream watershed area was burned at moderate and high soil burn severity, suggesting that downstream storm flows will be increased and filled with sediment, debris, and logs. It is advisable to clear and maintain maximum available freeboard under the bridge and evacuate the inmates and Camp #19 staff when high intensity storm events are predicted. To improve flow capacity over the bridge, it is recommended to remove existing steel pipe railings and replace them with railings that can be temporarily removed then replaced or constructed out of wood that will break away in the event of overtopping flows.

Wrightwood (WW_03, WW_08, WW_10, WW_16, WW_18, WW_18b, WW_27, WW_29, WW_32): Several burned and intact residential, commercial, and government structures (**WW_03, WW_08, WW_10**) are located on alluvial fans below burned catchments along the north side of Swarthout Valley near Wrightwood. Channels observed on the fans appear to flow adjacent to residential buildings with no observable drainage structures in some locations. The catchments range from 20 to 90 acres in size and are largely burned at moderate to high soil burn severity, suggesting flows in the channels will be larger than usually experienced and may overtop the existing channels and impact adjacent structures. Residential structures and infrastructure within Flume Canyon and Acorn Canyon (**WW_16, WW_18, WW_29**) are located on alluvial fan surfaces downslope of steep drainages that were burned. Soil burn severity (SBS) was more severe within Flume Canyon with approximately 30 percent of the slopes burned at moderate to high SBS compared to Acorn Canyon with only 10 percent burned at moderate SBS. The proximity of the structures to drainage channels suggest that the structures may be impacted by bulked and overtopping flows resulting from the burned catchments. The alluvial fan within Flume Canyon is fully developed, making it difficult to delineate past or relic drainages through the built environment. A drainage channel (**WW_18b**) appears to have been constructed to direct flows past residential structures within Flume Canyon. Debris and fallen logs were observed within Flume Canyon upstream of the constructed channel. Increased

postfire runoff may mobilize sediment and debris causing channel aggradation and debris jams to form. These fire-related changes will increase local flooding risks.

Similar to Flume Canyon, drainage from Acorn Canyon appears to be directed to the east within a constructed channel. The presence of relic channels observed within Acorn Canyon suggest that past flows have migrated across the fan surface. The St. Edward Retreat youth camp (**WW_27**) is located along the western bank of the constructed channel. Abandoned braided channels were observed crossing the campground. Though the basin upslope was burned at mostly low severity, there remains an elevated risk of increased runoff that can mobilize sediment and debris that could lead to shallow overtopping flows. Due to flow path uncertainty through the campground, evacuation of the campers and staff is advised when high-intensity storms are forecast and the National Weather Service issues a watch or warning.

Key Infrastructure

The Bridge Fire burned primarily undeveloped land within the San Gabriel Mountains in Los Angeles and San Bernardino Counties. Residential development, commercial development, and critical infrastructure are generally located within and below the northern, eastern, and southwestern Bridge Fire boundaries. Utilities and road/highway infrastructure allowing access into and through the burned area are discussed below. Additional information regarding signage and other geohazards are discussed under the General Recommendations portion of this report.

The county road network potentially affected by the Bridge Fire was not completely evaluated during the WERT investigation. All roads, stream crossings, and drainage structures downstream and downslope of hillslopes and drainages burned at moderate to high SBS are at risk of storm damage. For example, road crossings and drainage structures along Mt. Baldy Road (**MB_07, MB_15**) are at risk of plugging and overtopping that can lead to the crossings being compromised and access restricted. Some areas downstream of the Bridge Fire already experience frequent flooding and the severity of flooding is likely to increase due to upstream fire effects. Monitoring, maintenance, and repair costs are expected to be high until the Bridge Fire burn area revegetates and recovers, which is a period that typically can take 2 to 5 years but may occur faster in some areas where the soil burn severity was low. Crossings and drainage along all county roads within and downstream of the burned area should be evaluated and maintained prior to and following stressing storm events. In addition, crossings that pose a high risk of failure and sediment delivery may be reconstructed with properly sized culverts, lower fill-slope heights, and rock armor. We recommend receiving regional alerts (discussed in General Recommendations below) and watching storm forecasts so problematic roads can be avoided during storms. Some specific county road locations of concern are discussed below.

State Highway 2 (WW_01, WW_02, WW_07, WW_31, WW_33, WW_35) within the Swarthout Valley in Wrightwood and Big Pines may be impacted by debris flows and flooding initiated in tributary drainages. Several drainage locations (**WW_01, WW_02, WW_07**) appear to intersect the highway with no observable drainage structure. Culverts and other basins along Highway 2 (**WW_31, WW_33, WW_35**) are at risk of being overtopped. The State Highway 2 crossing at the Sheep Creek VAR (**WW_35**) recently overtopped during a monsoon storm event associated with the remnants of Tropical Storm Hilary in August 2023. The resulting flows were not associated with postfire conditions. The concrete box culvert at VAR **WW_31** crosses State

Highway 2 at a skewed angle, increasing the potential for flows through the culvert to reduce velocity and sediment/debris to drop out of suspension and plug the crossing. Overtopping flows at VAR **WW_31** will likely be directed onto the State Highway road surface, potentially impacting commercial and government structures downstream including the US Post Office. The Acorn Canyon drainage bisects residential structures within a meandering constructed drainage along the east side of the canyon before emptying onto the Pine Road running surface at Edna Street, 2 blocks upslope of State Highway 2. Pine Road just upgrade of State Highway 2 recently flooded during a monsoon storm event in August 2023. Sediment and rock was observed within the Acorn Canyon drainage that could be mobilized by increased postfire flows and transported down Pine Street to State Highway 2. Clearing culverts and drainage ditches of debris and sediment will improve conveyance capacity and minimize flooding.

Rockfall Hazards exist along portions of Mt Baldy Road, Glendora Ridge Road, and Camp Bonita Road. Increased rock exposure and root damage from the fire will increase the likelihood of rockfall. In high risk rockfall areas during significant storm events we suggest having local agencies patrol these areas for hazards, stage proper heavy equipment for response and provide signage to adequately warn drivers.

Flood and Water Supply Infrastructure

The San Bernardino County Flood Control District maintains a drainage diversion channel within the Heath Canyon drainage above the community of Wrightwood. Residential and commercial structures within Wrightwood downstream of Heath Canyon are primarily constructed on an approximately 250-acre alluvial fan. Heath Canyon has a long-recorded history of flooding and debris flows into the Wrightwood area, including large debris flows in 1941 and 1969. The purpose of the diversion channel is to limit flooding and debris flow impacts to the residential and commercial structures by diverting flood and debris flows to the east side of the canyon, under State Highway 2, and ultimately to the Sheep Canyon wash. Postfire impacts within Heath Canyon are anticipated to be low because of the mostly low to unburned SBS within the watershed. As a result, it appears the capacity of the diversion structure is adequate under normal storm conditions. However, due to the history of debris flows occurring under unburned conditions, there remains an elevated risk of overtopping flows within Heath Canyon during significant storms, particularly at road crossings.

The San Gabriel Dam, which is a rock-fill dam located along the San Gabriel River approximately 5 miles downstream of the southwestern Bridge Fire boundary, was constructed in 1939 and resulted in the formation of the San Gabriel Reservoir. The reservoir provides flood control, groundwater recharge, and hydroelectric power for developments within the San Gabriel Valley downstream. Much of the approximately 200-square mile catchment upstream of the San Gabriel Reservoir burned as a result of the Bridge Fire, suggesting that the reservoir will receive higher than normal flows and sediment loads, potentially increasing sedimentation rates and impacting storage capacity.

Critical water supply infrastructure, including water intakes, wells, storage tanks, and treatment plants (**VAR's MB_02, MB_05, MB_14, WW_06, WW_29**), for developed areas in the vicinity of the Bridge Fire are located within and downstream of burned drainages in the areas of Wrightwood, Big Pines, Mt. Baldy Village, and within the lower East Fork San Gabriel River upstream of the San Gabriel Reservoir. Much of the infrastructure is located within the active

channels, along low-lying alluvial terraces, along steep debris slide slopes, or in the mouths of potential debris flow canyons, suggesting that the infrastructure is susceptible to inundation by flood flows, hyperconcentrated flows, and debris flows during large rain events.

General Hazards to Water Quality

Per CAL FIRE, 81 structures were destroyed and 17 others partially damaged as a result of the Bridge Fire. Many of the destroyed buildings occur within the communities of Mt. Baldy Village and Wrightwood. Destroyed structures adjacent to watercourses have the potential to transfer contaminated soils, large and small debris, and hazardous materials into waterways which can impact water quality downstream. Based on current understanding of impacts on burned residential homes and structures from wildfires, the resulting ash and debris can contain concentrated and toxic amounts of polycyclic aromatic hydrocarbons and heavy metals such as antimony, arsenic, cadmium, copper, lead, and zinc. The characterization of hazardous materials and their impacts on the environment and water resources is outside the purview of the WERT and is generally under the review of other State and Federal Agencies, such as State Water Quality Control Board, Department of Toxic Substances Control, California Department of Office of Emergency Services (Cal OES), and the Federal Environmental Protections Agency. To protect water quality and human health, local agencies may request assistance from the Cal OES Watershed Mitigation, Coordination, and Outreach unit to deploy emergency protective measures (EPMs) in areas with high potential for hazardous material runoff and increased sedimentation within the watershed.

General Recommendations

Implement an Early Warning System

An effective early warning system requires the implementation of different components (Figure 9) for hazard risk reduction, as well as linkages between these components so that the goals of protecting life, safety, and property are accomplished. In previous sections, this report characterizes the spatial distribution of hazard and risk within and downstream of the burned area, greatly increasing knowledge about potential risk from postfire hazards. This report also contains a fire-specific rainfall threshold to be used as a trigger point for forecast-based watches and warnings. Each VAR is characterized by the potential postfire hazard, relative risk from the hazard, and the potential emergency protective measures that can be implemented for risk reduction. The granular nature of VAR characterization allows for more targeted communication and response planning by emergency responders, public works/flood control agencies, and other entities tasked with implementing risk reduction activities (e.g., NRCS).

<u>Increasing Knowledge of Risk</u> • Characterizing soil damage within burned area • Spatial distribution of postfire flooding, debris flows, and rockfall • Spatial distribution of values-at-risk (VARs); relative risk determined for VARs <u>Warning Dissemination and Communication</u> • Use of alert systems and media for issuance of watches and warnings • Targeted communication to those most at risk (i.e., identified VARs) • Signage in areas of dispersed hazards • Focus communication on preparedness and self-preventative measures	<u>Monitoring and Warning</u> • Utilize fire-specific WERT-derived rainfall thresholds • Weather forecasting • Issuance of “watches” and “warnings” based on fire-specific rainfall thresholds • Weather and watershed response monitoring; Refinement of thresholds <u>Refining Response Capability</u> • Storm event pre-planning • Development of operational response plans based on spatial distribution of hazard and risk • Trigger points for phased operational response using weather forecasts • Implementation of emergency protection measures recommended by WERT
Red text indicates where WERT products or CGS expertise can be utilized	

Figure 9. The four components of “people-centered” early warning systems (adapted from Garcia and Fearnley, 2012), along with steps necessary to implement each component specific to minimizing risks from postfire watershed hazards. This WERT report provides knowledge to implement each of these components in a manner specific to the fire.

Prescribed Rainfall Thresholds

The initial year rainfall thresholds are determined by WERT for the Bridge Fire by considering data such as the USGS modeled rainfall thresholds, regional debris flow thresholds (Staley et al., 2017; Cannon et al., 2008), previous flood and rainfall history, geologic/geomorphic conditions of the burned area, and the hazard and relative risk associated with each VAR. The following thresholds have been developed by the WERT and approved by the National Weather Service (NWS) and the USGS (Table 4).

Table 4. Year 1 rainfall thresholds for the Bridge Fire.

<i>Duration</i>	<i>Year 1 Threshold Intensity mm/hr (in/hr)</i>	<i>Year 1 Threshold Depth mm (in)</i>	<i>Recurrence Interval</i>
15 minutes	20 (0.79)	5 (0.20)	<1-years
30 minutes	16 (0.63)	8 (0.30)	<1-years
60 minutes	13 (0.50)	13 (0.50)	<1-years

The WERT strongly recommends that Los Angeles and San Bernardino County Offices of Emergency Management, Los Angeles County Fire Department and San Bernardino County Fire Protection District, Los Angeles and San Bernardino County Sheriff's Offices, Los Angeles and San Bernardino County Public Works and Flood Control work with the NWS and the California Geological Survey to monitor forecasts and rainfall intensity during storms, as well as observe postfire response following storm events. If the initial rainfall threshold is too conservative, and little response occurs during storm events, data and observations will be necessary to adjust the threshold upward in a defensible manner. Alternatively, rainfall thresholds can also be lowered based on gage data and observations.

Existing early warning systems should be used and iteratively 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 Bridge Fire should take advantage of the services described below.

Utilize 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 postfire debris flow "watch" and "warning" notifications in burn areas.

Watches are issued when the likelihood of hazardous weather or a hydrologic event has increased significantly, but its occurrence, location, and/or timing is still uncertain. Watches provide lead time for pre-storm planning and response.

Warnings are issued when hazardous weather or hydrologic events are occurring, are imminent, or have a very high probability of occurring.

For additional information, see the NWS Los Angeles/Oxnard Forecast Office webpage (<https://www.weather.gov/lox/>).

Residents Potentially Affected by Postfire Hazards Should Sign Up for Alerts

This report identifies areas in Los Angeles and San Bernardino Counties within and downstream of the Bridge Fire burn area with the highest potential for postfire flooding, debris flows, and rockfall. Each county has its own emergency notification system to warn residents of potential hazards. These emergency notification systems enable the counties to provide essential information quickly in a variety of situations, including in the event of fire-induced flooding and debris flows.

Los Angeles County emergency alerts can be received by text, phone call, or email alerts via Alert LA County, a community notification system. Anyone can register for these alerts at <https://public.coderedweb.com/CNE/en-US/BF5E205B1D69>.

San Bernardino County Office of Emergency Services offers an emergency preparedness app, a telephone emergency notification system, and online weather warnings accessible online at <https://oes.sbcounty.gov/stay-informed/>.

Wireless Emergency Alerts (WEA)

Residents should be aware of what to do when receiving an alert through WEA. WEA is an alert system originated by the NWS that can inform residents, visitors, 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 WEA-capable phones during an emergency. Since WEA alerts can be disabled by phone users, residents and businesses potentially subject to hazards associated with the Bridge Fire are urged not to opt out of WEA. You can find more information at the following link: <https://www.weather.gov/crp/wea>.

Communicating Hazard and Risk Associated with Bridge Fire

Increasing awareness is the key to minimizing risk on the Bridge Fire. The potential for debris flows and flooding exists near the communities of Wrightwood and Mt. Baldy. The potential for flooding exists along all waterways that drain the area impacted by the Bridge Fire, particularly the San Gabriel River, San Antonio Creek, and Sheep Creek and their tributaries. These hazards constitute a potential threat to life-safety and property. Residents and property owners downstream of burned areas should be aware that floods severity and frequency may increase. Soil burn severity was higher in the watersheds of the San Gabriel River and Bear Canyon. These drainages (e.g., San Gabriel River, Bear Canyon, and San Antonio Creek below Bear Canyon) will likely experience the highest increases in postfire discharge while drainages to the north will likely experience moderate increases in runoff (e.g., Sheep Creek). Public outreach should focus on communicating this to these affected residents and property owners.

Hazards exist to transportation corridors that allow ingress and egress to Wrightwood, Mt. Baldy, and the East Fork of San Gabriel Canyon. If these transportation corridors are affected by postfire hazards, they may leave residents stranded after storm events and prevent the delivery of emergency services to these residents. This constitutes a potential life-safety threat if emergency medical care is needed for residents stranded by storm events. Signage has been used effectively in similar situations on previous fires to inform the public traveling key corridors. Signage placed along portions of the affected road network, including State Highway 2, Mount Baldy Road, and E East Fork Rd, can help alert drivers of potential debris flow, flooding, and/or rockfall hazards during periods of rainfall. Owners of non-public road networks should be aware of the potential hazards along roadways following fire and should implement signage accordingly.

For those interested, links to additional information about postfire geohazards are listed below.

- CGS Burned Watershed Geohazards website: <https://www.conservation.ca.gov/cgs/bwg/program>
- CAL FIRE post wildfire safety website: <https://readyforwildfire.org/post-wildfire/>

- Cal OES postfire geohazards article: <https://news.caloes.ca.gov/flood-after-fire-preparing-for-the-post-disaster-danger>
- FEMA postfire factsheet: https://www.fema.gov/sites/default/files/documents/fema_flood-after-fire_factsheet_nov20.pdf

Response Planning for the Bridge Fire

An objective of the WERT process is to provide operational intelligence to those tasked with implementing risk reduction activities (e.g., emergency planners, fire departments, flood control agencies). WERT information should be used to narrow the decision-space for operational planning, strategy, and tactics. Key information provided by the WERT includes the following:

- VAR location (map and spatial data)
- Whether the VAR is a discrete structure (point) or a grouping of structures (polygon)
- The types of hazards posing risk to the VAR
 - The report discusses whether hazards are debris flows, debris flood/flooding, or rock fall
- What is the relative risk to life-safety and/or property?
 - Relative risk is characterized as low, moderate, and high
 - Response efforts should prioritize VARs with moderate to high life-safety and/or property risk
 - Low risk is associated with a nuisance level of hazard
- Emergency protective measures are recommended to reduce risk
 - WERT does not design direct protection measures (e.g., deflection structures)
 - Some measures need more intensive evaluation and design to reduce risk

Informing and empowering the public is a key step in risk reduction. Los Angeles and San Bernardino Counties have resources that can help reduce risk from postfire flooding and debris flows. San Bernardino County's Storm and Flood webpage includes sandbag information, a homeowner's guide to flood, debris and erosion control, flood after fire safety tips, and links for additional resources (<https://burnareainfo.sbcounty.gov/>). Los Angeles County Public Work's Fire Disaster Information webpage includes weather forecast information, mudflow protection information, information regarding obtaining sandbags, and links to other resources (<https://dpw.lacounty.gov/wrd/fire/index.cfm>).

The WERT recommends that local government conduct public outreach so that residents and property owners can make informed decisions that reduce their risk exposure to postfire hazards.

Transition/Temporary Housing

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 rockfall 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) 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 flows or flood flows could potentially erode the toe of the slope and trigger slope 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.

Increased Flood Flows, Erosion, Sedimentation, and Water Quality Impacts

First responders and Emergency Planning personnel should work in conjunction with Los Angeles County Public Works, San Bernardino Department of Public Works, and Caltrans to coordinate response planning for increased flood flows and resultant sedimentation in the area of the Bridge Fire. Postfire flood inundation mapping should be performed for areas downstream of the burn area and should be used as the basis for response planning and potential evacuations. All areas downstream/downslope of the burned areas will potentially be subject to nuisance flooding and sedimentation at the minimum.

Debris Flow Runout

Potential debris flow hazards were identified that could impact homes in Mt. Baldy and Wrightwood and other infrastructure identified in this report. Models used to predict postfire debris-flow runout are currently under development. Thus, WERT geologists rely partially on geomorphic evidence to estimate the downstream extent of potential debris-flow inundation. Some of the at-risk sites are within built environments where geomorphic evidence may have 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 postfire conditions. In areas below larger, severely burned drainages, the areal extent of debris-flow inundation is highly uncertain. It is recommended property owners are made aware of the potential hazards, get connected to receive advanced forecast and information through NWS and County Alert systems, and obey local evacuation notices issued by the County Sheriff or other Government Authority.

Increased Rockfall Hazards

Existing rockfall hazards were identified during field evaluations for various homes and for Glendora Ridge Road in the Mt Baldy community, and several structures in East San Gabriel

Canyon. 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.

General Recommendations for Mine Sites

No large mine sites are present within the burned area. A review of smaller mine sites mapped on Figure 6 of this report did not indicate signs of recent use, associated structures, or human activity. Therefore, significant postfire impacts related to mines are not anticipated from the Bridge Fire.

Road Drainage Systems, Storm Monitoring, and Storm Maintenance

Due to the presence of areas burned at moderate and high soil burn severities, increased flows on slopes and onto the road and storm drain systems can be expected. Increased erosion can inundate roads 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, or municipal road corridors. Existing road drainage systems should be inspected by the appropriate controlling agency to evaluate potential impacts from floods, debris floods, debris torrents, debris flows, and sedimentation resulting from storm events. Equipment should be staged in areas where risk is high and access is necessary. Spatial data generated by the USGS and the WERT (e.g., USGS debris-flow model and flood flow predictions) can be used to screen potential at-risk areas for increased monitoring and maintenance presence.

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Appendix A – Park Fire WERT Contact List

Appendix A. Bridge Fire WERT Contact List

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Appendix B – Values-at-Risk Summary Table

Bridge Fire
Final Values-at-Risk Table as of 10/09/2024

Site Number	Community / Local Area	Latitude	Longitude	Potential hazard / Field observation	Potential risk	Remarks	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life?	Potential hazard to property?	EPM	EPM2	EPM3	EPM4	EPM Text
EF_01	Camp 19			Surface flooding of Innate Camp 19. Flows diverted from San Gabriel River and Upper Monroe Rd could impact structures and block access to the Innate camp.	Likely occurrence with moderate consequence = high risk	Moderate and high flood hazards upstream will generate runoff and debris that can overtop the bridge and direct flows into the Innate camp.	flood	Innate camp infrastructure.	multiple	moderate	moderate	Early Warning	Deflection structure	Sandbags		Evacuate camp and install deflection structures to reduce impacts of flooding.
EF_02	Camp 19	34.238082	-117.820643	Bridge accessing camp 19. Limited flow capacity. Risk of debris and large flows relieving around approaches. Skew angle of bridge relative to channel will likely force flows to the west, placing pressure on the camp.	Access to camp will likely be impacted. Very likely occurrence with moderate consequence = very high risk	Right bank approach can be constructed as a critical relief to reduce flow being directed along left bank. Wood debris loading will likely impact railing, forcing flows around bridge.	debris flow / flood	Bridge accessing Innate camp 19	drainage structure	moderate	high	Early Warning	Deflection structure	Monitor and maintain		Access to camp will likely be cutoff. Recommend evacuating camp during large storms. Install deflection structure to protect diverted flow from impacting camp. Prepare right bank abutment to function as a critical relief. Consider removing the railings.
EF_03	East Fork San Gabriel			Residential structures along river that are accessed by a bridge. Structures appear to be positioned on terrace above river. Risk of debris and flood flow may impact bridge and cutoff access. An extreme event may impact structures. Evaluated remotely	Possible occurrence with moderate consequence = intermediate risk	Access may be lost during flooding. Behind locked gate, evaluated remotely.	flood	Residence.	multiple	low	moderate	Early Warning				
EF_04	East Fork San Gabriel			Campground, cabin, and restroom structure on river terrace. Potential hazard is flood mobilizing burnt debris and soil and impacting structures or campers.	Due to potential for restricting use of area, likely probability of occurrence with minor consequences = low risk.	Area has a restroom on grade, raised grade cabin, shed, and ~20 campsites.	flood	Campground and 3 structures	recreational	low	low	Early Warning	Monitor and maintain	Sandbags		
EF_05	East San Gabriel			Potential flood and debris flow hazards that may impact structures. Access to structures will be cut off due to flooding, rockfall, and debris flows.	Possible occurrence with moderate consequence = intermediate risk	Emergency access will likely be cut off due to damaged roads during and after storm events.	debris flow / flood	Structures	multiple	low	low	Early Warning				
EF_06	Coldwater Canyon			Flood and debris flows may impact structures. Access will likely be cutoff. Reviewed remotely	Possible occurrence with moderate consequence = intermediate risk	Evaluated remotely due to locked gates.	debris flow / flood	Structures	multiple	low	moderate	Early Warning	Deflection structure			
EF_07	Cattle Canyon			Potential flood and debris flow hazards that can impact remote mining area. Due to remote location and inaccessibility, evaluated site remotely.	Possible occurrence with moderate consequence = intermediate risk	Had to evaluate this site remotely due to access limitations. Site is adjacent to active channel and backs against steep slopes that show evidence of slope instability and debris flow activity.	debris flow / flood	Structures and heavy equipment	other	moderate	high	Early Warning	Deflection structure			
GRR_01	Glendora Ridge Road			Debris flow, rockfall, flood flow damage to Glendora Ridge Road that can limit access.	Very Likely occurrence with moderate consequence = Very High risk	Access along Glendora Ridge road will likely be cut off and reduce emergency services to Mount Baldy.	other	Glendora Ridge Road	other	low	moderate		Early Warning	Monitor and maintain		
Jub_01	Jubilee Road			Debris flood/flow that may overtop banks and impact improvements associated with a boy scout camp. Assessed remotely due to locked gates.	Likely probability with moderate consequences = intermediate risk	Threat to life only exists if the camp is occupied. Most of the camping area appears to be out of direct flow paths. Access may be cut off along Panorama Mtnwy.	debris flow / flood	Boy Scout Camp	other	moderate	low	Early Warning				
MB_01	Mt Baldy			Debris Flood to Debris Flow hazards emanating from Bear Canyon and slopes above Glendora Ridge Rd.	Very Likely occurrence with major consequence = Very High risk	Debris flow hazards will likely impact road and could extend into built environment down gradient. Area was reported being impacted by previous flood flows in 2014.	debris flow / flood	Access along Glendora Ridge Road.	drainage structure	high	high	Early Warning	Deflection structure	Clear and maintain culvert		Consider closing the road during potential events and installing deflections structures to control flow and direct it back into the channel and along roads to avoid impacts to residential structures.
MB_02	Mt Baldy	34.23896	-117.66095	Community service utility along Bear Canyon (possible gravity sewer line).	Very likely occurrence with moderate consequence = Very high risk	Sewer pipe is at risk of being damaged.	debris flow / flood	Sewer line	utilities	low	moderate	Monitor and maintain				Consider temporary closure of utility.
MB_03	Mt. Baldy			Houses below burned 50-60% slopes with perched rock/boulders. Potential hazard is that perched rock/boulders mobilize due loss of vegetation/dry ravel and impact structures.	Potential occurrence with minor consequences = low risk	Observed colluvial rock/boulders are generally sub-rounded and angular.	rock fall	Houses	home	low	low	Early Warning	Debris barrier			Potentially a debris barrier may capture mobilized rock/boulders.
MB_04	Mt Baldy			Debris flow and rockfall hazard	Potential occurrence with moderate consequences = intermediate risk	Nearby resident described mudflow inundation of home to depth of 3-4 ft in 2014 rain event. Recently repaired road/retaining wall	debris flow	Residence structures	home	moderate	moderate	Early Warning				
MB_05	Mt Baldy			Rockfall and debris flood to debris flow hazards. Rockfall hazards exist for structures burned. Debris flood hazards exist along Bear Canyon that will likely overtop the road and damage crossing structures, cutting off access to properties, and damage community utility lines.	Very likely occurrence with moderate consequence = Very high risk	Drainage is choked with sediment, debris, large wood with a large contributing area burned at moderate and high. Concern of debris flood and rockfall hazards that will impact temporary structures or structures under new construction.	debris flow / flood		multiple	moderate	high	Early Warning	Debris barrier	Deflection structure		Bear Canyon will not be safe during a significant runoff. Consideration to delay reconstruction of burnt structures until after the burn scar recovers a bit should be considered.
MB_06	Mt Baldy			Debris flood to Debris Flow could impact structures where channel has been laterally constrained by encroachment of surrounding development. Earthen berm on outside of bend may erode and get overtopped during a large runoff event.	Likely occurrence with Major consequence = Very High risk	Uncertain if drainage has been sized to accommodate flow plus debris. Structures have encroached into channel zone. Evulsion potential exists along outside bend above fire station.	debris flow / flood	Residential Structures	multiple	high	high	Early Warning	Monitor and maintain			Deflection structures along Mount Baldy Road may help direct overtopping flows down the road instead of into structures to the south.
MB_07	Mt Baldy	34.23623	-117.65981	Debris blocking culvert forcing overtopping flows.	Very likely occurrence with moderate consequence = Very High risk	Evidence of aggraded sediment upstream of crossing. Diverted flows will likely get diverted down road. 6x6 box with trash rack.	debris flow / flood	Crossing structure.	drainage structure	low	moderate	Early Warning	Clear and maintain culvert.	Deflection structure	Signage	
MB_08	Mt Baldy			Debris flood to debris flow hazards within drainage will discharge into the built environment and impact structures.	Likely occurrence with Major consequence = Very High risk	Existing drainage shows evidence of past debris flows. Flow path is uncertain. Potential for sediment and flood waters impacting structures and access roads. Locals report debris and mud impacting structures in late summer of 2014.	debris flow / flood	Residential structures.	multiple	high	high	Early Warning	Deflection structure	Monitor and maintain		Deflection structures should be considered to direct flows away from structures and attempt to constrain them to local roads for conveyance.
MB_09	Mt Baldy	34.2346461	-117.661132	Debris flood hazard potentially plugging bridge crossing and lead to backwater and overtopping flows. Reports of flooding in the area in 2014.	Likely occurrence with high consequence = Very High risk	6x17 opening under bridge. Bridge appears to have limited capacity to convey increased flows and debris.	debris flow / flood	Bridge structure and adjacent homes	drainage structure	moderate	high	Early Warning	Monitor and maintain	Deflection structure	Signage	
MB_10	Mt Baldy	34.2267083	-117.668612	Structure in flood runoff zone below low to moderate burn. Potential hazard is flood mobilizing burnt debris and soil and impacting structure.	Possible probability of occurrence with minor consequences for life and moderate consequences for structure = low to moderate risk.	Small structure has a red roof and connecting utility or fence observed from overlying road. Structure located at bottom of potential debris flow/flood source.	debris flow / flood	Unmanned structure	utilities	low	moderate	Monitor and maintain	Early Warning			
MB_11	Mt Baldy			Debris flow and flooding along Mount Baldy Road that will cut off access.	Likely occurrence with moderate consequence = high risk	Steep headwall burned at moderate plus with fan deposit above road.	debris flow / flood	Mount Baldy Rd.	other	moderate	moderate	Early Warning	Monitor and maintain			
MB_12	Mt Baldy			Debris-flow prone slopes that will discharge debris and water onto Mount Baldy Road, limiting emergency access.	Possible occurrence with minor consequence = low risk	Slopes upgradient are burned at low. Presence of alluvial fans immediately above road. Roadcut has been recessed into fan with no observed failures. Sediment and debris may flow onto road and plug adjacent crossing structure.	debris flow / flood	Mount Baldy Road	other	low	low	Early Warning	Clear and maintain culvert	Signage		
MB_13	Mt Baldy	34.24688	-117.65516	Debris flows may impact intake structure to municipal water supply in Bear Canyon. Observed remotely due to limited access.	Very likely occurrence with high consequence = Very High Hazard	Evaluated remotely. Location of infrastructure is within flow path of a potential debris flow with a high probability of occurrence.	debris flow / flood	Community water supply infrastructure	utilities	low	moderate	Early Warning	Monitor and maintain			
MB_14	Mt Baldy	34.24079	-117.65260	Rockfall and sediment impacting structure. Positive pressures may keep it the inlet free of debris.	Possible occurrence with moderate consequence = intermediate risk	Current retaining wall at foot of slope is being overtopped by scree.	rock fall	Community water intake.	utilities	low	moderate	Monitor and maintain				
MB_15	Mt Baldy			Concentrated runoff diverted down and collected on Mount Baldy Road by an outside berm discharges through an overside drain (MP 0.58) that could impact downslope buildings.	Possible occurrence with moderate consequence = intermediate risk	Diverted and concentrated flow will drain off Mount Baldy Road that may overwhelm the drainage structure and result in overtopping flows that may impact downslope residences.	debris flow / flood	Residential structures	home	low	moderate	Early Warning	Clear and maintain culvert	Deflection structure		
WW_01	Wrightwood - Swarthout Valley	34.3733415	-117.677479	Debris flood spilling onto Hwy 2 from a channel that is burned at moderate and low risk. Flows will travel down and across road where they may impact parking area of Mtn High Ski Resort.	Possible occurrence with moderate consequence = intermediate risk	Minimal evidence of pre-fire flow within channel. Increases in post-fire flow are anticipated that may overwhelm cross-drain culvert.	debris flow / flood	HWY 2 and Parking area of ski resort	drainage structure	low	moderate	Early Warning	Clear and maintain culvert	Deflection structure		

Bridge Fire
Final Values-at-Risk Table as of 10/09/2024

Site Number	Community / Local Area	Latitude	Longitude	Potential hazard / Field observation	Potential risk	Remarks	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life?	Potential hazard to property?	EPM	EPM2	EPM3	EPM4	EPM Text
WW_02	Wrightwood - Swarthout Valley	34.3723799	-117.674015	Channel with alluvial fan at outlet that exhibits signs of deposits extending onto fan surface. Catchment above is burned at moderate and high. Debris floods may exit the channel, extend across the fan, and spill out onto Hwy 2.	Possible occurrence with moderate consequence = intermediate risk	Evidence of aggraded alluvium observed on top of fan surface. Deposits don't appear to extend much past fan apex.	debris flow / flood	Hwy 2 / access	other	low	low	Early Warning	Monitor and maintain			
WW_03	Wrightwood - Swarthout Valley	34.3727125	-117.670745	Burned residential structure within mouth of 22-acre drainage burned at moderate to high sbs. Drainage appears directed to the east side of structure. Potential hazard is flood that could mobilize burnt debris and impact future structure.	Possible probability of occurrence with moderate consequence = intermediate risk	Hazard to property is based on reconstruction.	debris flow / flood	Burned residential structure	home	moderate	high	Early Warning	Deflection structure			The structure was not accessed in the field and was assessed remotely. There may be a potential for a deflection structure. Don't relocate temporary housing in potential flow paths.
WW_04	Wrightwood - Swarthout Valley	34.3702722	-117.670204	Flood and debris will block crossing, causing overtopping flows and possible washout. Access to structures and water tank will be lost in the event of a washout.	Possible occurrence with moderate consequence = intermediate risk	Crossing consists of three 36" diameter CMPs and forms a nick point in channel. Channel may head out through meadow above may occur if crossing is washed out.	debris flow / flood	Crossing structure/access	drainage structure	low	moderate	Clear and maintain culvert		Early Warning		
WW_05	Wrightwood - Government Cyn	34.3689915	-117.670397	Recreational ranch structure at the edge of alluvial fan. What appears to be the active drainage is directly adjacent. A 6' earthen berm was observed between drainage and ranch structure.	Potential hazard is flood that could mobilize burnt debris and impact the commercial structure. Flood/debris flow. Likely occurrence with moderate consequence = high risk	Low life hazard because no obvious permanent residents.	debris flow / flood	Recreational ranch structure	recreational	low	high	Early Warning	Monitor and maintain			Restrict access when high intensity storms are predicted. Berm should be maintained and possibly improved.
WW_06	Wrightwood - Government Cyn			Utility structures on fan below burned drainage. Potential hazard is flood that could mobilize burnt debris and impact structures/infrastructure	Debris flow/flood. Likely occurrence with moderate consequence = high risk	Utilities located below mouth on fan. Much of 250-acre catchment is moderate or high sbs.	debris flow / flood	Utility structures	utilities	low	moderate	Early Warning	Deflection structure			Further evaluation may determine effectiveness of deflection structure. Restrict access during predicted high intensity storms
WW_07	Wrightwood - Swarthout Valley	34.370722	-117.666123	Flows impacting Hwy 2. Drainage from burned slopes enters a ditch along the western edge of alluvial fan and discharges directly onto road.	Possible occurrence with moderate consequence = intermediate risk	There is an opportunity to improve drainage by directing ditch into adjacent culvert inlet. Culvert inlet is currently blocked and may need to be updated.	debris flow / flood	Crossing and road.	drainage structure	low	low	Early Warning	Monitor and maintain			
WW_08	Wrightwood - Swarthout Valley			Several houses and LA Sheriff training facility on fan. Two structures appear burned. Numerous flow paths make it difficult to determine where flow concentrates. Potential hazard is flood that could mobilize fine sediment/debris and impact structures.	Flood. Possible occurrence with moderate consequence = intermediate risk	Observed berm in channel appears to stop drainage upslope of houses with no diversion. Most of 90-acre drainage is burned at moderate and high sbs.	flood	Houses, two burned	home	moderate	moderate	Early Warning	Deflection structure			Further evaluation may determine effectiveness of deflection structure. Don't relocate temporary housing in potential flow paths.
WW_09	Wrightwood - Swarthout Valley			House at apex of fan. Drainage has been diverted to west of house. Potential hazard is flood that could mobilize fine sediment/trucks and impact structure.	Flood. Possible occurrence with moderate consequence = intermediate risk	Homeowner was aware of flood potential. He asked that I not photograph structure or property. Most of 35-acre catchment is burned at moderate and high sbs.	flood	House	home	low	moderate	Early Warning	Monitor and maintain	Deflection structure	Debris barrier	Drainage diversion should be maintained. Further evaluation may determine effectiveness of deflection structure/debris barrier.
WW_10	Wrightwood - Swarthout Valley			3 homes within fan with evidence of debris flows. Potential hazard is flood mobilizing burnt debris, soil, and rock and impacting structures.	Possible probability of occurrence with minor to moderate consequences = moderate risk.	Debris flow and debris flood hazard to homes on fans. Western basin has more drainage area and rockier fan deposit with debris flow evidence. Eastern basin has less drainage area and more planar fan deposit without channel on fan. Westernmost home has several foot tall berm above it. Overlying slopes exhibit debris slide slope and landslide characteristics. Protective berms are a feasible here with available room and access	debris flow / flood	Houses	home	moderate	moderate	Early Warning	Deflection structure	Monitor and maintain		
WW_11	Wrightwood - Flume Cyn	34.3643999	-117.654836	House at mouth of 2 burned drainages. An earthen berm was observed constructed along the eastern edge of structure. Approximately 1 to 2-feet of sediment, which appear to be past deposits, was observed excavated from along the side of the house.	Potential hazard is flood that could mobilize fine sediment/small rocks and impact structure. Flood/fine sediment. Possible occurrence with low consequence = low risk	Small rock and fine sediment observed in drainages. Berm constructed at mouth of drainage to divert low flow. Past deposits appear to have caused some level of dry rot in wood siding.	flood	House	home	low	low	Early Warning	Deflection structure			Deflection structure may be useful at western drainage, which appears the smaller of the two.
WW_12	Wrightwood - Swarthout Valley	34.3656416	-117.653429	Potential of flooding that may exceed capacity of vented flood crossing.	Possible occurrence with high consequence = High risk	Channel could benefit having a deflection structure direct flows back into channel before impacting residence on downstream right bank.	debris flow / flood	Adjacent homes	multiple	low	moderate	Early Warning	Deflection structure			
WW_13	Wrightwood - Swarthout Valley			1 structure in fan and likely at bottom of drainage based on LIDAR. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.	Possible probability of occurrence with minor consequences = low risk.	VAR is a structure with green roof. Could not access property and observed this property from road. Overlying slopes have debris slide slope characteristics and are moderate severity burn.	debris flow / flood	structure, home?	home	low	low	Debris barrier	Early Warning	Monitor and maintain	Sandbags	
WW_14	Wrightwood - Swarthout Valley			Home in fan. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.	Possible probability of occurrence with minor consequences = low risk.	Could not access property to closely observe fan or structure. Overlying basin exhibits debris slide slope characteristics. Several undeveloped pads also within or below alluvial fan.	flood	Home	home	low	low	Early Warning	Monitor and maintain	Debris barrier		
WW_15	Wrightwood - Flume Cyn	34.3611752	-117.655764	House at mouth of burned drainage. Small fan with drainage directed to the north side of house. Approximate 14 acre catchment above. Potential hazard is flood that could mobilize fine sediment/small rocks and impact structure.	Hyperconcentrated flow/flood. Possible occurrence with low consequence = low risk	SBS is generally low with moderate along ridge line. Mostly small rocks, possibility of flood or small hyperconcentrated flow	flood	House	home	low	low	Early Warning	Deflection structure			Deflection structure may help to keep flow to the north of the structure.
WW_16	Wrightwood - Flume Cyn			Houses at outlet of 2 burned drainages. Potential hazard is flood that could mobilize burnt debris and impact structures.	Debris flow/flood. Possible occurrence with moderate consequence = intermediate risk	Four houses in drainage, with one of them burned. Much of the sbs within 100-acre drainage is moderate.	debris flow / flood	Houses	home	moderate	moderate	Early Warning	Deflection structure			Further evaluation may be appropriate to determine the functionality of a deflection structure. Don't relocate temporary housing in potential flow paths.
WW_17	Wrightwood - Flume Cyn			Houses at outlet of 2 burned drainages. Potential hazard is flood that could mobilize burnt debris and impact structures.	Debris flow/flood. Possible occurrence with moderate consequence = intermediate risk	Four houses in drainage, with one of them burned. Much of the sbs within 100-acre drainage is moderate.	debris flow / flood	Houses	home	low	moderate	Early Warning	Deflection structure			Further evaluation may be appropriate to determine the functionality of a deflection structure. Don't relocate temporary housing in potential flow paths.
WW_18	Wrightwood - Flume Cyn			Houses located on low terrace at outlet of fan. Drainage channel appears to ramp onto terrace. Potential hazard is debris flow/flood that could mobilize burnt debris and impact structures.	Debris flow/flood. Likely occurrence with moderate consequence = high risk	Houses on fan at mouth of drainage. Homeowner says flows reach top of channel but have not overlapped in 37 years. 3' diameter boulders in channel and on terrace. Apparent "ramp" from channel to terrace upstream of houses. Much of 400-acre catchment is moderate and high sbs.	debris flow / flood	Houses	home	high	high	Early Warning	Monitor and maintain	Debris barrier		Further evaluation will determine effectiveness of debris barrier/deflection structure.
WW_18b	Wrightwood - Flume Cyn			Debris Flow/Flood mobilizing sediment and debris that may cause localized debris jams that can force flows over channel banks.	Likely probable with Moderate consequence = Moderate hazard	This hazard will be analyzed in more detail after performing hydrologic and hydraulic modeling.	debris flow / flood	Residential structures	multiple	moderate	moderate	Early Warning	Monitor and maintain	Deflection structure	Sandbags	
WW_19	Wrightwood - Flume Cyn			2 homes within fan. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.	Possible probability of occurrence with minor consequences = low risk.	Overlying slopes exhibit old debris slide slope characteristics. Minimal evidence of geologically recent debris flow deposits near homes. Low overlying burn severity, however high mortality of white fir likely. Boulders several feet wide are deposited in overlying gullies	flood	2 homes	home	low	low	Sandbags	Monitor and maintain	Early Warning		
WW_20	Wrightwood - Swarthout Valley	34.3614923	-117.64677	1 home centered on bottom of steep drainage swale. Potential hazard is flood mobilizing burnt debris and soil and impacting structures. Possible probability of occurrence with minor consequences = low risk.		Neighbor reports that home floods in normal years on first floor when drainage around home becomes blocked.	flood	Home	home	low	low	Monitor and maintain	Early Warning	Sandbags		Improve drainage
WW_21	Wrightwood - Swarthout Valley			Houses within mouth of burned drainages. Earthen berm along upslope house directs flow to lower house. Potential hazard is flood that could mobilize fine sediment/small rocks and impact structures.	Flood. Possible occurrence with low consequence = low risk	Earthen berm is approximately 3' high. Generally low sbs within the 15-acre catchment above.	flood	Houses	home	low	low	Early Warning	Monitor and maintain			
WW_22	Wrightwood - Acorn Cyn	34.3588653	-117.643001	Carport within fan and drainage path. Potential hazard is flood mobilizing burnt debris and soil and impacting structure. Possible probability of occurrence with minor consequences = low risk.		Main home appears mostly out of flow path and therefore not considered a VAR, however landscaping terraces may be in flow path. Observed a minor matrix supported debris flow deposit behind oak in channel above carport.	flood	Carport	other	low	low	Early Warning	Monitor and maintain	Sandbags		Improve drainage around carport

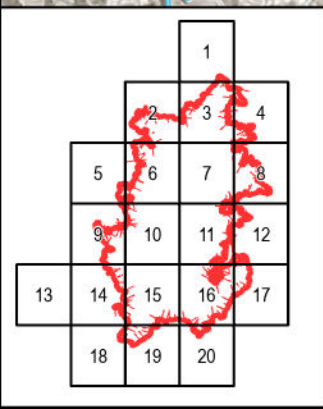
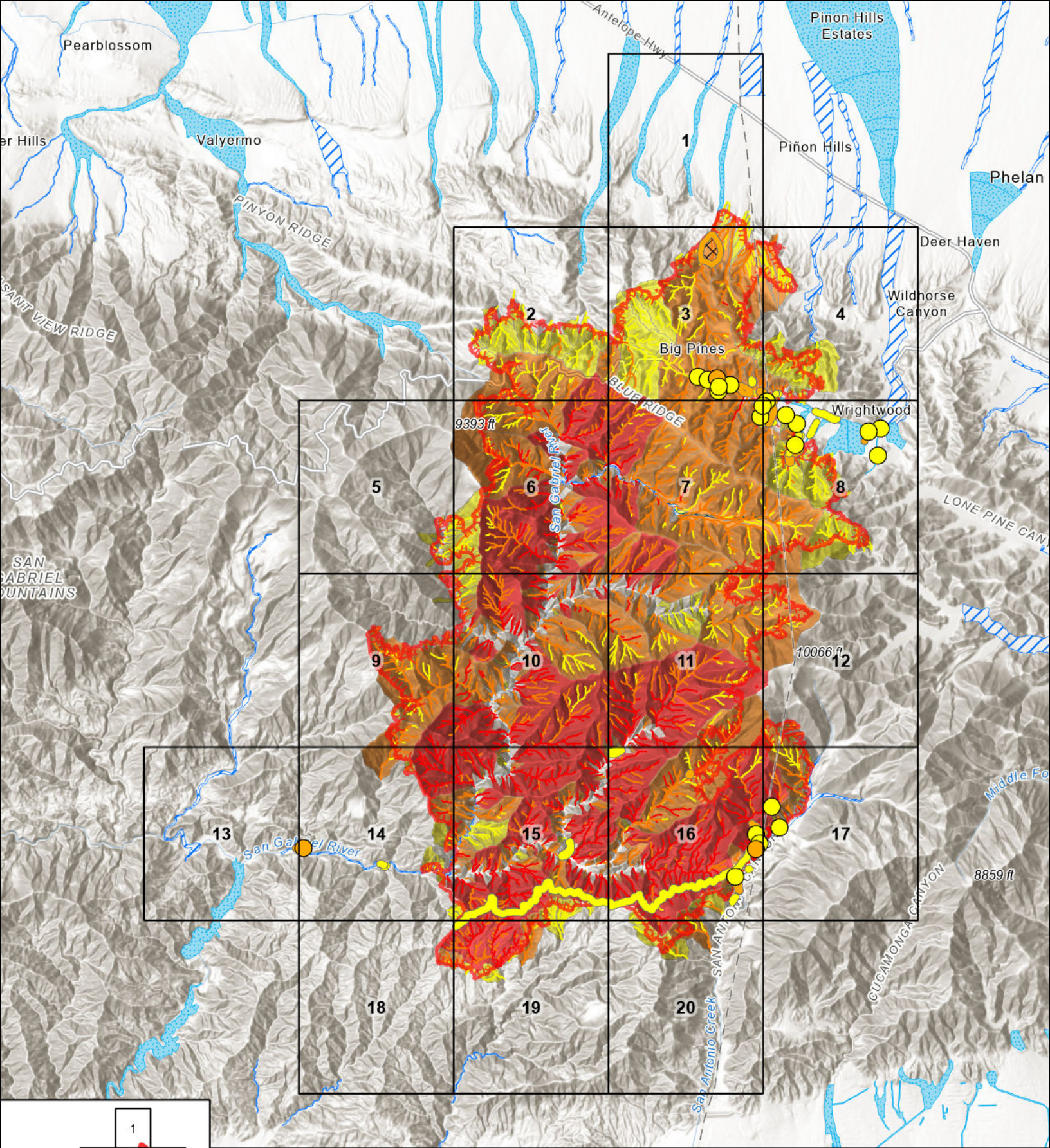
Bridge Fire
Final Values-at-Risk Table as of 10/09/2024

Site Number	Community / Local Area	Latitude	Longitude	Potential hazard / Field observation	Potential risk	Remarks	Hazard Category	Specific at-risk feature	Feature Category	Potential hazard to life?	Potential hazard to property?	EPM	EPM2	EPM3	EPM4	EPM Text
WW_23	Wrightwood - Acorn Cyn			1 home and 1 garage within fan. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.	Possible probability of occurrence with minor consequences = low to moderate risk	Fan exhibits minimal evidence of past debris flow, consisting of only one older matrix supported debris deposit above old oak. These structures are at moderate risk rather than low due to moderate severity burn. Channel at fan apex does not clearly continue to home and has been filled in during grading. Drainage alignment continues to house in below bar polygon and the next two homes below included in other adjacent lowlow VAR.	debris flow / flood	House and shed/garage	home	low	moderate	Monitor and maintain	Early Warning			
WW_24	Wrightwood - Acorn Cyn			3 homes within or below fans. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.	Possible probability of occurrence with minor consequences = low risk.	Apex of fan above southernmost home has angular matrix supported deposits and 4 ft boulders, lower part of fan has more subdued topography, so geologically recent debris flows have not traveled to home locations. Flooding appears to route around southernmost home and onto driveway. Northernmost home more likely to receive flood flow from northern (other) drainage but has similar low risk to both homes to the south.	flood	3 homes	home	low	low	Monitor and maintain	Early Warning			
WW_25	Wrightwood - Acorn Cyn	34.3526718	-117.643689	1 home on margin of flow path. Minimal fan here. Potential hazard is flood mobilizing burnt debris and soil and impacting structure. Possible to likely probability of occurrence with minor consequence=low risk.		There is a shallow bowl shaped steep swale above home with hydrophilic vegetation. Above the swale the low severity burn was in thick oak forest with much remaining canopy and the burn may not significantly impact hydrologic characteristics. However if flows in this basin increase, the home may experience more water flow than in the past and be slightly impacted by water and burnt debris. We observed unpinned home north of this home and it appears unlikely to receive flood flow.	flood	1 home	home	low	low	Monitor and maintain	Early Warning			
WW_26	Wrightwood - Acorn Cyn			4 homes within or below fan. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.	Possible probability of occurrence with minor consequences = low risk.	The 2 northernmost homes are lower in elevation from drainage and could receive flows even though not centered in fan. The home south of polygon not included due to higher position above drainage.	flood	4 homes and outbuilding	home	low	low	Monitor and maintain	Early Warning			
WW_27	Wrightwood - Acorn Cyn			Youth camp structures on debris flow fan. Main drainage is directed to east edge of cyn. Potential hazard is flood that could mobilize burnt debris and impact structures.	Debris flow/flood. Possible occurrence with low consequence = low risk	Most of sbs within 350-acre catchment above is low.	debris flow / flood	Camp structures	home	moderate	moderate	Early Warning	Monitor and maintain			Maintain drainage diversion. Consider closing the camp when high intensity storm events are predicted.
WW_28	Wrightwood - Acorn Cyn			Houses at mouth of burned drainage on fan. Potential hazard is flood that could mobilize burnt debris and impact structures.	Flood. Possible occurrence with moderate consequence = intermediate risk	Evidence of alluvial flow with houses cut into toe of fan. Most of 24-acre catchment is burned at low sbs.	flood	Houses	home	low	moderate	Early Warning				
WW_29	Wrightwood - Acorn Cyn			Houses and water tank located on debris flow fan. Relic channels observed west of main drainage. Potential hazard is flood that could mobilize burnt debris and impact structures.	Debris flow/flood. Possible occurrence with moderate consequence = intermediate risk	Alluvial and debris flow deposits observed on fan along with relic channels. Mostly low with patches of moderate sbs above.	debris flow / flood	Houses and water tank	home	moderate	moderate		Early Warning	Deflection structure		Further evaluation to determine whether a deflection structure could be beneficial.
WW_30	Wrightwood - Acorn Cyn			Acorn Cyn drainage is directed though built environment. Channel is confined and offset across streets with no watercourse crossing. Eventually the drainage outlets onto Pine Rd with no structure.	Potential hazard is flood that could mobilize fine sediment/rocks and impact structures. Flood. Possible occurrence with low consequence = low risk		flood	Houses	home	low	low	Early Warning	Sandbags	Clear and maintain culvert		
WW_31	Wrightwood - Swarthout Valley			Highway 2 crossing is offset increasing the potential for overtopping onto roadway, which slopes away from crossing at approximately 2 to 5%. Based on inclined slope along the road, structures along the northern side of Highway 2 may become inundated.	Flood. Possible occurrence with moderate consequence = intermediate risk	Structures include market, post office, and other commercial businesses. Berms were noted on the channel behind the businesses, suggesting that the channel, which was constricted and full of veg in areas, may overtop during high flows.	flood	Commercial and government structures	business	low	moderate	Early Warning	Clear and maintain culvert	Monitor and maintain	Sandbags	Further evaluation to determine where it may be possible to direct overtopping flow back into the natural channel. Heavy equipment should be staged in the area for response during intense storms.
WW_32	Wrightwood - Heath Cyn			House adjacent to bridge crossing of Heath Creek. Gap in channel levee, k-rails in front of house suggests flows/debris may have impacted house in the past. potential hazard is flood and debris availing out of levee at Thrush Rd. crossing.	Debris flow/flood. Possible occurrence with moderate consequence = intermediate risk		debris flow / flood	House	home	moderate	moderate	Early Warning	Debris barrier			Make sure k-rail is maintained and debris captured by k-rail is cleaned out.
WW_33	Wrightwood - Heath Cyn	34.35604	-117.61770	Debris flooding that may overwhelm 10' x 10' box culvert, leading to overtopping flows.	Possible occurrence with moderate consequence = intermediate risk	Crossing shows evidence of being damaged by previous debris flows. The potential for plugging and overtopping is likely greatest during large storm events. Post-fire impacts are likely low.	debris flow / flood	Box culvert along Hwy 2	drainage structure	low	low	Early Warning	Clear and maintain culvert			
WW_34	Wrightwood - Sheep Cyn	34.3489669	-117.614622	Debris overtopping culvert and possibly diverting down left bank. Very low post-fire effects due to limited burn of low severity.	Possible probability of occurrence with minor consequences = low risk	Diverted flows will go into old channel on left bank.	debris flow / flood	Crossing structure		low	low	Early Warning	Clear and maintain culvert	Deflection structure		
WW_35	Wrightwood - Sheep Cyn	34.3568619	-117.613424	Bridge crossing. Appears adequately sized and should only become an issue under very large flows. If plugged, flows will be diverted down the highway. Potential for aggradation at downstream confluence which may impact bridge capacity.	Possible probability of occurrence with minor consequences = low risk	Bridge appears to have experienced overtopping flows in 2023.	debris flow / flood	Bridge along Hwy 2	drainage structure	low	low	Early Warning	Monitor and maintain			

Summary of General Recommendations and Findings

- Utilize early warning systems available to homeowners, particularly those located in flood-prone areas. The WERT recommends using the National Weather Service early warning system and forecasts.
- Increase the situational awareness of affected residents and the communities regarding the hazards and risks associated with living downstream/downslope of burned areas.
- The WERT strongly recommends that San Bernardino County and Los Angeles County work with the NWS and the California Geological Survey to monitor forecasts and rainfall intensity during storms, as well as observe postfire response following storm events. The initial rainfall thresholds can be adjusted accordingly after assessing hydrological response to storms.
- Monitor and/or remove accumulated debris from culverts and channels that are upstream of culverts in areas that are subject to postfire flooding where there is an elevated risk to life and/or property.
- While the potential for debris flow exists within and downstream of the Bridge Fire, the primary hazard of concern is flooding and debris flooding impacting residential areas in East Fork San Gabriel River and within Wrightwood. These hazards constitute a potential threat to life-safety and property.
- Debris flood / flow hazards exist through the built environment within Mount Baldy and portions of Wrightwood.
- The WERT recommends that local government conduct public outreach so that residents and property owners can make informed decisions that reduce their risk exposure to postfire hazards.
- Close coordination between San Bernardino County and Los Angeles County, the National Weather Service, and local first responders will be necessary to effectively implement a response plan that will minimize risk.

Appendix C – Values-at-Risk Map Book



Incident: Bridge Fire (CA-ANF-243334)

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Value at Risk (Point)

Potential hazard to life

- Low
- Moderate
- High

Basin Combined Hazard

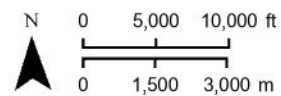
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- Low
- Moderate
- High

Segment Combined Hazard

15 min 24 mm/h

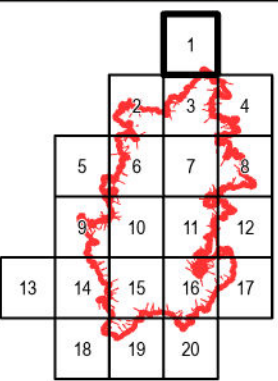
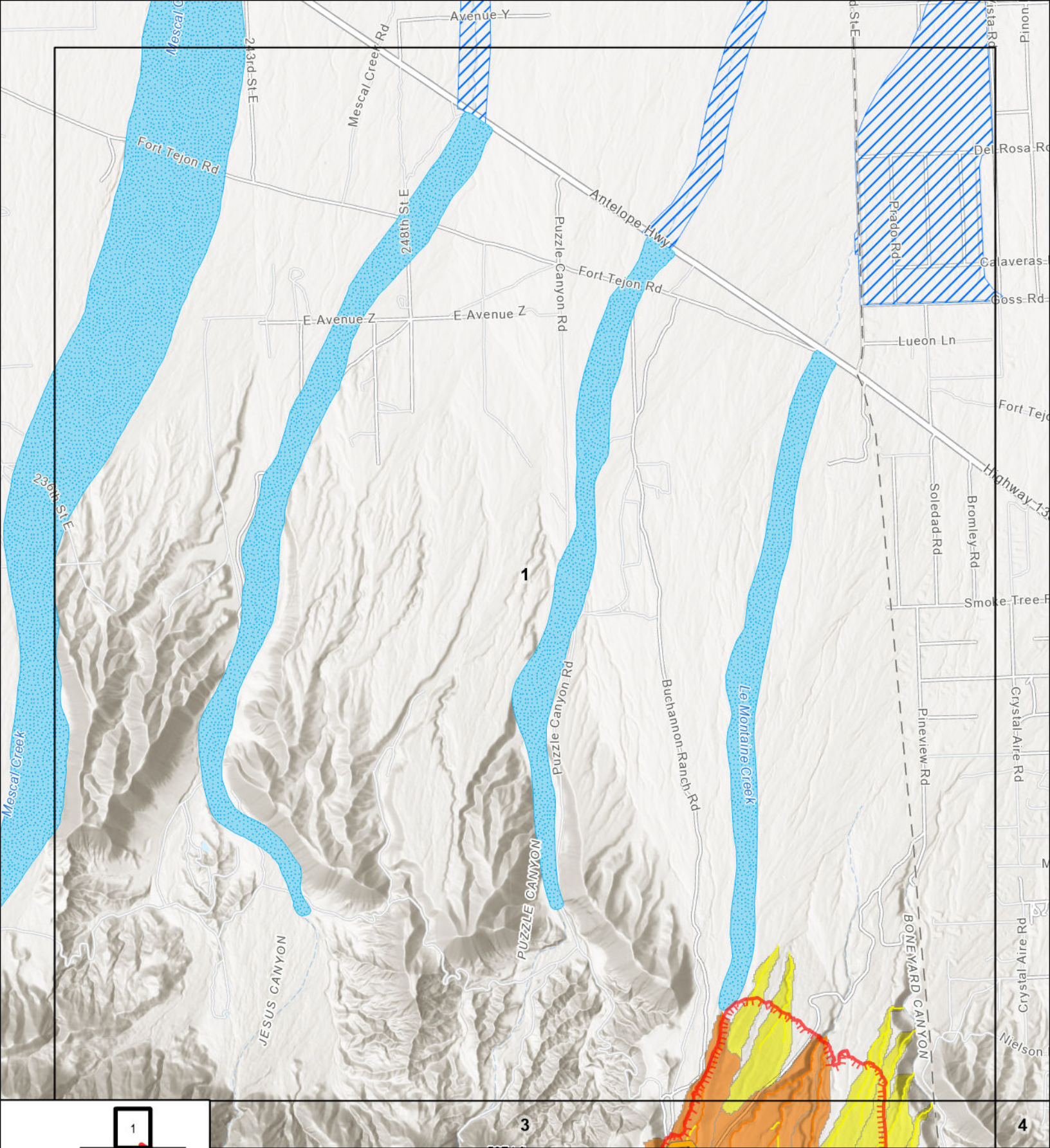
- Low
- Moderate
- High



Fire Perimeter

FEMA Special Flood Hazard Areas

DWR 100yr Awareness Floodplains



Incident: Bridge Fire (CA-ANF-243334)

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Value at Risk (Point)

Potential hazard to life

- Low
- Moderate
- High

Basin Combined Hazard

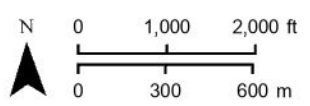
15 min 24 mm/h

- Low
- Moderate
- High

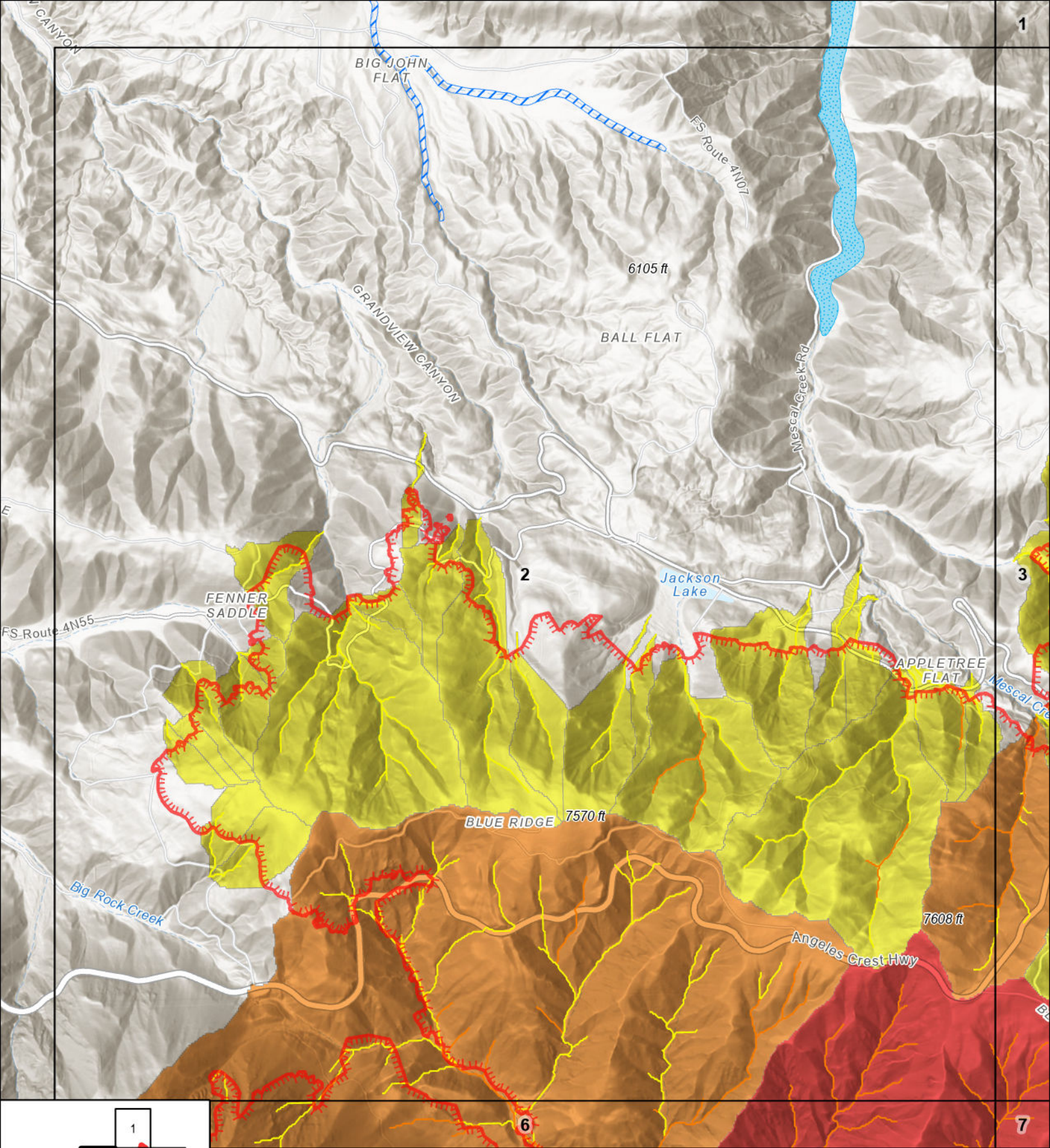
Segment Combined Hazard

15 min 24 mm/h

- Low
- Moderate
- High



- Fire Perimeter
- FEMA Special Flood Hazard Areas
- DWR 100yr Awareness Floodplains



Incident: Bridge Fire (CA-ANF-243334)

Values at Risk (Polygon)

Potential hazard to life

- Low
- Moderate
- High

Value at Risk (Point)

Potential hazard to life

- Low
- Moderate
- High

Basin Combined Hazard

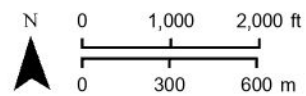
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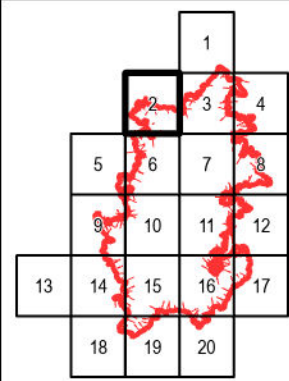
Segment Combined Hazard

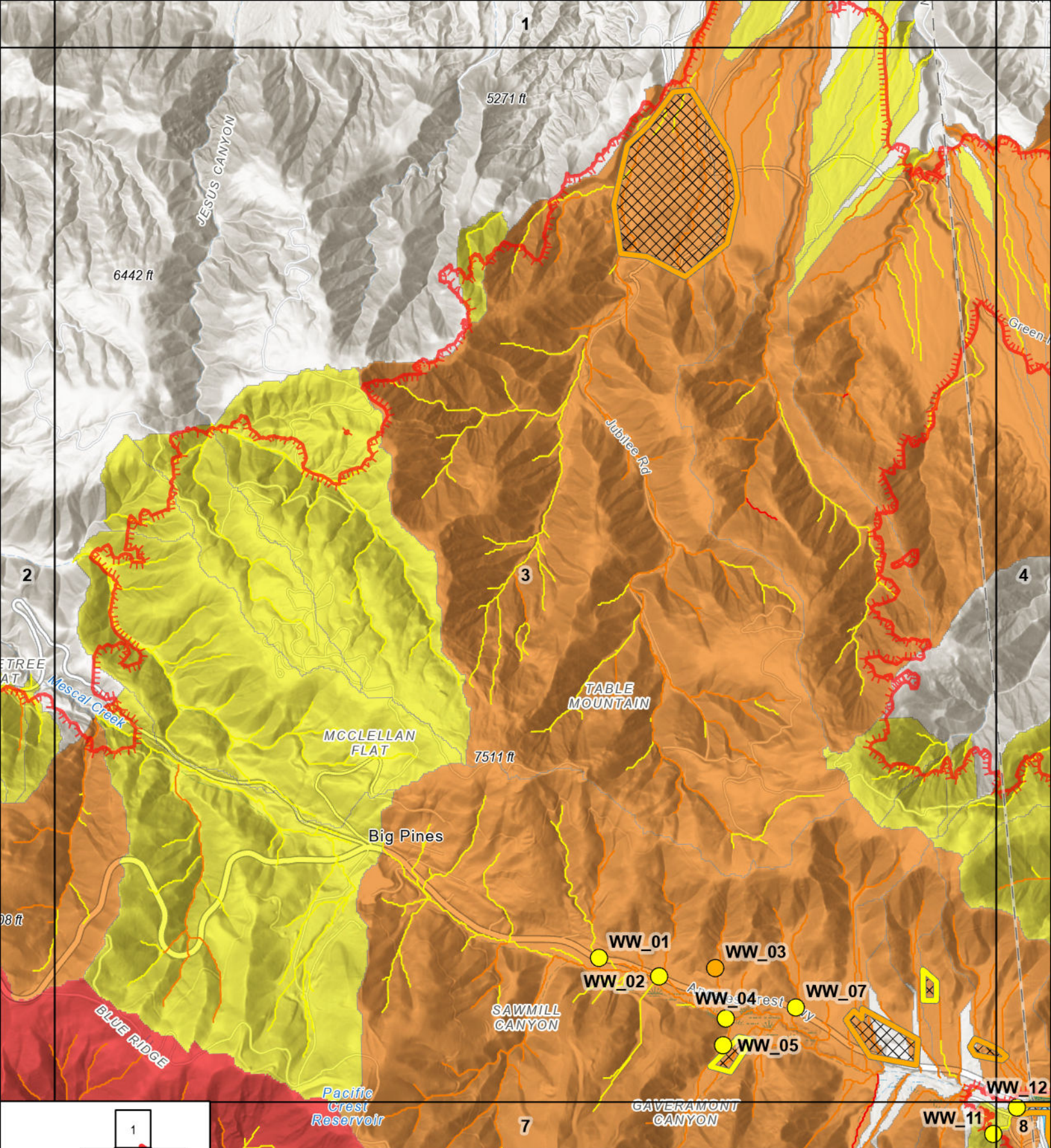
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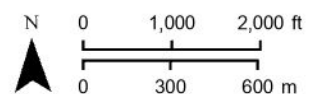
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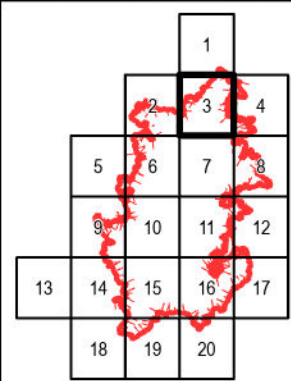
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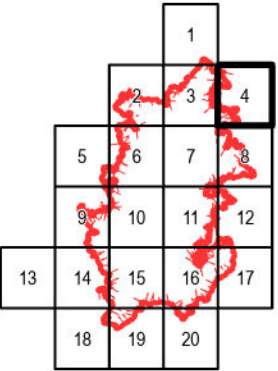
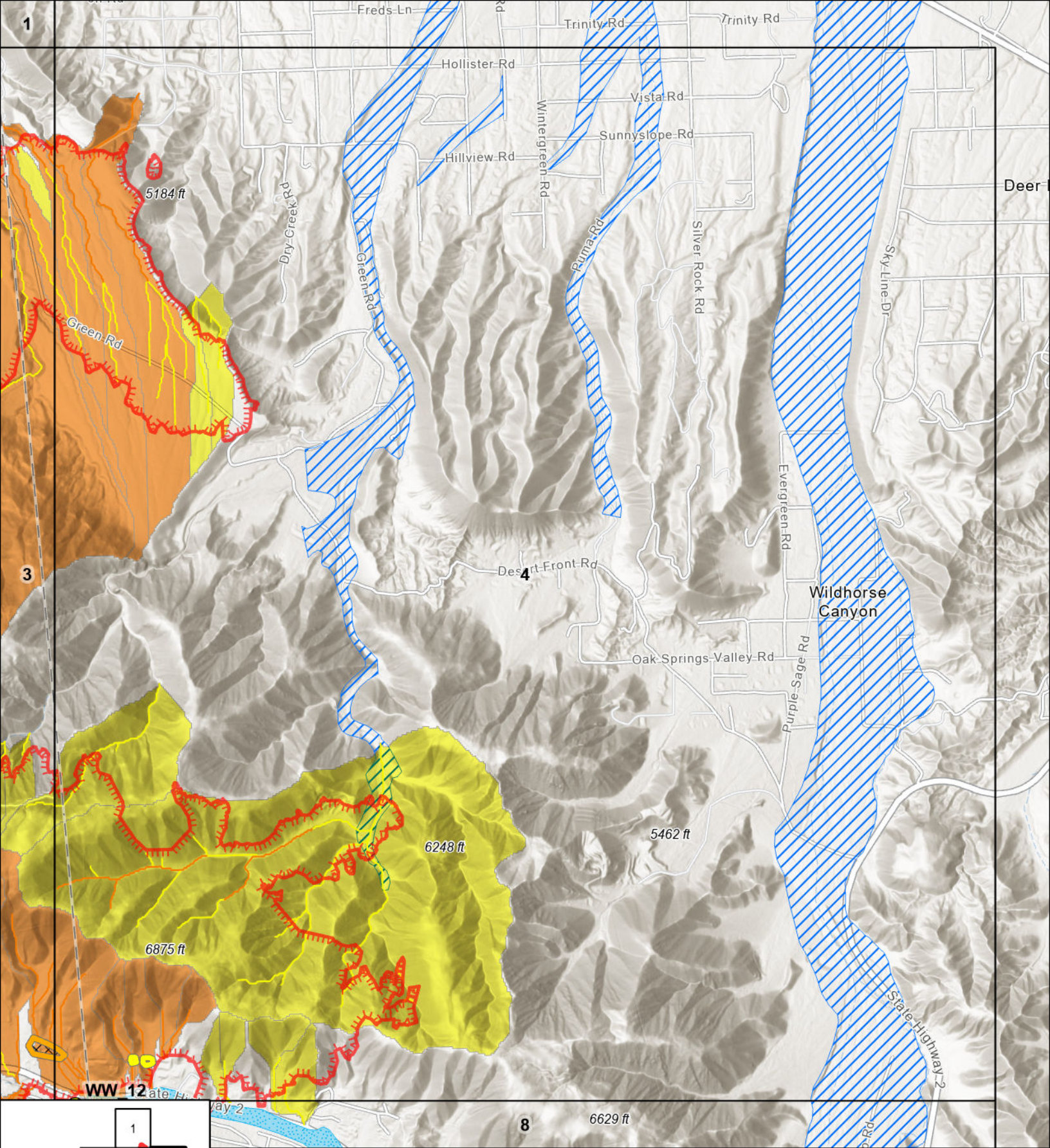


Fire Perimeter

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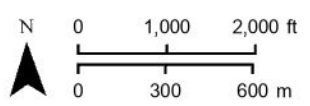
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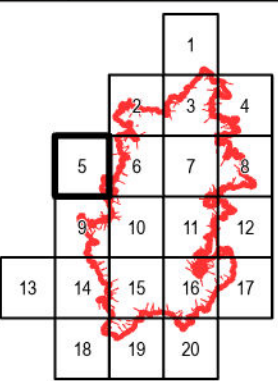
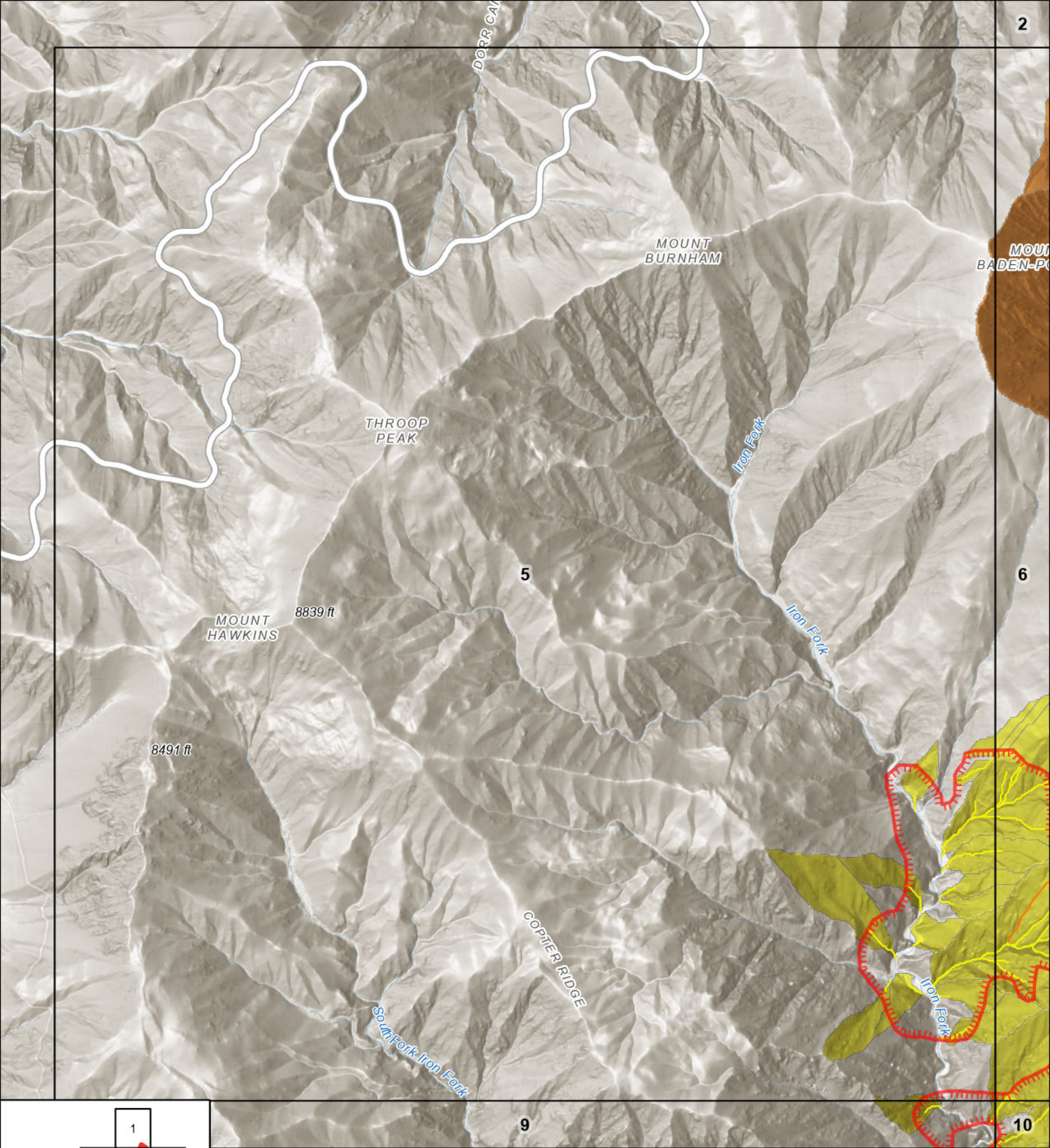
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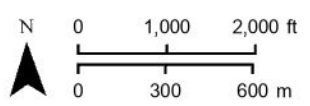
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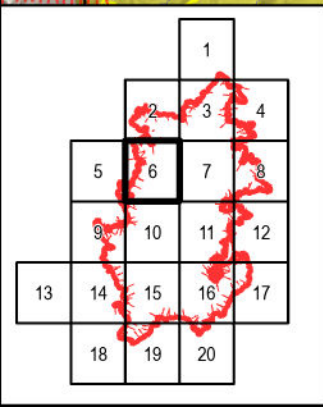
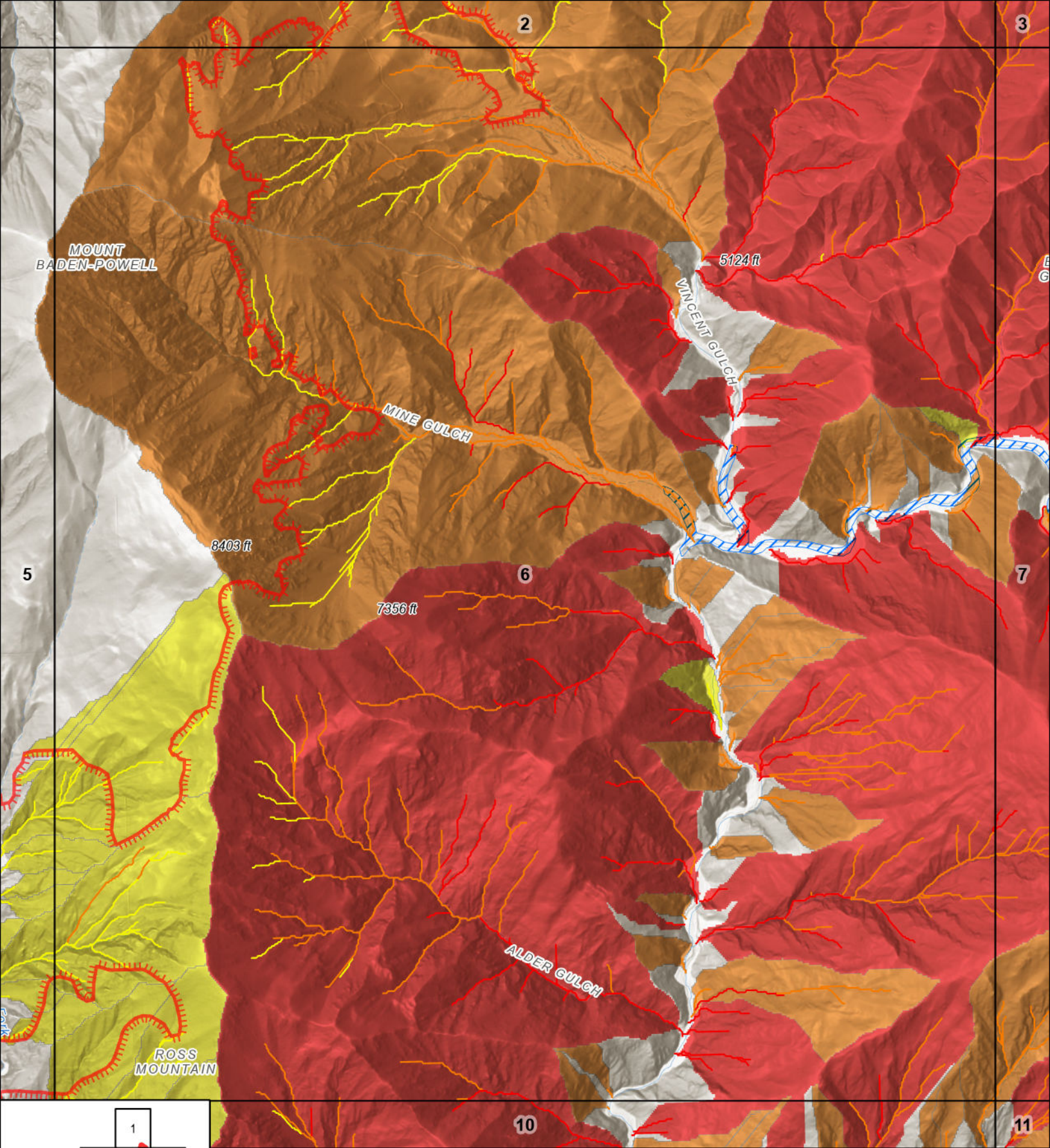
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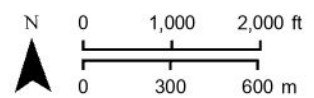
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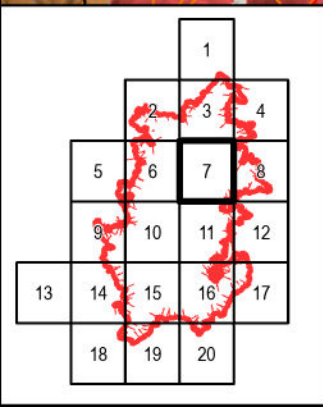
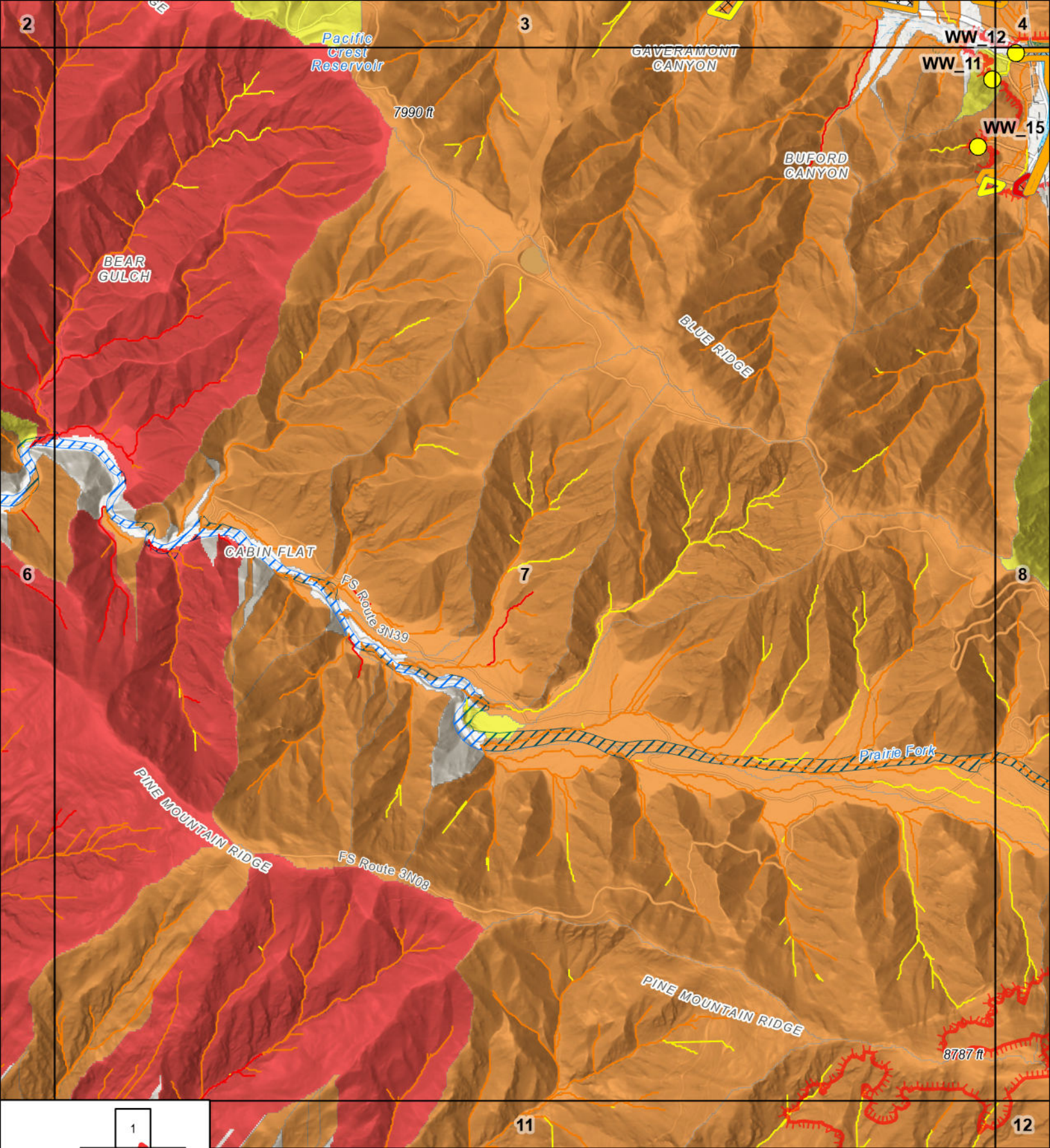
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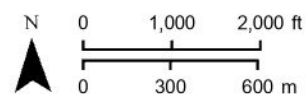
15 min 24 mm/h

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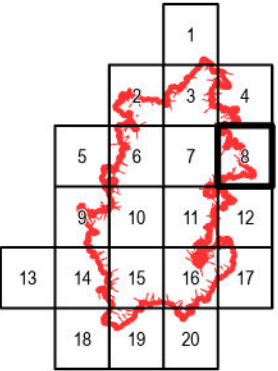
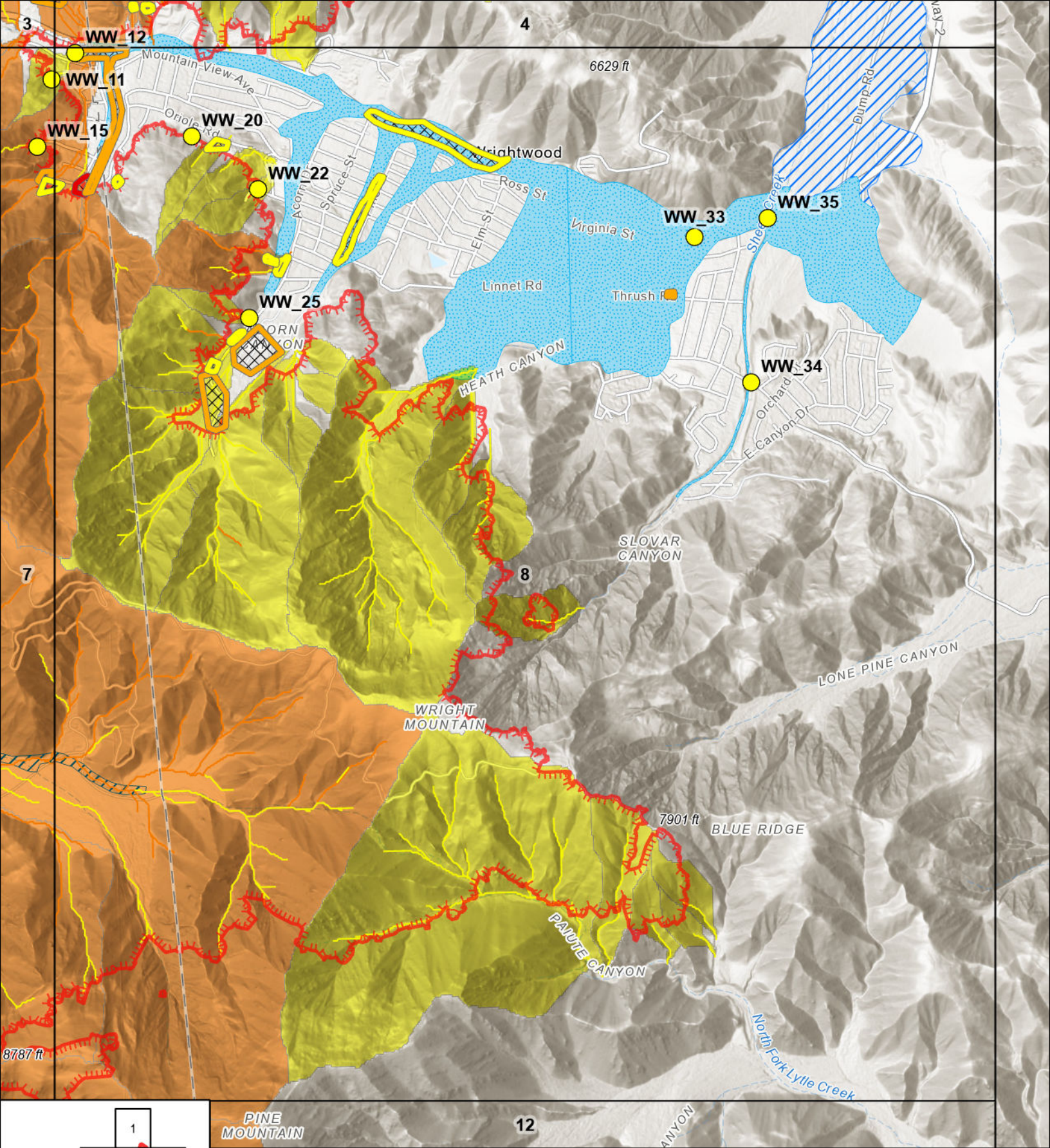
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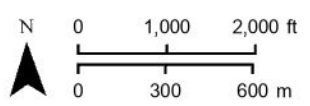
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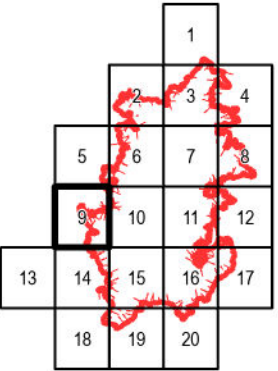
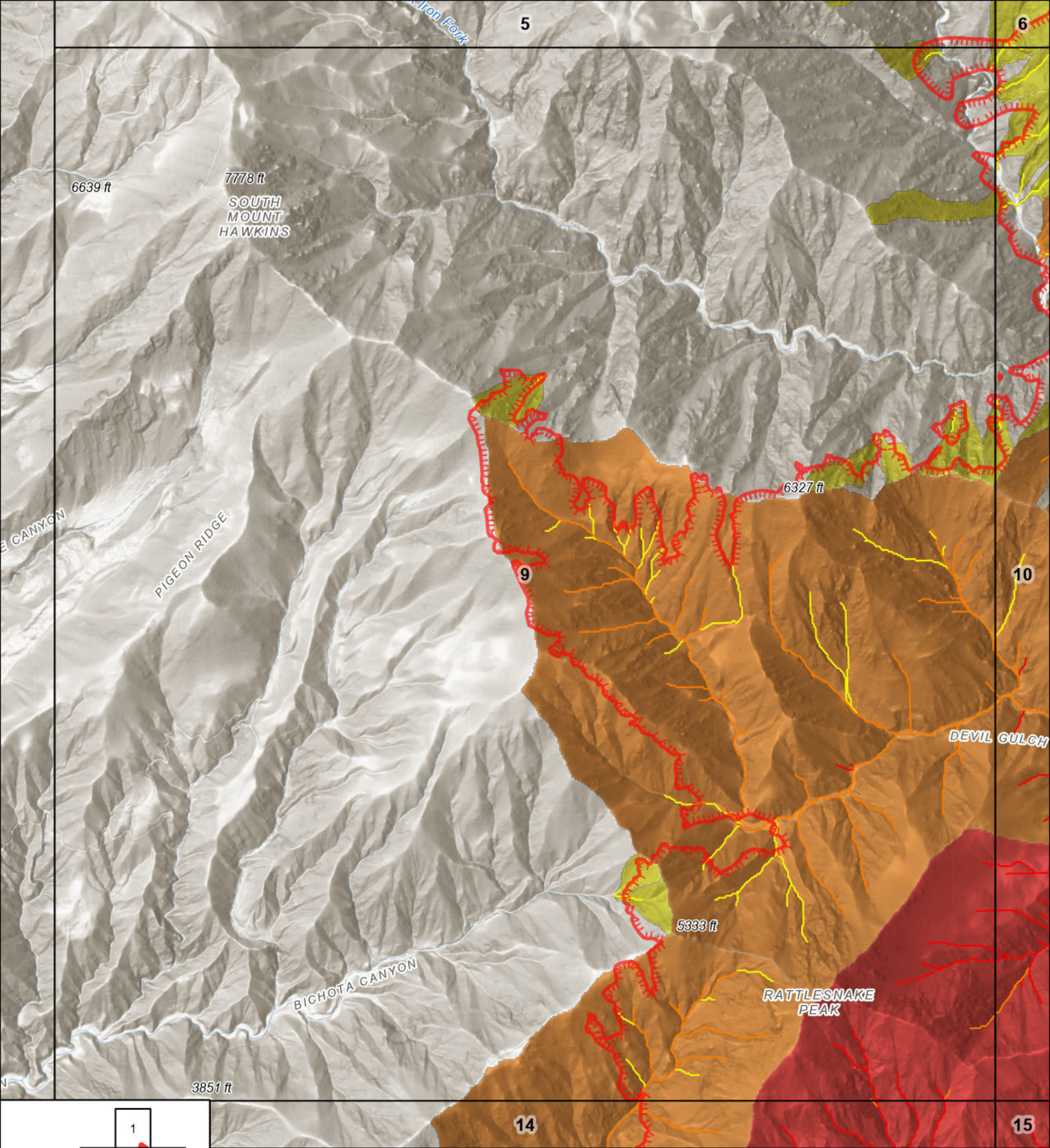
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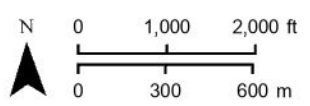
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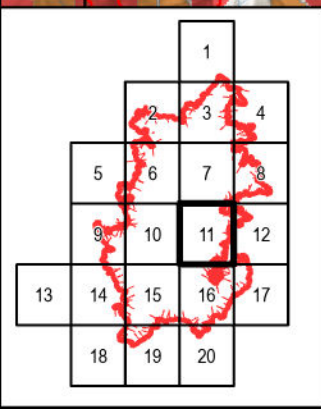
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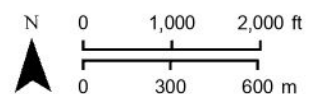
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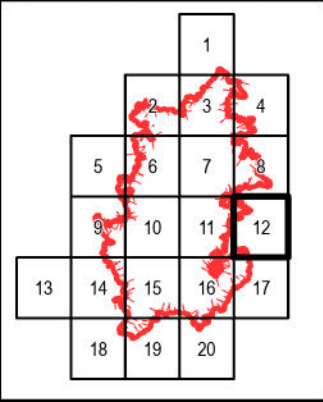
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DWR 100yr Awareness Floodplains



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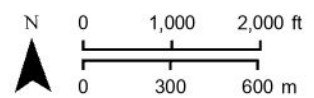
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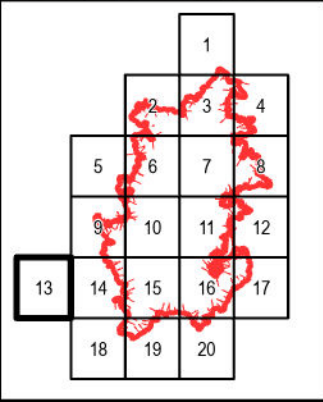
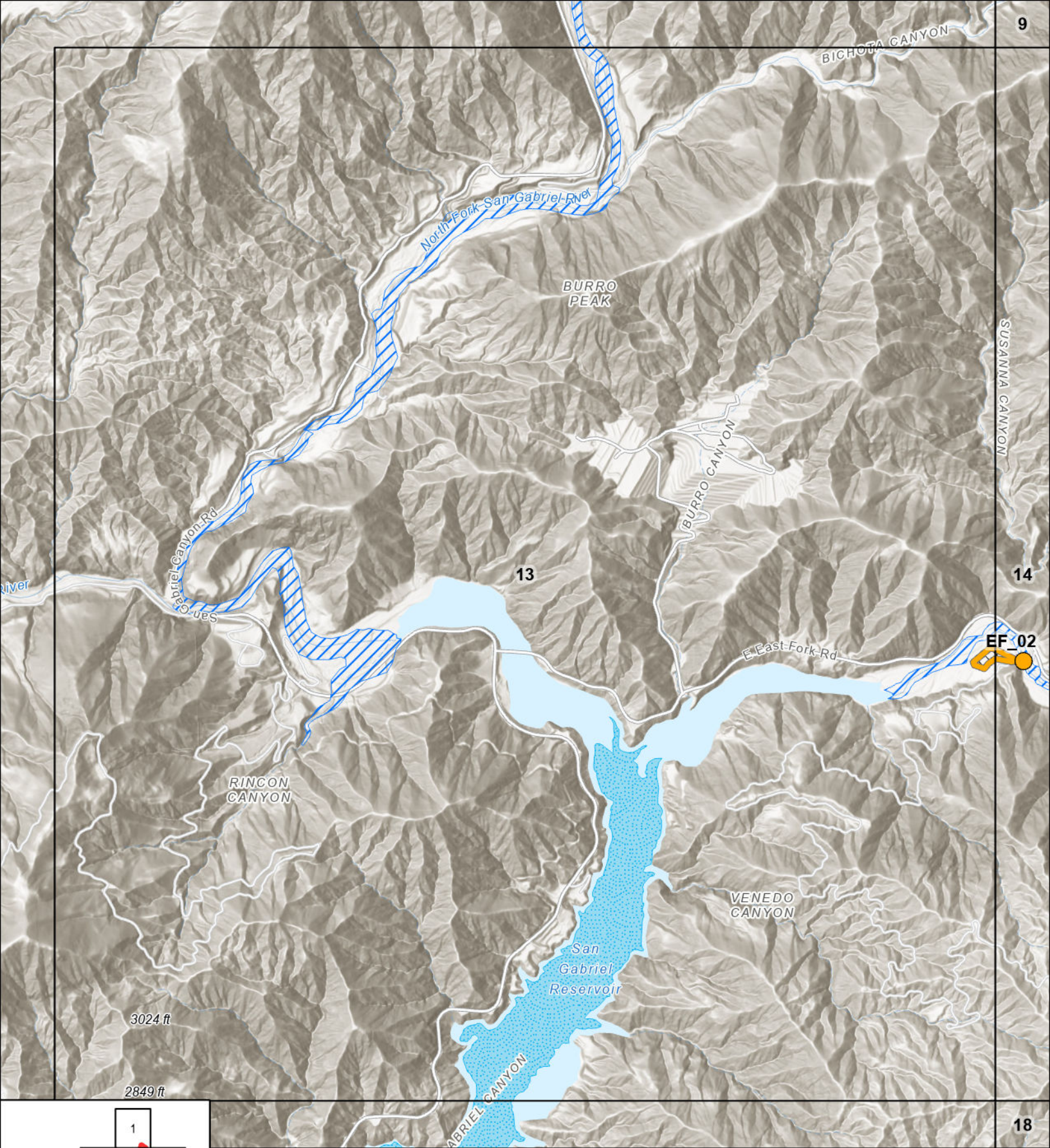
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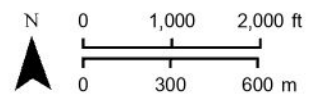
15 min 24 mm/h

- Low
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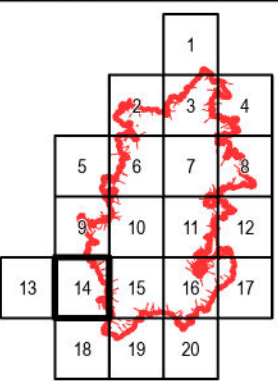
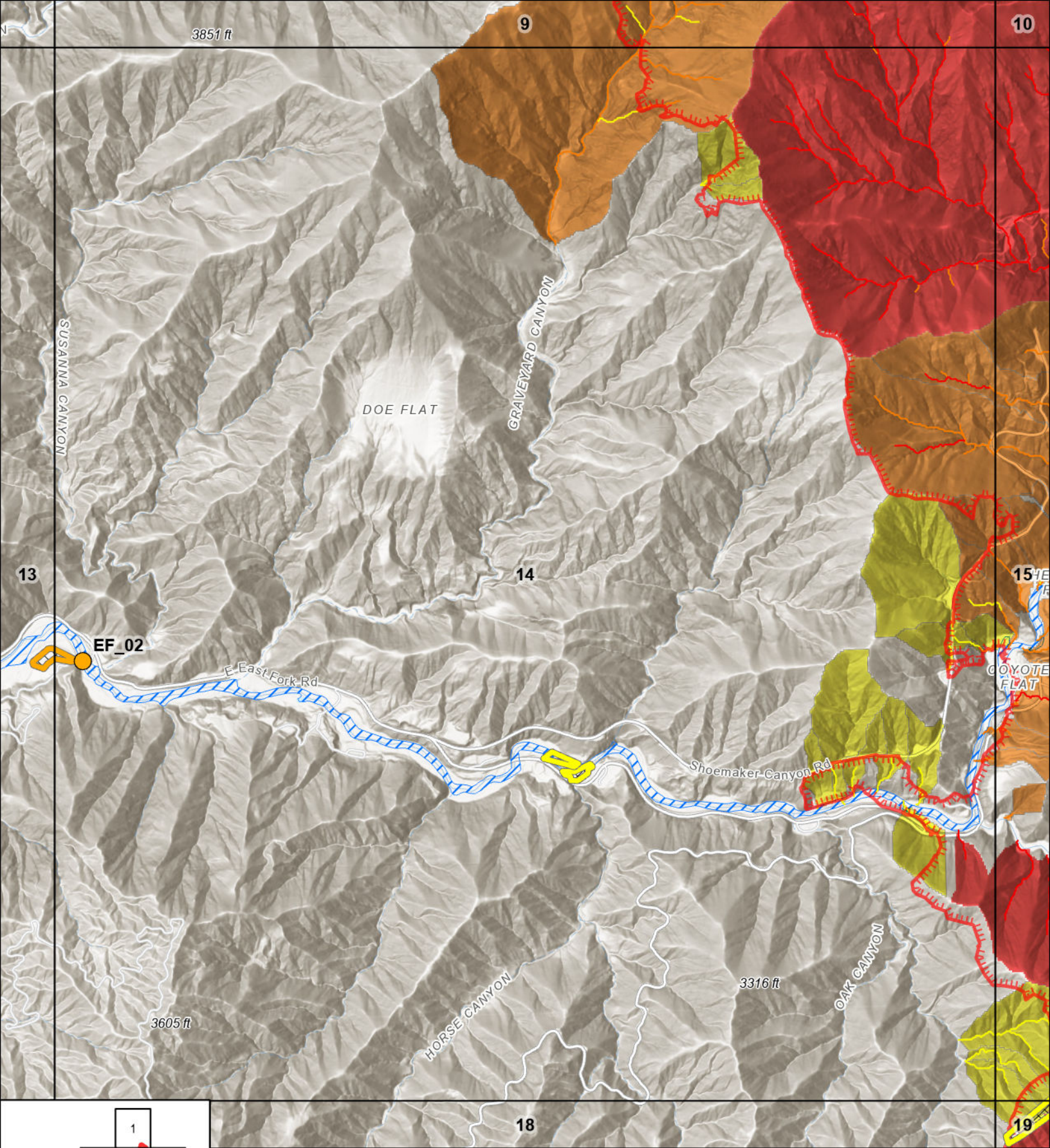
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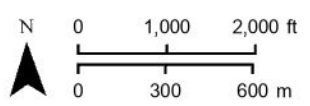
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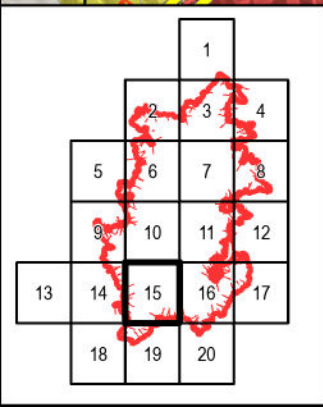
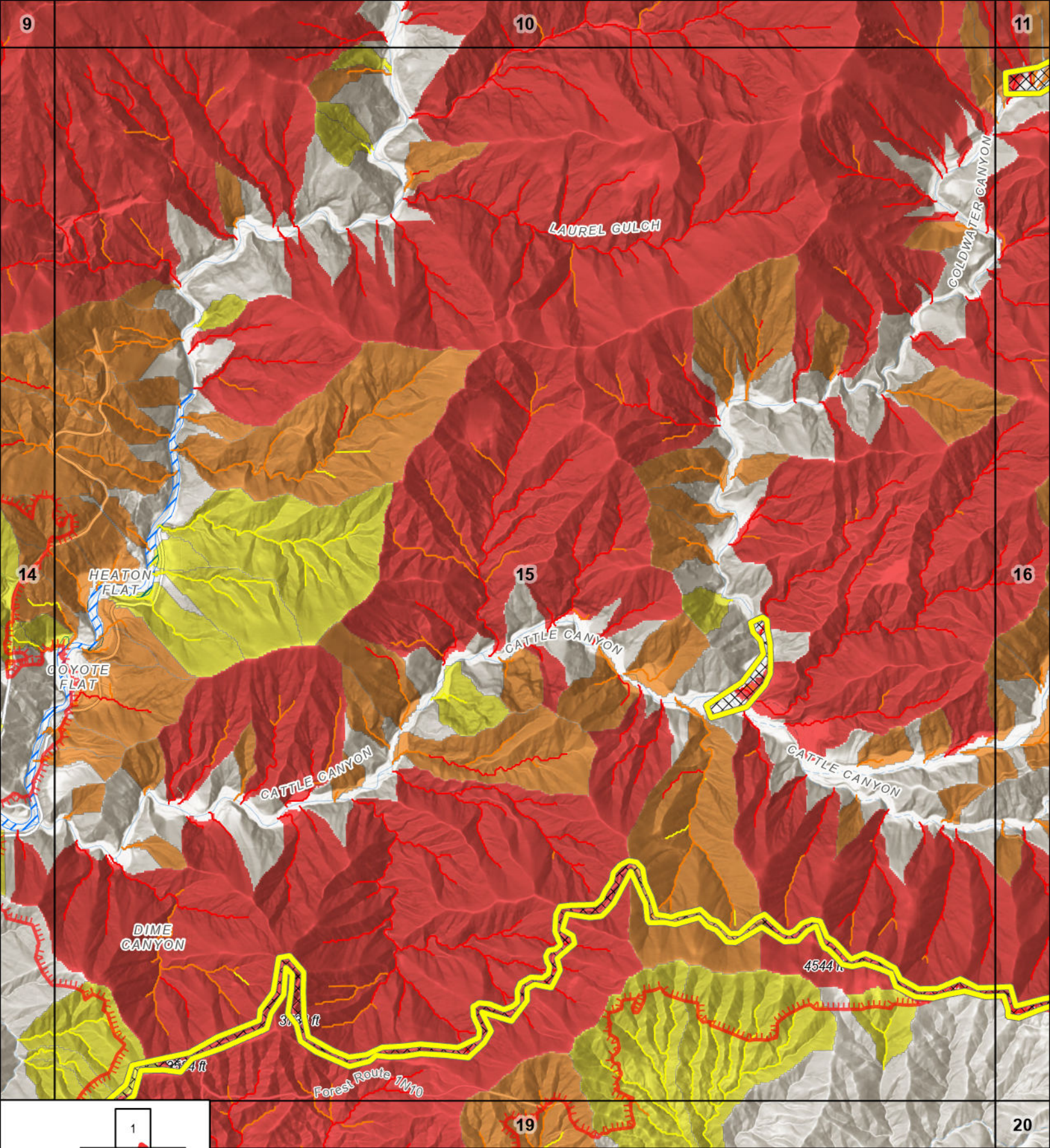
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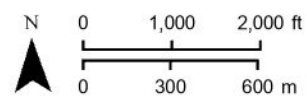
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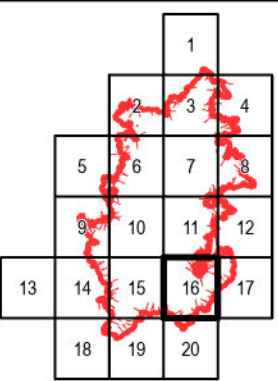
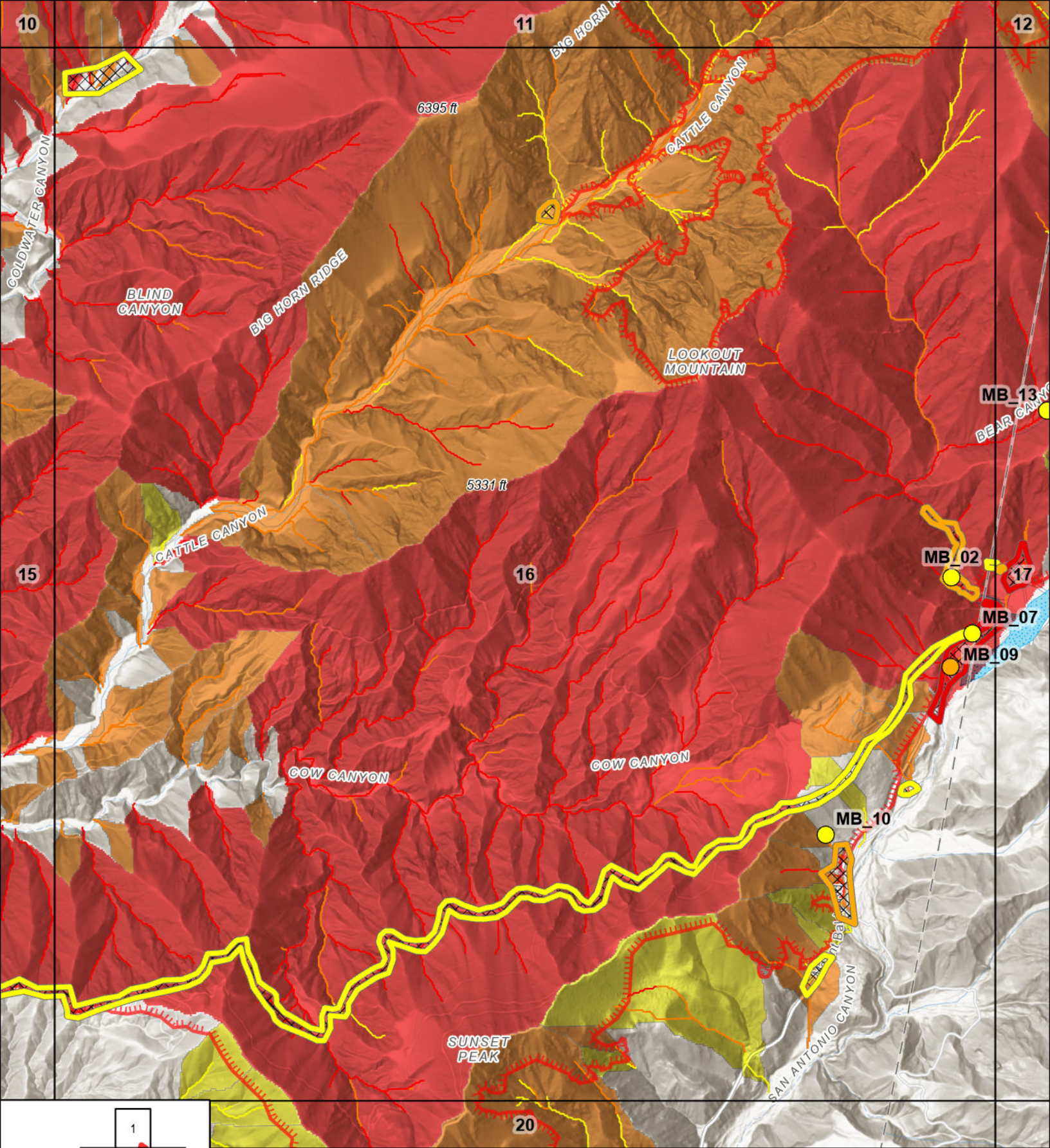
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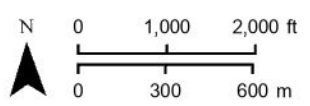
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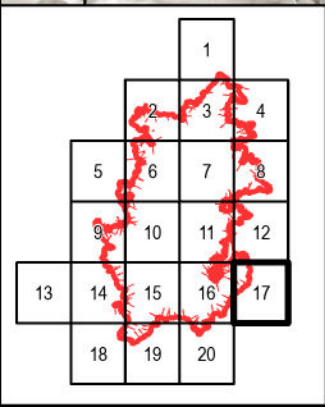
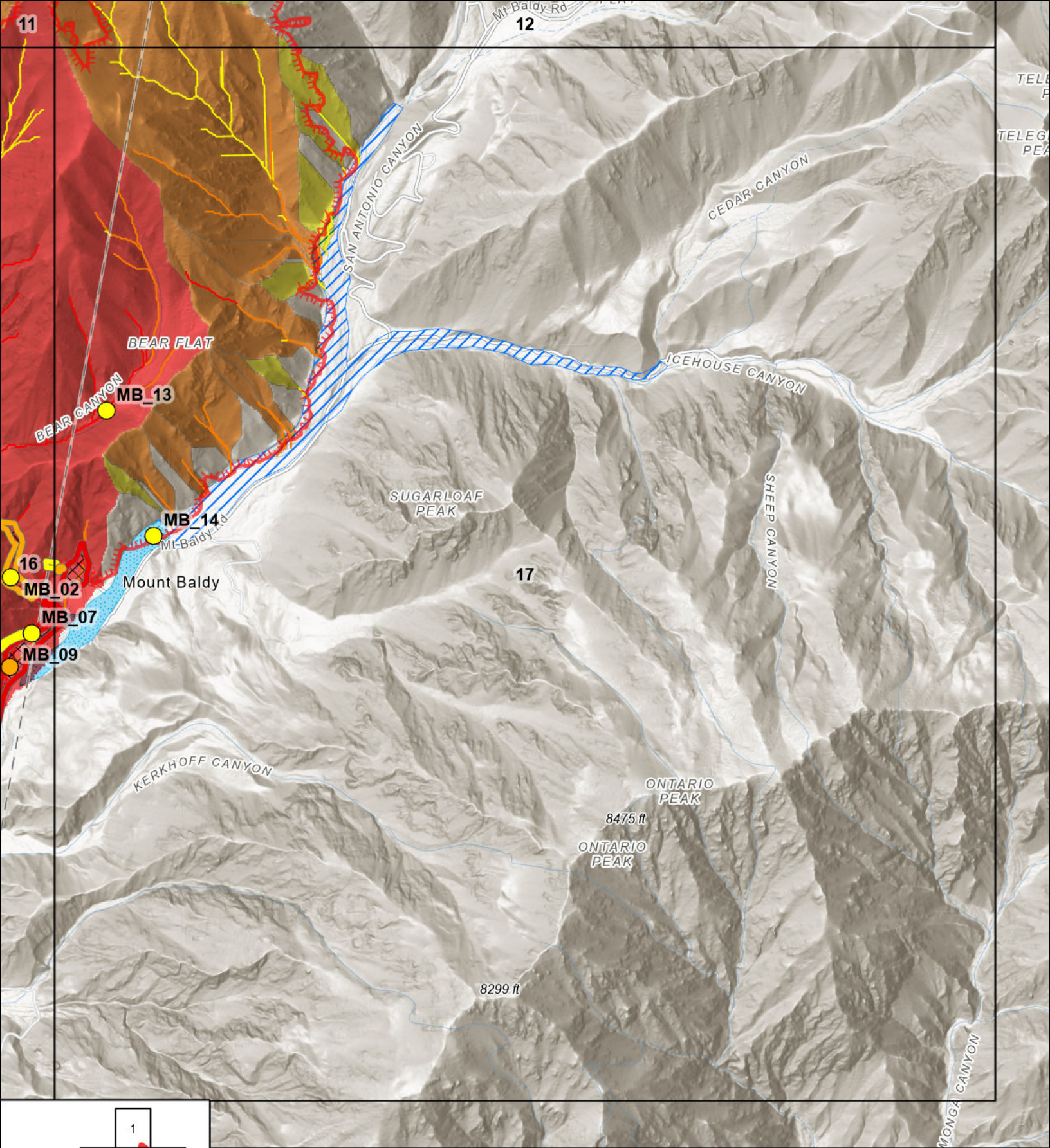
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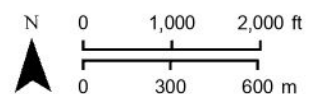
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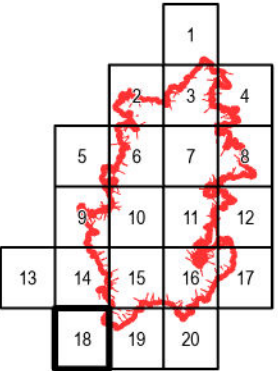
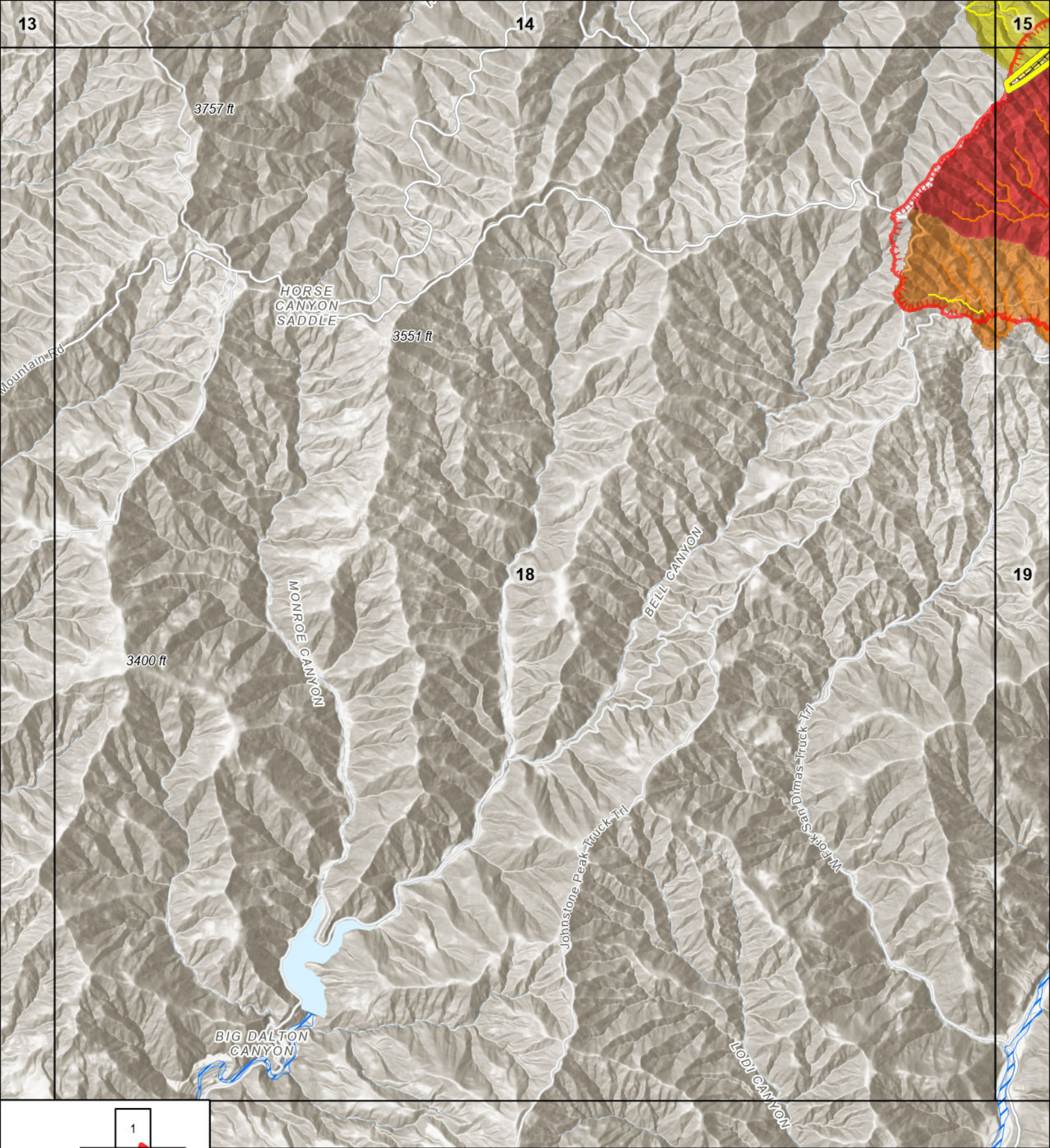
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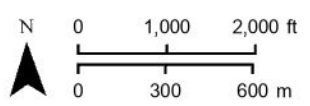
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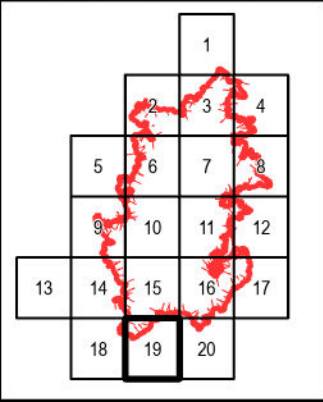
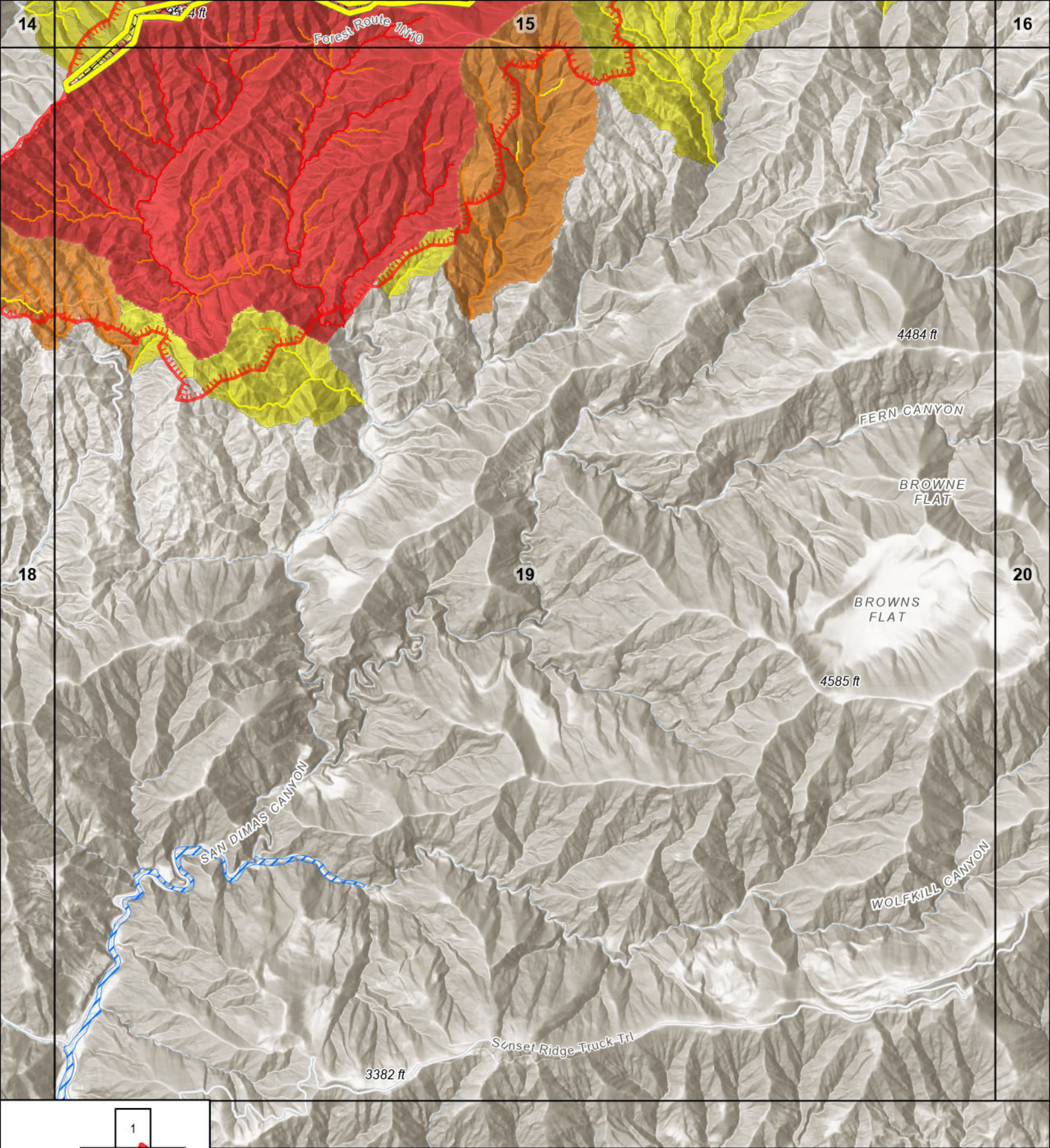
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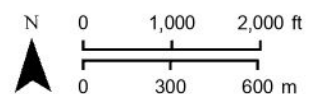
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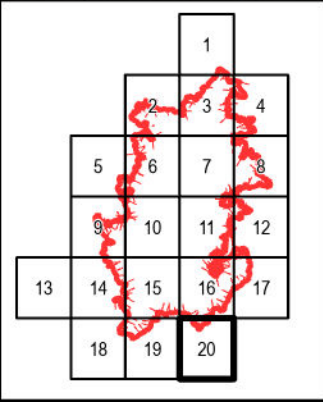
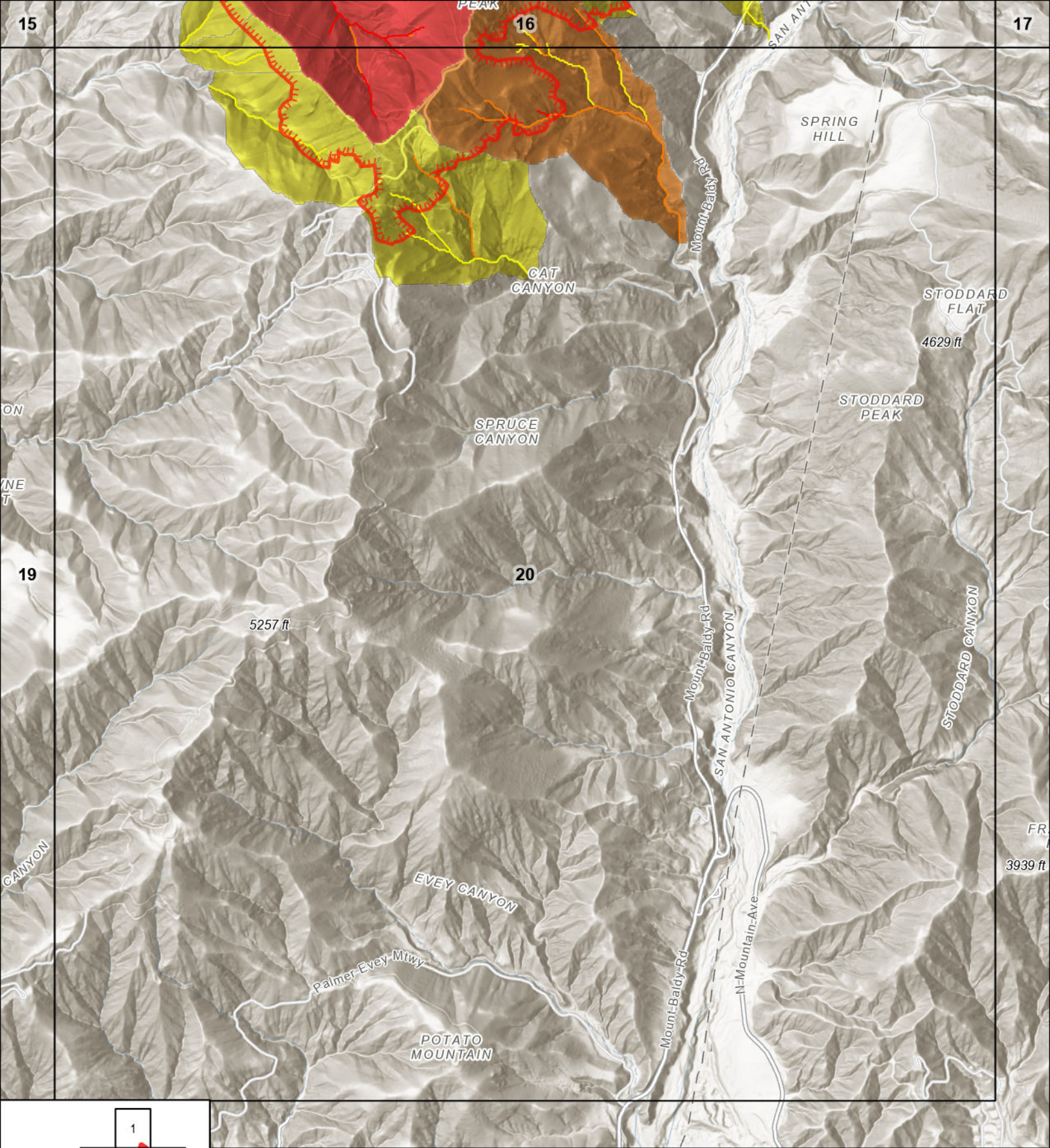
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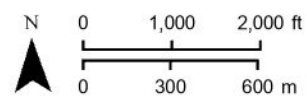
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Appendix D – Values-at-Risk Detail Sheets

VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Camp 19

Site Number: EF_02

Feature: Bridge accessing inmate camp 19

Feature Category: drainage structure

Field Observation or Bridge accessing camp 19. Limited flow capacity. Risk of debris and large flows relieving around approaches.

Potential Hazard: Skew angle of bridge relative to channel will likely force flows to the west, placing pressure on the camp.

Access to camp will likely be impacted. Very likely occurrence with moderate consequence = very high risk

Potential Hazard to Life: moderate

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

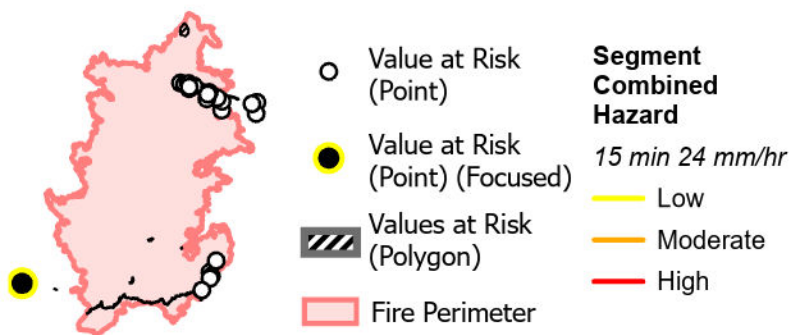
(3) Monitor and maintain

(4) NA

Text: Access to camp will likely be cutoff. Recommend evacuating camp during large storms. Install deflection structure to protect diverted flow from impacting camp. Prepare right bank abutment to function as a critical relief. Consider removing the railings.

Description: Right bank approach can be constructed as a critical relief to reduce flow being directed along left bank. Wood debris loading will likely impact railing, forcing flows around bridge.

LOCATION AND PHOTO



Latitude: 34.238082

Longitude: -117.820643



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_02**

Feature: **Sewer line**

Feature Category: **utilities**

Field Observation or Potential Hazard: Community service utility along Bear Canyon (possible gravity sewer line).

Very likely occurrence with moderate consequence = Very high risk

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures

(1) **Monitor and maintain**

(2) **NA**

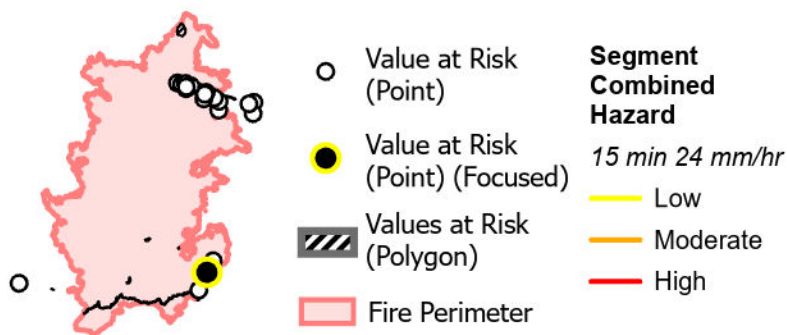
(3) **NA**

(4) **NA**

Text: Consider temporary closure of utility.

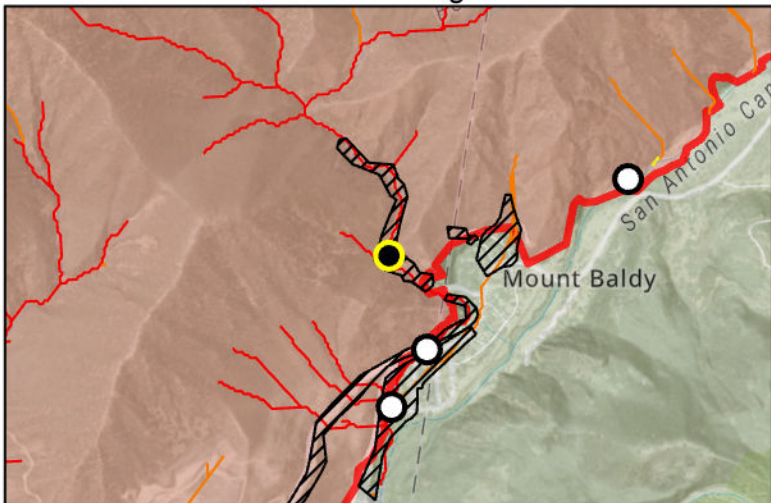
Description: Sewer pipe is at risk of being damaged.

LOCATION AND PHOTO



Latitude: 34.238964

Longitude: -117.660948



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_07**

Feature: **Crossing structure.**

Feature Category: **drainage structure**

Field Observation or Potential Hazard: Debris blocking culvert forcing overtopping flows.

Potential Hazard:

Very likely occurrence with moderate consequence = Very high risk

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Clear and maintain culvert**

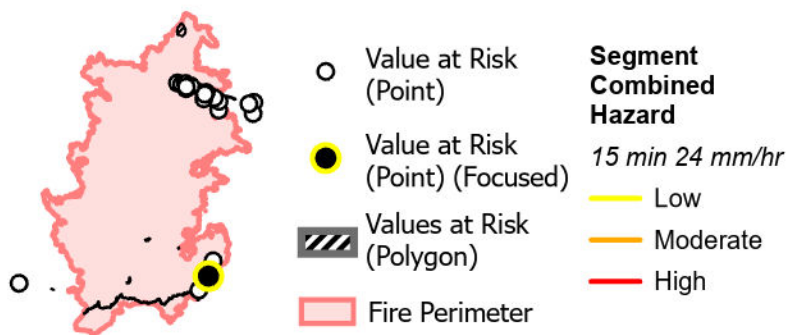
(3) **Deflection structure**

(4) **Signage**

Text: NA

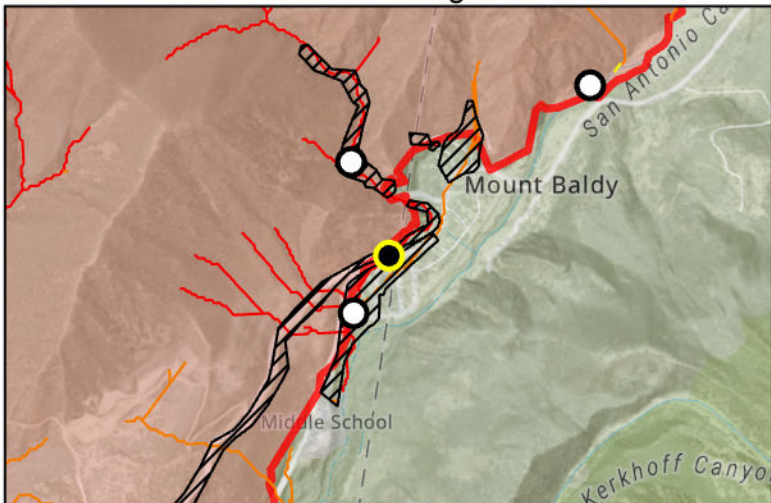
Description: Evidence of aggraded sediment upstream of crossing. Diverted flows will likely get diverted down road. 6x6 box with trash rack.

LOCATION AND PHOTO



Latitude: 34.236234

Longitude: -117.659814



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Mt Baldy

Site Number: MB_09

Feature: Bridge structure and adjacent homes

Feature Category: drainage structure

Field Observation or Potential Hazard: Debris flood hazard potentially plugging bridge crossing and lead to backwater and overtopping flows. Reports of flooding in the area in 2014.

Likely occurrence with high consequence = Very High risk

Potential Hazard to Life: moderate

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Monitor and maintain**

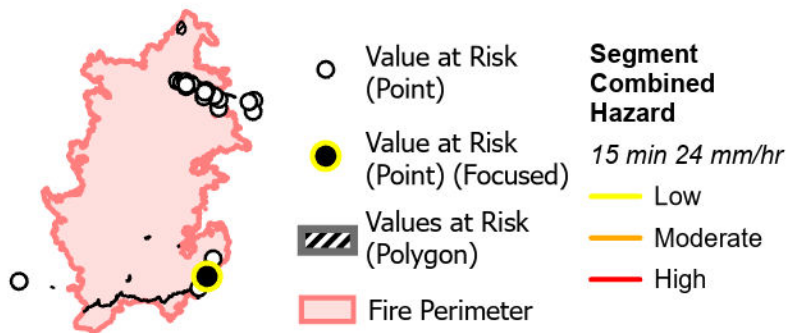
(3) **Deflection structure**

(4) **Signage**

Text: NA

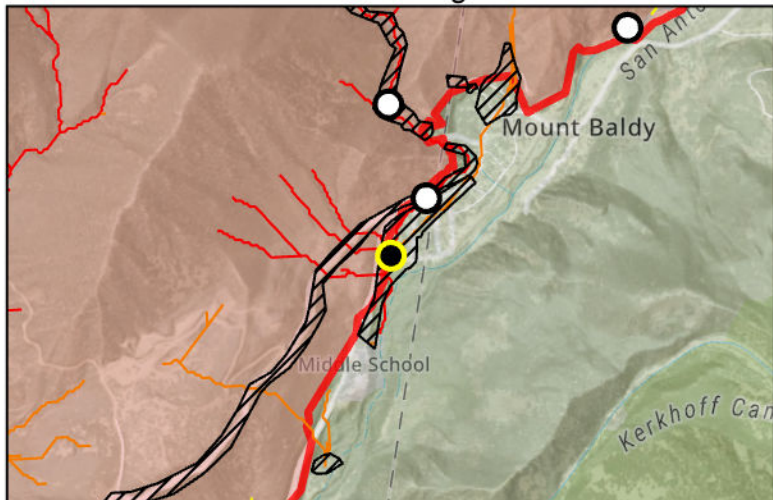
Description: 5x17 opening under bridge. Bridge appears to have limited capacity to convey increased flows and debris.

LOCATION AND PHOTO



Latitude: 34.234646

Longitude: -117.661132



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_10**

Feature: **Unmanned structure**

Feature Category: **utilities**

Field Observation or Structure in flood runout zone below low to moderate burn. Potential hazard is flood mobilizing burnt debris and
Potential Hazard: soil and impacting structure.

Possible probability of occurrence with minor consequences for life and moderate consequences for structure =
low to moderate risk.

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures

(1) **Monitor and maintain**

(2) **Early Warning**

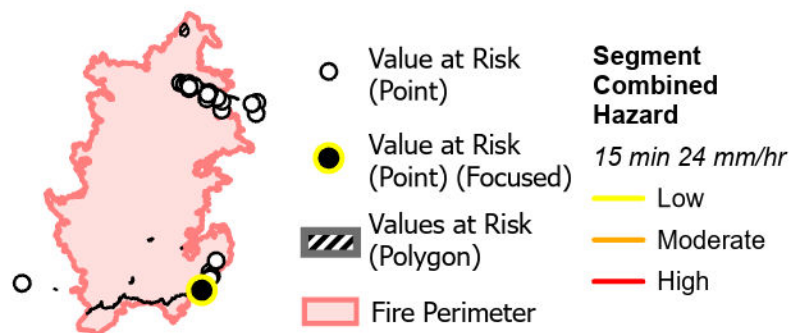
(3) **NA**

(4) **NA**

Text: NA

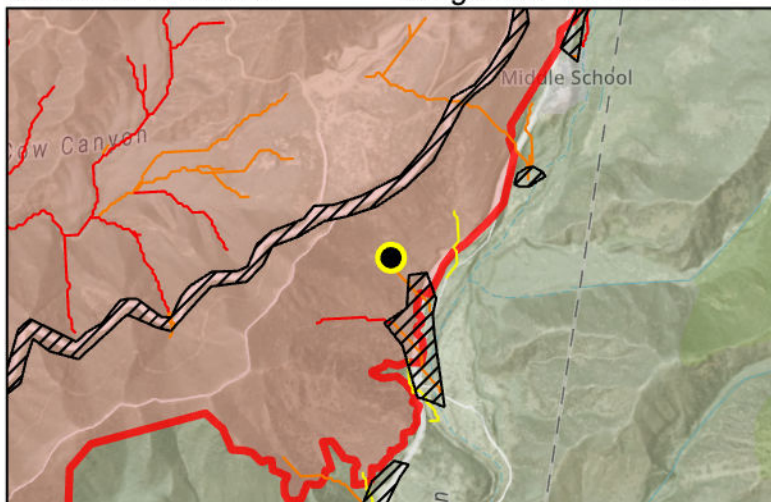
Description: Small structure has a red roof and connecting utility or fence observed from overlying road. Structure located at bottom of potential debris flow/flood source.

LOCATION AND PHOTO



Latitude: 34.226708

Longitude: -117.668612



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_13**

Feature: **Community water supply infrastructure**

Feature Category: **utilities**

Field Observation or Potential Hazard: Debris flows may impact intake structure to municipal water supply in Bear Canyon. Observed remotely due to limited access.

Very likely occurrence with high consequence = Very High Hazard

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Monitor and maintain**

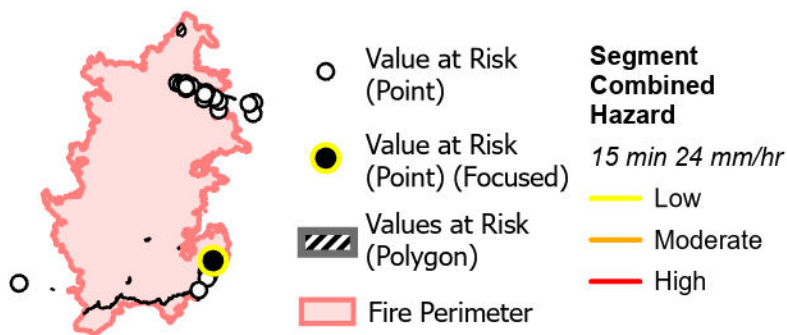
(3) **NA**

(4) **NA**

Text: NA

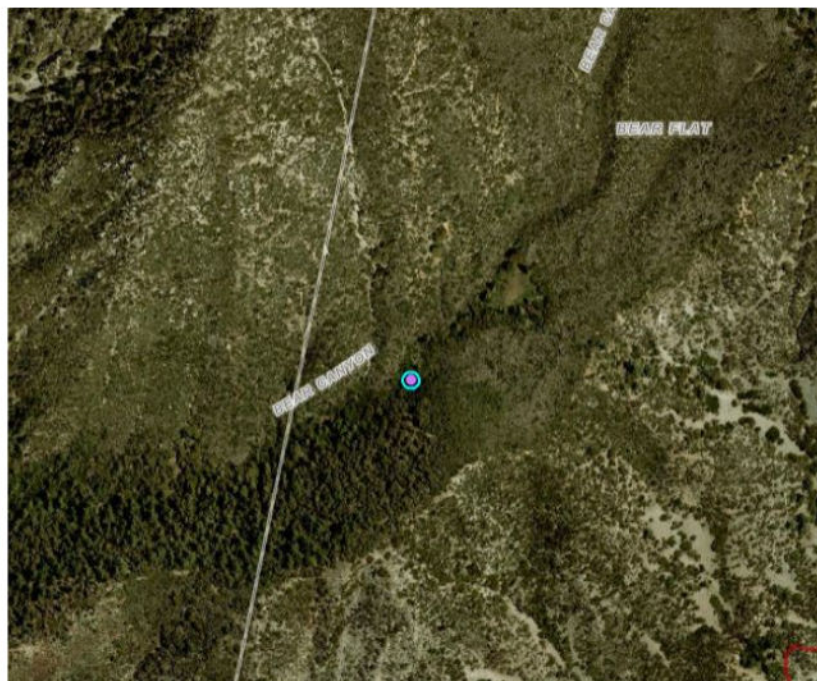
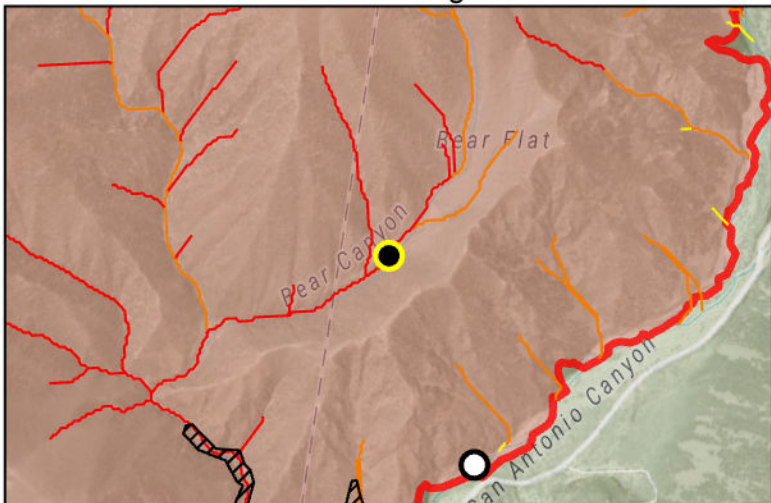
Description: Evaluated remotely. Location of infrastructure is within flow path of a potential debris flow with a high probability of occurrence.

LOCATION AND PHOTO



Latitude: 34.246884

Longitude: -117.655156



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_14**

Feature: **Community water intake.**

Feature Category: **utilities**

Field Observation or Potential Hazard: Rockfall and sediment impacting structure. Positive pressures may keep it he inlet free of debris.

Possible occurrence with moderate consequence = intermediate risk

Potential Hazard to Life: **low**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures

(1) **Monitor and maintain**

(2) **NA**

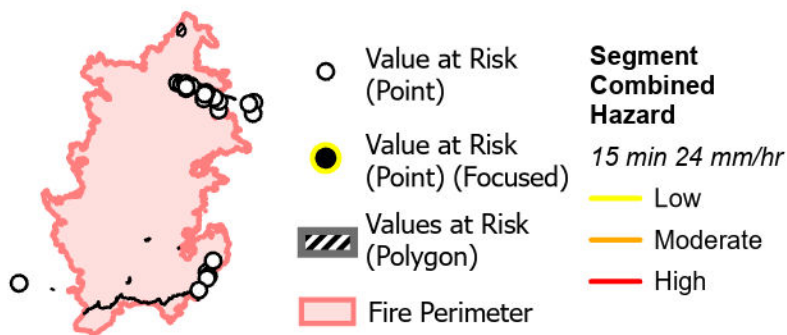
(3) **NA**

(4) **NA**

Text: NA

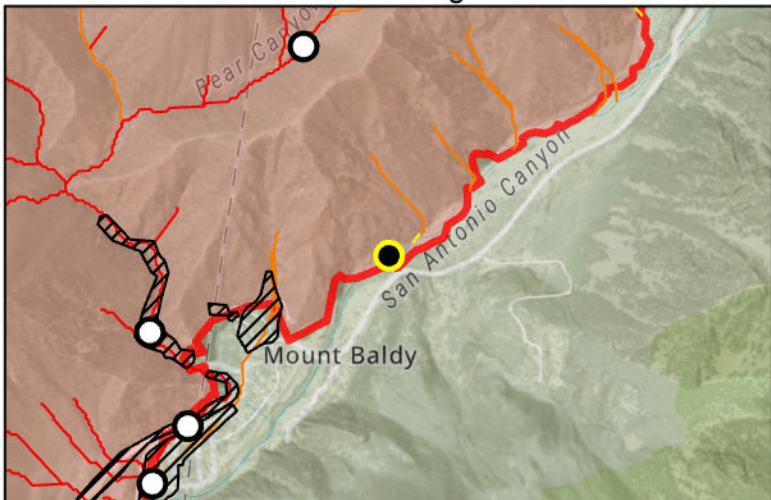
Description: Current retaining wall at foot of slope is being overtopped by scree.

LOCATION AND PHOTO



Latitude: 34.240790

Longitude: -117.652601



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_01

Feature: HWY 2 and Parking area of ski resort

Feature Category: drainage structure

Field Observation or Potential Hazard: Debris flood spilling onto Hwy 2 from a channel that is burned at moderate and low. Flows will travel down and across road where they may impact parking area of Mtn High Ski Resort.

Possible occurrence with moderate consequence = intermediate risk

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Clear and maintain culvert

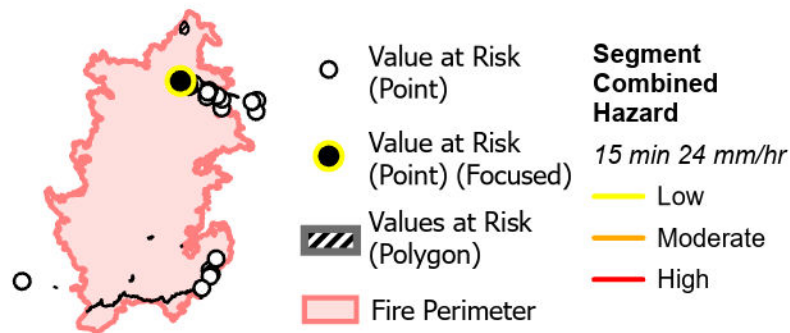
(3) Deflection structure

(4) NA

Text: NA

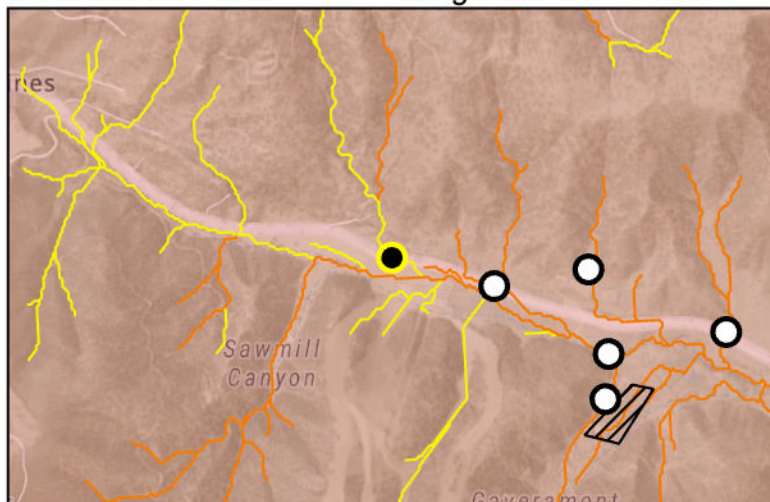
Description: Minimal evidence of pre-fire flow within channel. Increases in post-fire flow are anticipated that may overwhelm cross-drain culvert.

LOCATION AND PHOTO



Latitude: 34.373341

Longitude: -117.677479



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_02

Feature: Hwy 2 / access

Feature Category: other

Field Observation or Potential Hazard: Channel with alluvial fan at outlet that exhibits signs of deposits extending onto fan surface. Catchment above is burned at moderate and high. Debris floods may exit the channel, extend across the fan, and spill out onto Hwy 2.

Possible occurrence with moderate consequence = intermediate risk

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

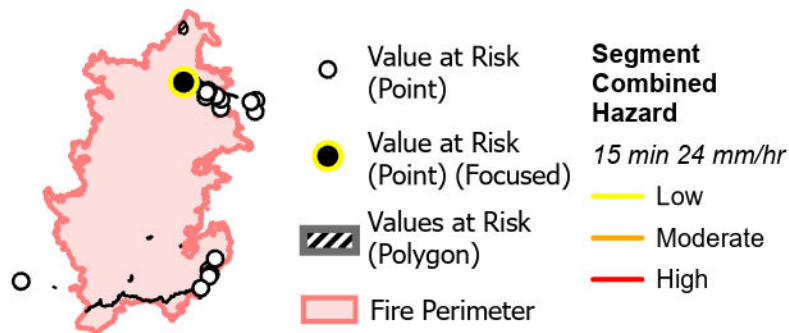
(3) NA

(4) NA

Text: NA

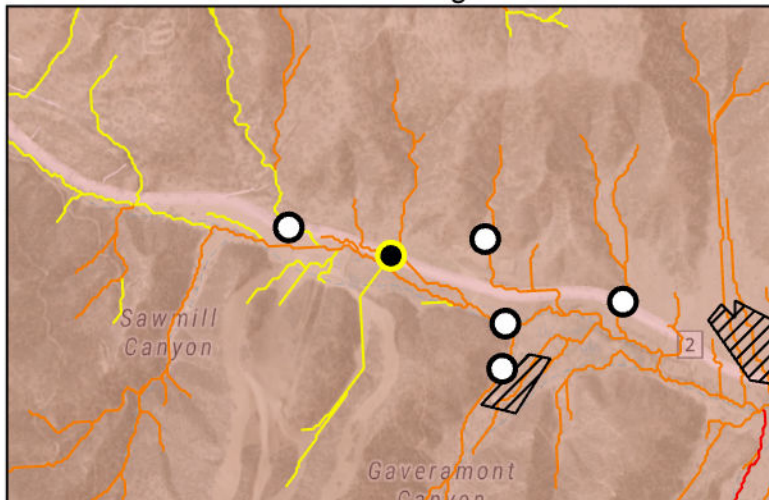
Description: Evidence of aggraded alluvium observed on top of fan surface. Deposits don't appear to extend much past fan apex.

LOCATION AND PHOTO



Latitude: 34.372380

Longitude: -117.674015



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_03

Feature: Burned residential structure

Feature Category: home

Field Observation or Potential Hazard: Burned residential structure within mouth of 22-acre drainage burned at moderate to high sbs. Drainage appears directed to the east side of structure. Potential hazard is flood that could mobilize burnt debris and impact future structure.

Possible probability of occurrence with moderate consequence = Intermediate risk

Potential Hazard to Life: moderate

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

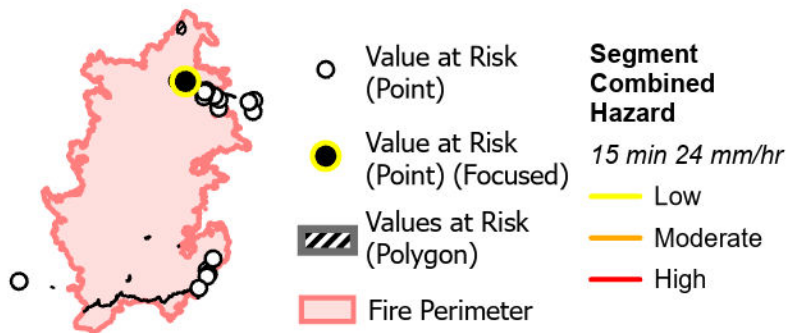
(3) NA

(4) NA

Text: The structure was not accessed in the field and was assessed remotely. There may be a potential for a deflection structure. Don't relocate temporary housing in potential flow paths.

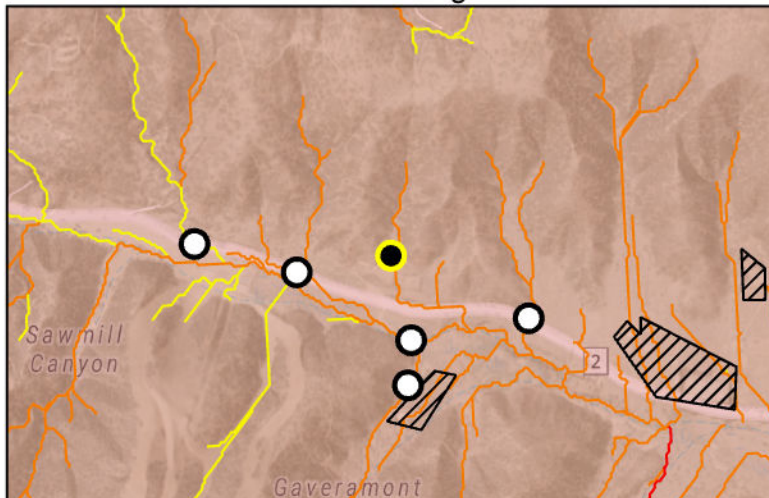
Description: Hazard to property is based on reconstruction.

LOCATION AND PHOTO



Latitude: 34.372713

Longitude: -117.670745



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_04

Feature: Crossing structure/access

Feature Category: drainage structure

Field Observation or Potential Hazard: Flood and debris will block crossing, causing overtopping flows and possible washout. Access to structures and water tank will be lost in the event of a washout.

Possible occurrence with moderate consequence = intermediate risk

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Clear and maintain culvert

(2) NA

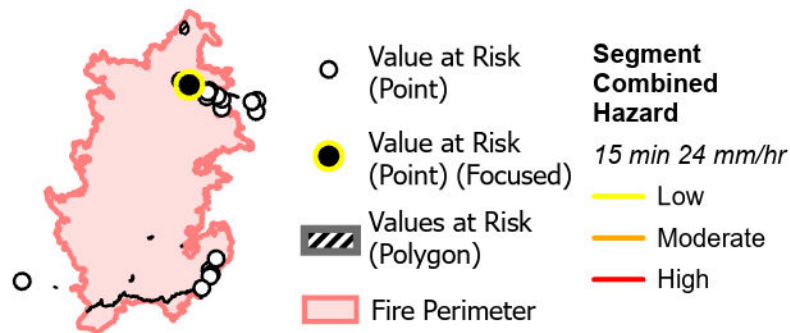
(3) Early Warning

(4) NA

Text: NA

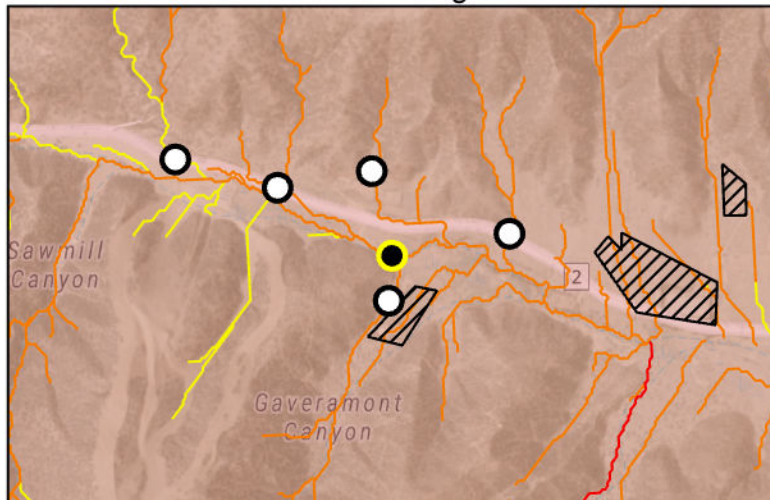
Description: Crossing consists of three 36" diameter CMPs and forms a nick point in channel. Channel may head cut through meadow above may occur if crossing is washed out.

LOCATION AND PHOTO



Latitude: 34.370272

Longitude: -117.670204



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Government Cyn

Site Number: WW_05

Feature: Recreational ranch structure

Feature Category: recreational

Field Observation or Potential Hazard: Recreational ranch structure at the edge of alluvial fan. What appears to be the active drainage is directly adjacent. A 6' earthen berm was observed between drainage and ranch structure.

Potential hazard is flood that could mobilize burnt debris and impact the commercial structure. Flood/debris flow. Likely occurrence with moderate consequence = high risk

Potential Hazard to Life: low

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Monitor and maintain**

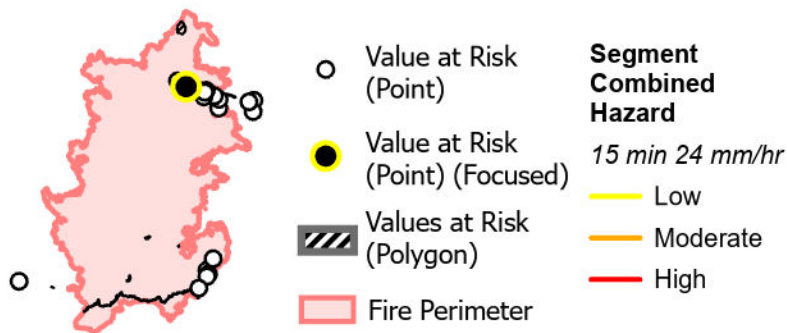
(3) **NA**

(4) **NA**

Text: Restrict access when high intensity storms are predicted. Berm should be maintained and possibly improved.

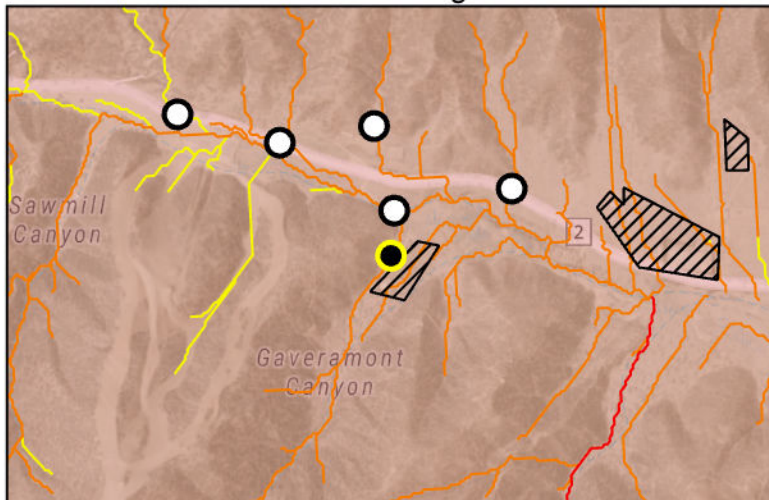
Description: Low life hazard because no obvious permanent residents.

LOCATION AND PHOTO



Latitude: 34.368992

Longitude: -117.670397



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_07

Feature: Crossing and road.

Feature Category: drainage structure

Field Observation or Potential Hazard: Flows impacting Hwy 2. Drainage from burned slopes enters a ditch along the western edge of alluvial fan and discharges directly onto road.

Possible occurrence with moderate consequence = intermediate risk

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

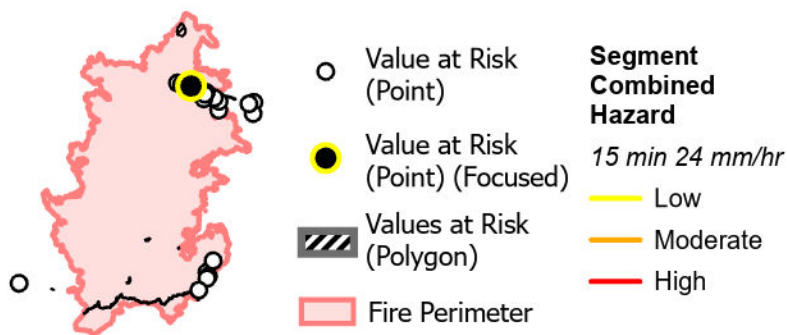
(3) NA

(4) NA

Text: NA

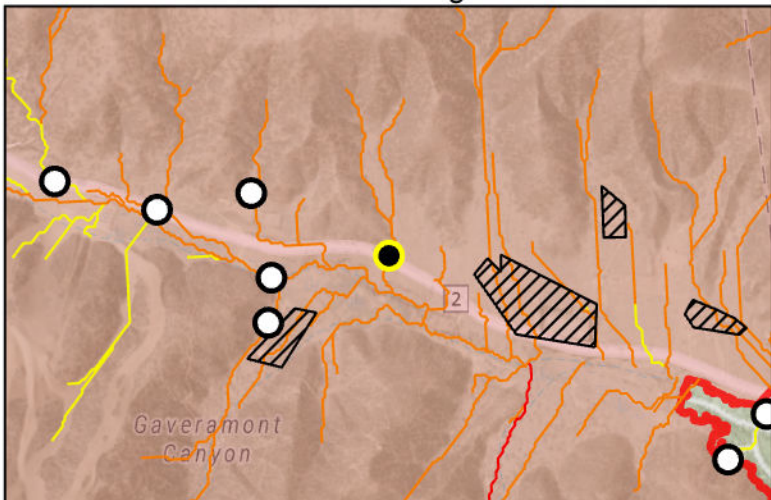
Description: There is an opportunity to improve drainage by directing ditch into adjacent culvert inlet. Culvert inlet is currently blocked and may need to be upsized.

LOCATION AND PHOTO



Latitude: 34.370722

Longitude: -117.666123



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Flume Cyn

Site Number: WW_11

Feature: House

Feature Category: home

Field Observation or Potential Hazard: House at mouth of 2 burned drainages. An earthen berm was observed constructed along the eastern edge of structure. Approximately 1 to 2-feet of sediment, which appear to be past deposits, was observed excavated from along the side of the house.

Potential hazard is flood that could mobilize fine sediment/small rocks and impact structure. Flood/fine sediment. Possible occurrence with low consequence = low risk

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

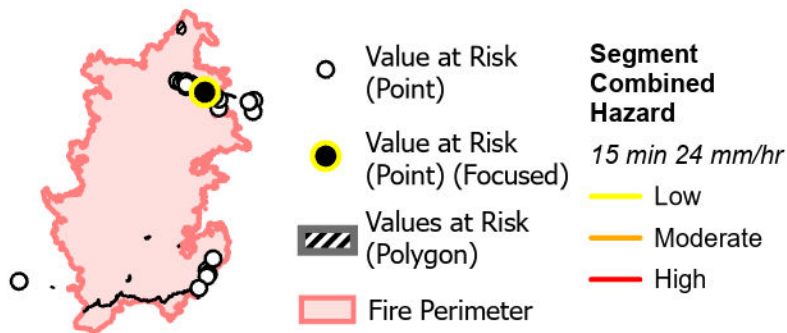
(3) NA

(4) NA

Text: Deflection structure may be useful at western drainage, which appears the smaller of the two.

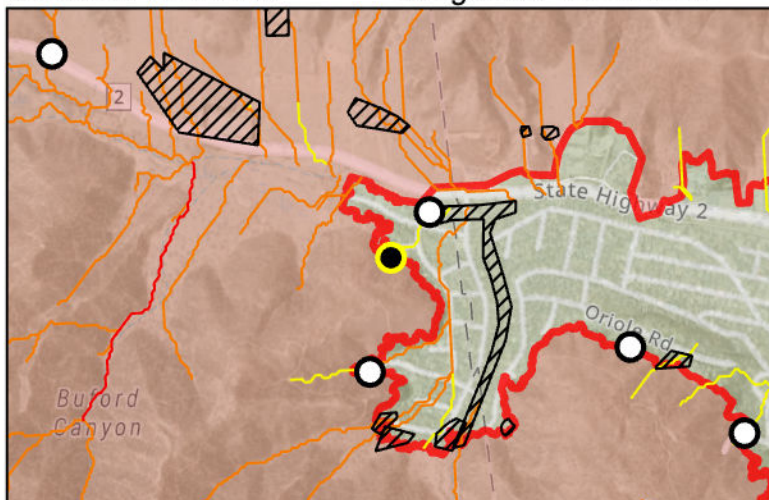
Description: Small rock and fine sediment observed in drainages. Berm constructed at mouth of drainage to divert low flow. Past deposits appear to have caused some level of dry rot in wood siding.

LOCATION AND PHOTO



Latitude: 34.364400

Longitude: -117.654836



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_12

Feature: Adjacent homes

Feature Category: multiple

Field Observation or Potential Hazard: Potential of flooding that may exceed capacity of vented ford crossing.

Possible occurrence with high consequence = High risk

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Deflection structure**

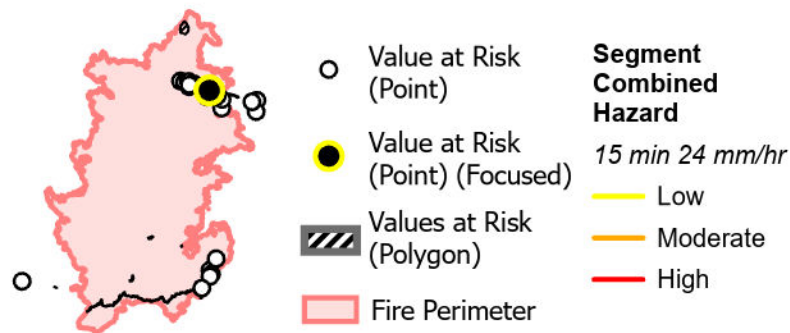
(3) **NA**

(4) **NA**

Text: NA

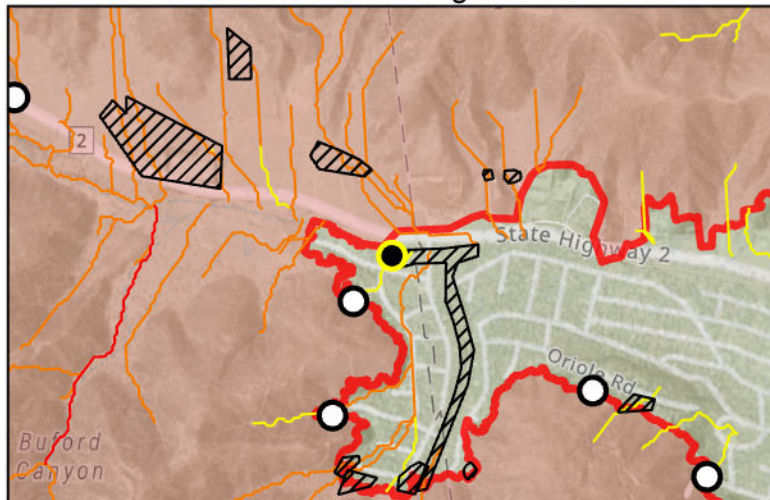
Description: Channel could benefit having a deflection structure direct flows back into channel before impacting residence on downstream right bank.

LOCATION AND PHOTO



Latitude: 34.365642

Longitude: -117.653429



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Flume Cyn

Site Number: WW_15

Feature: House

Feature Category: home

Field Observation or Potential Hazard: House at mouth of burned drainage. Small fan with drainage directed to the north side of house. Approximate 14 acre catchment above. Potential hazard is flood that could mobilize fine sediment/small rocks and impact structure.

Hyperconcentrated flow/flood. Possible occurrence with low consequence = low risk

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

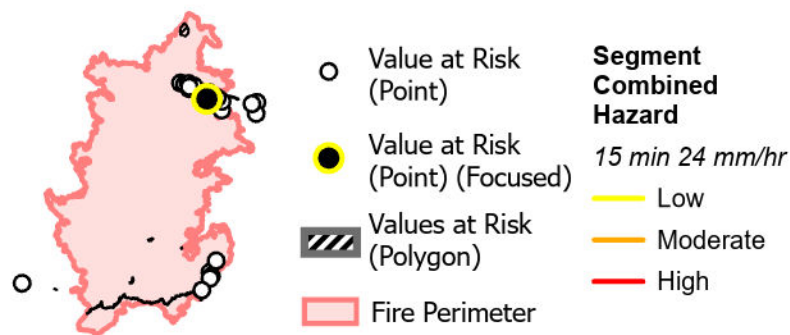
(3) NA

(4) NA

Text: Deflection structure may help to keep flow to the north of the structure.

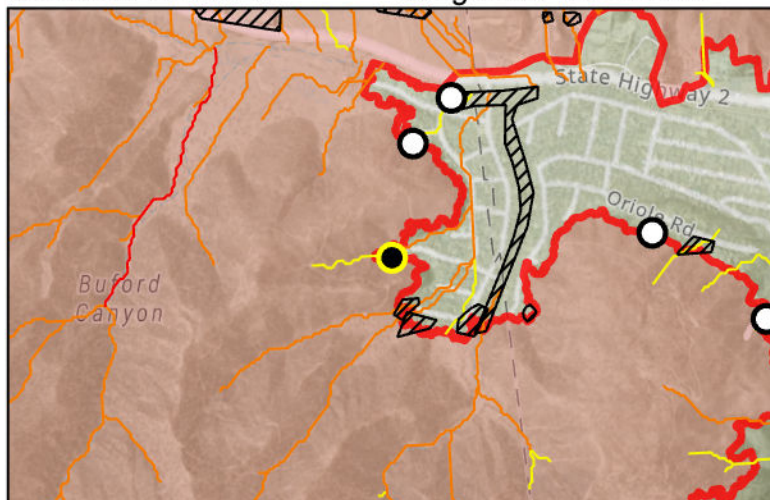
Description: SBS is generally low with moderate along ridgelne. Mostly small rocks, possibility of flood or small hyperconcentrated flow

LOCATION AND PHOTO



Latitude: 34.361175

Longitude: -117.655764



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_20

Feature: Home

Feature Category: home

Field Observation or 1 home centered on bottom of steep drainage swale. Potential hazard is flood mobilizing burnt debris and soil
Potential Hazard: and impacting structures. Possible probability of occurrence with minor consequences = low risk.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Monitor and maintain

(2) Early Warning

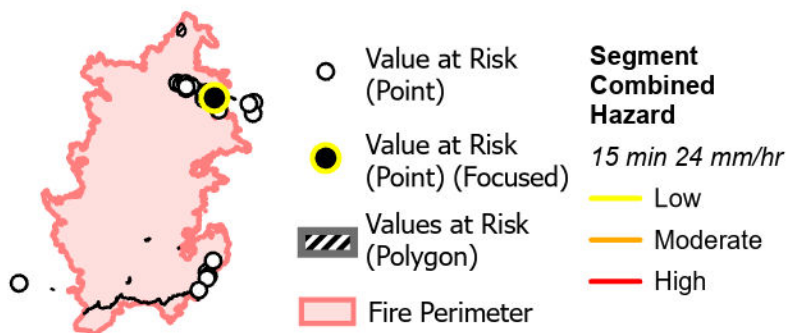
(3) Sandbags

(4) NA

Text: Improve drainage

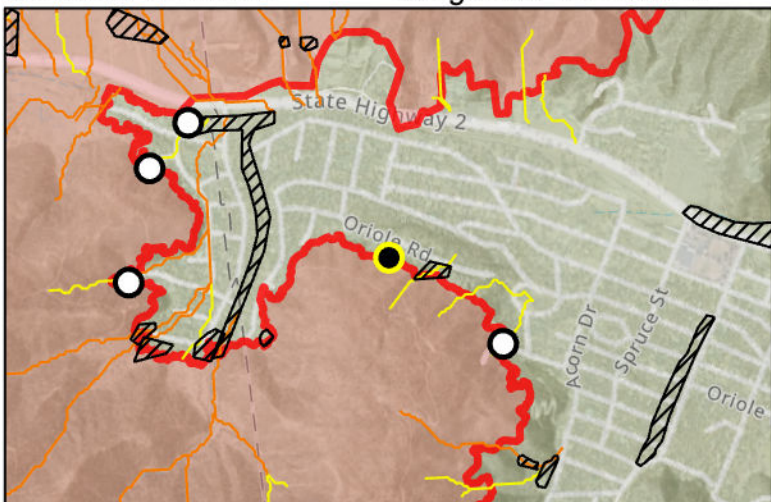
Description: Neighbor reports that home floods in normal years on first floor when drainage around home becomes blocked.

LOCATION AND PHOTO



Latitude: 34.361492

Longitude: -117.646770



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_22

Feature: Carport

Feature Category: other

Field Observation or Carport within fan and drainage path. Potential hazard is flood mobilizing burnt debris and soil and impacting structure. Possible probability of occurrence with minor consequences = low risk.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

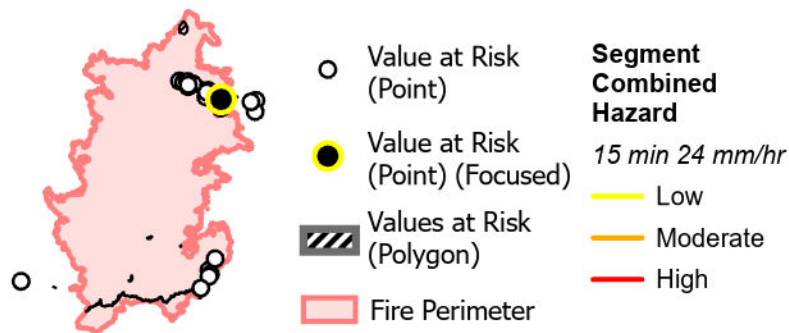
(3) Sandbags

(4) NA

Text: Improve drainage around carport

Description: Main home appears mostly out of flow path and therefore not considered a VAR, however landscaping terraces may be in flood path. Observed a minor matrix supported debris flow deposit behind oak in channel above carport.

LOCATION AND PHOTO



Latitude: 34.358865

Longitude: -117.643001



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_25

Feature: 1 home

Feature Category: home

Field Observation or 1 home on margin of flow path. Minimal fan here. Potential hazard is flood mobilizing burnt debris and soil and
Potential Hazard: impacting structure. Possible to likely probability of occurrence with minor consequence=low risk.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Monitor and maintain

(2) Early Warning

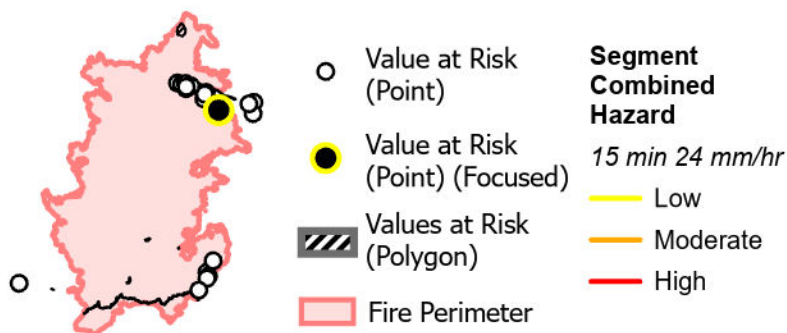
(3) NA

(4) NA

Text: NA

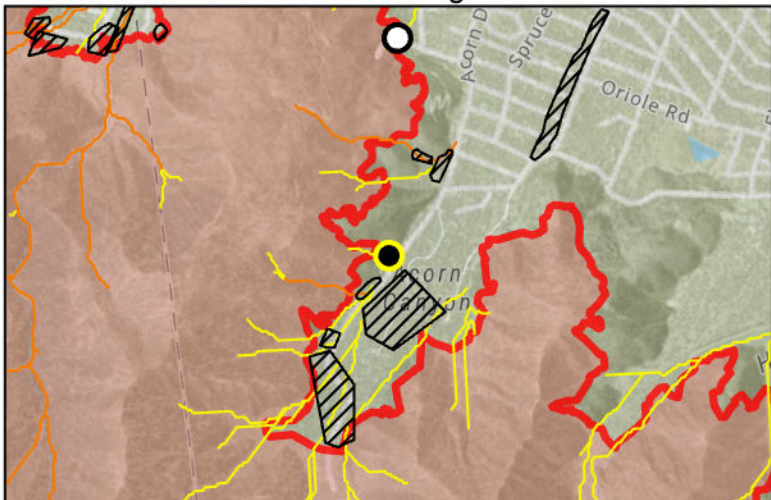
Description: There is a shallow bowl shaped steep swale above home with hydrophilic vegetation. Above the swale the low severity burn was in thick oak forest with much remaining canopy and the burn may not significantly impact hydrologic characteristics. However if flows in this basin increase, the home may experience more water flow than in the past and be slightly impacted by water and burnt debris. We observed unpinned home north of this home and it appears unlikely to receive flood flow.

LOCATION AND PHOTO



Latitude: 34.352672

Longitude: -117.643689



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Heath Cyn

Site Number: MB_09

Feature: Box culvert along Hwy 2

Feature Category: drainage structure

Field Observation or Potential Hazard: Debris flooding that may overwhelm 10' x 10' box culvert, leading to overtopping flows.

Likely occurrence with high consequence = Very High risk

Potential Hazard to Life: moderate

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Clear and maintain culvert

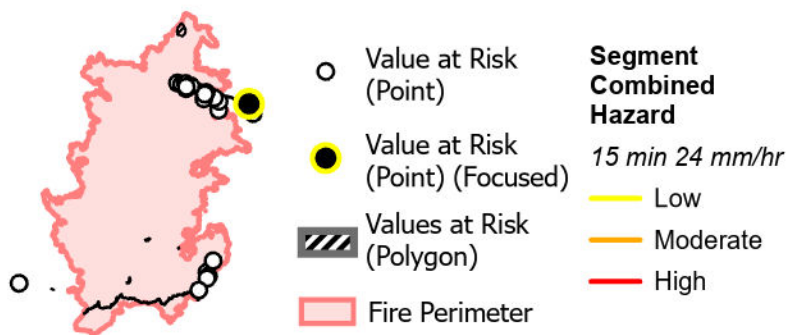
(3) NA

(4) NA

Text: NA

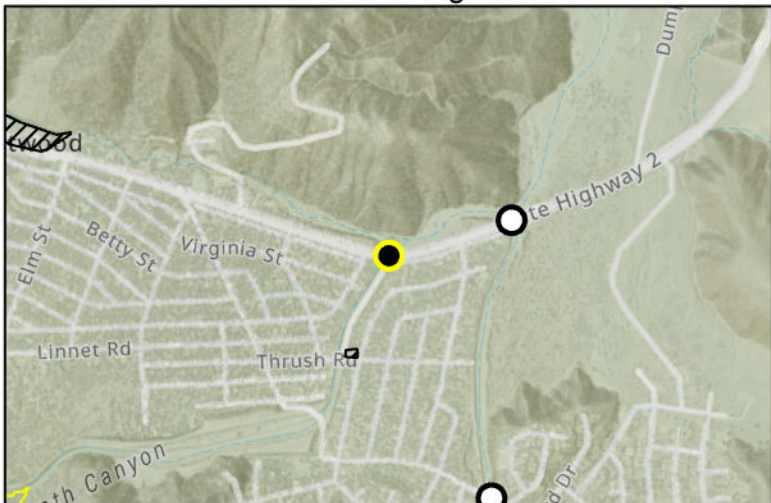
Description: Crossing shows evidence of being damaged by previous debris flows. The potential for plugging and overtopping is likely greatest during large storm events. Post-fire impacts are likely low.

LOCATION AND PHOTO



Latitude: 34.234646

Longitude: -117.661132



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Sheep Cyn

Site Number: WW_34

Feature: Crossing structure

Feature Category: NA

Field Observation or Potential Hazard: Debris overtopping culvert and possibly diverting down left bank. Very low post-fire effects due to limited burn of low severity.

Possible probability of occurrence with minor consequences = low risk

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Clear and maintain culvert

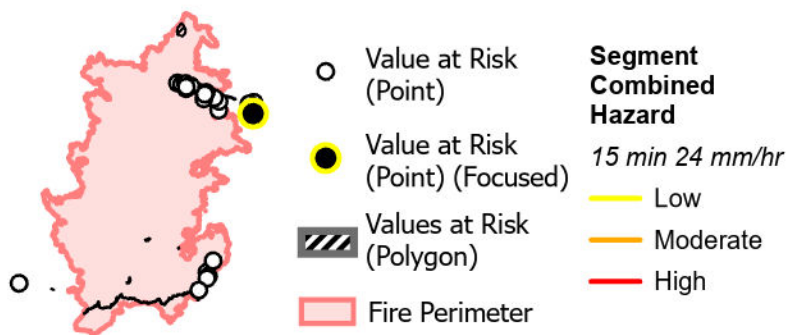
(3) Deflection structure

(4) NA

Text: NA

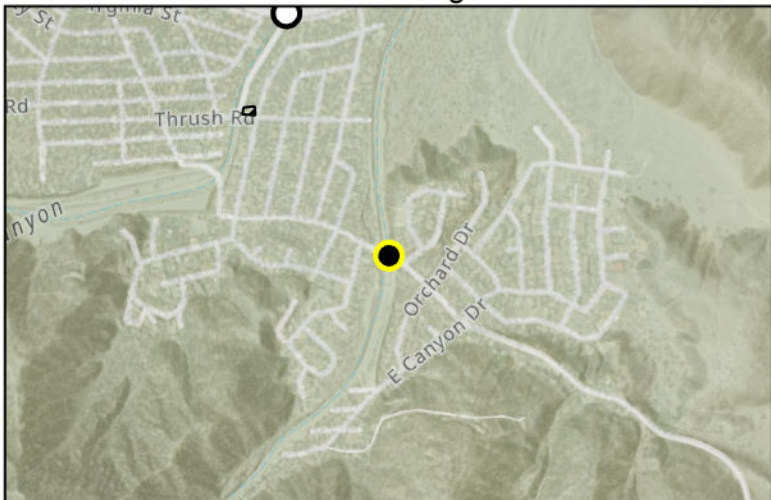
Description: Diverted flows will go into old channel on left bank.

LOCATION AND PHOTO



Latitude: 34.348967

Longitude: -117.614622



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Sheep Cyn

Site Number: WW_35

Feature: Bridge along Hwy 2

Feature Category: drainage structure

Field Observation or Potential Hazard: Bridge crossing. Appears adequately sized and should only become an issue under very large flows. If plugged, flows will be diverted down the highway. Potential for aggradation at downstream confluence which may impact bridge capacity.

Possible probability of occurrence with minor consequences = low risk

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

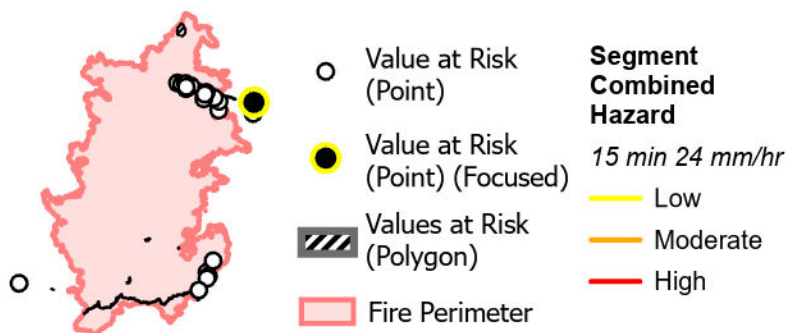
(3) NA

(4) NA

Text: NA

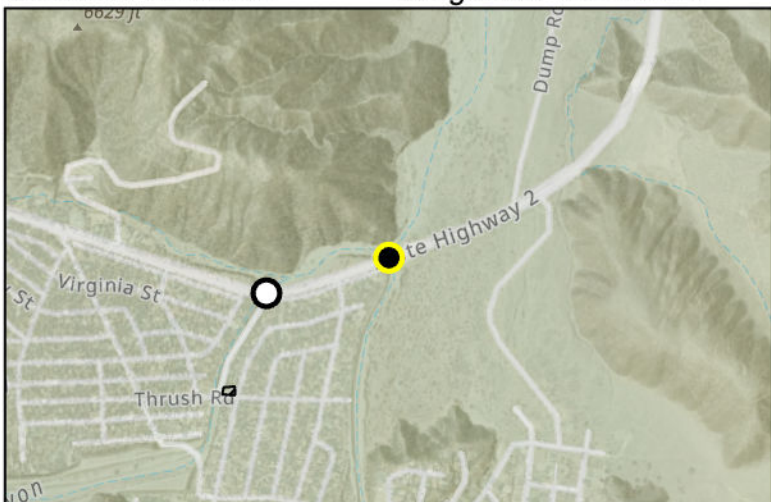
Description: Bridge appears to have experienced overtopping flows in 2023.

LOCATION AND PHOTO



Latitude: 34.356862

Longitude: -117.613424



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Camp 19

Site Number: EF_01

Feature: Inmate camp infrastructure.

Feature Category: multiple

Field Observation or Surface flooding of inmate Camp 19. Flows diverted from San Gabriel River and Upper Monroe Rd could
Potential Hazard: impact structures and block access to the inmate camp.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

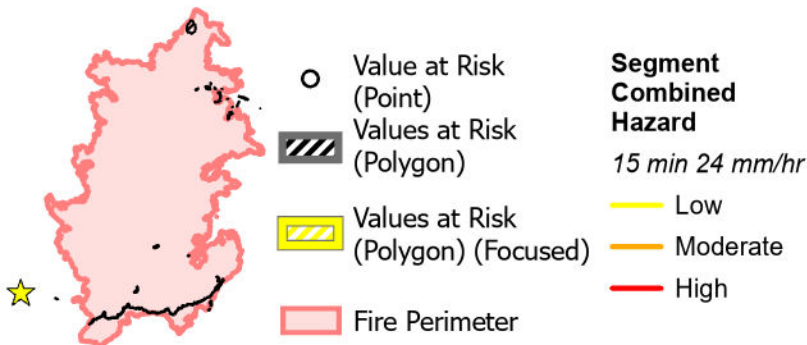
(3) Sandbags

(4) NA

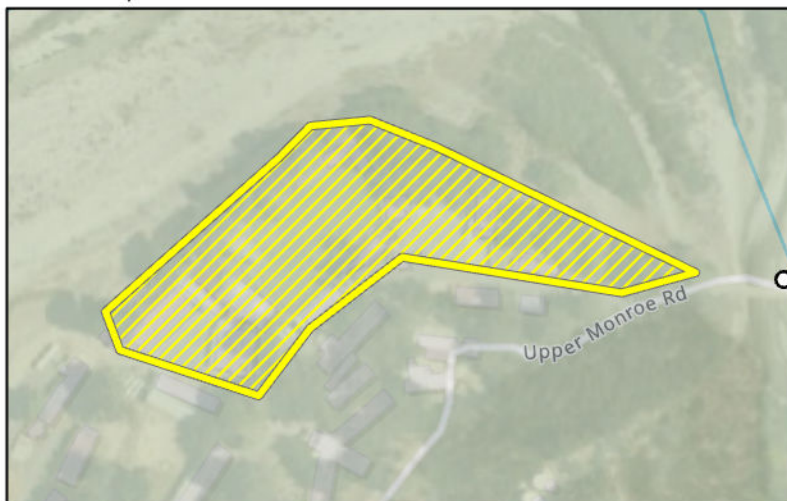
Text: Evacuate camp and install deflection structures to reduce impacts of flooding.

Description: Moderate and high flood hazards upstream will generate runoff and debris that can overtop the bridge and direct flows into the inmate camp.

LOCATION AND PHOTO



Scale: 1:3,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: East Fork San Gabriel

Site Number: EF_03

Feature: Residence.

Feature Category: multiple

Field Observation or Potential Hazard: Residential structures along river that are accessed by a bridge. Structures appear to be positioned on terrace above river. Risk of debris and flood flow may impact bridge and cutoff access. An extreme event may impact structures. Evaluated remotely

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) NA

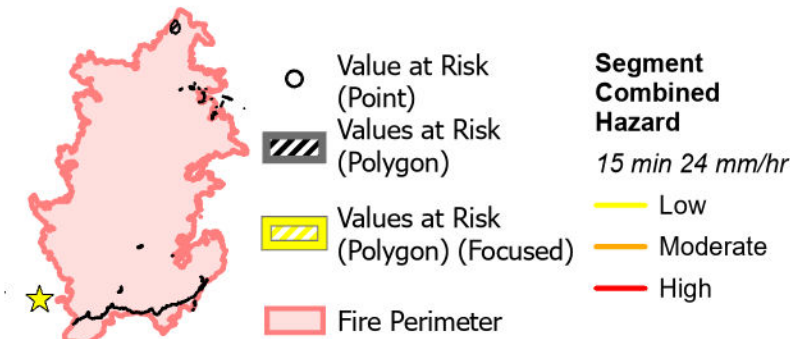
(3) NA

(4) NA

Text: NA

Description: Access may be lost during flooding. Behind locked gate, evaluated remotely.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: East Fork San Gabriel

Site Number: EF_04

Feature: Campground and 3 structures

Feature Category: recreational

Field Observation or Potential Hazard: Campground, cabin, and restroom structure on river terrace. Potential hazard is flood mobilizing burnt debris and soil and impacting structures or campers.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

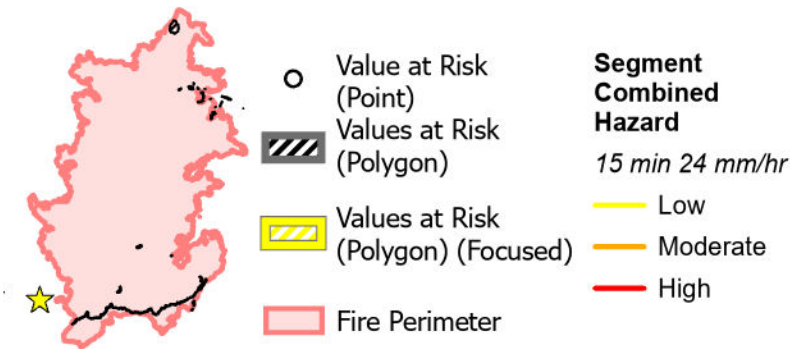
(3) Sandbags

(4) NA

Text: NA

Description: Area has a restroom on grade, raised grade cabin, shed, and ~20 campsites.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: East San Gabriel

Site Number: EF_05

Feature: Structures

Feature Category: multiple

Field Observation or Potential flood and debris flow hazards that may impact structures. Access to structures will be cut off due to Potential Hazard: flooding, rockfall, and debris flows.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) NA

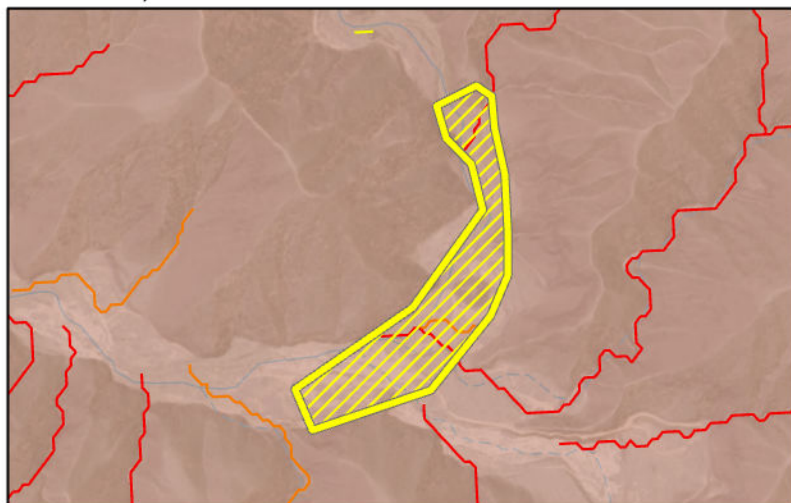
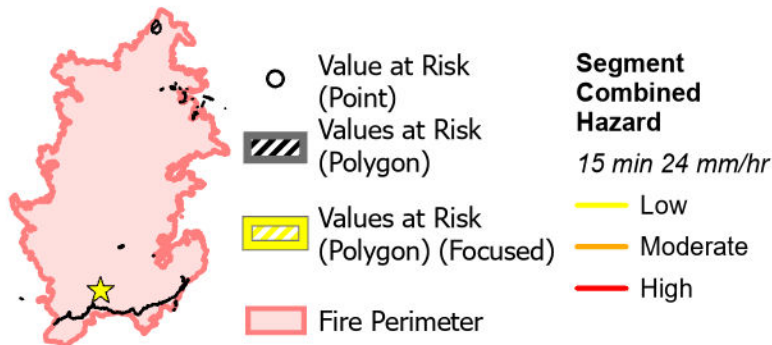
(3) NA

(4) NA

Text: NA

Description: Emergency access will likely be cut off due to damaged roads during and after storm events.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Coldwater Canyon

Site Number: EF_06

Feature: Structures

Feature Category: multiple

Field Observation or Flood and debris flows may impact structures. Access will likely be cutoff. Reviewed remotely.
Potential Hazard:

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

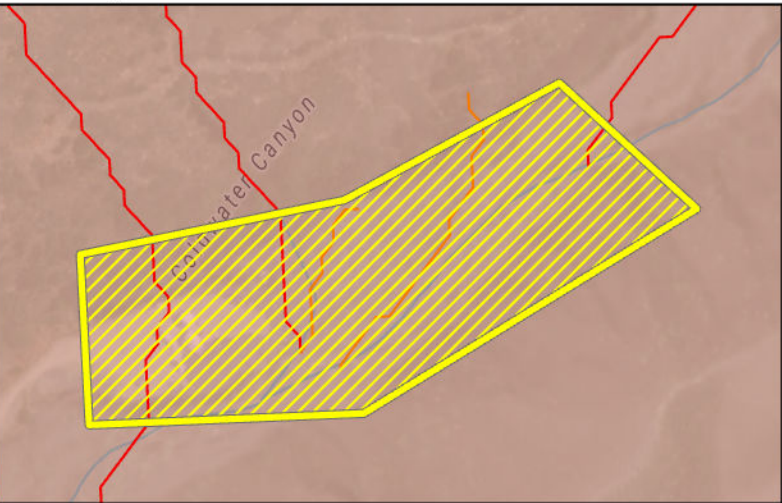
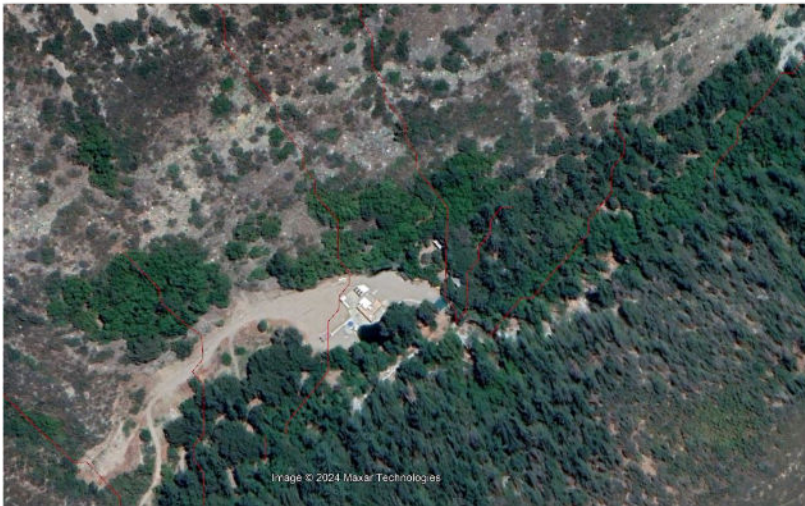
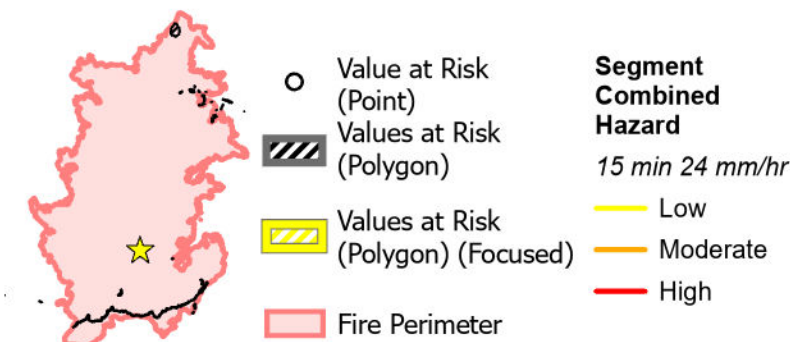
(3) NA

(4) NA

Text: NA

Description: Evaluated remotely due to locked gates.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Cattle Canyon

Site Number: EF_07

Feature: Structures and heavy equipment

Feature Category: other

Field Observation or Potential Hazard: Potential flood and debris flow hazards that can impact remote mining area. Due to remote location and **Potential Hazard:** inaccessibility, evaluated site remotely.

Potential Hazard to Life: moderate

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

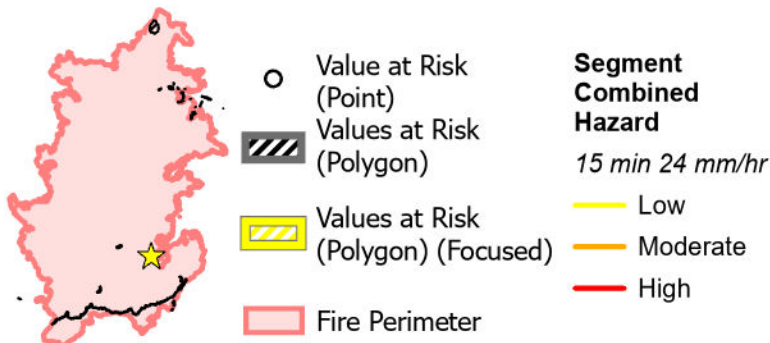
(3) NA

(4) NA

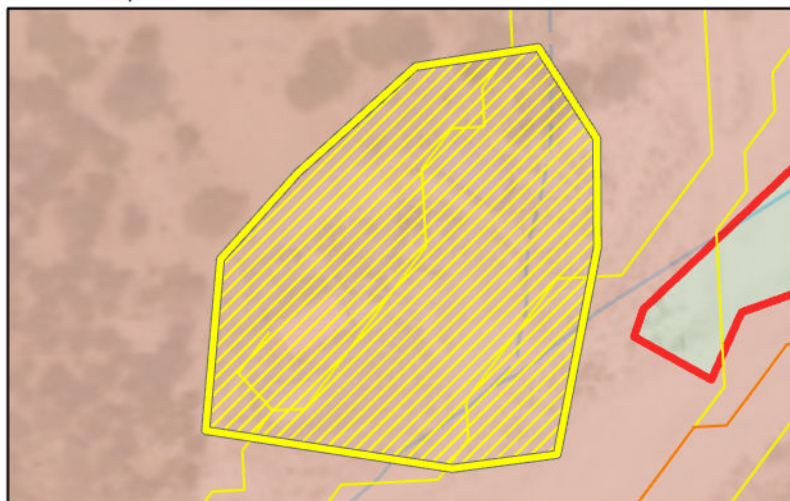
Text: NA

Description: Had to evaluate this site remotely due to access limitations. Site is adjacent to active channel and backs against steep slopes that show evidence of slope instability and debris flow activity.

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Glendora Ridge Road

Site Number: GRR_01

Feature: Glendora Ridge Road

Feature Category: other

Field Observation or Debris flow, rockfall, flood flow damage to Glendora Ridge Road that can limit access.

Potential Hazard:

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1)

(2) **Early Warning**

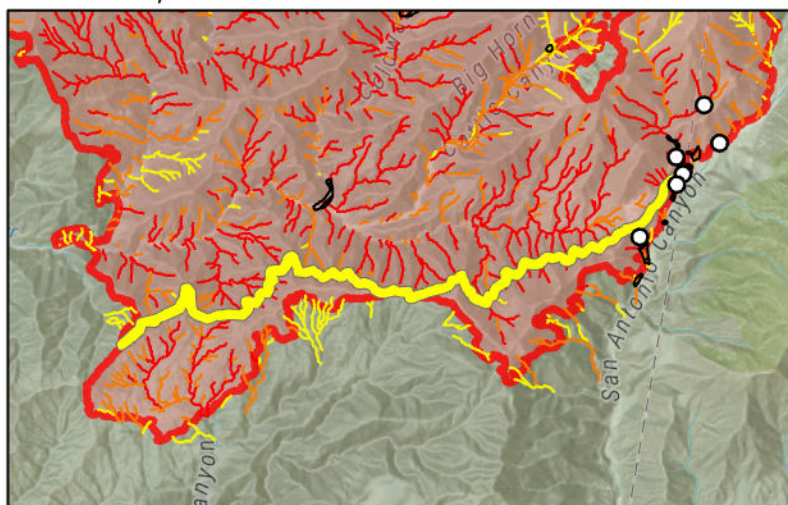
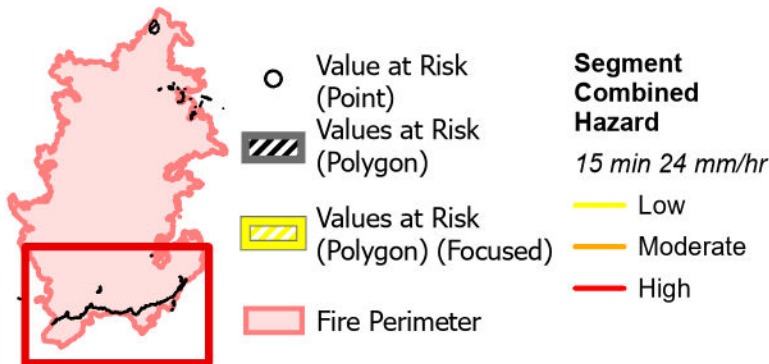
(3) **Monitor and maintain**

(4) **NA**

Text: NA

Description: Access along Glendora Ridge road will likely be cut off and reduce emergency services to Mount Baldy.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Jubilee Road

Site Number: Jub_01

Feature: Boy Scout Camp

Feature Category: other

Field Observation or Debris flood/flow that may overtop banks and impact improvements associated with a boy scout camp.

Potential Hazard: Assessed remotely due to locked gates.

Potential Hazard to Life: moderate

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **NA**

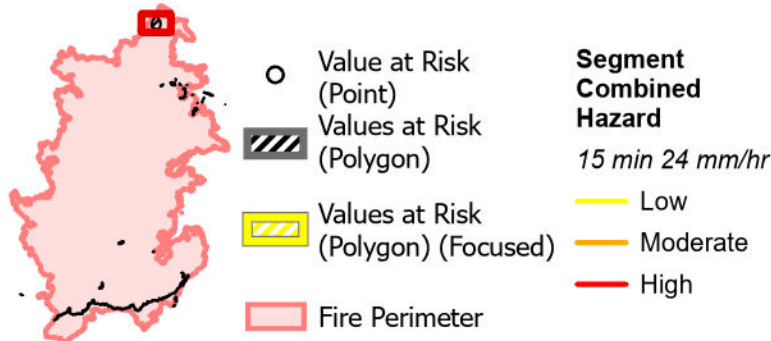
(3) **NA**

(4) **NA**

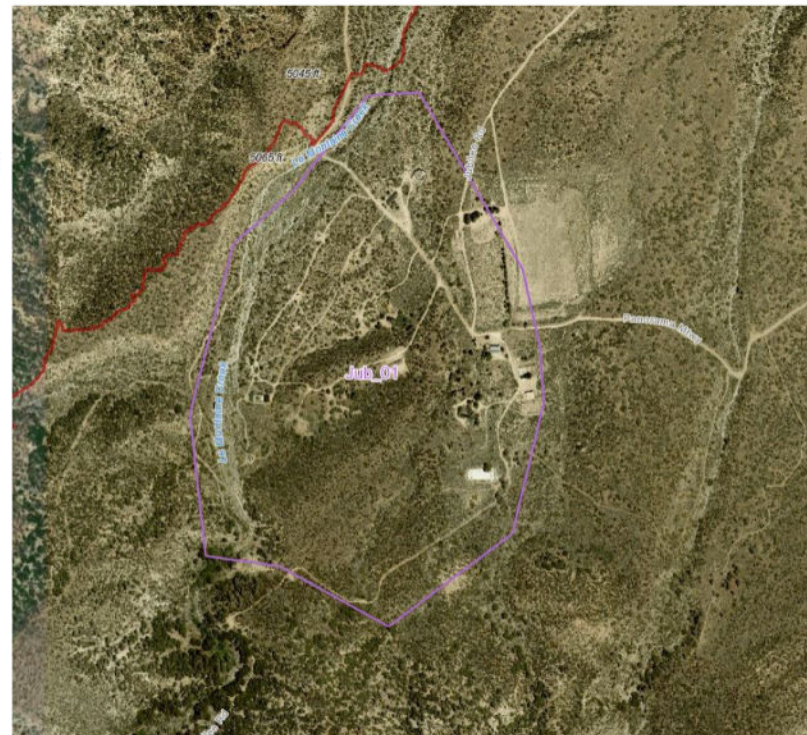
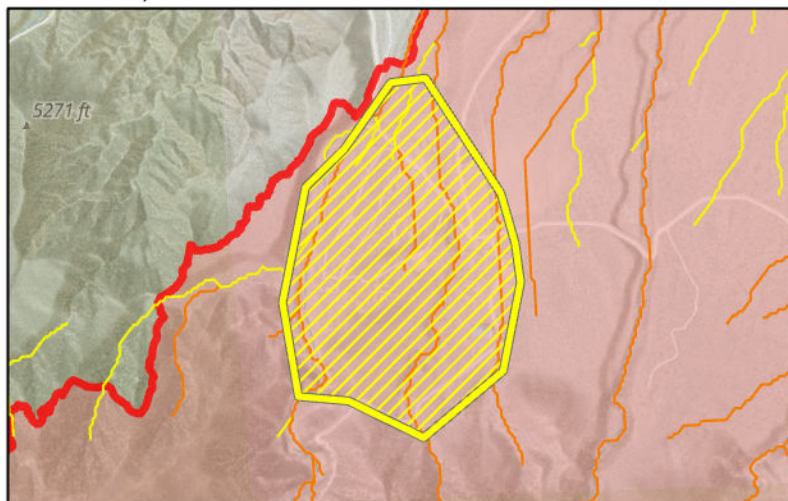
Text: NA

Description: Threat to life only exists if the camp is occupied. Most of the camping area appears to be out of direct flow paths. Access may be cut off along Panorama Mtnwy.

LOCATION AND PHOTO



Scale: 1:21,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Mt Baldy

Site Number: MB_01

Feature: Access along Glendora Ridge Road.

Feature Category: drainage structure

Field Observation or Potential Hazard: Debris Flood to Debris Flow hazards emendating from Bear Canyon and slopes above Glendora Ridge Rd.

Potential Hazard to Life: high

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

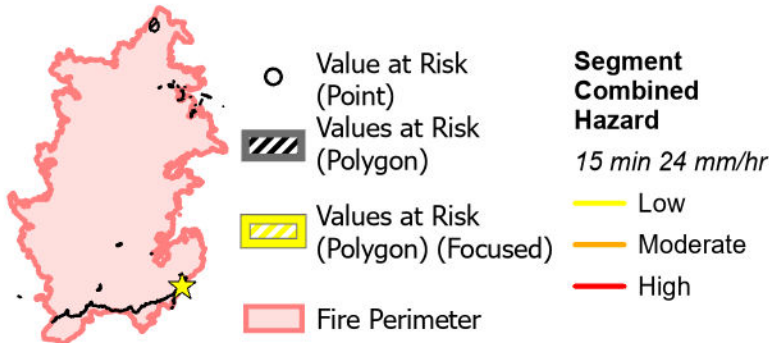
(3) Clear and maintain culvert

(4) NA

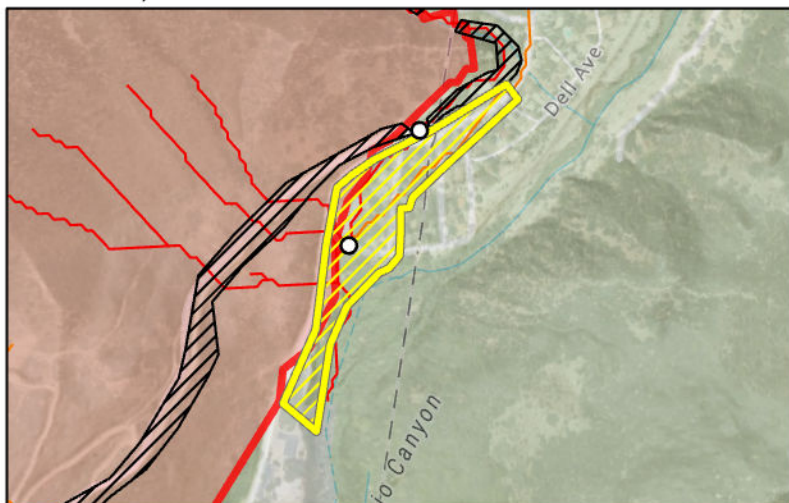
Text: Consider closing the road during potential events and installing deflections structures to control flow and direct it back into the channel and along roads to avoid impacts to residential structures.

Description: Debris flow hazards will likely impact road and could extend into built environment down gradient. Area was reported being impacted by previous flood flows in 2014.

LOCATION AND PHOTO



Scale: 1:12,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Mt. Baldy

Site Number: MB_03

Feature: Houses

Feature Category: home

Field Observation or Houses below burned 50-60% slopes with perched rocks/boulders. Potential hazard is that perched rock/
Potential Hazard: boulders mobilize due loss of vegetation/dry ravel and impact structures.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Debris barrier

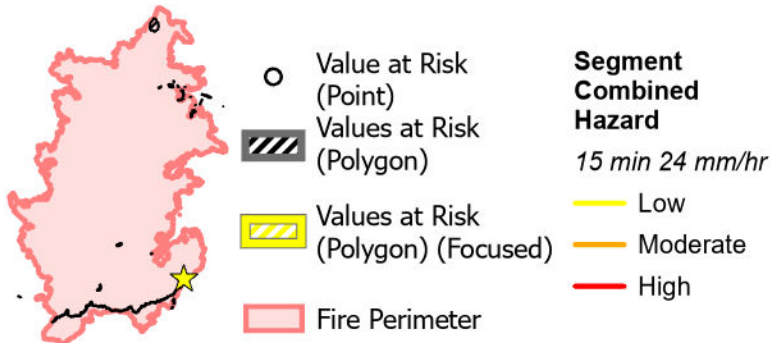
(3) NA

(4) NA

Text: Potentially a debris barrier may capture mobilized rock/boulders.

Description: Observed colluvial rock/boulders are generally sub-rounded and angular.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_04**

Feature: **Residence structures**

Feature Category: **home**

Field Observation or Debris flow and rockfall hazard

Potential Hazard:

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **NA**

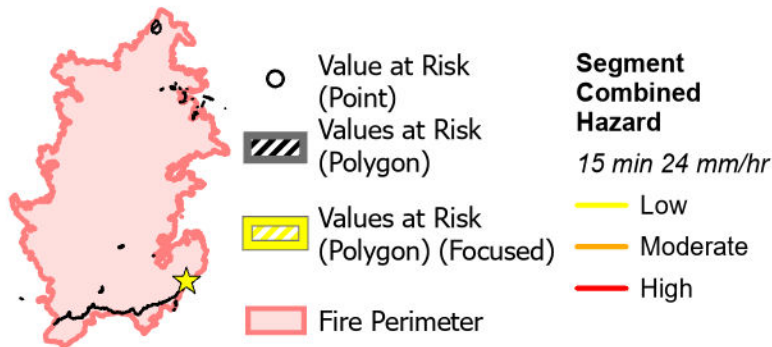
(3) **NA**

(4) **NA**

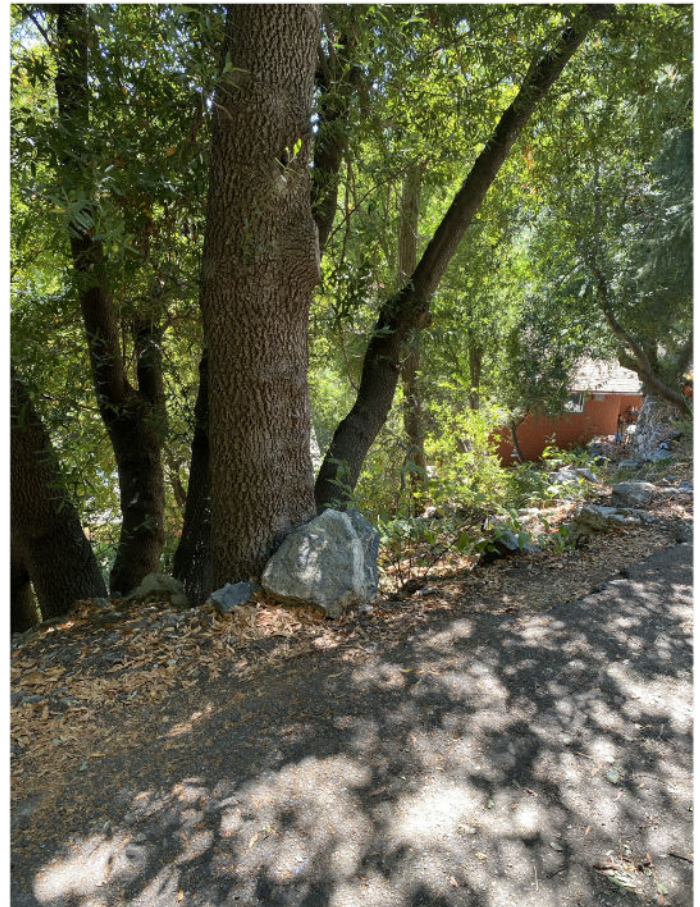
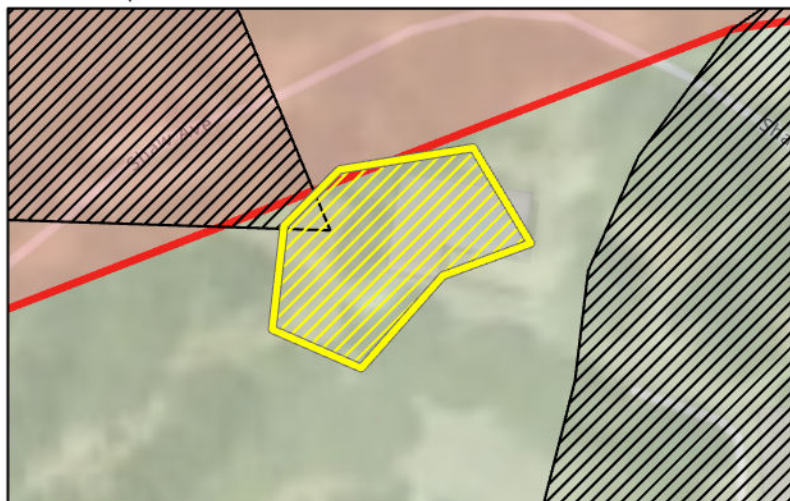
Text: NA

Description: Nearby resident described mudflow inundation of home to depth of 3-4 ft in 2014 rain event. Recently repaired road/retaining wall

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_05**

Feature: **NA**

Feature Category: **multiple**

Field Observation or Rockfall and debris flood to debris flow hazards. Rockfall hazards exist for structures burned.
Potential Hazard:

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Debris barrier**

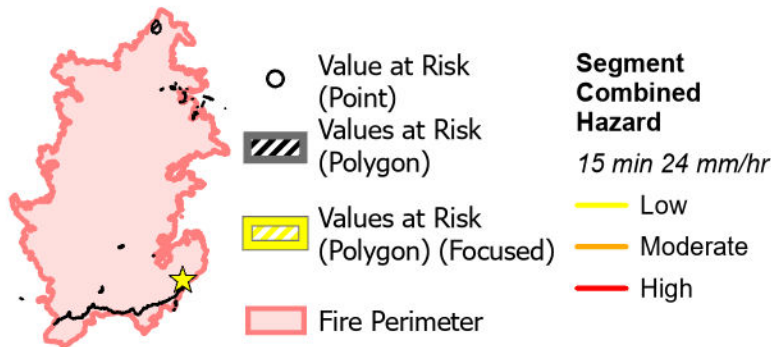
(3) **Deflection structure**

(4) **NA**

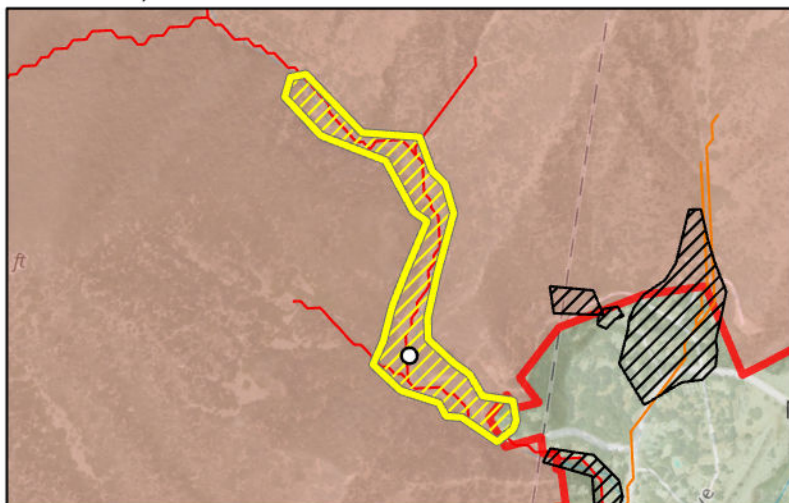
Text: Bear Canyon will not be safe during a significant runoff. Consideration to delay reconstruction of burnt structures until after the burn scar recovers a bit should be considered.

Description: Drainage is choked with sediment, debris, large wood with a large contributing area burned at moderate and high. Concern of debris flood and rockfall hazards that will impact temporary structures or structures under new construction.

LOCATION AND PHOTO



Scale: 1:10,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Mt Baldy

Site Number: MB_06

Feature: Residential Structures

Feature Category: multiple

Field Observation or Potential Hazard: Debris flood to Debris Flow could impact structures where channel has been laterally constrained by encroachment of surrounding development. Earthen berm on outside of bend may erode and get overtopped during a large runoff event.

Potential Hazard to Life: high

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

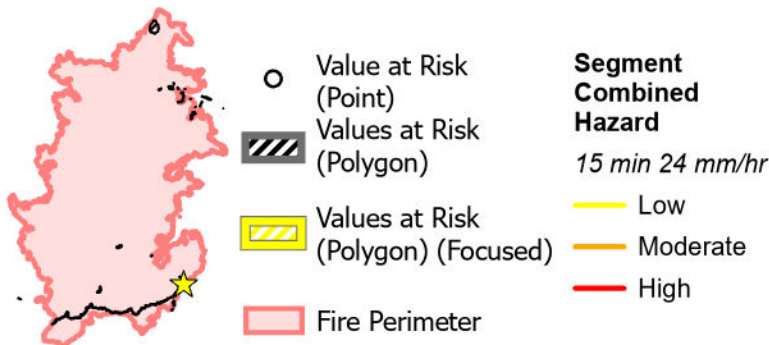
(3) NA

(4) NA

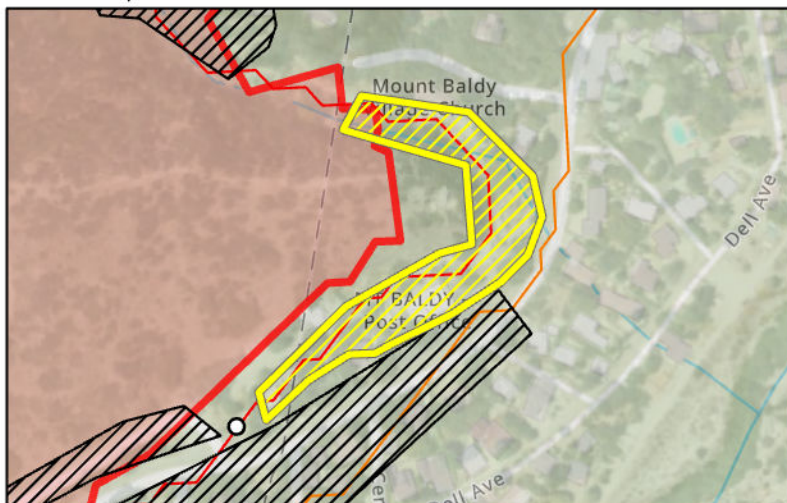
Text: Deflection structures along Mount Baldy Road may help direct overtopping flows down the road instead of into structures to the south.

Description: Uncertain if drainage has been sized to accommodate flow plus debris. Structures have encroached into channel zone. Evulsion potential exists along outside bend above fire station.

LOCATION AND PHOTO



Scale: 1:4,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_08**

Feature: **Residential structures.**

Feature Category: **multiple**

Field Observation or Potential Hazard: Debris flood to debris flow hazards within drainage will discharge into the built environment and impact structures.

Potential Hazard to Life: **high**

Potential Hazard to Property: **high**

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Deflection structure**

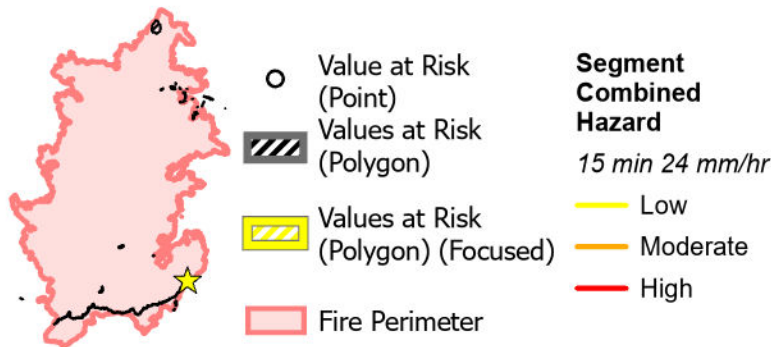
(3) **Monitor and maintain**

(4) **NA**

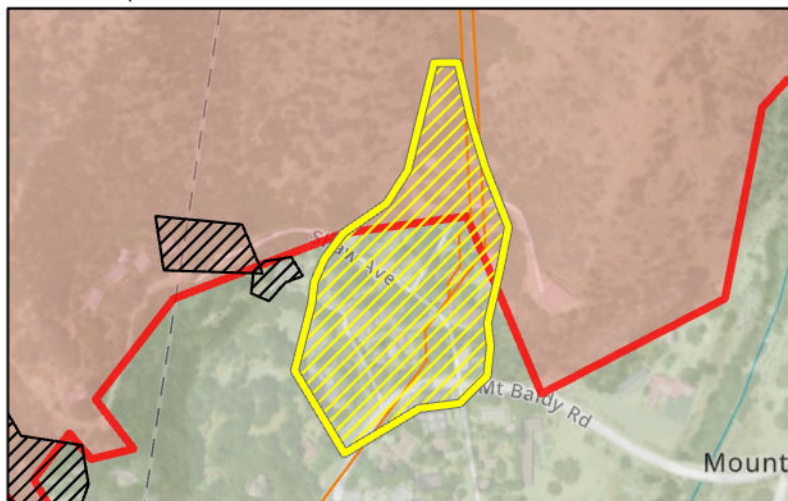
Text: Deflection structures should be considered to direct flows away from structures and attempt to constrain them to local roads for conveyance.

Description: Existing drainage shows evidence of past debris flows. Flow path is uncertain. Potential for sediment and flood waters impacting structures and access roads. Locals report debris and mud impacting structures in late summer of 2014.

LOCATION AND PHOTO



Scale: 1:5,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_11**

Feature: **Mount Baldy Rd.**

Feature Category: **other**

Field Observation or Potential Hazard: Debris flow and flooding along Mount Baldy Road that will cut off access.

Potential Hazard:

Potential Hazard to Life: **moderate**

Potential Hazard to Property: **moderate**

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Monitor and maintain**

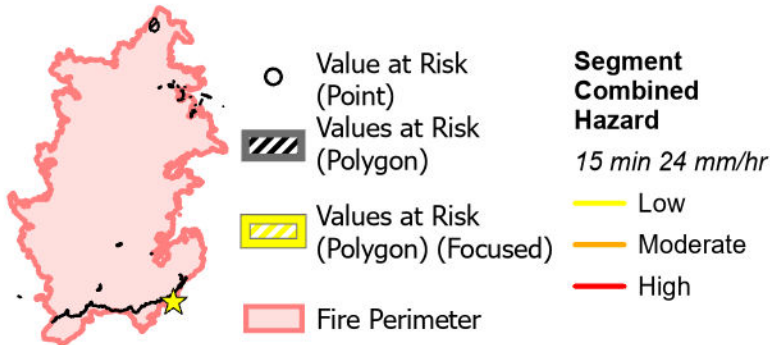
(3) **NA**

(4) **NA**

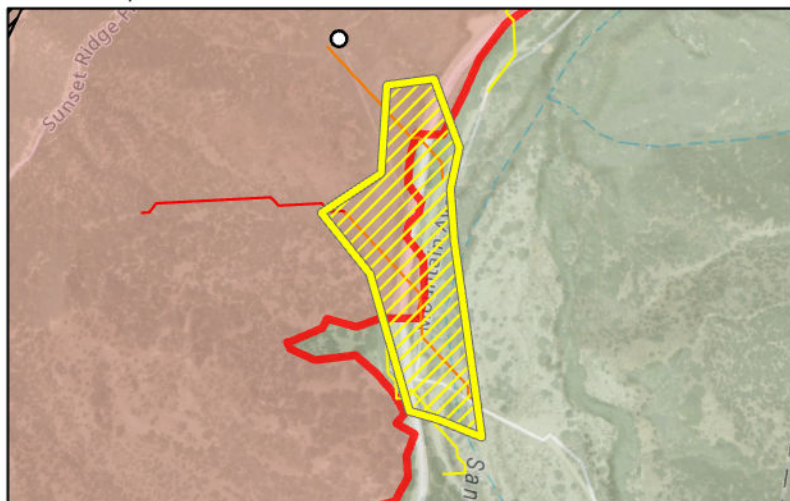
Text: NA

Description: Steep headwall burned at moderate plus with fan deposit above road.

LOCATION AND PHOTO



Scale: 1:9,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: **Mt Baldy**

Site Number: **MB_12**

Feature: **Mount Baldy Road**

Feature Category: **other**

Field Observation or Potential Hazard: Debris-flow prone slopes that will discharge debris and water onto Mount Baldy Road, limiting emergency access.

Potential Hazard to Life: **low**

Potential Hazard to Property: **low**

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Clear and maintain culvert**

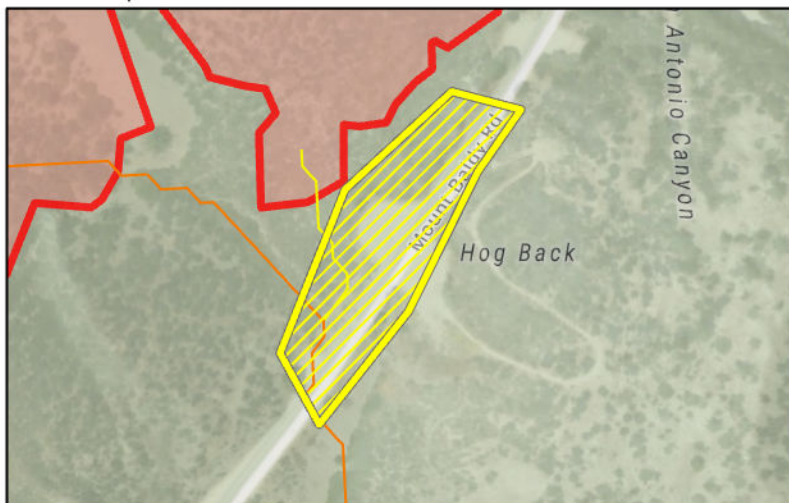
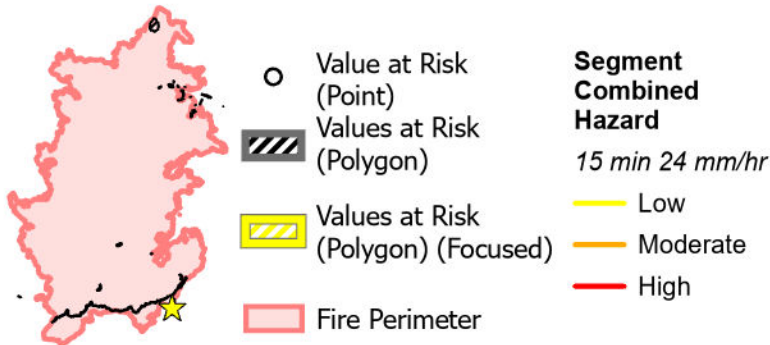
(3) **Signage**

(4) **NA**

Text: NA

Description: Slopes upgradient are burned at low. Presence of alluvial fans immediately above road. Roadcut has been recessed into fan with no observed failures. Sediment and debris may flow onto road and plug adjacent crossing structure.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Mt Baldy

Site Number: MB_15

Feature: Residential structures

Feature Category: home

Field Observation or Concentrated runoff diverted down and collected on Mount Baldy Road by an outside berm discharges through
Potential Hazard: an overside drain (MP 0.58) that could impact downslope buildings.

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Clear and maintain culvert

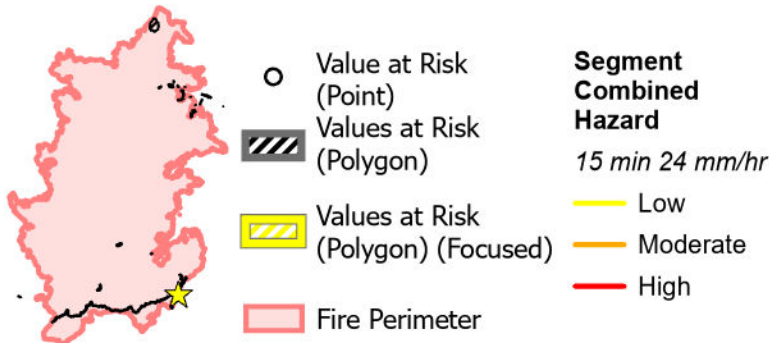
(3) Deflection structure

(4) NA

Text: NA

Description: Diverted and concentrated flow will drain off Mount Baldy Road that may overwhelm the drainage structure and result in overtopping flows that may impact downslope residences.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Government Cyn

Site Number: WW_06

Feature: Utility structures

Feature Category: utilities

Field Observation or Utility structures on fan below burned drainage. Potential hazard is flood that could mobilize burnt debris and
Potential Hazard: impact structures/infrastructure

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

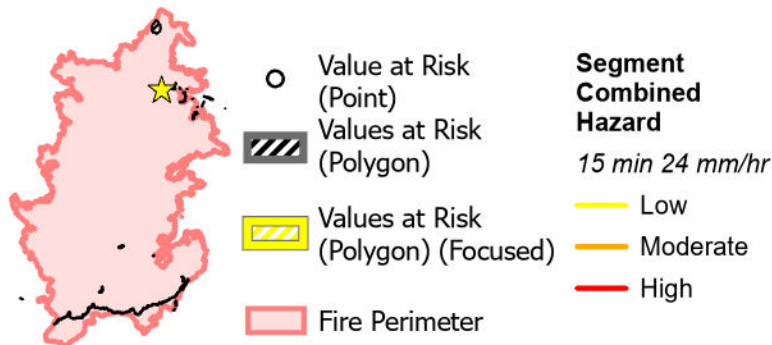
(3) NA

(4) NA

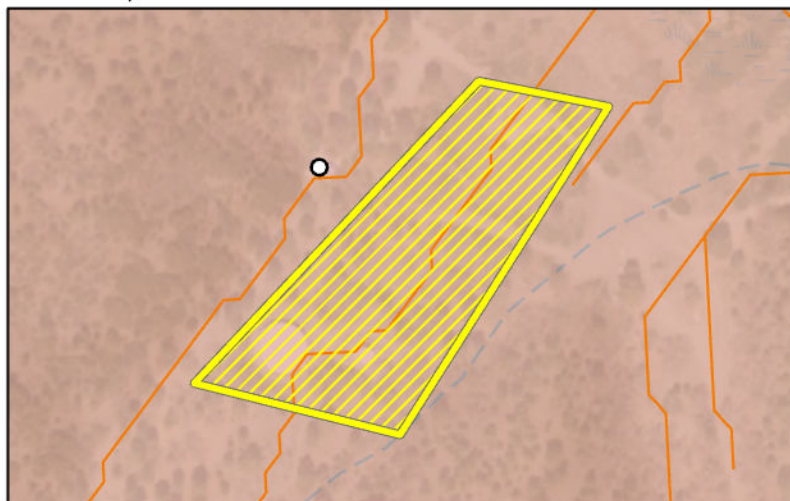
Text: Further evaluation may determine effectiveness of deflection structure. Restrict access during predicted high intensity storms

Description: Utilities located below mouth on fan. Much of 250-acre catchment is moderate or high sbs.

LOCATION AND PHOTO



Scale: 1:4,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_08

Feature: Houses, two burned

Feature Category: home

Field Observation or Several houses and LA Sheriff training facility on fan. Two structures appear burned. Numerous flow paths

Potential Hazard: make it difficult to determine where flow concentrates. Potential hazard is flood that could mobilize fine sediment/debris and impact structures.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Deflection structure**

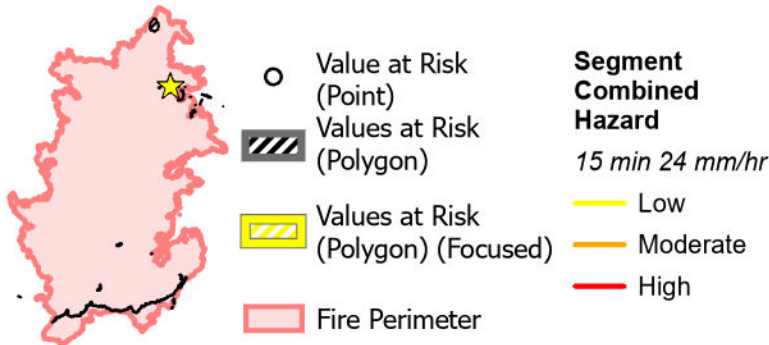
(3) **NA**

(4) **NA**

Text: Further evaluation may determine effectiveness of deflection structure. Don't relocate temporary housing in potential flow paths.

Description: Observed berm in channel appears to stop drainage upslope of houses with no diversion. Most of 90-acre drainage is burned at moderate and high sbs.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_09

Feature: House

Feature Category: home

Field Observation or House at apex of fan. Drainage has been diverted to west of house. Potential hazard is flood that could mobilize
Potential Hazard: fine sediment/rocks and impact structure.

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

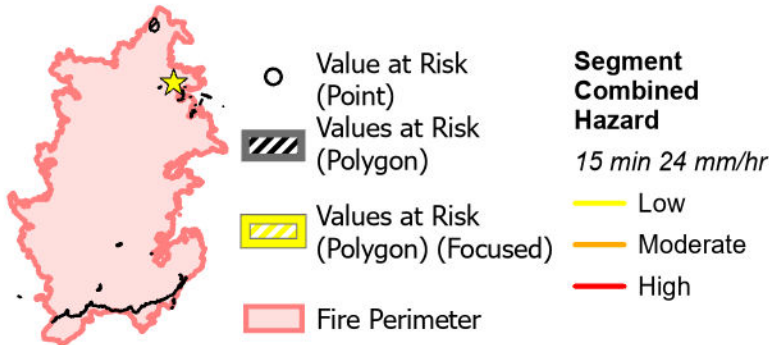
(3) Deflection structure

(4) Debris barrier

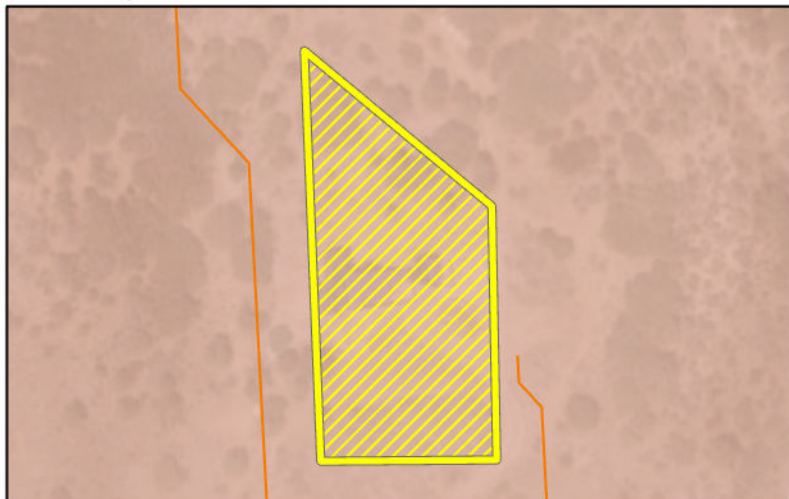
Text: Drainage diversion should be maintained. Further evaluation may determine effectiveness of deflection structure/debris barrier.

Description: Homeowner was aware of flood potential. He asked that I not photograph structure or property. Most of 35-acre catchment is burned at moderate and high sbs.

LOCATION AND PHOTO



Scale: 1:3,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_10

Feature: Houses

Feature Category: home

Field Observation or 3 homes within fan with evidence of debris flows. Potential hazard is flood mobilizing burnt debris, soil, and rock
Potential Hazard: and impacting structures.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

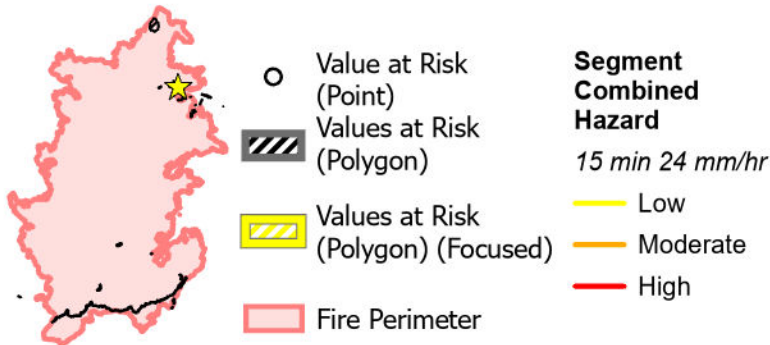
(3) Monitor and maintain

(4) NA

Text: NA

Description: Debris flow and debris flood hazard to homes on fans. Western basin has more drainage area and rockier fan deposit with debris flow evidence. Eastern basin has less drainage area and more planar fan deposit without channel on fan. Westernmost home has several foot tall berm above it. Overlying slopes exhibit debris slide slope and landslide characteristics. Protective berms are a feasible here with available room and access

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_13

Feature: structure, home?

Feature Category: home

Field Observation or 1 structure in fan and likely at bottom of drainage based on LiDAR. Potential hazard is flood mobilizing burnt
Potential Hazard: debris and soil and impacting structures.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Debris barrier

(2) Early Warning

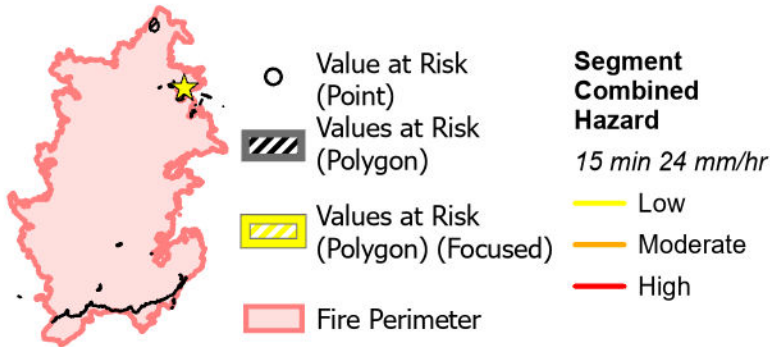
(3) Monitor and maintain

(4) Sandbags

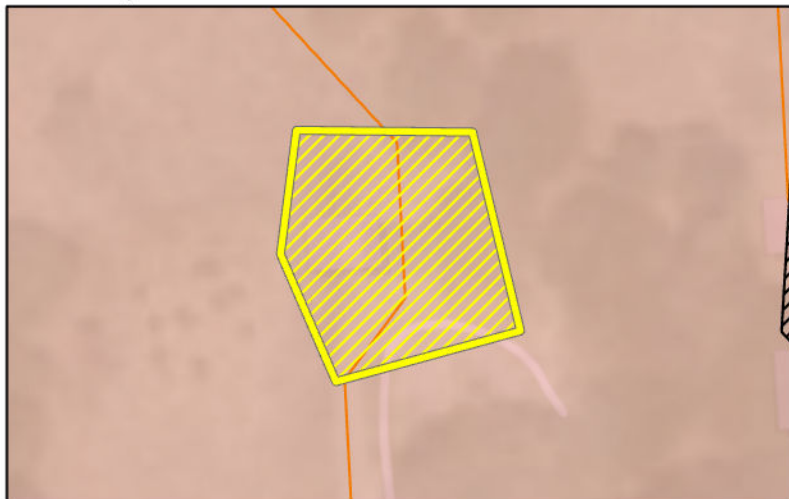
Text: NA

Description: VAR is a structure with green roof. Could not access property and observed this property from road. Overlying slopes have debris slide slope characteristics and are moderate severity burn.

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_14

Feature: Home

Feature Category: home

Field Observation or Home in fan. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.
Potential Hazard:

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

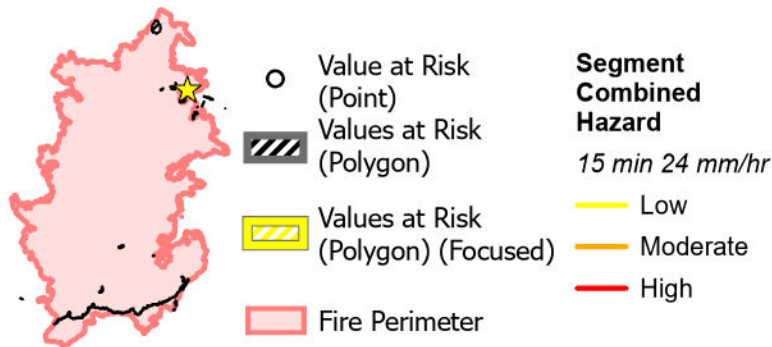
(3) Debris barrier

(4) NA

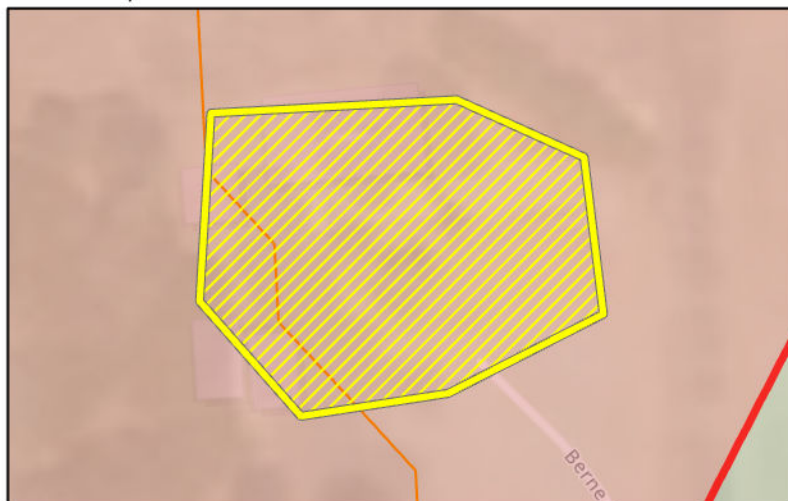
Text: NA

Description: Could not access property to closely observe fan or structure. Overlying basin exhibits debris slide slope characteristics. Several undeveloped pads also within or below alluvial fan.

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Flume Cyn

Site Number: WW_16

Feature: Houses

Feature Category: home

Field Observation or Potential Hazard: Houses at outlet of 2 burned drainages. Potential hazard is flood that could mobilize burnt debris and impact structures.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

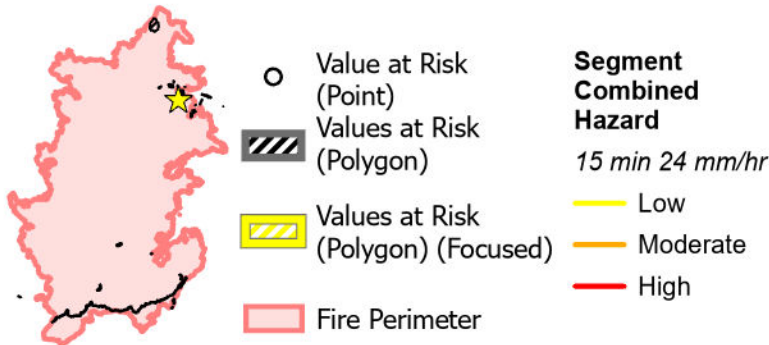
(3) NA

(4) NA

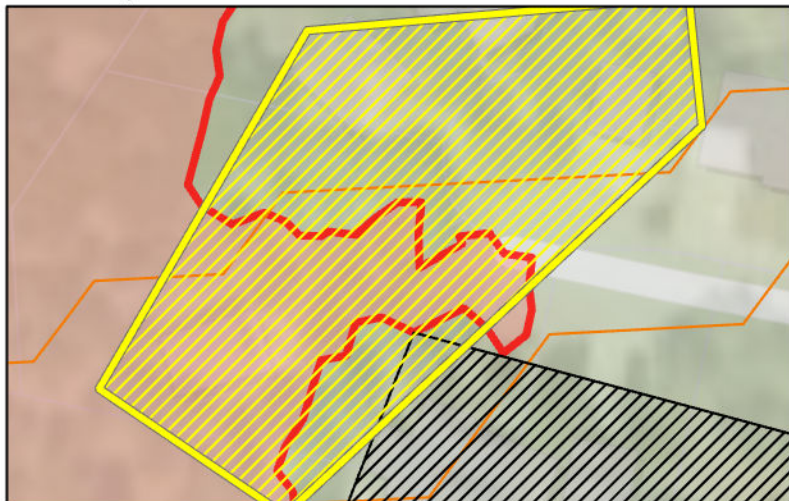
Text: Further evaluation may be appropriate to determine the functionality of a deflection structure. Don't relocate temporary housing in potential flow paths.

Description: Four houses in drainage, with one of them burned. Much of the sbs within 100-acre drainage is moderate.

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Flume Cyn

Site Number: WW_17

Feature: Houses

Feature Category: home

Field Observation or Potential Hazard: Houses at outlet of 2 burned drainages. Potential hazard is flood that could mobilize burnt debris and impact structures.

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Deflection structure

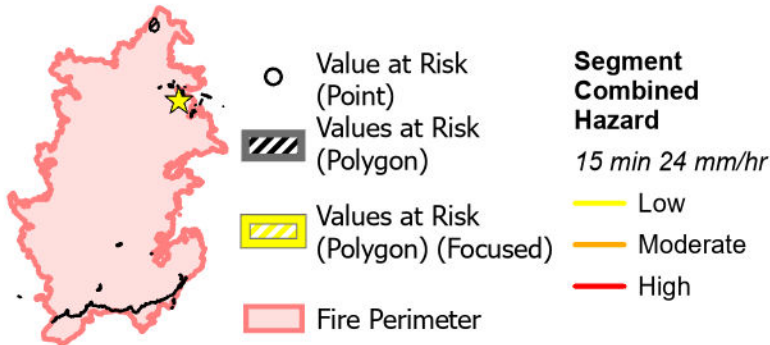
(3) NA

(4) NA

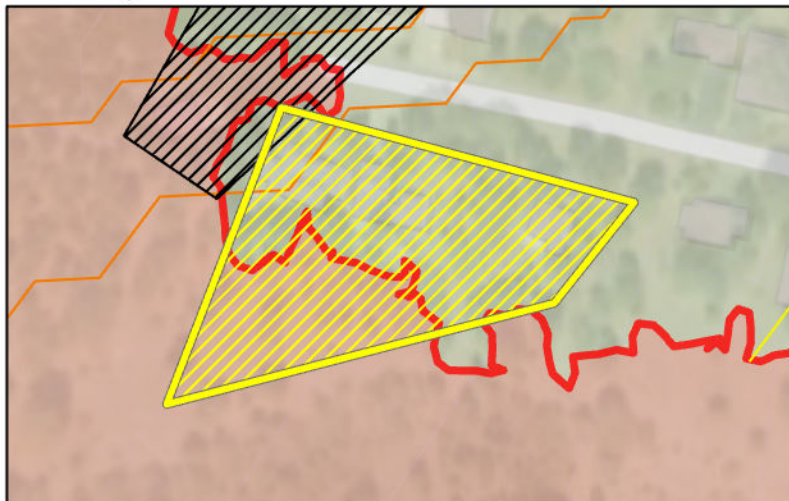
Text: Further evaluation may be appropriate to determine the functionality of a deflection structure. Don't relocate temporary housing in potential flow paths.

Description: Four houses in drainage, with one of them burned. Much of the sbs within 100-acre drainage is moderate.

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Flume Cyn

Site Number: WW_18

Feature: Houses

Feature Category: home

Field Observation or Houses located on low terrace at outlet of fan. Drainage channel appears to ramp onto terrace. Potential hazard
Potential Hazard: is debris flow/flood that could mobilize burnt debris and impact structures.

Potential Hazard to Life: high

Potential Hazard to Property: high

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

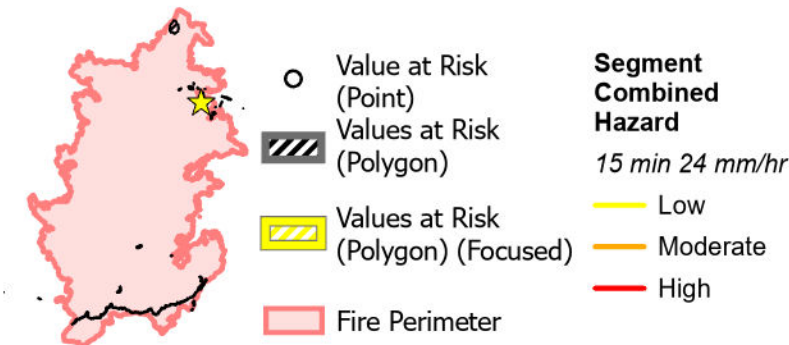
(3) Debris barrier

(4) NA

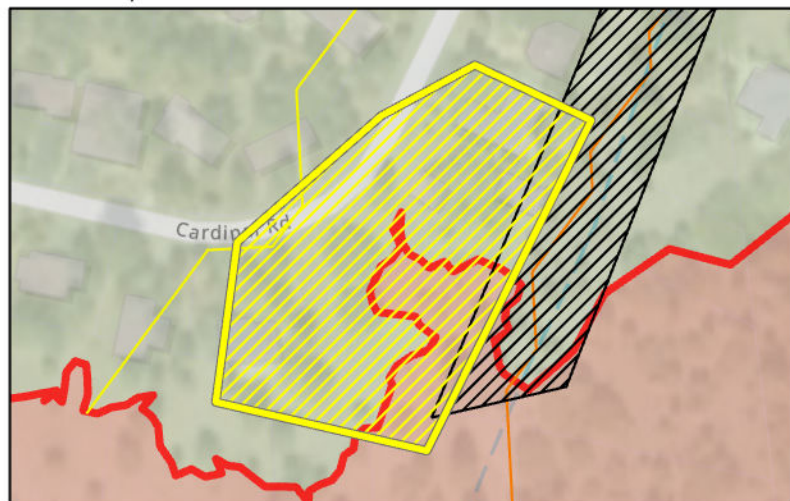
Text: Further evaluation will determine effectiveness of debris barrier/deflection struction.

Description: Houses on fan at mouth of drainage. Homeowner says flows reach top of channel but have not overtopped in 37 years. 3' diameter boulders in channel and on terrace. Apparent "ramp" from channel to terrace upstream of houses. Much of 400-acre catchment is moderate and high sbs.

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Flume Cyn

Site Number: WW_18b

Feature: Residential structures

Feature Category: multiple

Field Observation or Debris Flow/Flood mobilizing sediment and debris that may cause localized debris jams that can force flows
Potential Hazard: over channel banks.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

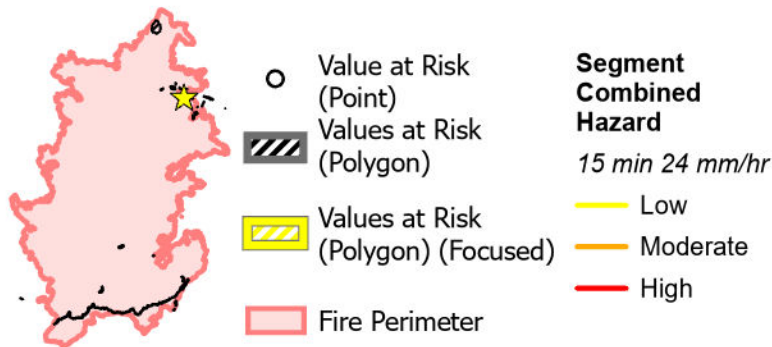
(3) Deflection structure

(4) Sandbags

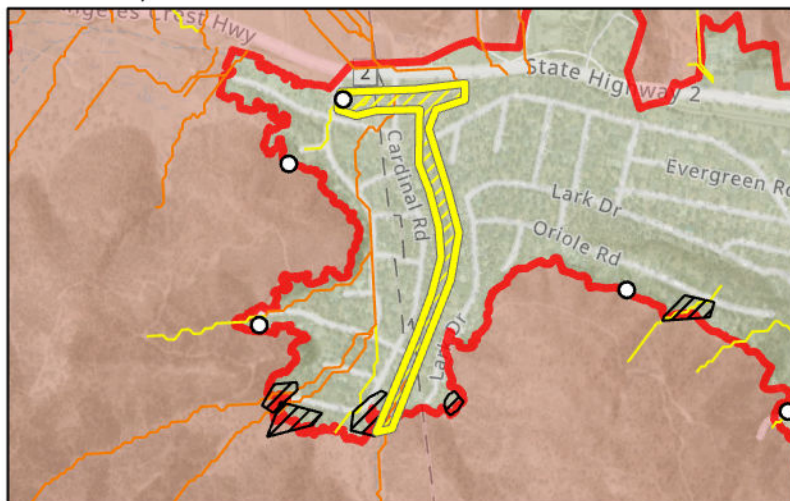
Text: NA

Description: This hazard will be analyzed in more detail after performing hydrologic and hydraulic modeling.

LOCATION AND PHOTO



Scale: 1:17,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Flume Cyn

Site Number: WW_19

Feature: 2 homes

Feature Category: home

Field Observation or 2 homes within fan. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.
Potential Hazard:

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Sandbags

(2) Monitor and maintain

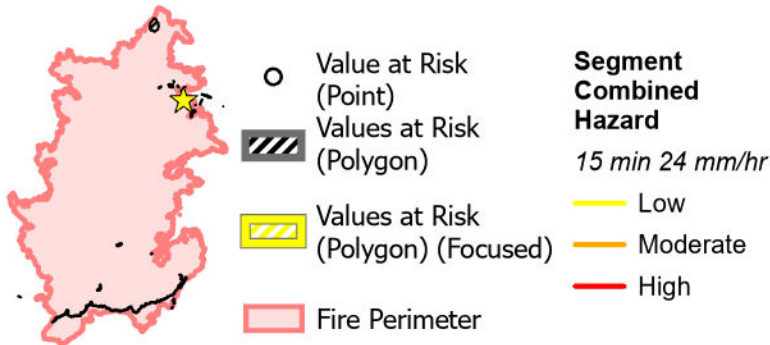
(3) Early Warning

(4) NA

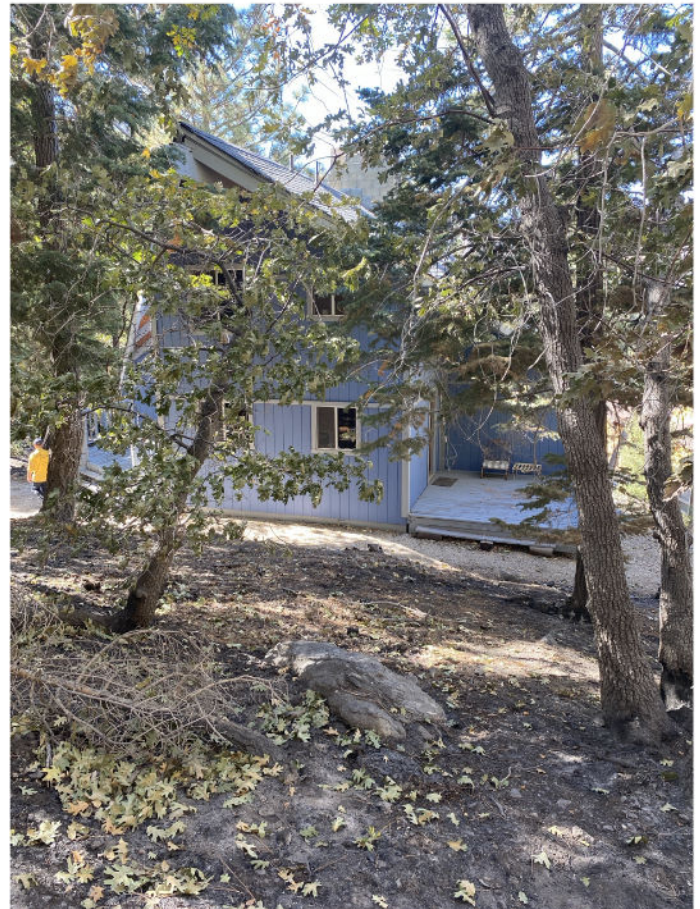
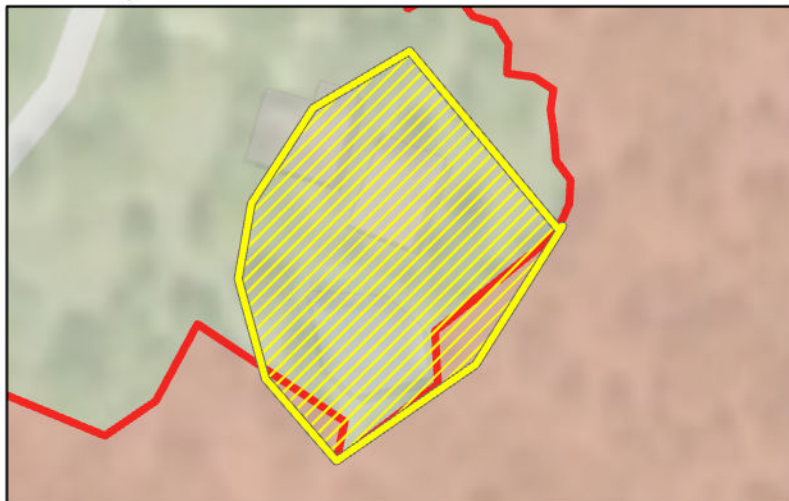
Text: NA

Description: Overlying slopes exhibit old debris slide slope characteristics. Minimal evidence of geologically recent debris flow deposits near homes. Low overlying burn severity, however high mortality of white fir likely. Boulders several feet wide are deposited in overlying gullies

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_21

Feature: Houses

Feature Category: home

Field Observation or Houses within mouth of burned drainages. Earthen berm along upslope house directs flow to lower house.

Potential Hazard: Potential hazard is flood that could mobilize fine sediment/small rocks and impact structures.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

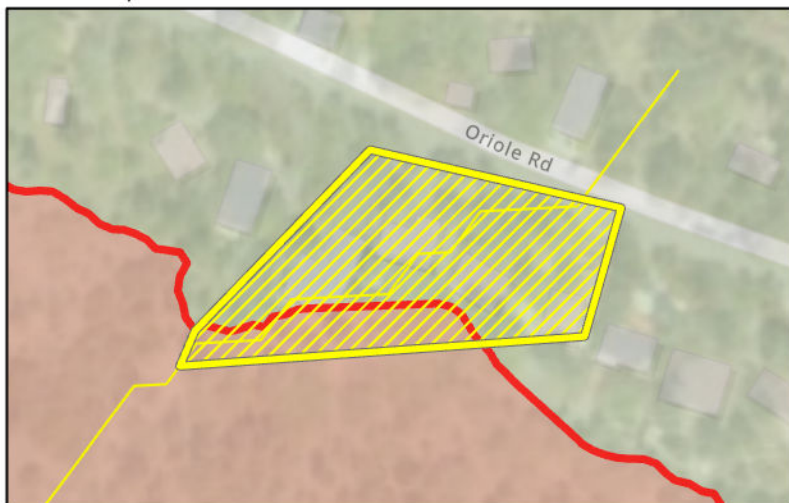
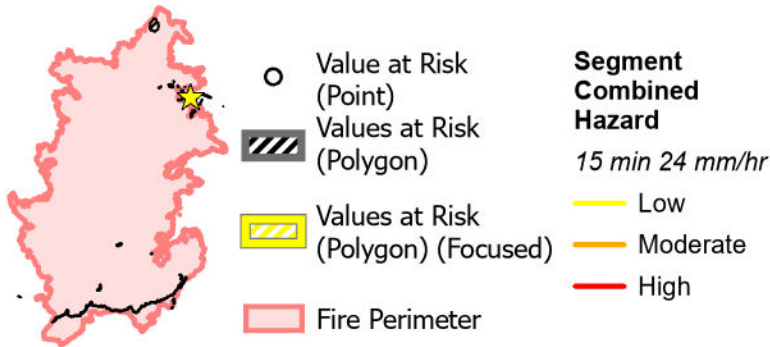
(3) NA

(4) NA

Text: NA

Description: Earthen berm is approximately 3' high. Generally low sbs within the 15-acre catchment above.

LOCATION AND PHOTO



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_23

Feature: House and shed/garage

Feature Category: home

Field Observation or 1 home and 1 garage within fan. Potential hazard is flood mobilizing burnt debris and soil and impacting
Potential Hazard: structures.

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Monitor and maintain

(2) Early Warning

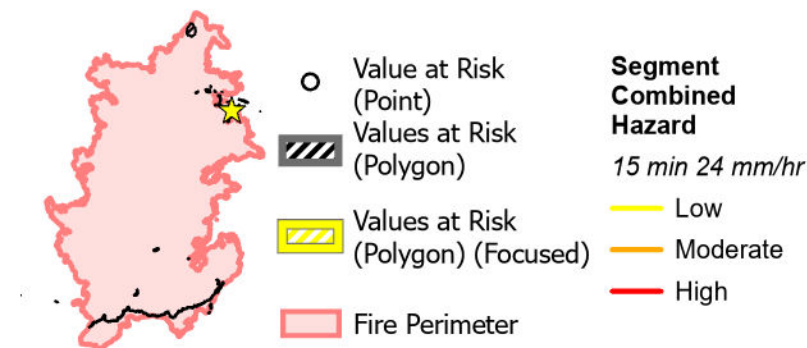
(3) NA

(4) NA

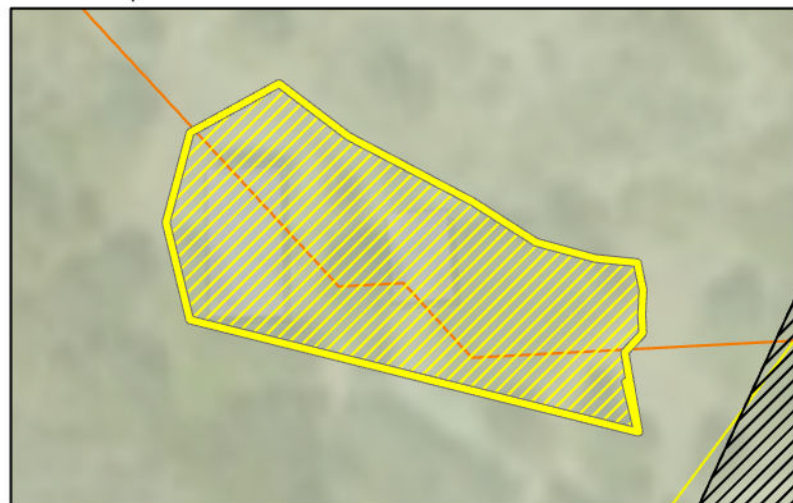
Text: NA

Description: Fan exhibits minimal evidence of past debris flow, consisting of only one older matrix supported debris deposit above old oak. These structures are at moderate risk rather than low due to moderate severity burn. Channel at fan apex does not clearly continue to home and has been filled in during grading. Drainage alignment continues to house in below bar polygon and the next two homes below included in other adjacent low/low VAR.

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_24

Feature: 3 homes

Feature Category: home

Field Observation or 3 homes within or below fans. Potential hazard is flood mobilizing burnt debris and soil and impacting
Potential Hazard: structures.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Monitor and maintain

(2) Early Warning

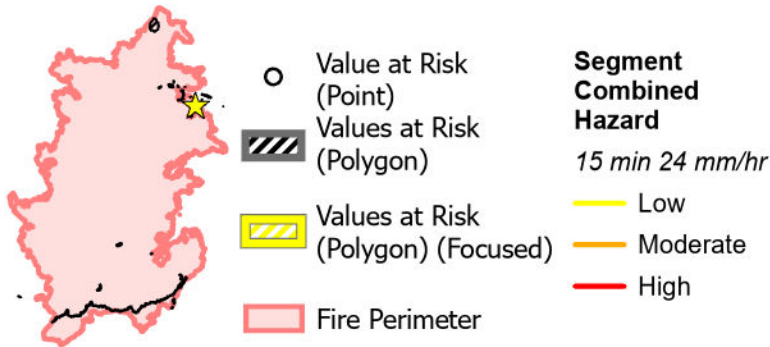
(3) NA

(4) NA

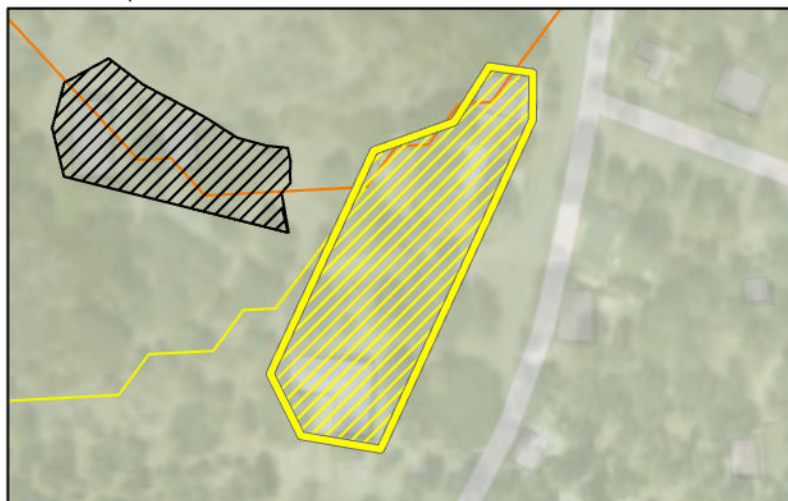
Text: NA

Description: Apex of fan above southernmost home has angular matrix supported deposits and 4 ft boulders, lower part of fan has more subdued topography, so geologically recent debris flows have not traveled to home locations. Flooding appears to route around southernmost home and onto driveway. Northernmost home more likely to receive flood flow from northern (other) drainage but has similar low risk to both homes to the south.

LOCATION AND PHOTO



Scale: 1:2,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_26

Feature: 4 homes and outbuilding

Feature Category: home

Field Observation or 4 homes within or below fan. Potential hazard is flood mobilizing burnt debris and soil and impacting structures.
Potential Hazard:

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) Monitor and maintain

(2) Early Warning

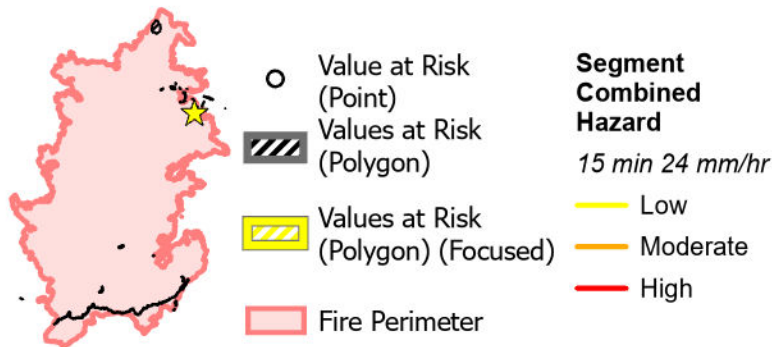
(3) NA

(4) NA

Text: NA

Description: The 2 northernmost homes are lower in elevation from drainage and could receive flows even though not centered in fan. The home south of polygon not included due to higher position above drainage.

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_27

Feature: Camp structures

Feature Category: home

Field Observation or Youth camp structures on debris flow fan. Main drainage is directed to east edge of cyn. Potential hazard is
Potential Hazard: flood that could mobilize burnt debris and impact structures.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Monitor and maintain

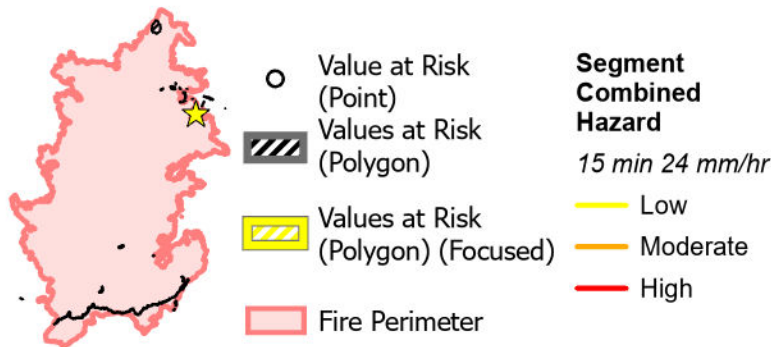
(3) NA

(4) NA

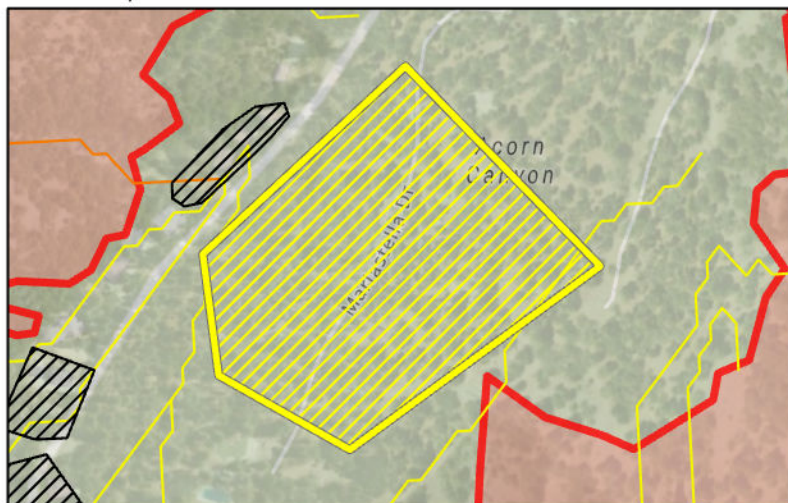
Text: Maintain drainage diversion. Consider closing the camp when high intensity storm events are predicted.

Description: Most of sbs within 350-acre catchment above is low.

LOCATION AND PHOTO



Scale: 1:5,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_28

Feature: Houses

Feature Category: home

Field Observation or Houses at mouth of burned drainage on fan. Potential hazard is flood that could mobilize burnt debris and
Potential Hazard: impact structures.

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) NA

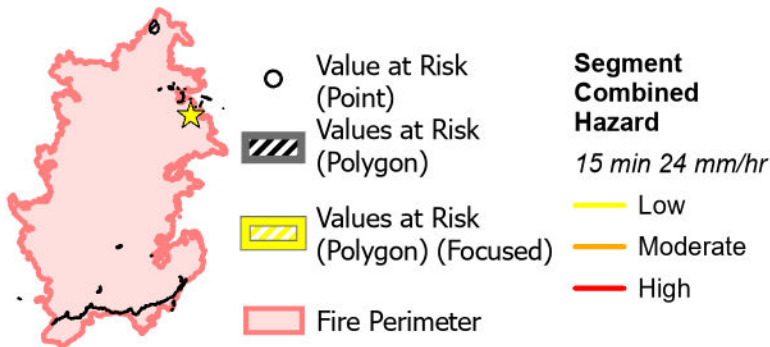
(3) NA

(4) NA

Text: NA

Description: Evidence of alluvial flow with houses cut into toe of fan. Most of 24-acre catchment is burned at low sbs.

LOCATION AND PHOTO



Scale: 1:1,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_29

Feature: Houses and water tank

Feature Category: home

Field Observation or Houses and water tank located on debris flow fan. Relic channels observed west of main drainage. Potential
Potential Hazard: hazard is flood that could mobilize burnt debris and impact structures.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1)

(2) **Early Warning**

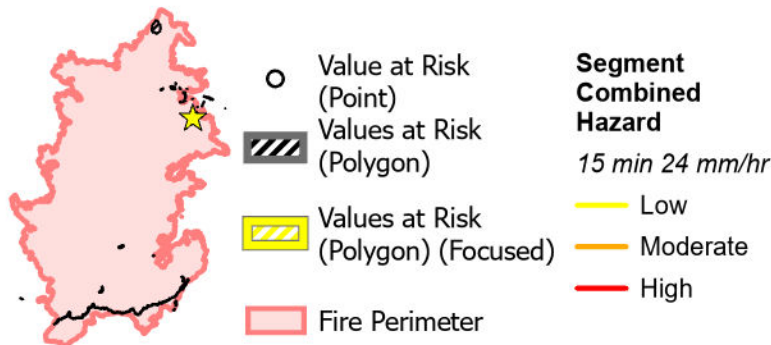
(3) **Deflection structure**

(4) **NA**

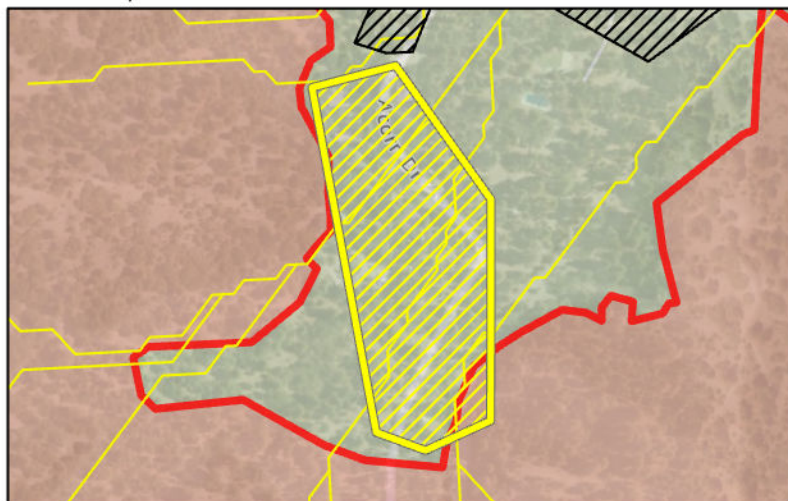
Text: Further evaluation to determine whether a deflection structure could be beneficial.

Description: Alluvial and debris flow deposits observed on fan along with relic channels. Mostly low with patches of moderate sbs above.

LOCATION AND PHOTO



Scale: 1:6,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Acorn Cyn

Site Number: WW_30

Feature: Houses

Feature Category: home

Field Observation or Acorn Cyn drainage is directed though built environment. Channel is confined and offset across streets with no **Potential Hazard:** watercourse crossing. Eventually the drainage outlets onto Pine Rd with no structure.

Potential Hazard to Life: low

Potential Hazard to Property: low

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Sandbags**

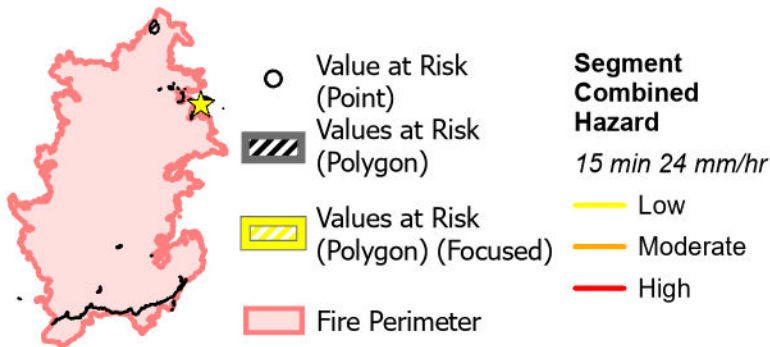
(3) **Clear and maintain culvert**

(4) **NA**

Text: NA

Description:

LOCATION AND PHOTO



Scale: 1:10,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Swarthout Valley

Site Number: WW_31

Feature: Commercial and government structures

Feature Category: business

Field Observation or Potential Hazard: Highway 2 crossing is offset increasing the potential for overtopping onto roadway, which slopes away from crossing at approximately 2 to 5%. Based on inclined slope along the road, structures along the northern side of Highway 2 may become inundated.

Potential Hazard to Life: low

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) **Early Warning**

(2) **Clear and maintain culvert**

(3) **Monitor and maintain**

(4) **Sandbags**

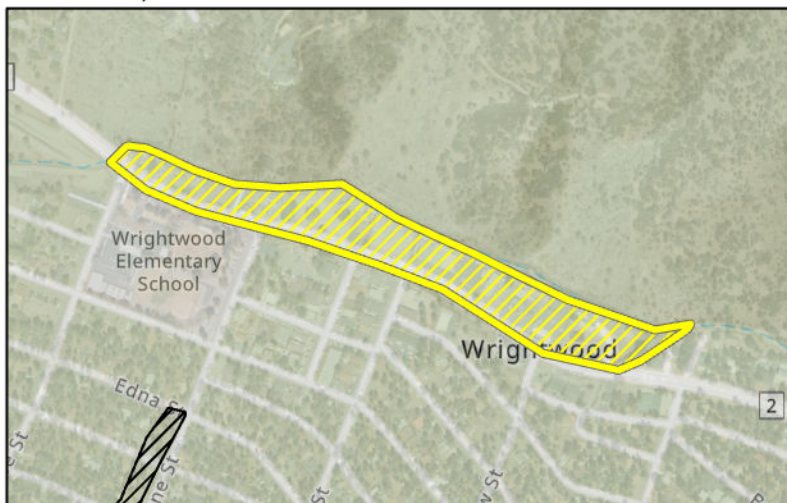
Text: Further evaluation to determine where it may be possible to direct overtopping flow back into the natural channel. Heavy equipment should be staged in the area for response during intense storms.

Description: Structures include market, post office, and other commercial businesses. Berms were noted on the channel behind the businesses, suggesting that the channel, which was constricted and full of veg in areas, may overtop during high flows.

LOCATION AND PHOTO



Scale: 1:10,000



VALUE AT RISK DETAIL

Incident: Bridge Fire

Incident Number: CA-ANF-243334

Community: Wrightwood - Heath Cyn

Site Number: WW_32

Feature: House

Feature Category: home

Field Observation or House adjacent to bridge crossing of Heath Creek, Gap in channel levee, k-rails in from of house suggests
Potential Hazard: flows/debris may have impacted house in the past. potential hazard is flood and debris avulsing out of levee at Thrush Rd. crossing.

Potential Hazard to Life: moderate

Potential Hazard to Property: moderate

Preliminary Emergency Protective Measures

(1) Early Warning

(2) Debris barrier

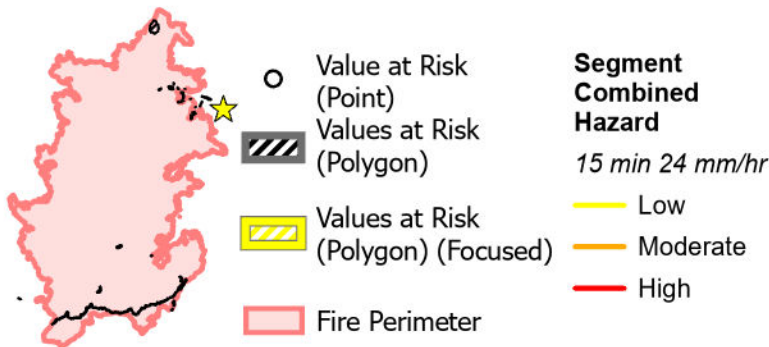
(3) NA

(4) NA

Text: Make sure k-rail is maintained and debris captured by k-rail is cleaned out

Description:

LOCATION AND PHOTO



Scale: 1:1,000

