Appendix E
Local Community Wildfire Protection Plans

Truckee Fire Protection District CWPP (2024)

https://www.truckeefire.org/cwpp

TRUCKEE FIRE PROTECTION DISTRICT COMMUNITY WILDFIRE PROTECTION PLAN

SWCA®

Prepared by SWCA for Truckee Fire Protection District

We would like to formally thank the Project Team and all stakeholders, notably Nevada and Placer County Office of Emergency Services, Nevada County FSC, Placer County FSC, Nevada County Resource Conservation District, U.S. Forest Service Tahoe National Forest, Truckee River Watershed Council, Town of Truckee Police Department, Tahoe Donner Forestry Department, Sierra Pacific Industries, Truckee Donner Land Trust, Tahoe Donner Association, Tahoe Truckee Community Foundation, Mountain Area Preservation, State Parks, Town of Truckee, Town of Truckee Unified School District, Truckee Donner Public Utility District, NV Energy, and CAL FIRE, for contributing their time and expertise throughout the planning process. Your participation has contributed to creating resilient landscapes, implementing public education, reducing structural ignitability, and ensuring safe and effective wildfire response.

Funding for this project was provided by the Local Tax Measure T Community Wildfire Prevention Implementation Plan and a grant made on behalf of the Forest Futures Campaign Fund at Tahoe Truckee Community Foundation.

For additional information, questions, or concerns regarding this project, please contact Project Manager Angela Chongpinitchai at Angela.Chongpinitchai@swca.com.

For all your planning and implementation needs, please visit www.swca.com.

SWCA®
ENVIRONMENTAL CONSULTANTS

The entities listed below participated in the development of and/or reviewed and are in support of the Truckee Fire Protection District Community Wildfire Protection Plan:

Truckee Fire Protection District	Town of Truckee
_____	_____
Signature	**Signature**
_____	_____
Name (printed)	**Name (printed)**
_____	_____
Date	**Date**
_____	_____
Agency /Position (printed)	**Agency /Position (printed)**

Placer County	Nevada County
_____	_____
Signature	**Signature**
_____	_____
Name (printed)	**Name (printed)**
_____	_____
Date	**Date**
_____	_____
Agency /Position (printed)	**Agency /Position (printed)**

CAL FIRE NEU	Tahoe National Forest
Signature	**Signature**
Name (printed)	**Name (printed)**
Date	**Date**
Agency /Position (printed)	**Agency /Position (printed)**
Fire Safe Council(s)	Tahoe Donner
Signature	**Signature**
Name (printed)	**Name (printed)**
Truckee Donner Land Trust	State Parks
Date	**Date**
Agency /Position (printed)	**Agency /Position (printed)**

Tahoe Truckee Community Foundation	Truckee River Watershed Council
Signature	**Signature**
Name (printed)	**Name (printed)**
SPI	
Date	**Date**
Agency /Position (printed)	**Agency /Position (printed)**

CONTENTS

FIGURES

TABLES

ABBREVIATIONS AND ACRONYMS

BOF	California Board of Forestry and Fire Protection
CA GOPR	California Governor's Office of Planning and Research
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Governor's Office of Emergency Services
CalVTP	California Vegetation Treatment Program
CAR	community at risk
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
Cohesive Strategy	National Cohesive Wildland Fire Management Strategy
CRC	California Residential Code
CRS	Congressional Research Service
CWPP	Community Wildfire Protection Plan
EIR	environmental impact report
ESRI	Environmental Systems Research Institute
FHSZ	fire hazard severity zone
FIRESCOPE	Firefighting Resources of Southern California Organized for Potential Emergencies
FPD	Fire Protection District
FRA	Federal Responsibility Area
GACC	Geographic Area Coordination Center
GIS	geographic information system
GR	grass fuel type
GS	grass-shrub fuel type
HFRA	Healthy Forests Restoration Act of 2003
HOA	homeowners association
LRA	Local Responsibility Area
NB	non-burnable fuel type
NEPA	National Environmental Policy Act
NEU	Nevada-Yuba-Placer Unit
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NWCG	National Wildfire Coordinating Group
OES	Office of Emergency Services
POD	potential operational delineation

PRC	Public Resource Code
SAF	Society of American Foresters
SARAs	strategic areas, resources, and assets
SB	slash-blowdown fuel type
SDI	Suppression Difficulty Index
SH	shrub fuel type
SRA	State Responsibility Area
SWCA	SWCA Environmental Consultants
TFPD	Truckee Fire Protection District
TL	timber litter fuel type
TU	timber understory fuel type
USDA	U.S. Department of Agriculture
USFA	U.S. Fire Administration
USFS	U.S. Forest Service
WRSC	Western Regional Strategy Committee
WUI	wildland-urban interface

EXECUTIVE SUMMARY

WHAT IS THE PURPOSE OF THIS COMMUNITY WILDFIRE PROTECTION PLAN?

The goal of the 2024 Truckee Fire Protection District Community Wildfire Protection Plan (CWPP) is to improve the community's wildfire-mitigation capacity while working with government and local agencies to identify high fire risk areas and prioritize areas for mitigation and emergency preparedness. This CWPP serves as a framework and wildfire mitigation roadmap to 1) identify and prioritize future wildfire protection projects and 2) foster a community-wide collaborative approach to reduce wildfire risk and hazards to life, property, and natural resources. CWPPs are also central to creating increased public awareness, enhancing residents' understanding of the natural and human-caused risks of wildland fires that threaten lives, safety, and the local economy. The following are the minimum requirements for a CWPP, as stated in the Healthy Forests Restoration Act (HFRA) (Society of American Foresters [SAF] 2004):

- **Collaboration:** Local and state government representatives, in consultation with federal agencies or other interested groups, must collaboratively develop a CWPP.
- **Prioritized Fuel Reduction:** A CWPP must identify and prioritize areas for hazardous fuels reduction and treatments and recommend the types and methods of treatment that will protect one or more communities at risk (CARs) and their essential infrastructures.
- **Treatments of Structural Ignitability:** A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan.

This CWPP aims to provide support in safeguarding human lives and minimizing property damage caused by wildfires through the implementation of the following activities:

1. provide a landscape-scale assessment of wildfire risk and protection needs (see Chapters 3 and 4),
2. bring together all the responsible wildfire management and suppression entities in the Truckee Fire Protection District (TFPD) to address the identified needs,
3. provide a framework for future planning and implementation of necessary mitigation measures (see Chapter 5), and
4. provide a list of actionable projects that may qualify for grant funding and provide sources for grant funding (see Chapter 5).

Recently the Truckee Fire Protection District has implemented funding programs that help with wildfire protection, including the Measure T parcel tax for parcels within the TFPD. Funding generated from the annual Measure T parcel tax goes to Truckee Fire to implement fuels reduction work and wildfire mitigation efforts through the Community Wildfire Prevention Fund. Recommended actions (see Chapter 5) and other existing programs discussed in this CWPP may qualify for funding under the Measure T program, or federal and state grant programs, depending on the nature of the individual project. Truckee Fire has also recently formed a Wildfire Prevention Division tasked with wildfire prevention, education, and enforcement of fire regulations to protect the lives of citizens and infrastructure of the community.

HOW IS THE PLAN ORGANIZED?

Chapter 1 provides a general overview of CWPPs; the Project Team; planning area; critical infrastructure; strategic areas, resources, and assets (SARAs); wildland-urban interface (WUI) boundary; land ownership; and public involvement.

Chapter 2 defines the wildfire problem of the planning area, including fire ecology, climate, local fire history, and aspects of the wildland fire environment.

Chapter 3 describes the communities and resources at risk by providing an overview of the defined WUI boundaries and SARAs in the planning area with data supported by Land Tender.

Chapter 4 provides a wildfire assessment including an overview of the risk category classifications from the risk assessment, an analysis of current fuels condition and expected fire behavior, areas at higher risk of wildfire ignition and burn intensities, and defensible space and structure assessments.

Chapter 5 details the action plan that will allow implementation and adaptation of the plan long-term following adoption of the final CWPP.

HOW WAS THE TRUCKEE CWPP DEVELOPED?

A multijurisdictional Project Team, comprising federal, state, and local agencies, organizations, and residents, collaboratively developed this CWPP. Project Team members with experience ranging from fire and land management to community initiatives contributed their expertise. The CWPP planning process had several purposes: modeling and mapping wildfire risk, identifying and mapping hazards that increase the threat of wildfires, determining stakeholder and community values and assets, and prioritizing tailored treatments to reduce fire risk. Public involvement was a crucial aspect, with community members actively participating in public meetings, online surveys, web-based interactive applications, and review of the CWPP. The process also fostered collaboration between wildfire responders and land managers, establishing lasting working relationships. By incorporating input from the public and the Project Team, the CWPP recommendations and treatments are specifically tailored for Truckee Fire and its key partners. This CWPP underscores the importance of collaboration among agencies and the public in developing mitigation programs to address wildfire hazards.

The development of the Truckee CWPP was led by Truckee Fire Protection District (Truckee Fire), with Project Team representatives and key stakeholders from various government agencies and private entities, including the Truckee Donner Land Trust, Tahoe Donner Association, California Department of Forestry and Fire Protection (CAL FIRE) Nevada-Yuba-Placer Unit (NEU), U.S. Forest Service (USFS) Tahoe National Forest, Nevada County and Placer County Office of Emergency Services (OES), Placer County Resource Conservation District, Nevada County and Placer County Fire Safe Councils, Nevada County Resource Conservation District, Truckee River Watershed Council, Town of Truckee Police Department, Tahoe Donner Forestry Department, Tahoe Truckee Community Foundation, California State Parks, Town of Truckee, Truckee Donner Public Utility District, NV Energy, Sierra Pacific Industries, Union Pacific Railroad, Tahoe Truckee Unified School District, Truckee Tahoe Airport, Liberty Utilities, and Vibrant Planet.

This CWPP was developed in collaboration with Vibrant Planet and Ladris. Vibrant Planet's decision support tool Land Tender streamlined public input and helped collaboratively prioritize hazardous fuels reduction projects (see Chapters 4 and 5). Ladris Technology's artificial intelligence–based evacuation platform helped Truckee Emergency Management better plan evacuation scenarios (see Chapter 3).

WHERE IS THE PLANNING AREA?

The planning area includes the Truckee Fire Protection District and surrounding WUI as delineated by its geographic and political boundaries (Figure ES.1). Many identified communities are within the planning area.

This CWPP landscape was divided into five larger communities based on geography, population, fire response, and local knowledge: Central Truckee, Donner Summit, East Truckee, Martis Valley, and Tahoe Donner (Figure ES.2). There is a community-level approach to certain sections of this CWPP. A risk assessment was conducted for each of the communities, along with on-the-ground assessments of defensible space and home hardening surveys. Each community was also analyzed to determine an overall rating for wildfire risk by combining a variety of metrics.

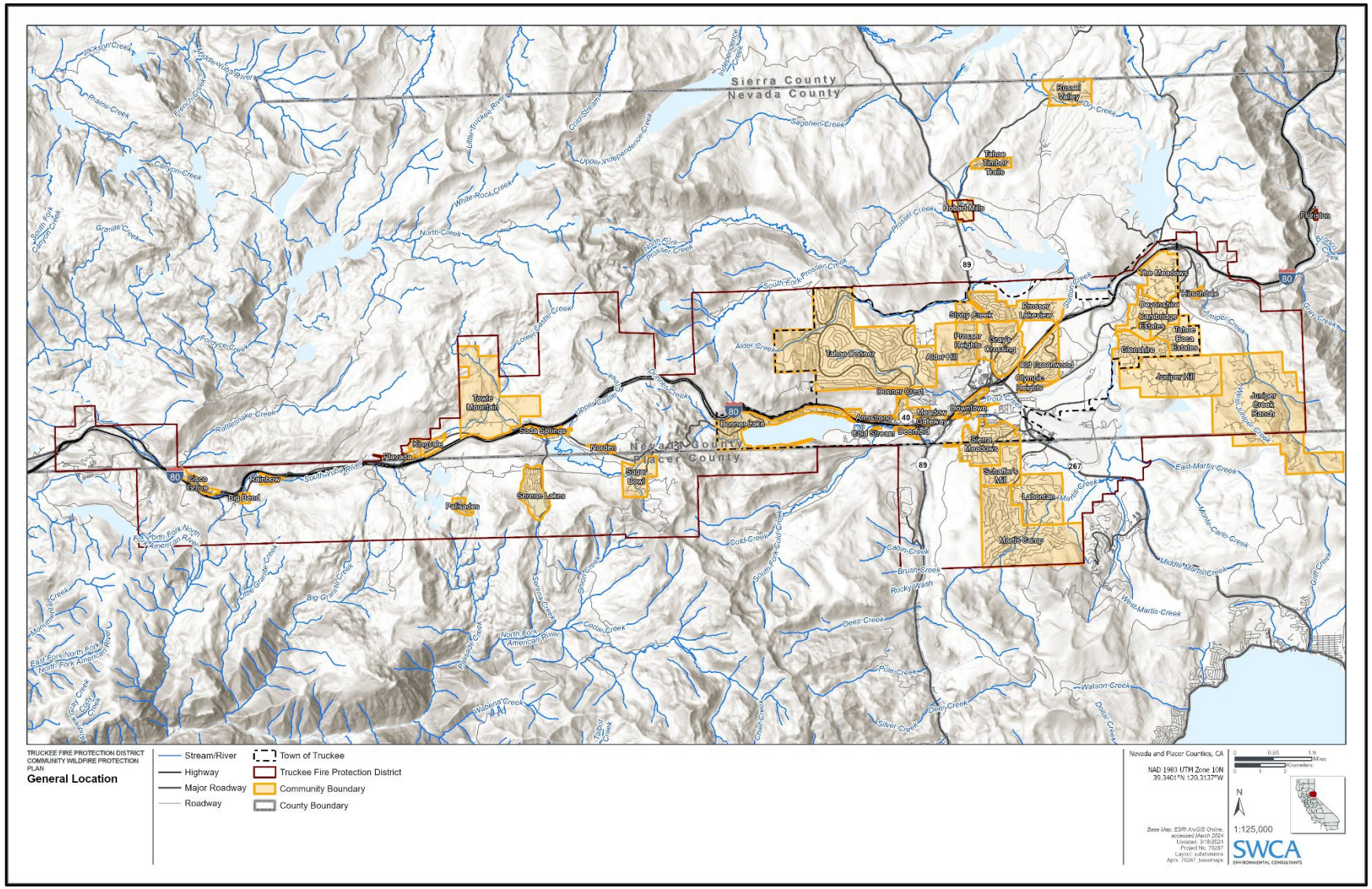


Figure ES.1. Truckee CWPP planning area.

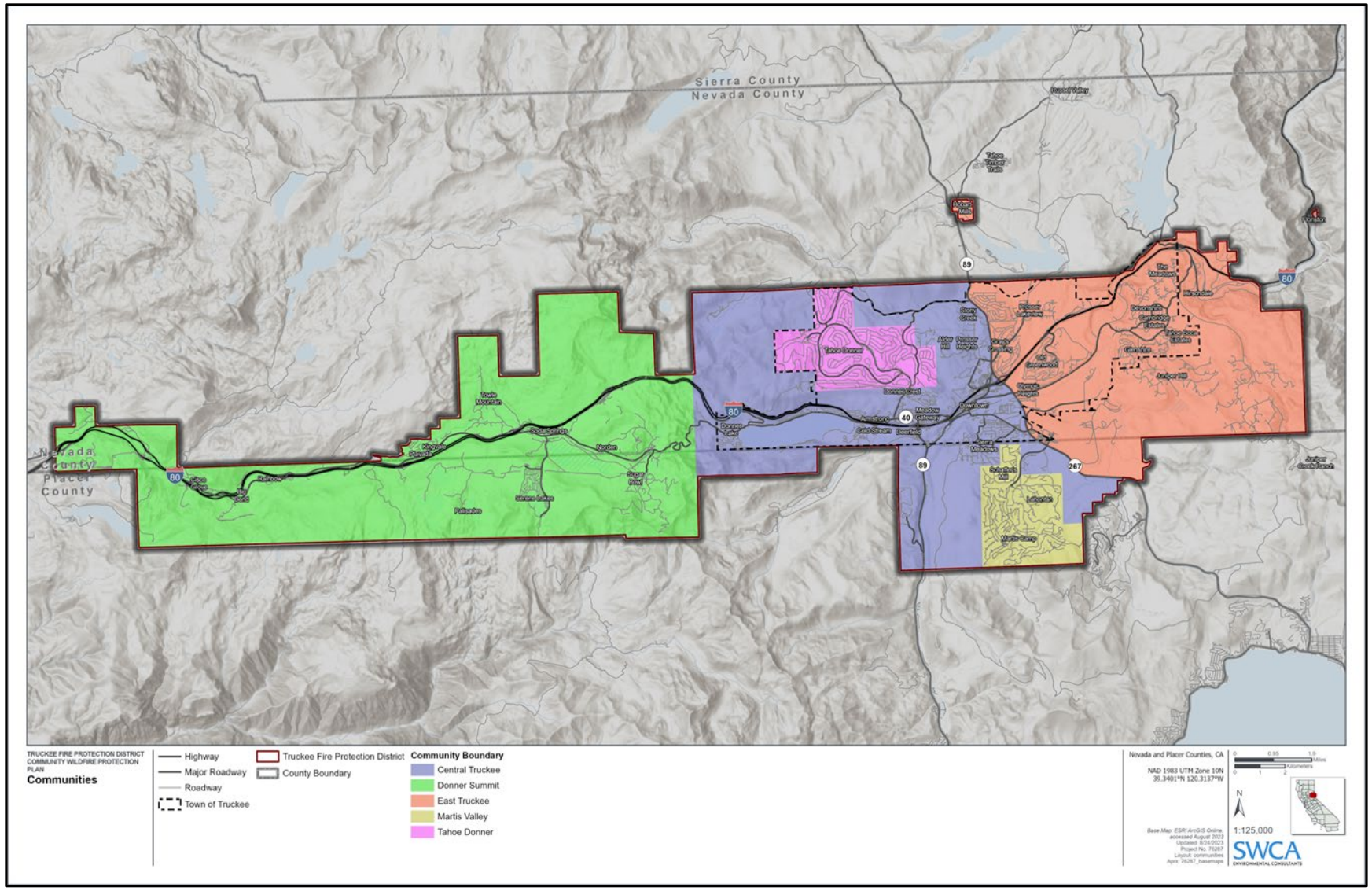


Figure ES.2. CWPP TFPD communities.

WHO WILL LEAD THE IMPLEMENTATION OF THIS CWPP?

Implementation of most projects identified in this CWPP will require the collaboration and cooperation of multiple individuals and entities such as community residents, fire safe councils, and local, state, and federal agencies. However, to ensure that projects move forward, the plan will be governed by Truckee Fire.

PROJECT TEAM LIST

Name	Organization
Alessandra Zambrano	Nevada County OES
Alex Keeble-Toll	Nevada County OES
Anne Graham	Tahoe Truckee Community Foundation
Ben Gwerder	Tahoe Donner Forestry Department
Ben Raynal	Sierra Pacific Industries
Bob Womack	Town of Truckee - Police Department
Dan Joannes	Truckee Donner Land Trust
Dillon Sheedy	Truckee Fire Protection District
Eben Swain	Truckee River Watershed Council
Eric Horntvedt	Truckee Fire Protection District
Jamie Jones	Fire Safe Council of Nevada County
Jo Ann Fites-Kaufman	Nevada County RCD
John Groom	Tahoe Donner Association
Joe King	Sierra Pacific Industries
Kerri Timmer	Placer County OES
Kevin Mecham	USFS Tahoe National Forest
Kevin Starr	Truckee Donner Land Trust
Lindsay Ryan	Tahoe Donner Association
Matt Furtado	CAL FIRE NEU
Thomas Smith	CAL FIRE NEU

CHAPTER 1 – TRUCKEE FIRE PROTECTION DISTRICT OVERVIEW

The United States is facing urgent forest and watershed health concerns. The number of annual wildfires throughout the United States has been increasing in recent years (58,100 in 2018, 50,000 in 2019, 59,000 in 2021, and 69,000 in 2022). Similarly, the number of acres burned has been on the rise (Congressional Research Service [CRS] 2023). On average, 7 million acres nationwide are burned every year due to wildfire, more than doubling the annual average of acres burned in the 1990s (CRS 2023). Communities are seeing the most destructive wildfire seasons in history. Within the last decade, the 2020 fire season had the most acreage impacted in a single year at 10.1 million acres, and 2017 was the second highest with 10 million acres (CRS 2023). These statistics demonstrate that wildfires are becoming larger and increasingly impactful.

California's Forests and Rangelands 2017 Assessment states that California faces urgent issues concerning the frequent and severe pest and wildfire events that are unprecedented and threaten the sustainability of these ecosystems. These issues require reexamination of land and fire management policies and practices as human populations demand more from natural systems and climate change continues (California Department of Forestry and Fire Protection [CAL FIRE] 2018).

As wildfire severity increases, communities need a plan to help prepare for, reduce the risk of, and adapt to wildland fire events. Community wildfire protection plans (CWPPs) help accomplish these goals. A CWPP provides recommendations that are intended to reduce, **but not eliminate**, the extreme severity or risk of wildland fire.

The 2024 Truckee CWPP development involves meaningful collaboration among stakeholders at the local, state, and federal levels. Through examination of past fires, treatment achievements, scientific literature from the western region and insights from experienced fire managers, the plan identifies current wildfire risks and needs in the planning area. The CWPP ensures alignment with existing plans and identifies priority areas for mitigation measures, with the aim to protect life, property, and critical infrastructure. It does not mandate treatment projects; instead, it suggests potential treatments and priorities. The responsibility for implementing mitigation measures lies with landowners and community, while the plan serves as a guide.

GOAL OF A COMMUNITY WILDFIRE PROTECTION PLAN

The goal of a CWPP is to enable local communities to improve their wildfire-mitigation capacity while working with government agencies to identify high fire risk areas and prioritize areas for mitigation, fire suppression, and emergency preparedness. Another goal of the CWPP is to enhance public awareness by helping residents better understand the natural and human-caused risks of wildland fires that threaten lives, safety, and the local economy. The minimum requirements for a CWPP, as stated in the Healthy Forests Restoration Act (HFRA), are:

- **Collaboration:** Local and state government representatives, in consultation with federal agencies or other interested groups, must collaboratively develop a CWPP (Society of American Foresters [SAF] 2004).
- **Prioritized Fuel Reduction:** A CWPP must identify and prioritize areas for hazardous fuels reduction and treatments and recommend the types and methods of treatment that will protect one or more communities at risk (CARs) and their essential infrastructures (SAF 2004).
- **Treatments of Structural Ignitability:** A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan (SAF 2004).

This 2024 CWPP intends to provide a town-wide scale of wildfire risk and protection needs, bring together all responsible wildfire management and suppression entities to address the identified needs, and support these entities in planning and implementing the necessary mitigation measures.

ALIGNMENT WITH THE NATIONAL COHESIVE STRATEGY

This 2024 CWPP aligns with the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) and its Phase III Western Regional Action Plan by adhering to the nationwide goal "to extinguish fire safely and effectively, when needed; use fire where allowable; manage our natural resources; and collectively, learn to live with wildland fire." (Forests and Rangelands 2023).

The primary national goals identified as necessary to achieving the vision are:

- **Restore and maintain landscapes:** Landscapes, regardless of jurisdictional boundaries are resilient to fire, insect, disease, invasive species and climate change disturbances, in accordance with management objectives.
- **Fire-adapted communities:** Human populations and infrastructure are prepared to receive, respond to, and recover from wildland fire.
- **Wildfire response:** All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

For more information on the Cohesive Strategy 2023 Addendum update, please visit: https://www.forestsandrangelands.gov/documents/strategy/natl-cohesive-wildland-fire-mgmt-strategy-addendum-update-2023.pdf

Alignment with these Cohesive Strategy goals is described in more detail in Chapter 5, Action Plan, Maintenance, and Monitoring.

In addition to aligning with the Cohesive Strategy, this CWPP also incorporates information on post-fire recovery, the significant hazards of a post-fire environment, and the risk that post-fire effects pose to communities (Figure 1.1).

Figure 1.1. The CWPP incorporates the three primary goals of the Cohesive Strategy and post-fire recovery and serves as a holistic plan for fire prevention and resilience.

ALIGNMENT WITH LOCAL PLANS AND FIRE POLICIES

This CWPP aligns with multiple local, state, and federal planning documents.

Town of Truckee 2040 General Plan: Chapter 8 of Truckee's General Plan, Safety and Noise Element, contains information on wildfire risk, response, and the 2016 CWPP and this update. It also aims to reduce new development in very high fire hazard severity zones (FHSZs) by changing areas designated for rural development, to natural resource conservation.

Measure T: The Measure T Community Wildfire Prevention Fund provides funding for outreach, education, fuels reduction projects, initiatives such as this CWPP update, and other activities related to wildfire planning and mitigation. An annual tax of $179 per parcel will give Truckee Fire approximately $3.7 million per year for implementing projects, such as those described above in this document. Truckee

Fire already administers a green waste pickup program, defensible space inspections and education, and fuels reduction projects with many more ready for implementation. The measure began during the 2022–2023 fiscal year and will continue for eight years (Truckee Fire 2021).

Local Hazard Mitigation Plan: Truckee adopted and updated Nevada County's Local Hazard Mitigation Plan in 2018 and worked with the County for redevelopment in 2023, and every 5 years thereafter. The plan addresses hazard mitigation and coordination between County and multijurisdictional partners.

OES Wildfire Evacuation Preparedness Plan: Nevada County's plan for ensuring safe evacuation routes in case of wildfire. See Evacuation Section in Chapter 3 for more details.

OES Emergency Operations Plan: Nevada County's 2011 overview of typical emergency response operations, and a list of initial actions to be taken by Emergency Service Organization personnel.

Nevada County CWPP: Nevada County is concurrently updating their 2016 CWPP. The planning area represents the "Truckee Donner" Forecast Zone.

CAL FIRE 2019 Strategic Plan: A state-level plan that highlights efforts to improve fire operations, enhance internal operations, and ensure health and safety. This plan is in the process of being updated and is expected to be released in 2024.

CAL FIRE NEU 2023 Strategic Plan: A county-level (Nevada, Yuba, and Placer Counties) plan for implementation of the state Strategic Plan. This lays out Unit goals, implementation of fuels reduction projects, and highlights the need for education among residents on living in a fire-adapted community.

Chapter 7A and California Residential Code (CRC) Section R337 of the California Building Code: Truckee aims to direct new construction within the Town and throughout the wildland-urban interface (WUI). Established within the Wildland-Urban Interface (WUI) Fire Conformance Checklist are regulations on fire management activities and requirements for construction practices. These directives are aimed at limiting the risk of fire intrusion and safeguarding communities within the WUI (Town of Truckee Community Development Department 2021).

2022 California Fire Code: The Town of Truckee adopted the most recent state Fire Code as well as additions that are more stringent on building materials, roofing, and large development projects.

Table 1.1. Additional State Laws Concerning Wildfire

Category:	Bills:
Climate Change/ Forest Resilience	AB 179: funding for wildfire resilience and forest health
Climate Change/ Forest Resilience	SB 246: established ICARP and Adaptation Clearing House for data and coordination
Community Risk Reduction	PRC 4202: mandates designation of all SRA land into FHSZ
Community Risk Reduction	PRC 4290.1: designated "Fire Risk-Reduction Community"
Community Risk Reduction	PRC 4290.5: State Board identifies high risk communities and make recommendations
Community Risk Reduction	PRC 4290: base level fire safety standards
Community Risk Reduction	SB 1241: minimize unreasonable wildfire risk, developed FHSZ
Community Risk Reduction	SB: 901: fuel breaks and greenbelt regulations

Community Risk Reduction	SB 535: priority CCIP funding for disadvantaged communities
Community Risk Reduction	AB 2911: community planning and subdivision review
Evacuation Planning	AB 1409: local level evacuation regulation and scenario planning
Evacuation Planning	CFAC 2350: 'pass program' to allow agriculture operators access to closed areas
Evacuation Planning	SB 99: identify communities with less than two evacuation routes
Homeowner Risk Reduction	AB 3074: defines Zone 0 and ember-resistant areas
Homeowner Risk Reduction	AB 38: financial support for home hardening, FHSZ disclosure during sale
Homeowner Risk Reduction	PRC 4291: defensible space standard
California Plans and Programs:	
Strategic Plan for California: wildfire-resistant environment, increase cooperation	
Fire Hazard Planning Technical Advisory: regulatory committee for wildfire in General Plans	
Tahoe-Central Sierra Initiative: collaborative effort to improve forest health and resilience in Central Sierra and Lake Tahoe Basin	
California Forest and Rangeland Assessment: evaluates and delineates priority landscapes	
Vegetation Management Plan: resource management and wildfire fuel hazards in SRA	
California Vegetation Treatment Program: programmatic environmental impact report (EIR) for 20.3 million acres on SRA land for fuels reduction	
California Wildfire and Forest Resilience Action Plan: increase fuel breaks, protect communities, improve infrastructure	

Note: Assembly Bill (AB), Senate Bill (SB), and Public Resources Code (PRC) are different regulatory laws.

PROJECT TEAM

Truckee Fire invited engagement from adjacent government, nonprofit, and private agencies in the development of this 2024 Truckee Fire CWPP update. Stakeholder involvement is critical in producing a meaningful document that includes all collaborators' diverse perspectives. The Project Team drives the planning process in its decision making, data sharing, experience, and communication with community members. The project was kicked off on December 13, 2022; the Project Team met for the first time on January 25, 2023, and met for the final time on April 16, 2024, with regular monthly meetings throughout the project time frame. The Project Team List is provided in the Executive Summary. A larger Stakeholder Group was also convened, with multiple (four) meetings during the process of writing the CWPP. This group additionally includes CAL FIRE Nevada-Yuba-Placer Unit (NEU), departments from the Town of Truckee, Truckee River Watershed Council, Mountain Area Preservation, and California State Parks.

PLANNING AREA

The planning area includes the TFPD and the adjacent WUI, encompassing approximately 128 square miles (see Figure ES.1). The TFPD service area extends along Interstate 80 (I-80) through Nevada and Placer Counties and includes the town of Truckee and numerous subdivisions in the Truckee and Donner Summit areas. Major subdivisions within the TFPD service area include, but are not limited to, Tahoe Donner, Glenshire Devonshire, Prosser-Lakeview, Martis Camp, Lahontan, Schaffer's Mill, Juniper Hill, Sierra Meadows, Gray's Crossing, Serene Lakes, Donner Lake, and Old Greenwood.

Truckee is situated centrally in California's Sierra Nevada mountains, just north of Lake Tahoe and west of the Nevada state line. Donner Lake is located within the Truckee town limits, with the historically significant Donner Pass present west of town. Experiencing notable growth in the 1960s and 1970s, Truckee has become a residential center of the region. The town is also recognized as an economic hub, attracting tourists, daily visitors, and second property owners through its natural beauty and various recreational opportunities. I-80 is a prominent transportation corridor intersecting Truckee, providing residents and visitors with enhanced connectivity to the surrounding region. In 2022, the population of the incorporated town of Truckee was estimated at 16,850. In 2021, the town contained 6,247 households (U.S Census Bureau 2022). TFPD has just over 20,000 parcels, with approximately 14,082 of these being developed parcels (Truckee Fire 2021; Truckee Fire 2023c).

For this CWPP, the entire planning area was further divided into five major communities:

DONNER SUMMIT

At the far west of the planning area, and largest geographically and least densely populated, is Donner Summit. This community has many lakes and streams, and much of the land is owned by the USFS and the Truckee Donner Land Trust. This area includes multiple ski resorts. I-80 runs through the center of this community, providing connectivity. Donner Summit spans both Nevada and Placer Counties.

CENTRAL TRUCKEE

Central Truckee is home to the downtown area and has the densest population and buildings. This community includes the land south of Tahoe Donner Ski Resort including Donner Lake. I-80 and CA-89 are major roads within this community. The USFS has already completed a variety of fuels reduction projects along CA-89 heading south of the Town. Central Truckee spans both Nevada and Placer Counties.

TAHOE DONNER

Located north of the downtown area is the major subdivision of Tahoe Donner. This area encompasses Tahoe Donner Ski Resort, which offers recreational activities including skiing and hiking. Multiple fuels reduction projects have already been completed around the subdivision to protect it from the threat of wildfire. Tahoe Donner is located entirely within Nevada County.

MARTIS VALLEY

Made up of multiple smaller subdivisions, the community of Martis Valley is located between CA-89 and CA-267. This community is located entirely in Placer County. Immediately south of Martis Valley is another ski resort, and to the west it is bordered by a large section of USFS-owned land.

EAST TRUCKEE

East Truckee is characterized by multiple subdivisions that are more spread out compared to Martis Valley and Tahoe Donner. This area includes the Truckee Tahoe Airport. The I-80 corridor winds through

the community and several other major roads provide good connectivity. East Truckee spans both Nevada and Placer Counties.

WILDLAND-URBAN INTERFACE

The WUI is composed of both interface and intermix communities and is defined as areas where human habitation and development meet or intermix with wildland fuels (U.S. Department of the Interior and U.S. Department of Agriculture [USDA] 2001:752–753).

- Interface areas include housing developments that meet or are in the vicinity of continuous vegetation.
- Intermix areas are those areas where structures are scattered throughout a wildland area where the cover of continuous vegetation and fuels is often greater than cover by human habitation.

CAL FIRE further defines WUI using housing density classes. For more information visit https://frap.fire.ca.gov/media/10300/wui_19_ada.pdf.

In the WUI, fire can move readily from vegetation to structures and other development, and under certain conditions, from structure-to-structure. This greatly increases the potential for damage to or loss of life and property. Continued human expansion in the WUI, combined with effects from climate change, is conducive to more extreme fire behavior and has created the need to modify current incident response and management policies while managing risk. Today, more than 46 million residences in 70,000 communities are at risk for WUI fires (USFA 2021b). When it comes to wildfire, this trend is of high concern since WUI conditions are linked with an increased risk of loss of human life, property, natural resources, and economic assets.

A CWPP offers the opportunity for collaboration of land managers to establish a definition and boundary for the local WUI; to better understand the unique resources, fuels, topography, and climatic and structural characteristics of the area; and to prioritize and plan fuels treatments to mitigate fire risks. According to the HFRA, the WUI can be defined by a CWPP. In this CWPP, the WUI (Figure 1.2) used a 2022 structure map as the base.

- **WUI Intermix** was created by placing a 250-foot buffer around structures. Subdivision boundaries were manually corrected to create contiguous WUI Intermix.
- **WUI Defense** was created by a 0.25-mile buffer from the WUI Intermix, and a 500-foot buffer from major roadways (Figure 1.3).
- **WUI Threat** was created by a 1.25-mile buffer from the WUI Defense. The total WUI area is therefore more than a 1.5-mile total buffer.

According to the 2019 Strategic Fire Plan for California, CAL FIRE responds to an average of 6,000 wildland fires per year, encompassing approximately 260,000 acres of burned landscape (CAL FIRE 2019). The NEU notes in its Strategic Fire Plan that much of the region exhibits a scattered WUI, which can lead to severe impacts to structures if response is not carried out swiftly and effectively (CAL FIRE 2022a). The factors of structure survivability in WUI fire include defensive actions from first responders, structure hardening and defensible space, community hardening, and housing density. Low -density residential areas with larger lots allow residents to have more control over auxiliary structure placement and prevent exposing their primary structure to receptive fuels. To increase the likelihood of structure survival in WUI fires, homeowners should reduce, relocate, replace, and remove parcel-level fuels (National Institute of Standards and Technology [NIST] 2022).

Developments in high or very high FHSZs are required to be constructed in a way that reduces the risk from fire hazards and meets all appropriate county and state fire standards. The requirement includes the use of fire-resistant materials produced to minimize fire susceptibility within high or very high FHSZs per the California Fire Code, Fire Safe Regulations, and other standards. New development schemes must contain certain fire protection plans, codes, and actions for fire engineering components for buildings and structures in very high FHSZs (see Table 1.1).

IMPACTS TO PROPERTY-OWNERS INSURANCE

The wildfire risk assessment conducted for this CWPP is not intended to be used to determine insurance premiums of homes and properties. Insurance companies utilize their own wildfire risk assessments to write and renew policies. Additionally, a partnership among Insurance Commissioner Ricardo Lara the California Governor's Office of Emergency Services (Cal OES), California Public Utilities Commission, CAL FIRE, and California Governor's Office of Planning and Research (CA GOPR) has led to the development of a regulatory action that creates insurance incentives for implementing actions that build up home and community resilience to wildfire. This new wildfire safety regulation aims to make insurance more affordable while increasing public involvement in risk mitigation and awareness regarding local hazards (California Department of Insurance 2022).

Wildfire risk reduction actions identified in this CWPP (such as home hardening, creating defensible space, and community collaboration) are in alignment with the mitigation actions specified in the Safer from Wildfires initiative. Implementing actions to reduce wildfire risk, such as those identified in this CWPP, may support homeowners to qualify for insurance discounts (see Figure 1.4 as a current example in Truckee).

Additional information can be found at the following:

- Safer from Wildfires: Being Safer from Wildfires can help with your insurance: https://www.insurance.ca.gov/01-consumers/200-wrr/Safer-from-Wildfires.cfm
- FAQ: Mitigation in Rating Plans and Wildfire Risk Models Regulation: https://www.insurance.ca.gov/0250-insurers/0800-rate-filings/0200-prior-approval-factors/upload/FAQ-Mitigation-in-Rating-Plans-and-Wildfire-Risk-Models-Regulation_2023-02-16.pdf
- About the FAIR Plan: https://ains.assembly.ca.gov/sites/ains.assembly.ca.gov/files/FAIR%20Plan-Factsheet-2.23.23.pdf

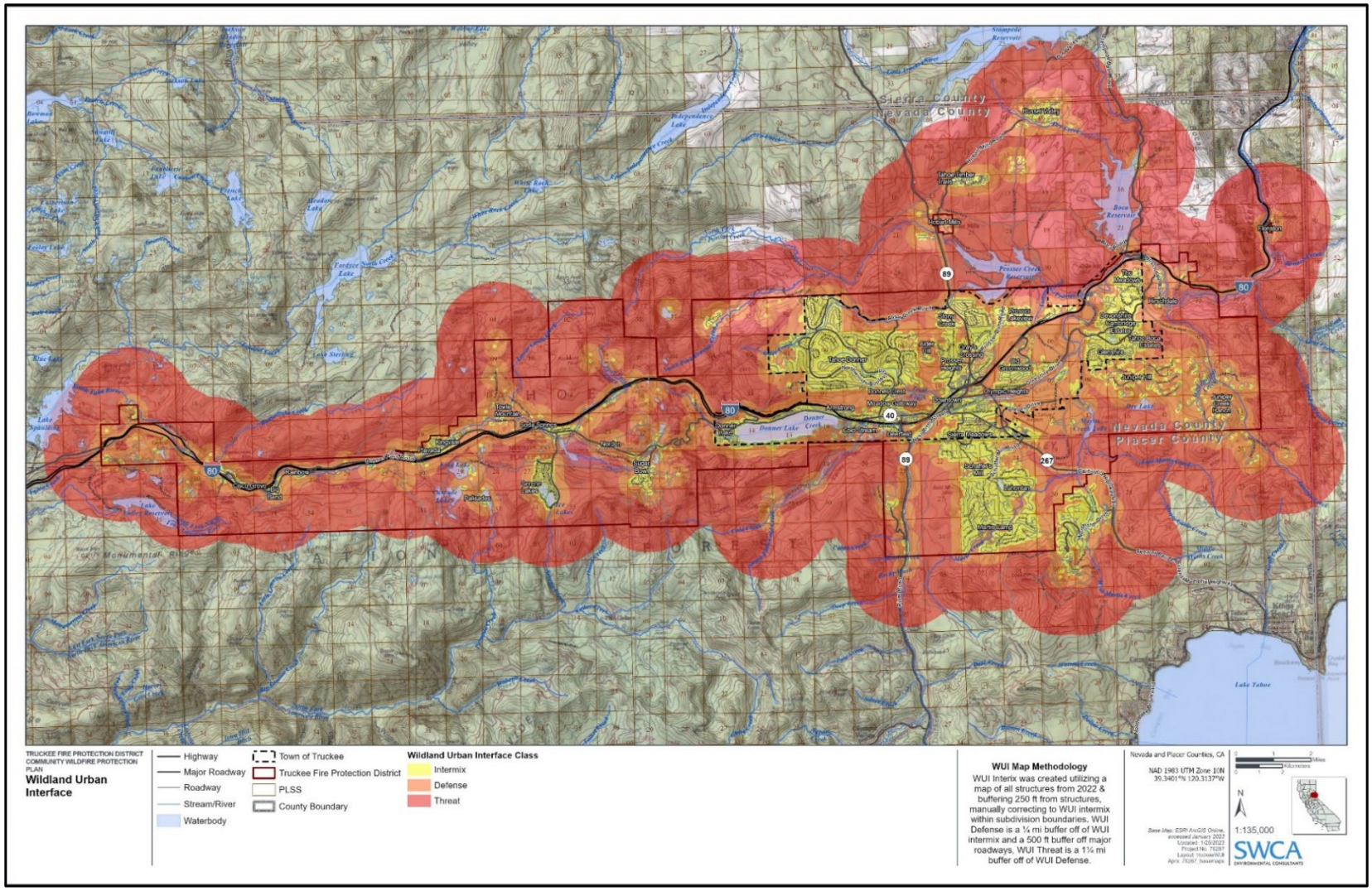


Figure 1.2. Truckee WUI zones.

Note: this is a WUI classification, not a measure of risk. See Chapter 4: Risk Assessment Results for more information on risk.

*SWCA used a tiered, three layer WUI metric. **WUI Intermix**: 250-foot buffer around structures. Subdivision boundaries were manually corrected to create contiguous WUI Intermix. **WUI Defense**: 0.25-mile buffer from the WUI Intermix, and a 500-foot buffer from major roadways. **WUI Threat**:1.25-mile buffer from the WUI Defense. The total WUI area is therefore more than a 1.5-mile total buffer.

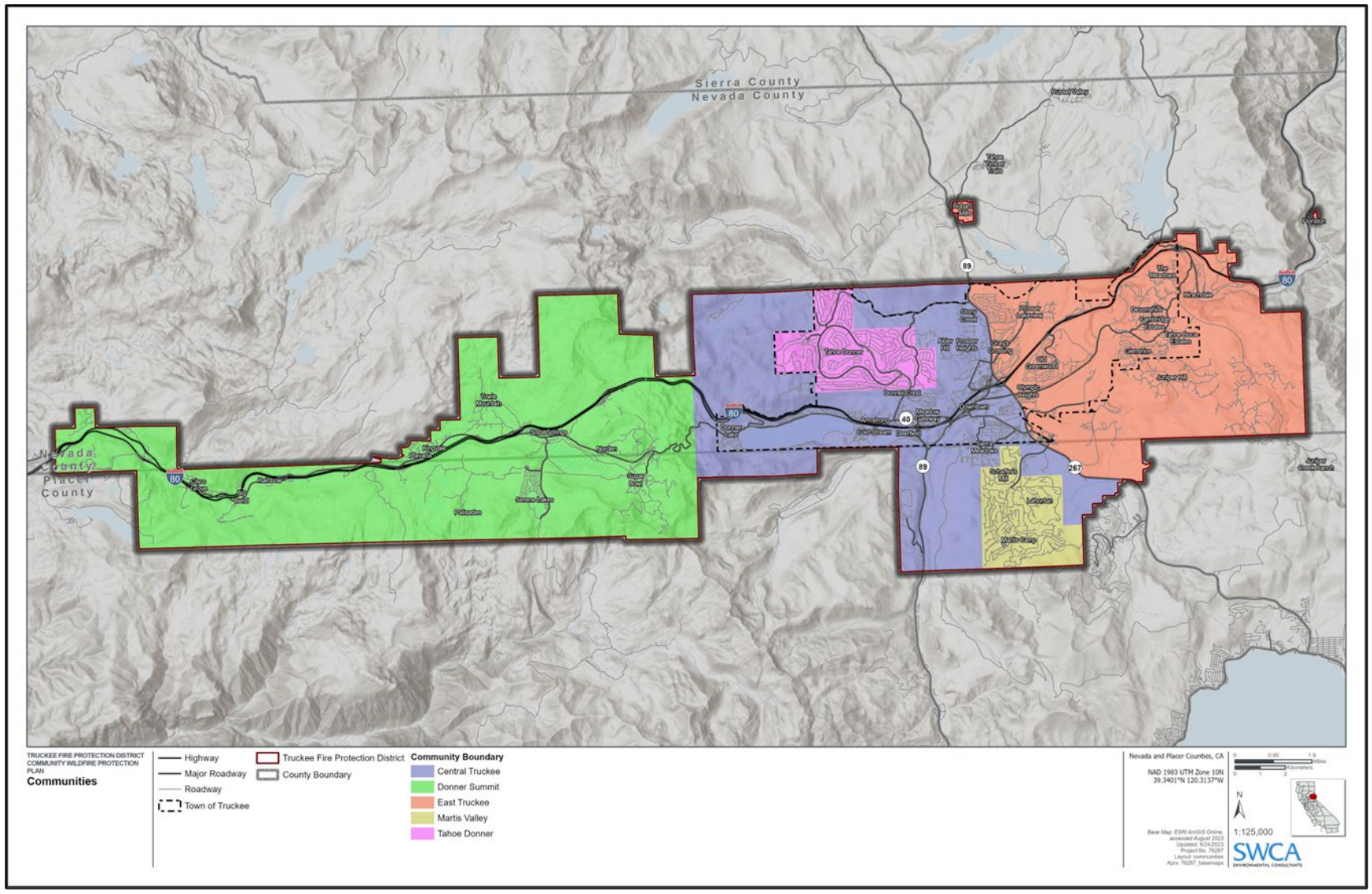


Figure 1.3. TFPD communities.

Figure 1.4. Example of the WUI in the Truckee FPD.

LAND OWNERSHIP

The planning area has relatively uniform land ownership, with most (60%) of the land belonging to private owners (Figure 1.5). The USFS is the next largest landowner with 27% of the planning area within its jurisdiction. Conservancies and land trusts own about 10% of the planning area, with the Tahoe Donner Land Trust accounting for 9% of the planning area. The Department of Defense owns approximately 2%. The remaining land in the county (about 1% combined) is managed by different agencies, including the California Department of Parks and Recreation, local government, U.S. Fish and Wildlife Service, and State of California.

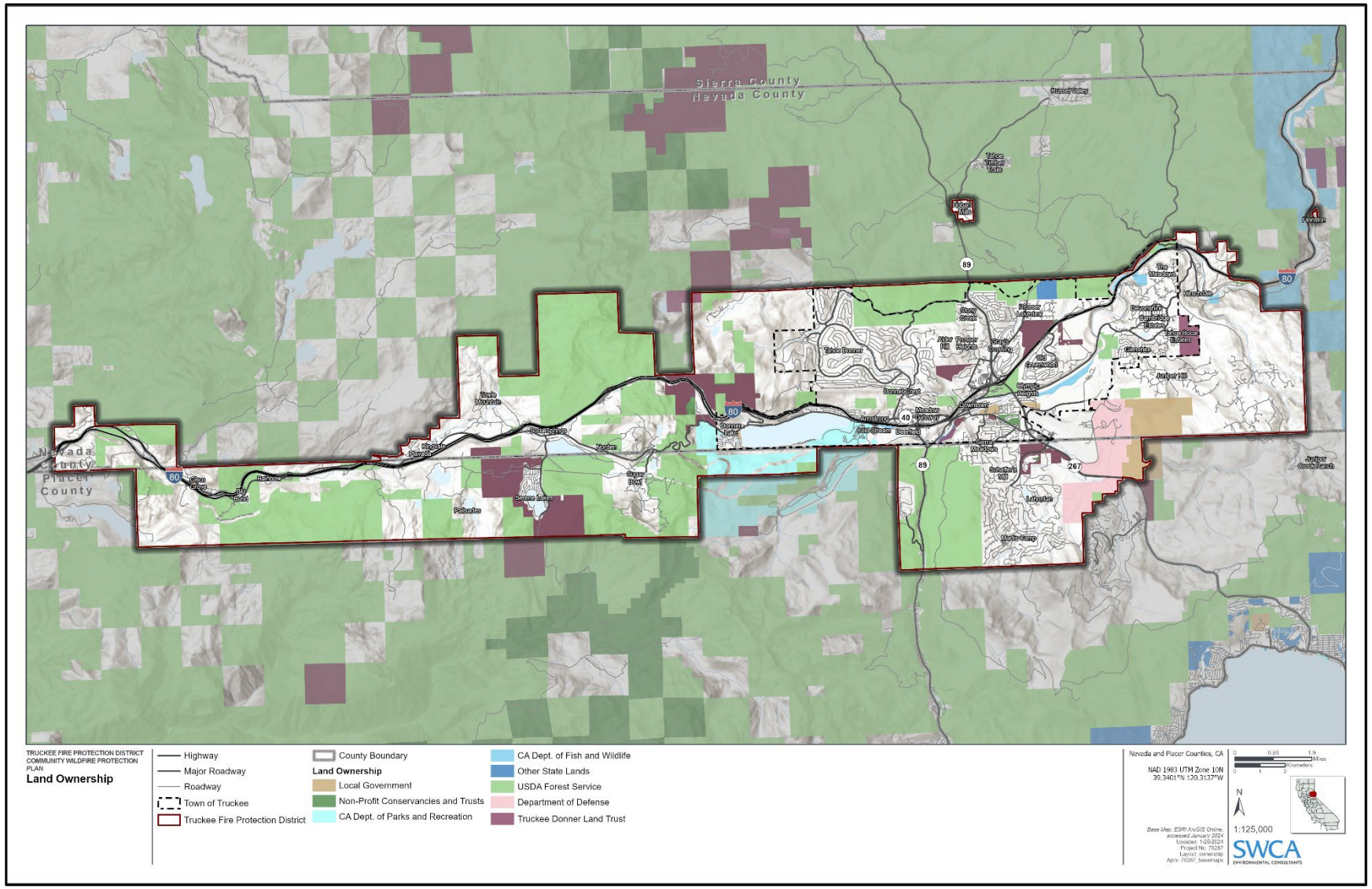


Figure 1.5. TFPD land ownership.

PUBLIC INVOLVEMENT

A key element in the CWPP process is the meaningful discussions it generates among community members regarding their priorities for local fire protection and forest management (SAF 2004). The draft CWPP and project recommendations were discussed extensively during virtual and in-person meetings with the Project Team and Stakeholder Group and were then made available for public review and comment from January 22, 2024, through February 20, 2024. Four public meetings were held during the public review period: two in-person meetings on February 7, 2024, at the Town Hall and the Tahoe Donner Golf Course, and two virtual meetings on February 12, 2024. The varied meeting types and locations allowed for the greatest community engagement. The Project Team and Stakeholder Group's input was especially key for the development of the recommendation tables in Chapter 5; local knowledge ensured that the concerns and goals of the community were heard, and recommendations were subsequently tailored to the needs of the planning area. The Project Team and Stakeholder Group also provided local expertise on environmental settings and community characteristics during the risk assessment process.

In addition to the public meetings, an online community survey was available from June through September 2023 to gather community input. The survey was available early during the project process to glean feedback on community members' concerns, priorities, and goals; this feedback helped shape the CWPP development, ensuring key topics were addressed in the document. The results of the community survey can be reviewed here. Approximately 200 responses were received, capturing a diverse cross-section of individuals' associations to the Town of Truckee. Two major findings of the survey are that both defensible space by property owners and hazardous fuels reduction in open spaces surrounding communities can be improved. Nevada County conducted a 2023 community survey for the ongoing (at the time of this publication) County-wide CWPP effort; results for the Truckee zip codes can be reviewed here.

Every effort was made to include a broad cross section of the planning area in the outreach process, and different communication channels were used to engage as many members of the public as possible (e.g., online platforms, email distributions, and in-person activities). Moreover, all residents were provided multiple opportunities and encouraged to provide input.

Recommendations for future community engagement and outreach are provided in Chapter 5, Tables 5.3, 5.5, and 5.6 and the Environmental Justice section (see Chapter 3).

CHAPTER 2 – DEFINING THE WILDFIRE PROBLEM

VEGETATION, FUELS, AND FIRE REGIMES

The planning area is characterized by steep mountain slopes, a variety of fuel types, and human development, converting what was previously wildland fuels into the expanding WUI. Snowpack in the Sierra Nevada, both total amount and timing of melt, is a major driver of vegetation growth and fire susceptibility. Increased duration of snowpack decreases risk of fire, both natural and human caused (Estes and Gross 2020). Conversely, years of abundant snow followed by drought years can cause an abundance of fine fuels initially, which then cure (dry out), leading to more frequent and larger fires, especially in lower elevations, because of increased fuel availability (Keeley and Syphard 2015).

A fire regime characterizes the spatial and temporal patterns of fire and impacts to the landscape, including fire intensity, frequency, and seasonality (Table 2.1). Fire regimes are affected by vegetation (fuels), terrain, slope exposure, and other factors (NIFTT 2010).

Historic fire regimes maintained relatively lower fuel loads for the forested mountain regions and smaller but more frequent surface fires, creating a mosaic pattern across the landscape. However, human development and expansion of the WUI, along with contemporary fire suppression practices, have increased the likelihood of human ignitions and led to increased fuels accumulation. Similar to the rest of the Sierra Nevada, much of the planning area and surrounding area is overstocked (high tree density) and has a higher proportion of snags than historically present (California Wildfire and Forest Resilience Task Force 2022). These changes to the landscape have influenced frequency and severity of fire, ultimately changing the fire regime. Changes, or departure, from historic fire regimes can be measured and classified into three different categories – low, moderate, and high (Table 2.2) (NIFTT 2010)[1].

[1] Additional information on departure from historic fire regimes is in Chapter 4. Figure 4.11 shows mean fire return interval departure classifications in the planning area.

Table 2.1. Fire Regime Group

Fire Regime Group	Fire Frequency	Fire Severity
I	0-35 years	Low to mixed
II	0-35 years	Replacement
III	35-200 years	Low to mixed
IV	35-200 years	Replacement
V	200+ years	Replacement/ any severity

Table 2.2. Fire Return Interval Departure (FRID)

Condition Class	FRID	Percent Departure
FRCC 1	low	<33%
FRCC 2	moderate	33-66%
FRCC 3	high	>66%

Within the planning area, three major vegetation classes are present: mixed conifer-fir alliance, eastside pine alliance, and mixed shrub alliance.

The mixed conifer-fir alliance is the prevalent vegetative community at the highest elevations in the planning area. White-fir (*Abies concolor*), Jeffrey pine (*Pinus jeffreyi*), and/or lodgepole pine (*Pinus contorta*) are the predominant species. Other species observed in this alliance include red fir (*Abies magnifica*), sugar pine (*Pinus lambertiana*), and incense cedar (*Calocedrus decurrens*) (Cal Veg 2008). Stand composition of codominant species varies widely depending on elevation, slope, and site-specific conditions. Depending on species composition, this alliance historically had highly variable fire return intervals, ranging from 25 to 150 years (Cal Veg 2008). This alliance fits between fire regime groups III and IV, depending on the predominant species of the stand.

The eastside pine alliance dominates the mid-elevations of the Truckee area. White fir can be a codominant species or even the dominant species of the stand in places. Jeffery pine, lodgepole pine, and a variety of mixed-conifer species are also commonly present in varying degrees, depending on elevation and aspect (CALVEG 2008). Surface fuels are mostly composed of continuous needle cast and grasses, with shrubs dominating the understory and providing a ladder to the canopy. Historically, low-intensity surface fires at frequent return intervals (15-30 years, fire regime group I) maintained a healthy stand, but with longer return intervals (due to fire suppression practices), the increased fuel loading can cause high-severity, stand-replacing fires (Safford and Stevens 2017). Due to higher density and elevation, this fuel type has been significantly impacted by drought stress and insect mortality (Sherlock et al. 2005).

Intermixed within the mixed conifer and east pine alliances is a mixed shrub alliance. It consists of multiple species, including but not limited to, sagebrush, bitterbrush, huckleberry oak, mountain mahogany, and other woody shrubs depending on elevation, aspect, soil type, and moisture (CALVEG 2008). Many of these species can grow quickly; generate plentiful fine, dead branches; and have leaves with high resin content (oils) (Abrahamson 2014). When these communities are decadent and have conditions to burn, fire spreads through the shrub canopy, typically resulting in a stand-replacing crown fire (Abrahamson 2014). Historically this community has had stand-replacing fire return intervals anywhere from 30 to 125 years (fire regime group IV); however, repetitious fire (under 10 years) allows

nonnative species to outcompete the tall shrub (USFS 2012). Invasive grasses frequently colonize areas that are in recovery from a disturbance and persist until the shrubs close the canopy; however, if fire occurs during the grass succession phase, competition from shrub species is reduced and can allow grass seeds to survive and propagate a cycle of more frequent fires and decreased shrub cover (USFS n.d.(c)).

WEATHER PATTERNS AND CLIMATE CHANGE

The climate of Truckee is influenced by its high-elevation topography. Snowpack, and especially peak runoff, are important factors in fire potential and fire behavior. Extended snowpack and slower melting extend the plant's green stage, reducing fire risk by limiting its availability to burn. Snowpack duration also decreases the risk of lightning caused fires by keeping surface temperatures too low for lightning to travel to the ground (Lutz et al. 2009). Over the past 50 years, peak snowmelt/runoff has shifted to earlier; it is estimated to be an average of 10 to 15 days earlier than just a half century ago (Baldwin et al. 2003).

The 2012–2016 drought, combined with beetle infestations, brought extreme levels of tree mortality to the Sierra Nevada. Most of the planning area was spared from the worst effects, but there are pockets of pine and fir mortality across the region. In most areas, mortality is less than 5%; however, this adds complexity and fuel to any wildfire event (Estes and Gross 2020). The plant communities are well adapted to extended drought, but this extreme dryness, combined with fire exclusion and increased summer temperatures, creates a novel condition for fire management (McAffee et al. 2022, Westerling 2016). The high elevation of Truckee causes drastic temperature differentials, especially in the summer. July is typically the hottest month of the year in Truckee, with average July maximum temperatures an average of 83ºF, dropping only to 82ºF for August (Figure 2.1). January is usually the coldest month, with an average minimum temperature of 14ºF. Table 2.3 shows the high and low temperatures averaged across the entire year (U.S. Climate Data 2022).

Truckee experiences the same seasonally dependent precipitation patterns common in the Sierra Nevada, with December, January, and February generally receiving the highest precipitation and July and August receiving the least (Figure 2.1). A significant portion of yearly precipitation comes in the form of snow, averaging 202 inches annually (U.S. Climate Data 2023).

Table 2.3. Mean Annual Temperature and Precipitation for Truckee, California

				Mean Monthly Temperature (°F)		
Station	Period of Record	Mean Annual Precipitation (inches)	Mean Annual Snowfall (inches)	Max	Min	Mean Annual Temperature (°F)
Truckee	1981–2010	31.24	202	83.0	14.0	43.0

Source: U.S. Climate Data (2023)

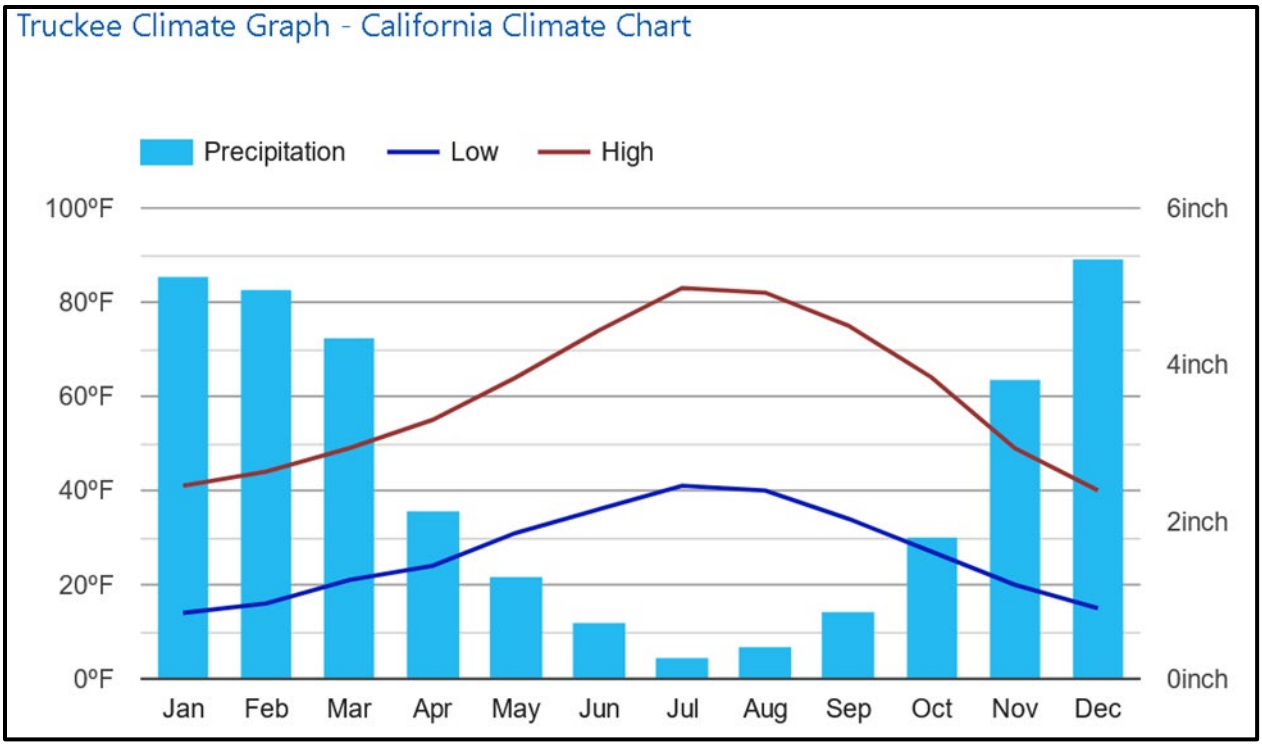


Figure 2.1. Monthly climate norms for the city of Truckee
Source: U.S. Climate Data (2022)

Accurately predicting fire weather remains a challenge for forecasters, especially in a changing climate. Fine fuels (grass, small twigs, and leaf litter) can dry rapidly, making them available to burn even shortly after light precipitation. Low live fuel moistures of shrubs and trees, which can happen during drought, can significantly contribute to fire behavior in the form of crowning and torching. With a high wind gust, grass fires can spread rapidly, often with limited time for preparation. Thus, the creation of defensible space and wildfire resilient forests is of vital importance in protecting communities from fire. For instance, a fuel break constructed in a strategic location could reduce risk to homes or possibly an entire community from fire. Additionally, defensible space around a home can also provide safer conditions for firefighters, improving their ability to suppress fire and protect life and property.

It is generally thought that human-induced climate change will have a disproportionately large impact on the amount of fires, fire spread and intensity, and altering fire regimes (Westerling et al. 2011). Even differences of seasonal weather patterns can account for drastic changes in fire frequency and intensity (Keeley and Syphard 2016). This increase in fire behavior and fire seasons, coupled with expansion of homes into the WUI, requires advanced planning and coordination across jurisdictions.

Topography is important in determining fire behavior. Aspect also plays a crucial role as southern-facing slopes receive more direct sunlight and are drier, while northern aspects usually experience wetter conditions and have a heavier fuel load. Highly steep and varied topography along the WUI and throughout the planning area affects wildland fuels, wind speed and direction, and the configuration of the WUI (for example, communities downslope of flammable fuels). Many of the communities in the planning area are in the foothills and valleys surrounded by steep terrain.

Removing natural fire from a fire-dependent ecosystem, and the increased occurrence of drought, insects, and diseases stemming from climate change, have led to increased fuels build-up and alterations to vegetation composition and structure. Decades of fire suppression has greatly increased understory

and ladder fuel densities, generally increasing fire severity and size (Stephens and Sugihara 2018). Additionally, widespread tree mortality from different stressors has added to the fuels build-up and poses increased hazards to firefighters during wildfire operations (Keeley and Syphard 2016). These vegetation changes increase the risk of uncharacteristically large, high-severity fires (California Department of Fish and Wildlife 2021). In the past few years, fires have grown to record sizes and are burning earlier, longer, hotter, and more intensely than they have in the past (Westerling et al. 2006; Westerling 2016). Incident statistics show that 60% of the top 20 largest wildfires in California occurred in the last 5 years, including the August Complex Fire (August 2020) and the Dixie Fire (July 2021). These two fires alone burned a combined total of nearly 2 million acres and well over 2,000 structures (CAL FIRE 2022b).

A study of wildfires spanning from 1970 to 2003 found increases in large fires. From 1987 to 2003, the number of wildfires was 4 times higher than that of the preceding decade (Westerling et al. 2006). An update to Westerling et al.'s (2006) work found that the frequency of large wildfires has continued to increase with each decade since 1970 (Westerling 2016). Recent studies suggest that this trend will continue (Iglesias et al. 2022). By 2050, Truckee is expected to experience a 5-7 degree increase in maximum temperatures, a 68-71% reduction of April snowpack, and up to 61% increase in the annual average area burned by wildfire (Town of Truckee 2020). With increased fires come increased suppression costs; the 2021 fire season beat all previous records, with federal firefighting costs reaching over $4 billion (National Interagency Fire Center 2021).

Within the 2040 General Plan (Town of Truckee 2023), Truckee developed a Climate Action Plan and a Climate Adaptation Plan element to protect current and future generations from wildfires among other natural disasters. Strategies in the Climate Adaptation Plan to create wildfire resistance and resilience include increasing public awareness of the importance of reducing fuel loads and ignition sources, requiring native/ fire-resistant species for Town properties, removing invasive/fire-spreading species on public lands, and re-introducing fire into the ecosystem through prescribed burning (Town of Truckee 2020).

FIRE HISTORY

Fire is a natural part of California's diverse landscapes and is essential to many ecosystems across the state. Almost all of California's diverse ecosystems are fire-dependent or fire-adapted. For centuries, many California Native American tribes recognized this interdependence between fire and the ecosystem and, using cultural prescribed fire practices, maintained ecosystem health. However, in the 1800s, a shift in management actions due to increased numbers of settlers led to issues we face today, such as dense forest conditions with more available flammable vegetation.

In 2021 both the Dixie Fire and Caldor Fire burned across the Sierra Nevada Crest. This is a novel pattern in fire behavior for the area, highlighting the changing fire environment, and increased risk for communities in the Sierra Nevada region (Brown et al. 2023). The Caldor fire burned just south of Lake Tahoe, roughly 30 miles from the planning area. The 2022 Mosquito Fire (California's largest wildfire of the year) burned through the southern portion of Placer County, primarily in the Tahoe National Forest, approximately 25 miles southwest of Truckee. The Mosquito Fire burned for 6 weeks, destroyed 78 structures, and burned approximately 76,788 acres in total (CAL FIRE 2023a).

In addition to large fires in the region, the planning area has also experienced many smaller fires and ignitions from human causes (i.e., arson, equipment use, and unauthorized encampments).
An examination of fire history within the planning area (1908–2022) shows few patterns regarding the size or number of fires. Generally, there are more fires in the northeastern quadrant of the TFPD (Figure 2.2).

This may be due to the specific fuel types; the prevalence of pine woodlands and chaparral bordering human-developed commercial industrial areas provide a constant flammable fuel source or patterns of human activities (LANDFIRE 2022).

Fire history in Truckee shows a high degree of variability in total number of fires from decade to decade and year to year. For example, the planning area had no fires in the 1980s, but three fires each year in 1926 and 1949. There has been a notable increase in the total number of fires in the past two decades (Figure 2.3). There is also variability in amount of land burned: most fires in the past two decades have been small in size (less than 10 acres (Figure 2.4), and total area burned within the planning area has fallen sharply in that same time (Figure 2.5). Human-caused fires are a concern as more people live and recreate in the WUI (Li and Banerjee 2021). In the past two decades, human-caused fires have increased compared with the previous century (Figure 2.6). The largest recent fire near the planning area, the Martis Fire in 2001 totaling over 14,000 acres, was human caused. Seasonally, August is by far the most active month, accounting for 30% of all wildfires. This aligns with historic peak fire season in northern California, which is generally July to November (Figure 2.7).

The largest fire that started or burned into the planning area was the Donner Ridge fire in 1960. Also human caused, it burned over 43,000 acres in August before containment 10 days later. Only approximately 5,500 acres were within the planning area boundary. Since 2000 seven fires have burned over 16,800 acres of the planning area (Figure 2.5).

Data comes from publicly available sources, and data for some fires may be missing or incorrect. This is due to the loss or damage of historical records as well as inadequate documentation (CAL FIRE 2022b). Given the limitations of the data, our fire history analysis may contain discrepancies.

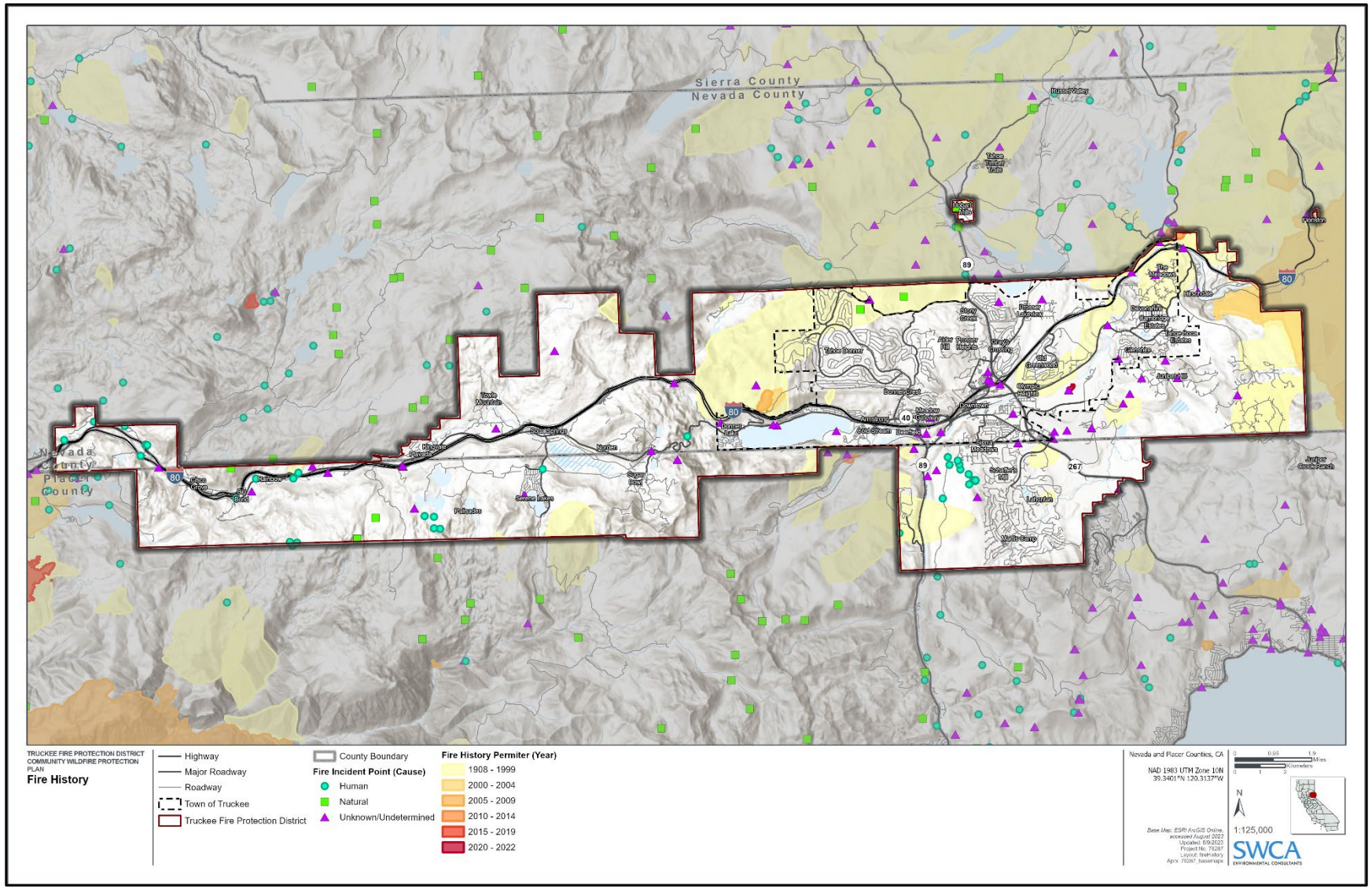


Figure 2.2. Historic fire perimeters and fire incident points for the planning area from 1908 through 2022.

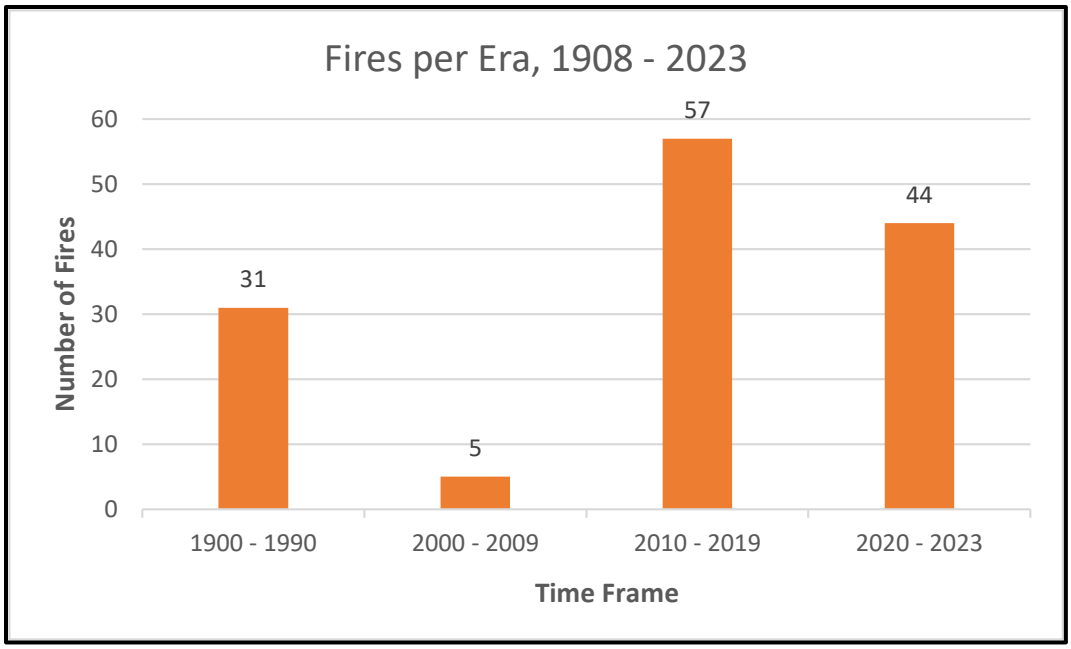
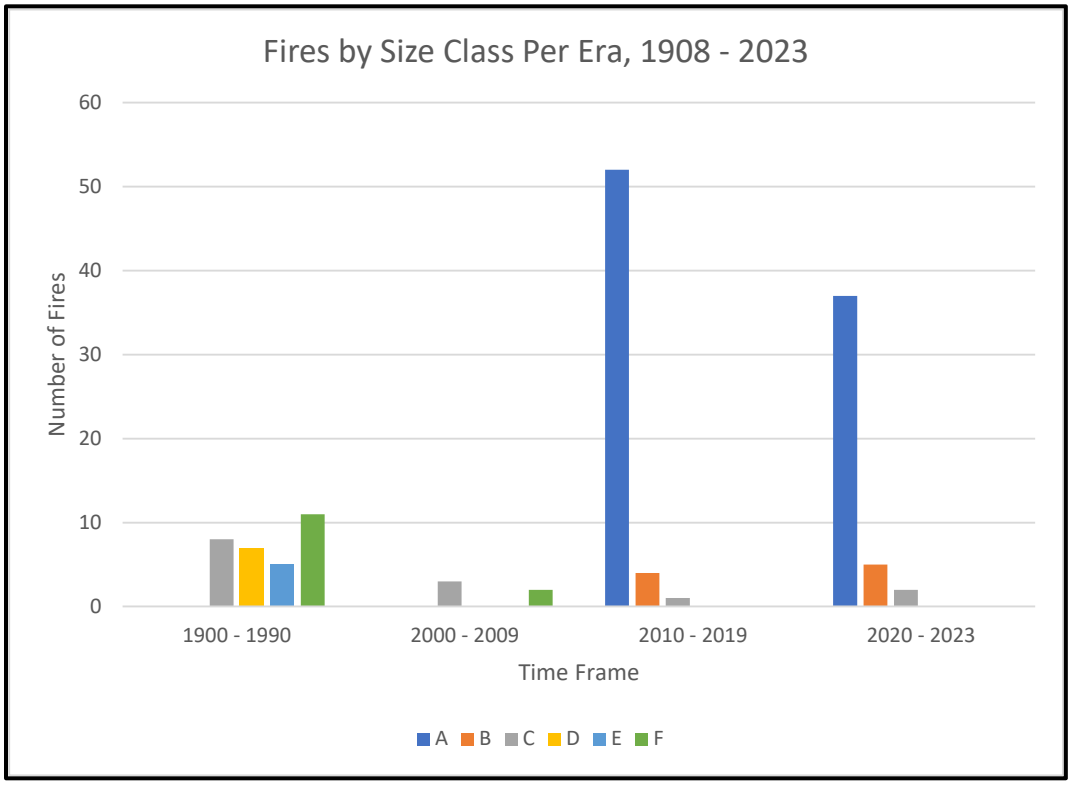


Figure 2.3. Wildfire frequency in the planning area from 1908 through 2023 based on available data.



Note: Size Class: A = 0.25 acre or less; B = greater than 0.25 to 10 acres; C = 10 to 100 acres; D = 100 to 300 acres; E = 300 to 1,000 acres; F = 1,000+ acres.

Figure 2.4. Fire size statistics per decade for the planning area based on fire history data from 1908 through 2023.

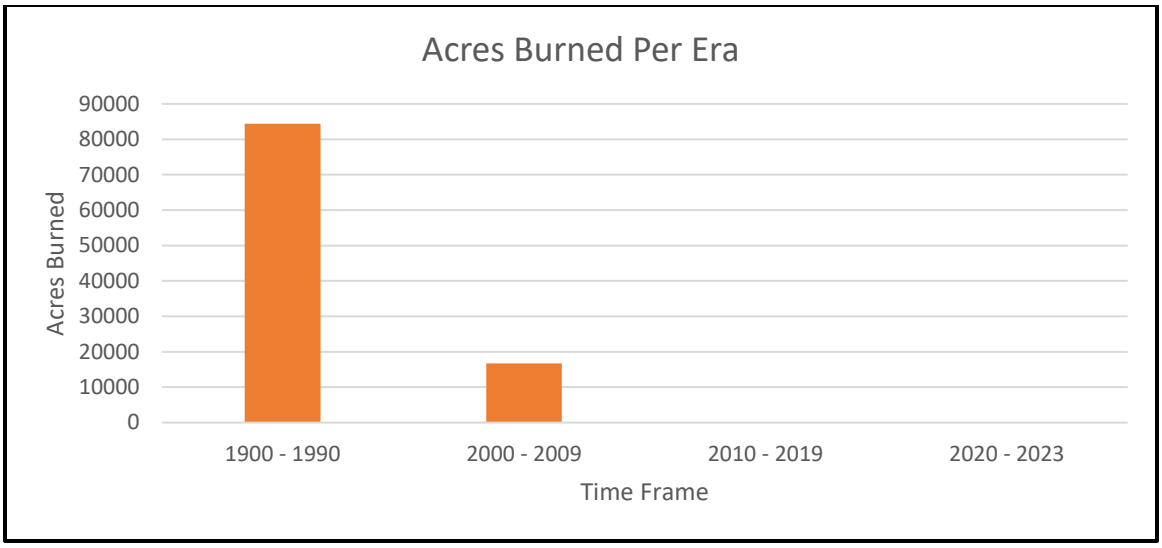


Figure 2.5. Acres burned per decade for the planning area based on fire history data from 1908 through 2022.

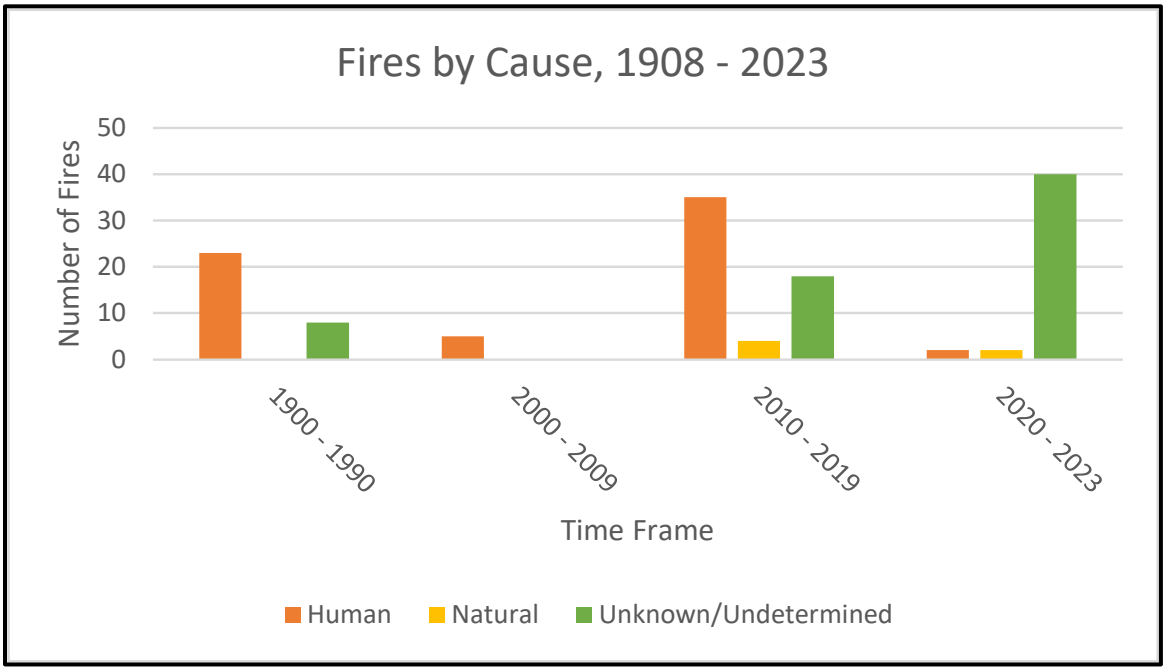


Figure 2.6. Fire causes for the planning area from 1908 through 2023.

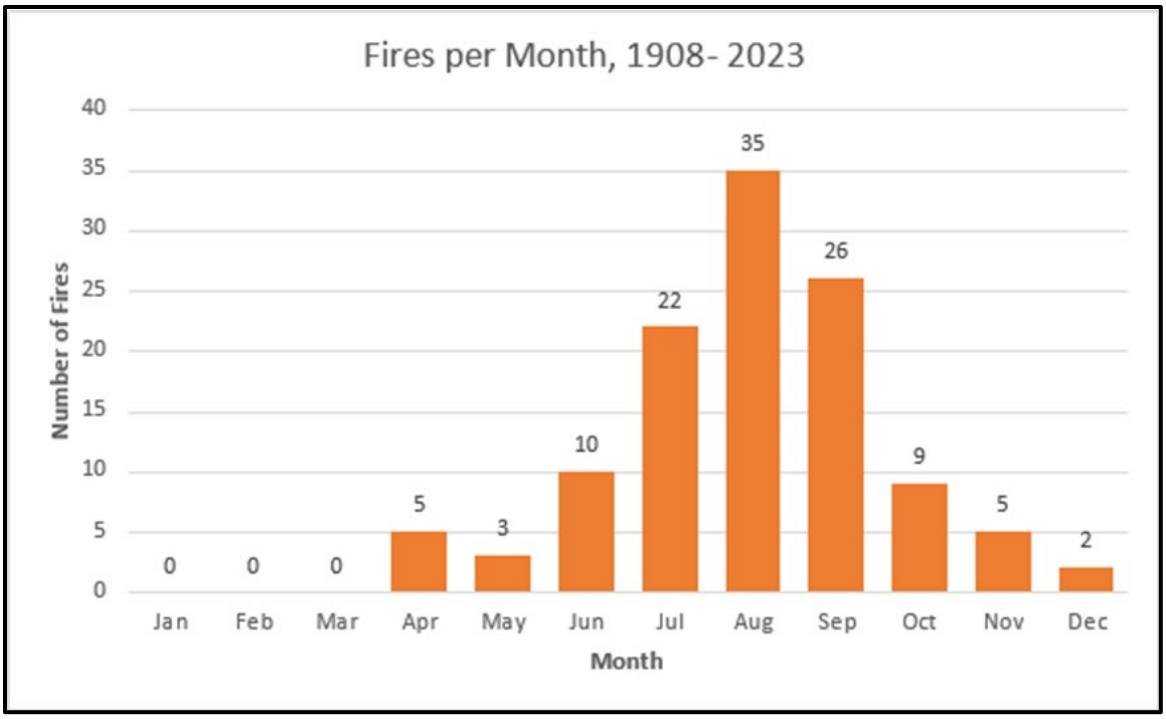


Figure 2.7. Monthly fire frequency in the planning area based on data from 1908 through 2023.

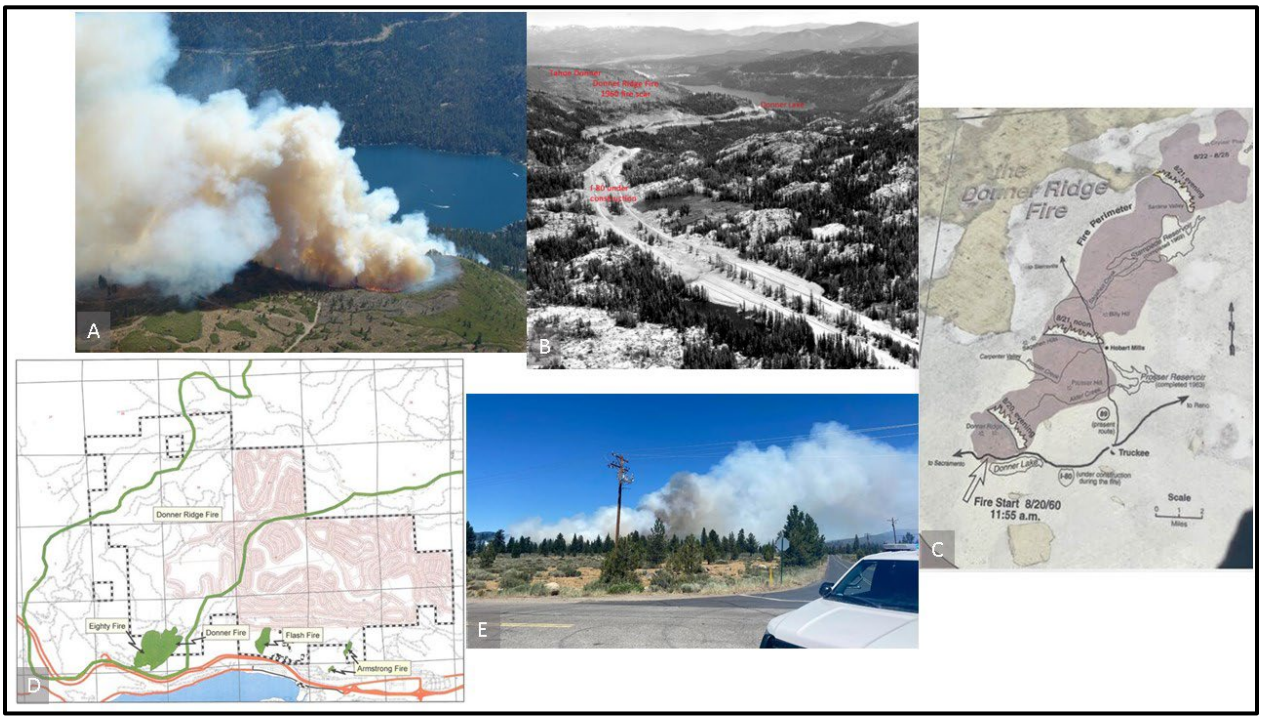


Figure 2.8. Photographs of fire history in the planning area.

A (top left) shows a 2007 I-80 fire that burned within the 1960 Donner Ridge Fire burn scar towards Tahoe Donner. B (top middle) aerial view circa 1962 of Donner Ridge. C (far right) shows the timeline of the flaming front, and the full burn perimeter of the Donner Ridge Fire. D (bottom left) a portion of the

Donner Ridge Fire that shows where it burned, overlayed with present day Tahoe Donner and more recent fires. D (bottom middle) the 2022 Butterfield Fire in Truckee burning near Joerger Drive and Butterfield Drive. (Photos B, C, and D courtesy of Truckee- Donner Historical Society, full images can be found here. Photo A available at Tahoe Daily Tribune here. Photo E available at Fox 40 local news here).

FIRE RESOURCES

California has many federal, state, and local fire protection organizations that are well integrated through a variety of mutual aid and fire protection agreements and coordinated by organizations such as the California Wildfire Coordinating Group, the Northern and Southern California Geographic Area Coordination Centers (GACCs), and FIRESCOPE. Agencies such as the California Office of Emergency Management, U.S. Forest Service (USFS), and CAL FIRE form the basis of a robust wildfire response capacity that can be deployed in wildfire situations throughout the state. At the local level, Truckee Fire operates eight stations, four of which have wildfire capacity (Table 2.4)

At the federal level, the Tahoe National Forest (USFS) borders the planning area and has a variety of wildland fire personnel including three Hotshot crews, engines, and aviation resources. A mutual aid agreement will also provide additional resources as needed within the planning area. Both USFS and CAL FIRE are coordinated from the same dispatch center in Grass Valley. Should the need arise, additional local, state, and federal resources can be called in for a fire within the planning area.

At the state level, CAL FIRE NEU staffs 17 fire stations during peak wildfire season, with Station 50 in Truckee being the local resource. NEU provides various fire resources, support teams, and aviation to any emerging incident. Its designated area of response is State Responsibility Area (SRA) land to the immediate west and northern middle of the planning area, but through a mutual aid agreement will also respond to wildfire on Local Responsibility Area (LRA) land within the Truckee FPD.

Truckee Fire has eight fire stations in the planning area. Four of these have the capability to respond to wildfires (Stations 92, 95, 96 and 97). These four stations are staffed 24 hours per day, 7 days per week to provide immediate response to any emerging wildfire incident. Station 92 is the “main station” and services the Central Truckee community. Station 95 services East Truckee, Station 96 services the Martis Valley area, and Station 97 services the Donner Summit community. Station 93 (Donner Lake), 94 (Tahoe Donner), and 98 (Serene Lakes) are resident stations that house off-duty firefighters and extra equipment/engines. These three resident stations house structure engines as opposed to wildland brush engines but can be called on in an emergency. Station 91 is the main administration and prevention office for Truckee Fire (Truckee Fire 2023a).

Table 2.4. Fire Stations in the Planning Area and Vicinity

Agency	Station Name	Location	Wildfire Specific?
Truckee Fire	91	Central Truckee	No
Truckee Fire	92	Central Truckee	Yes
Truckee Fire	93	Donner Lake	No
Truckee Fire	94	Tahoe Donner	No
Truckee Fire	95	East Truckee	Yes
Truckee Fire	96	Maris Valley	Yes

Agency	Station Name	Location	Wildfire Specific?
Truckee Fire	97	Donner Summit	Yes
Truckee Fire	98	Serene Lakes	No
CAL FIRE NEU	50	Maris Valley	Yes
Tahoe National Forest	Engine 34	Big Bend	Yes
Tahoe National Forest	Engines 71 and 73	Truckee	Yes
Tahoe National Forest	Engine 72	Stampede Lake	Yes

WATER SOURCES

Within the Town of Truckee there are fire hydrants, pumps, tanks, and natural water sources that can be used to support fire suppression operations. The remainder of the planning area has fewer fire hydrants, but abundant natural water bodies firefighting crews can access (Figure 2.9).

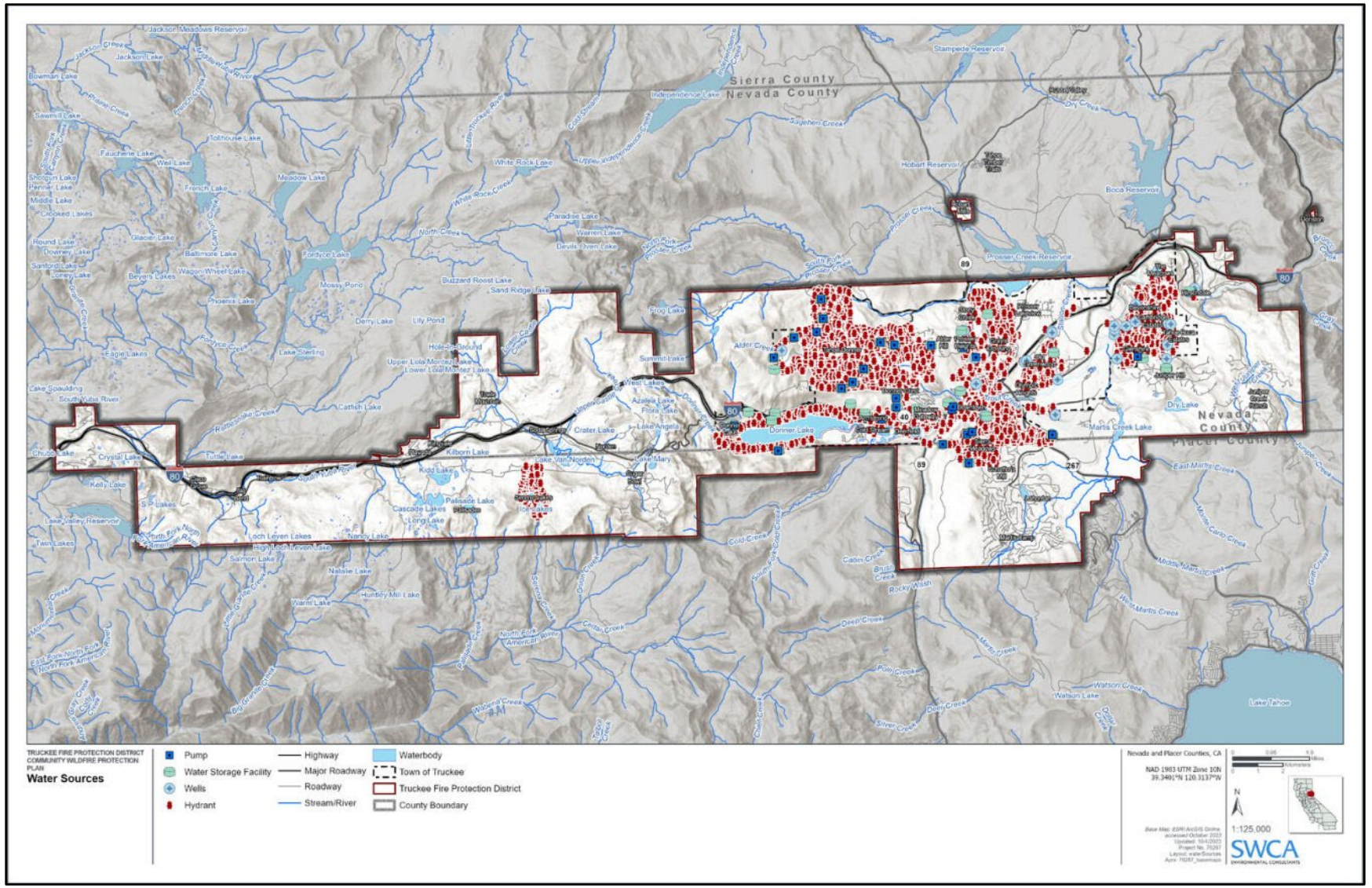


Figure 2.9. Water sources in the planning area.

Note: Data come from the Town of Truckee and Sierra Nevada Water.

CHAPTER 3 – COMMUNITIES AND RESOURCES AT RISK

VALUES AT RISK

Compilation of the critical infrastructure data, community assessments, public outreach, and Project Team input has helped in the development of a list of values at risk from wildland fire, known here as strategic areas, resources, and assets (SARAs) derived from a collaborative effort of the Project Team (Table 3.1).

Table 3.1. SARA Categories Used in Analysis

Category	Sub-category	Item/ Detail
Assets	Structures	
	Transportation	Railroads- Union Pacific
		Bridges
	Utilities	Aboveground Water Delivery
		Source Water (hydrants, well pumps, etc.)
		Energy Facilities and Substations
		Reservoirs and Dams
		Transmission and Distribution Lines Kinder Morgan petroleum pipeline
		Water Treatment and Holding Facilities
Safety	Community Transmission Zone	
	Safety Zones and Critical Access Routes	
	Services	Communication Infrastructure
		Emergency Facilities (hospitals, police station, fire and EMS stations, etc.)

Category	Sub-category	Item/ Detail
Recreation	Campgrounds	
	Trails	
	Recreation Facilities/Infrastructure	
Haz/Mat Buildings		
Critical Infrastructure		Town Hall, Government buildings, Schools, Community centers
Airport		Truckee-Tahoe Airport
Biodiversity	Plant and Animal Communities	
Ecological Commodity	Extractive	Plantations
Carbon		Aboveground live tree biomass
Water	Hydrogeomorphology	Erosion potential
	Surface Water	Perennial rivers and streams, Lakes
History and Knowledge	Cultural Resources	
	Monitoring Stations	

The identification of SARAs can inform treatment recommendations. Appropriateness of treatment, land ownership, locations of ongoing projects, available resources, and other physical, social, or ecological barriers must all be considered to fully prioritize areas for treatment.

The scope of this CWPP does not allow determination of the absolute natural, socioeconomic, and cultural values that could be impacted by wildfire in TFPD. In terms of socioeconomic values, the impact due to wildfire would cross many scales and sectors of the economy and call upon resources locally, regionally, and nationally. Curated data from Land Tender did not include information such as home values or economic standing by population statistics.

Each of the five major communities that make up the planning area has SARAs; some are unique to the community and some overlap. Homes are considered structures in the Assets category and are present in all five communities. The following is a breakdown of SARAs present in each community (this is not an exhaustive list):

Donner Summit:

- Two critical infrastructure areas
- Multiple energy facilities
- Critical access routes: I-80, Soda Springs Road, and Donner Pass Road
- Emergency Services: Truckee Fire Stations 97 and 98, USFS Big Bend Fire Station
- Railroad (paralleling I-80)
- Pipeline (oil & natural gas products)
- Multiple cellular towers
- Multiple bridges

- Hazardous materials site

Central Truckee:

- Critical infrastructure: two Tahoe Truckee Area Regional Transportation branches, five schools, Truckee Donner Public Utility District, Placer County Road Department and Fleet Services
- Multiple energy facilities
- Critical Access Routes: I-80, CA-267, CA-89, Old Brockway Road, Martis Valley Road, Ponderosa Drive, Donner Pass Road, Northwood Boulevard, Comstock Drive, South Shore Drive, Alder Drive, and Alder Creek Road
- Emergency services: Truckee Fire Station 92; Tahoe Forest Hospital, Emergency Room, and associated pharmacy; California Highway Patrol
- Railroad (main lines)
- Pipeline (oil & natural gas products)
- Many communication values
- Multiple bridges
- Many hazardous materials sites
- Many timber/forest plantations

Martis Valley:

- Critical access route: Schaffer Mill Road
- Railroad
- Transmission lines
- Waterways and wildlife habitat

Tahoe Donner:

- Critical access routes: Northwoods Boulevard and Alder Creek Road
- Emergency Service: Truckee Fire Station 94
- Transmission lines
- Cellular towers
- A bridge
- Many hazardous materials sites
- Recreation sites and trails
- Waterways, wildlife habitat, and aspen stands

East Truckee:

- Truckee Tahoe Airport
- Critical infrastructure: Glenshire Elementary School, Tahoe Truckee Unified School District Transportation Services, Truckee Sanitary District

- One energy facility
- Multiple critical access routes: I-80, CA-267, CA-89, Prosser Dam Road, Glenshire Drive, and Martis Peak Road, as well as smaller roads that connect subdivisions to these main roads
- Emergency Services: Truckee Fire Station 96/CAL FIRE Station 50, Truckee Fire Station 95
- Railroad (several main lines)
- Communication infrastructure: A variety of cellular towers and air traffic communications associated with the airport (20+)
- Many bridges
- Many hazardous materials sites

EVACUATION

As part of emergency management protocols, Truckee Fire partnered with Nevada County and CAL FIRE, adopting the CAL FIRE Ready, Set, Go! handbook for emergency preparedness and protocols for community evacuation. Nevada County mails the Handbook as well as the Truckee Fire flyer to all residents.

Truckee has also partnered with CodeRED & Genasys Protect to let residents with cellular devices quickly and efficiently know of emergencies and evacuation status by zone. Residents are required to sign up for this service via text, phone call, or web-browser (Truckee Fire 2023b). Residents should know their zone and be made aware of other notification systems. Local law enforcement (Truckee Police Department, Nevada and Placer County Sheriff's Offices, and others) have similar systems and are the responsible officials for declaring and enforcing an evacuation order. Dialing 2-1-1 will also connect residents to the Tahoe/ Truckee regional disaster hotline, Connecting Point.

Town of Truckee and Nevada County have partnered with Ladris Technology's artificial intelligence–based evacuation platform to help Truckee Emergency Management better plan and prepare for a potential evacuation of residents. This online platform (available here) can provide up to date information of any incident, and allows emergency managers and partners to simulate evacuation routes depending on the location of a potential wildfire (Ladris 2022). Figure 3.1 shows likely evacuation routes many Town of Truckee residents would take based on road size and population density. The exact route depends on the type and location of emergency and a suite of other factors. Residents should have several evacuation routes in mind ahead of time, as well as secondary or backup routes. It is key that residents understand that emergency situations and potential evacuations are dynamic situations.

Additionally, local radio stations 1670 AM, 101.5 KTKE, and 780 KOH will be updated with relevant news and evacuation orders during emergency incidents. There are multiple stages to any evacuation order: shelter in place, evacuation warning, immediate evacuation order, and rescue; details can be found on the Truckee Fire website (Truckee Fire 2023b).

Truckee Fire recommends having a "Go Bag" ready at all times in case an evacuation order is given. Key components of a "Go Bag" include non-perishable food, water, clothing for inclement weather, toiletries, and money, all of which can be stored ahead of time to expedite the evacuation process. Other daily-use and sensitive items, such as laptops, passports, birth certificates, medications, and memorabilia, will have to be gathered at the time of the order. Making a plan for which of these items residents will grab for their "Go Bag" can save valuable time in the event of an evacuation (Truckee Fire 2023b).

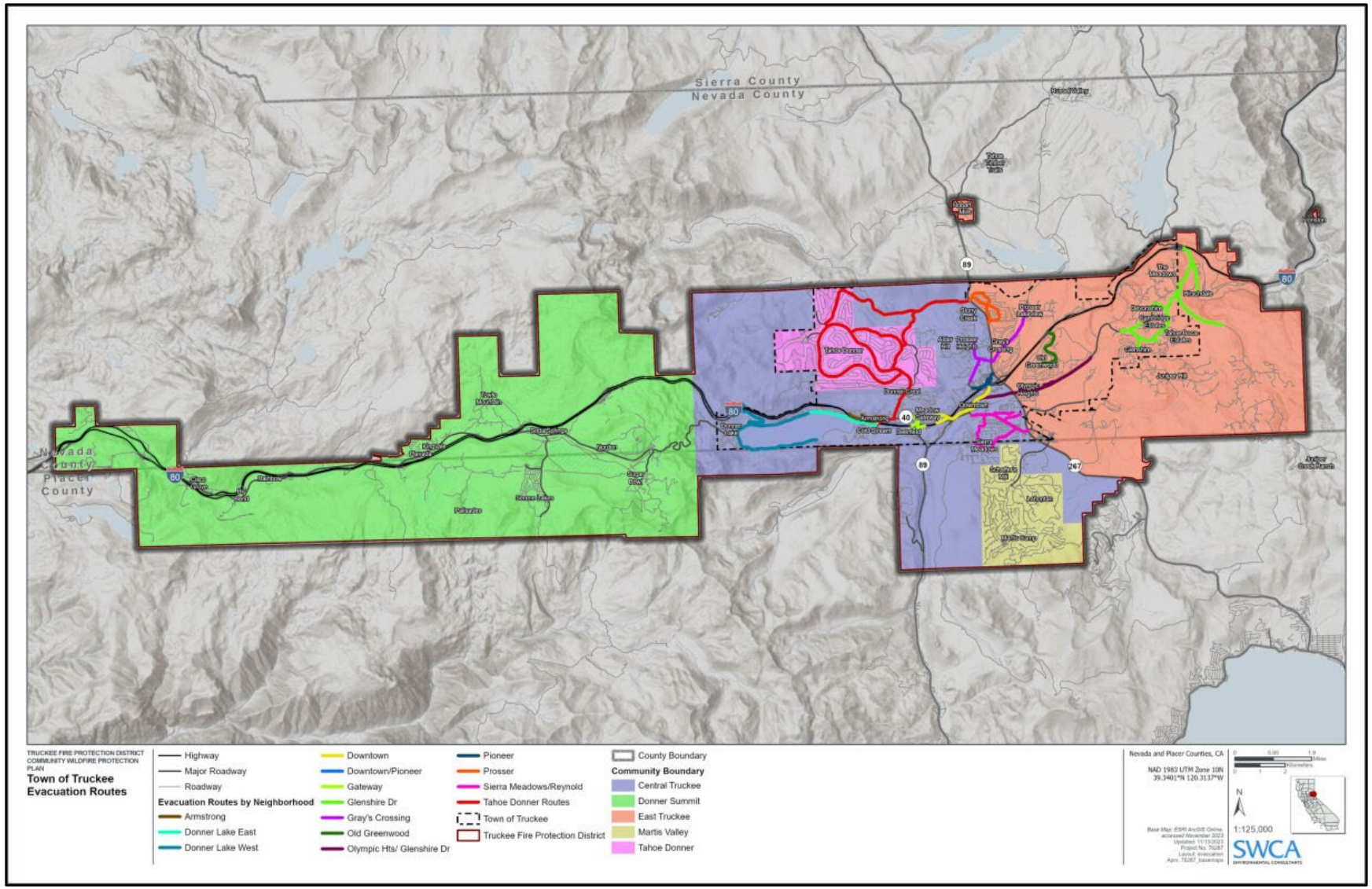


Figure 3.1. Likely evacuation routes for the Town of Truckee.

Note: Likely evacuation routes are from Truckee Office of Emergency Services and thus do not include areas outside the town limits. Law enforcement agencies are typically responsible for declaring and enforcing an evacuation order.

Pursuant to AB 2911, the California Board of Forestry and Fire Protection (BOF) conducted the Subdivision Review Program which included completing surveys for 17 subdivisions within the Truckee Fire jurisdiction, accounting for an estimated 2,723 dwellings (Table 3.2, Figure 3.2). AB 2911 requires BOF to identify existing subdivisions with more than 30 dwelling units, located in an SRA or LRA Very High FHSZ, which are at significant fire risk and lack a secondary egress route. Of the 17 subdivisions surveyed by BOF in the Truckee area, only Sugar Bowl was identified as having a secondary egress route, an unmaintained forest road. The remainder are "one-way in, one-way out" (Heartwood, just west of the airport, does have an alternate, but limited and locked access road which may not be sufficient during emergency situations). In general, the BOF recommends implementing a secondary access route, reflective/high-visibility address and evacuation route signs, running subdivision-wide evacuation drills, and limiting side-street parking during red flag warnings for all the surveyed subdivisions (BOF 2022). It should be noted that the BOF surveys are not comprehensive and may not fully capture every subdivision evacuation route or signage. BOF is responsible for protecting all wildland forest resources in California that are not under federal jurisdiction.

Table 3.2. Truckee Area Subdivisions Identified and Reviewed by BOF under the Subdivision Review Program

Subdivision Names	
Alder Drive	Martis Landing
Baden*	Martis Peak Community
Basque Drive	Pla Vada Drive
Beaver Pond	Regency
China Camp Road	Serene Lakes
Donnington	South Shore Drive
Floriston Way*	Sugar Bowl
Gray Wolf	Swiss
Heartwood	

*Spatial data was not publicly available for these subdivisions.

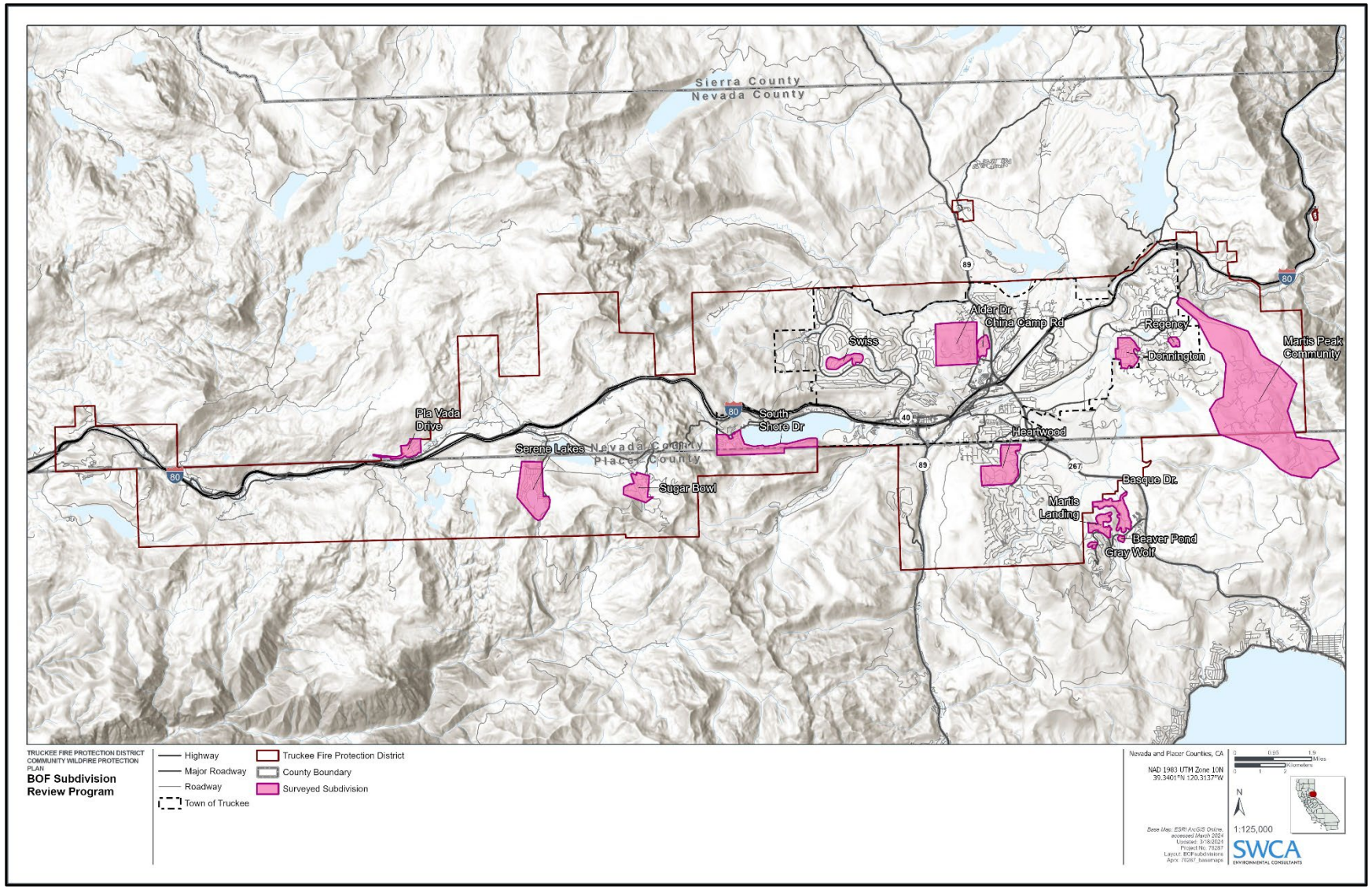


Figure 3.2. Subdivisions surveyed by BOF for ingress and egress routes under the Subdivision Review Program.

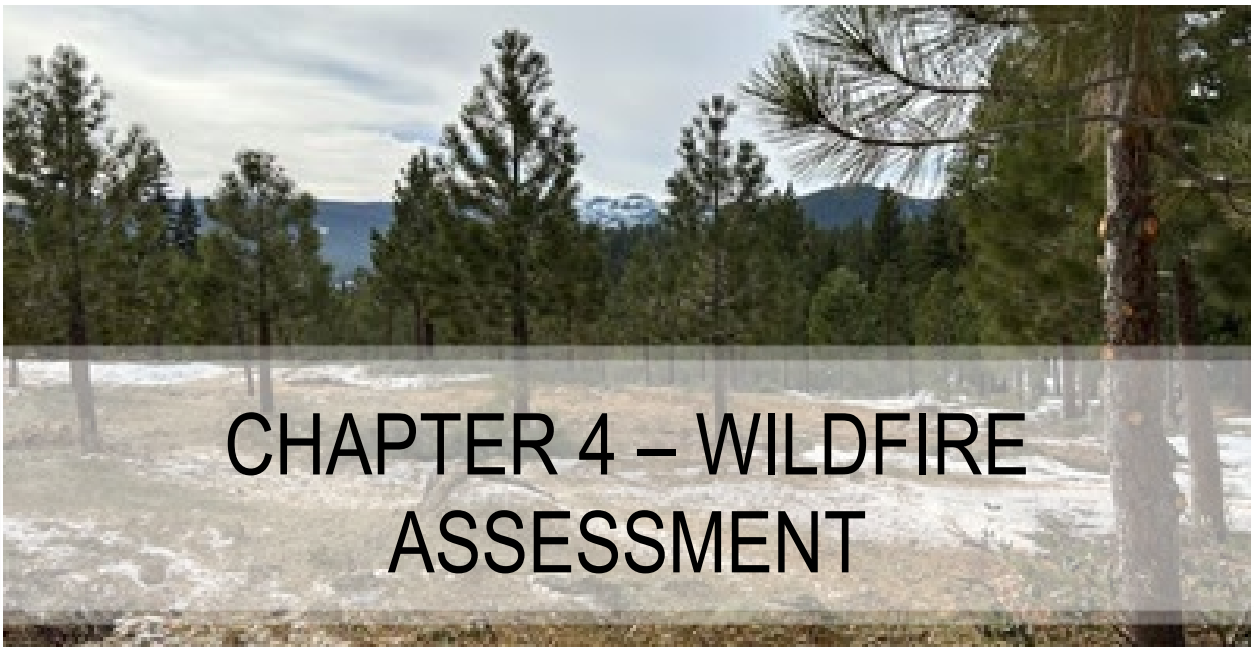
Note: Data were provided by CAL FIRE on August 8, 2023. Some data may be missing or have been updated.

ENVIRONMENTAL JUSTICE

The planning area has not been immune to the complex challenges posed by environmental disparities and the unequal distribution of environmental benefits and burdens. Examining the spatial and census data allows a deeper dive into the socioeconomic demographics of the affected populations in the planning area. These data are often grouped based on city or county rather than a Fire Protection District. The following will examine only the city limits of Truckee but is still representative of the planning area.

The Town of Truckee has a *very high* risk of wildfire, higher than 94% of all communities nationwide, and a high proportion of *vulnerable populations* (USFS 2023). While all of Truckee is at risk of wildfire, the impact to residents may not be uniform across the community. The eastern portion of Truckee has an above-average number of residents in the population that speak limited English. The western portion of the town has an above-average number of residents in the population that are elderly and disabled, which could present additional evacuation difficulties. There is an above-average number of mobile homes (running north to south) in the town center (USFS 2023). When wildfire impacts these structures, it is much more likely to travel from one structure to the next than traditional stick-built homes due to close proximity to one another (Pierce et al. 2022).

Any future mitigations, evacuation plans, and emergency response should account for differences in the communities of the planning area and the risks posed to the population and first responders based on socioeconomic data. For example, almost 400 people within Truckee Town limits have difficulty with English and are mostly Hispanic. Therefore, signage and alerts in Spanish would benefit a substantial group (USDA 2023).



CHAPTER 4 – WILDFIRE ASSESSMENT

Disclaimer[2]

PURPOSE

The intent of the risk assessment is to create a useable reference for evaluating the hazard of wildland fires to communities and open spaces within the planning area, including the WUI, and the exposure and susceptibility of values and assets identified as important by stakeholders and the community. Although many definitions exist for hazard and risk, the terms in this document are as defined by the USFS to communities (USFS 2023):

Hazard is the likelihood and intensity of a wildfire occurring in a location on the landscape.

Risk is the hazard plus the exposure and susceptibility to that hazard.

The risk assessment characterizes predicted threat from fire on values that often overlap across the landscape. It uses a GIS-based model formed from key inputs. The resulting risk assessment classifies the amount of risk across the landscape.

[2] The purpose of the risk assessment is solely to provide a landscape and community-level overview of general wildfire risks within the planning area as of the date hereof, and to provide a potential resource for pre-fire planning efforts. This risk assessment is premised on various assumptions and models based on data, software tools, and other information provided by third parties (collectively, "Third-Party Information and Tools"). SWCA, Incorporated, doing business as SWCA Environmental Consultants ("SWCA"), relied on various Third-Party Information and Tools in the preparation of this risk assessment, and SWCA shall have no liability to any party in connection with this risk assessment including, without limitation, as a result of incomplete or inaccurate Third-Party Information and Tools used in the preparation hereof. This risk assessment may not be relied upon by any party without the express written consent of SWCA. SWCA hereby expressly disclaims any responsibility for the accuracy or reliability of the Third-Party Information and Tools relied upon by SWCA in preparing this risk assessment. SWCA shall have no liability for any damage, loss (including loss of life), injury, property damage, or other damages whatsoever arising from or in connection with this risk assessment, including any person's use or reliance on the information contained in this risk assessment. Any reproduction or dissemination of this risk assessment or any portion hereof shall include the entirety of this plan disclaimer.

This assessment aids land managers, fire officials, and stakeholders in planning treatments across the landscape, designing monitoring programs, and developing preparedness measures for communities to reduce the fire risk.

This document aligns with Chapter 8 of the recently adopted Truckee 2040 General Plan, which recognizes wildland fire occurrence as an annual threat, exacerbated by heavy fuel loads, highly susceptible topography, and critical weather conditions (Town of Truckee 2023).

RISK ASSESSMENT INPUTS AND METHODOLOGY

INPUTS

The risk assessment was conducted using a desktop analysis of the following inputs:

Values – natural and human-made assets we care about on the landscape.

- Strategic Areas, Resources, and Assets (SARAs)

Landscape Fire Behavior – the likelihood and intensity of a fire occurring on the landscape, influenced by the fire environment.

- Historic Fire Occurrence
- Fire Return Interval Departure – Condition Class
- Fuel Models (vegetation)
- Tree Canopy Base Height
- Conditional Flame Length
- Burn Probability

Exposure and Susceptibility – the spatial overlap of a value with the likelihood and intensity of a fire.

- WUI

Values, or SARAs, were determined through a collaborative effort between Truckee Fire and the Project Team. They include natural assets (plant and wildlife communities, waterways, carbon storage, and others), human-made assets (utilities, roads and other infrastructure, access routes, recreational facilities, and others), and cultural assets. The landscape fire behavior used curated data from Vibrant Planet specific to the project region; details of the methodology used can be found in the Tahoe National Forest Supplemental Technical Report (Vibrant Planet 2022). Vibrant Planet's Land Tender is a cloud-based scenario-developing and decision support tool. It streamlines stakeholder collaboration and the natural environment to prioritize hazardous fuels reduction projects. The data accounts for disturbances on the landscape through 2022, including fuels treatments completed by Truckee Fire and partnering agencies. The exposure and susceptibility data come from the WUI layer, again determined through a collaborative effort of Truckee Fire and the Project Team, unique to this project. Fire response was not an input as the majority of the CWPP planning area is within Truckee Fire's jurisdiction. Evacuation was incorporated via the SARAs curated data as key access roads under natural assets.

While fire behavior metrics are part of the risk assessment, it is important to note that the risk assessment is not a model of expected fire behavior, but a classification of values at risk from wildfire.

METHODOLOGY

The risk assessment, using a weighted sum model, assigned equal weight to all the inputs, resulting in a comprehensive qualitative risk assessment for the landscape (Figure 4.1). In a weighted sum model, the weighted values of each pixel (30 × 30 meters) from each input are added together so that the resulting data set contains pixels with summed values of all the inputs. Each of the original pixel values have been reclassified with a new value between 1 and 4, based on the significance of the data (1 = lowest, 4 = highest). The landscape is thus classified by categories of fire risk—low, moderate, high, and extreme. This was done using the natural breaks method (Jenks method). The risk assessment data have been processed using Environmental Systems Research Institute (ESRI) ArcGIS Desktop and the ESRI Spatial Analyst Extension. Information on these programs can be found at http://www.esri.com. Data have been gathered from all relevant agencies, and the most current data available have been used.

Table 4.1 illustrates the inputs and the relative weights assigned within the risk assessment modeling framework, and the data source. Figure 4.1 illustrates a schematic of the inputs.

Table 4.1. Risk Assessment Inputs, Sources, and Weights

Input	Source	Weight
Fire Occurrence Density	Vibrant Planet – Land Tender	1
Fire Return Interval Departure – Condition Class	Vibrant Planet – Land Tender	1
Conditional Flame Length	Vibrant Planet – Land Tender	0.5
Burn Probability	Vibrant Planet – Land Tender	0.5
Fuel Models	Vibrant Planet – Land Tender	1
Tree Canopy Base Height	Vibrant Planet – Land Tender	1
Strategic Areas, Resources, and Assets	Project Team	1
Wildland-Urban Interface (WUI)*	Project Team	1
Suppression Difficulty Index (SDI)	Project Team	0

Note: Additional information on data curation by Vibrant Planet for Land Tender can be found here.

SDI is a metric of how difficult it is to contain a wildfire based on terrain and fuels. While not included in the risk assessment, it does help to more fully understand the implications of a wildfire.

*SWCA used a tiered, three layer WUI metric. **WUI Intermix**: 250-foot buffer around structures. Subdivision boundaries were manually corrected to create contiguous WUI Intermix. **WUI Defense**: 0.25-mile buffer from the WUI Intermix, and a 500-foot buffer from major roadways. **WUI Threat**:1.25-mile buffer from the WUI Defense. The total WUI area is therefore more than a 1.5-mile total buffer.

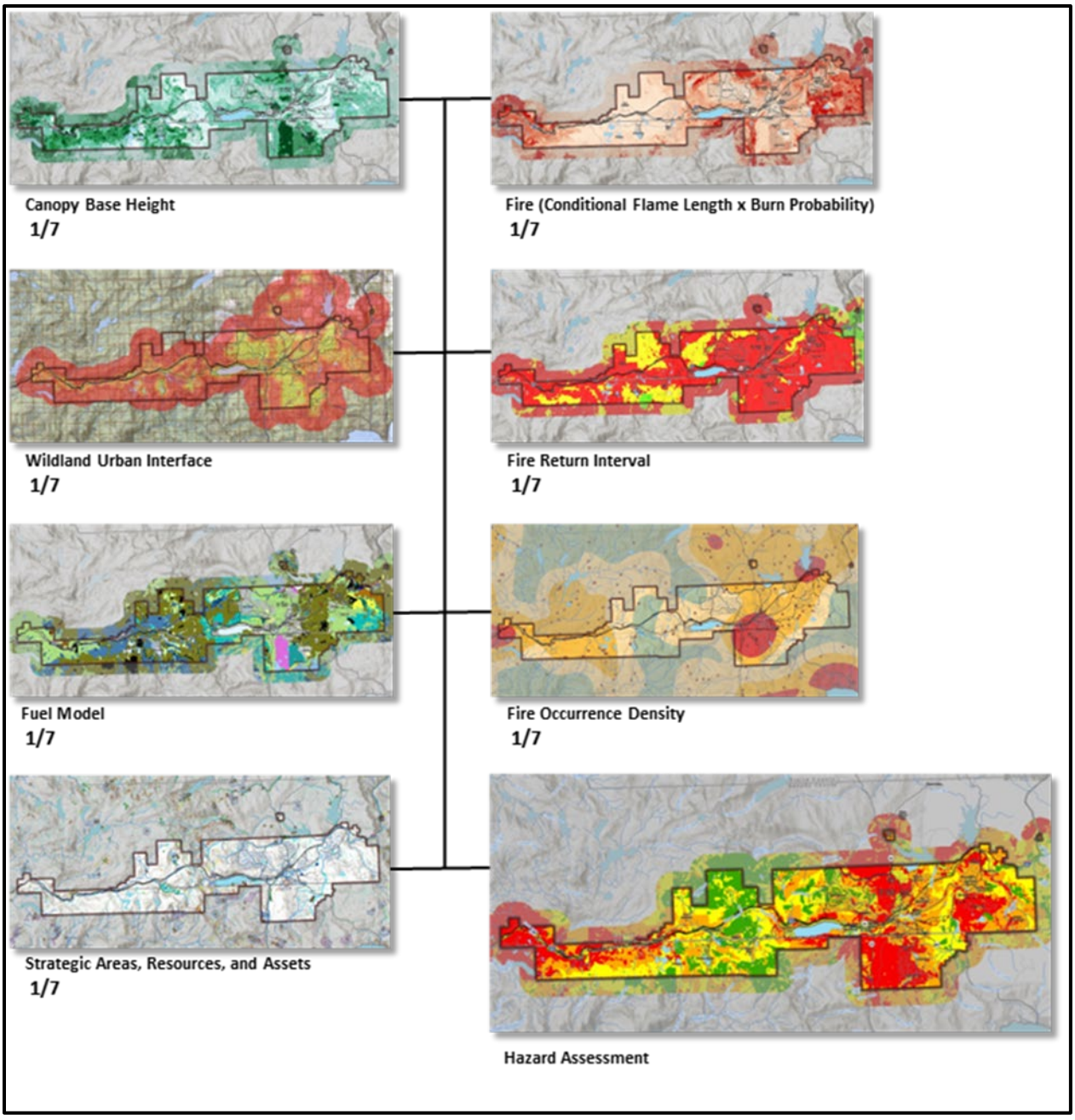


Figure 4.1. Risk assessment inputs.

RISK ASSESSMENT RESULTS

The risk assessment (Figure 4.2) shows high and extreme wildfire risk areas in the western portion of the planning area, especially along the I-80 corridor, and for most of the area from Truckee proper east. Figure 4.1 shows how multiple variables can combine to create extreme wildfire risk. Figure 4.2 shows that, aside from the central areas, a large proportion of the planning area is considered under threat. As individuals continue to move into the WUI fuel connectivity, even if treated, will be a challenge into the future (Theobald and Romme 2007). The far eastern and far western portions of the planning area have a high flame length and burn probability, where denser fuels and WUI encroachment combine. A majority of

the planning area has a large departure from the historic fire return interval (see Risk Assessment Inputs Definition), which can lead to hazardous fuel buildup and greatly increases overall risk.

The risk assessment was executed at the landscape and community level and not at the parcel, or property owner, level. Therefore, this risk assessment is not intended to depict the level of risk at the individual parcel level. Additional information regarding the risk assessment inputs can be found below in the Risk Assessment Inputs Definition section. Detailed information regarding topography, weather, fire regimes, fire history, and fire response is provided in Chapter 2. It is important to note that fire response was not included in the risk assessment as the planning area is primarily Truckee Fire's responsibility.

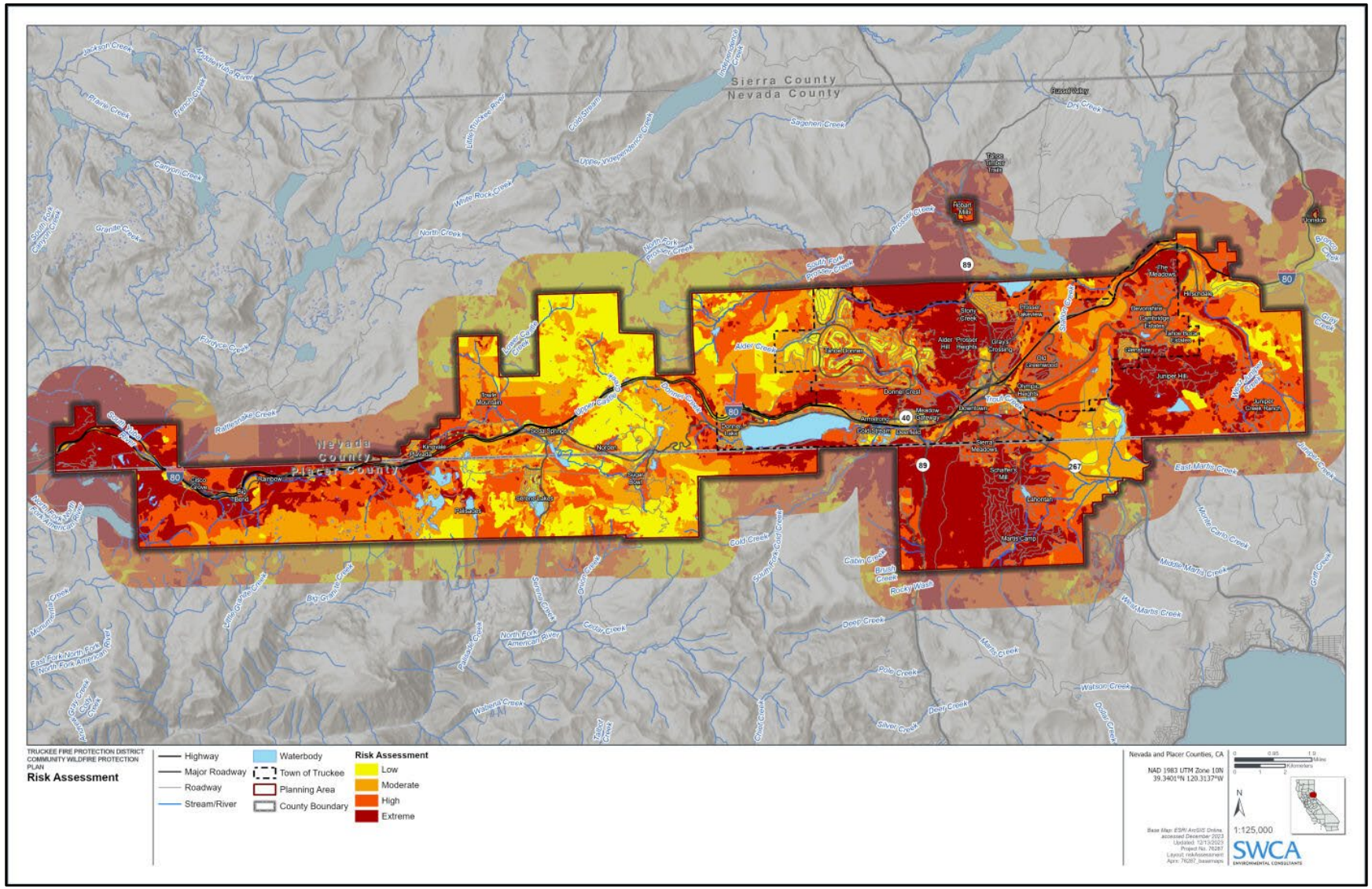


Figure 4.2. Risk assessment classification in the planning area.

Note: Risk assessment maps show the level of risk relative to other parts of the analysis area; it's not a model of expected fire behavior, but a classification of values at risk from wildfire.

DONNER SUMMIT

The risk to the Donner Summit community is largely driven by fuel type, fuel characteristics, and reported fire history (Figure 4.3). The far western portion of the planning area is the mixed-conifer forest type—a high load of conifer litter with shrub understory. This can produce moderate flame lengths and spread rates, and the thick understory vegetation can make on-the-ground firefighting efforts slow and difficult. On the far eastern portion of the community, there is much less risk, which could be due, in part, to a different fuel type of grass and sparser shrubs interspersed with large areas of natural rock outcroppings and multiple lakes that, together, create a discontinuous fuel bed. While fire spread is faster in the grass fuel type, grass fires are much easier to control. This eastern area also has a historically low fire occurrence density and is only moderately departed from its historic fire return interval (see Risk Assessment Inputs and Methodology and Risk Assessment Inputs Definition sections for more details). This community also has a lower amount of SARAs, which are mostly concentrated within the I-80 corridor. Although fewer in number, the SARAs in this community are very important. SARAs in this community include critical access routes that, if damaged, put Truckee at risk of becoming geographically isolated. Other SARAs in this community include energy facilities, emergency services, cell towers, and bridges, among others. Along this corridor there are also riparian areas that are important to water quality and could be impacted by severe wildfire.

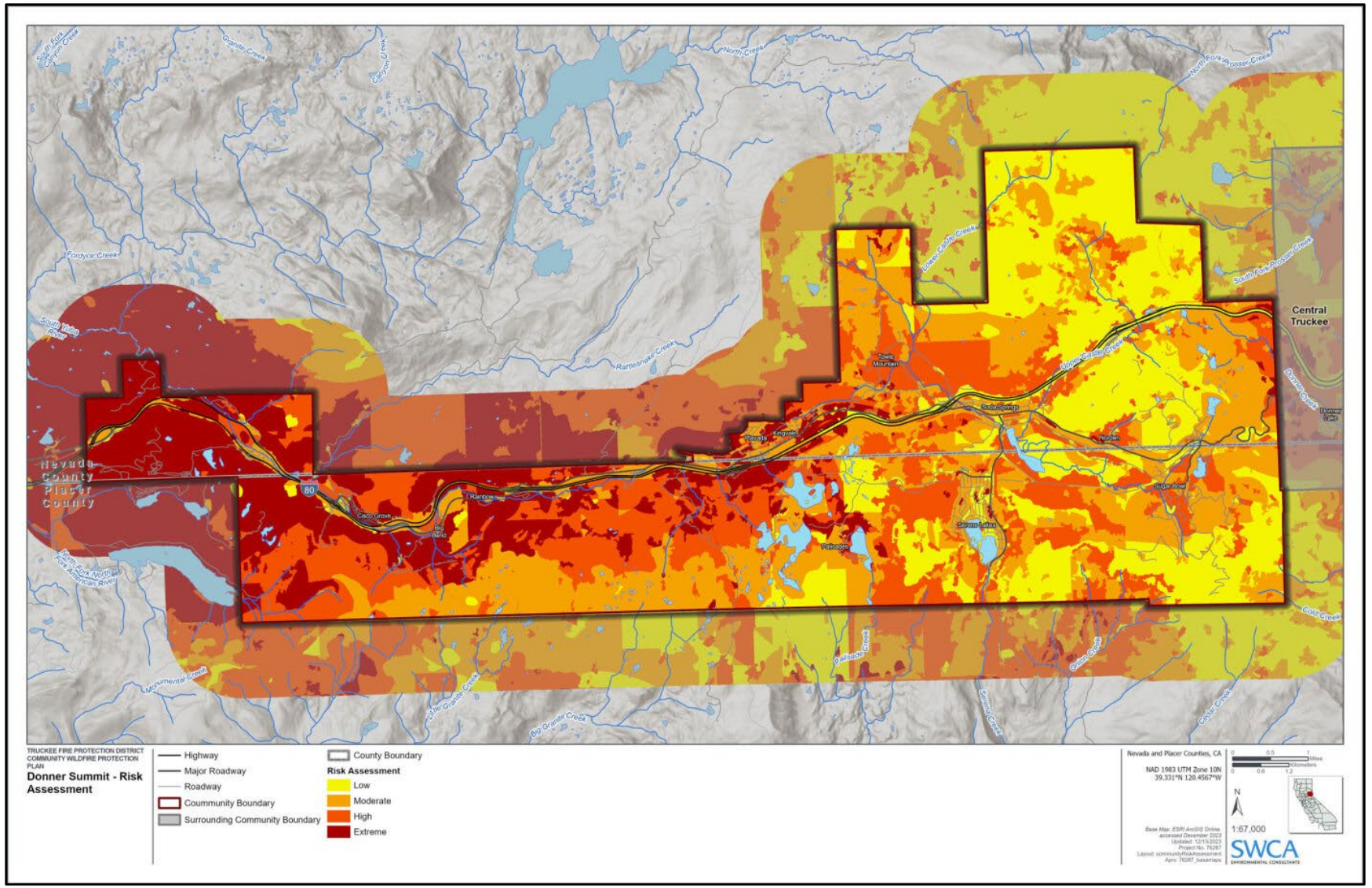


Figure 4.3. Donner Summit risk assessment.

Note: Risk assessment maps show the level of risk relative to other parts of the analysis area; it's not a model of expected fire behavior, but a classification of values at risk from wildfire.

CENTRAL TRUCKEE

Central Truckee has two main areas of wildfire risk: the northeastern quadrant, and the south-central area (Figure 4.4). To the north, the risk is largely driven by an abundance of SARAs (especially in the downtown area north of I-80) and expected fire behavior due to burn probability and conditional flame length. SARAs in this area include essential services that residents rely on including critical access routes and infrastructure, energy facilities, emergency services, and bridges, among others; damage to or loss of these SARAs would have a great impact to the community. To the south there is a very high historic fire occurrence (the highest in the entire planning area). With the proximity of humans and expansion of human development and recreation into the WUI in this area, and with human-caused fires a known concern as more people live and recreate in the WUI (Li and Banerjee 2021), the potential for ignitions will continue to be high. This area also has a large slash component where a fuels treatment was in progress during the data range; the treatment end goal is to further modify and reduce the fuel loads in the area. Slash is very difficult to control for on-the-ground firefighters, but once this treatment is complete there should be reduced fire behavior. Both of these extreme risk areas in Central Truckee are heavily departed from the historic fire return interval (see Risk Assessment Inputs and Methodology section for more details). Along the CA-89 corridor are important source water features, as well as established goshawk packs and habitat for willow flycatchers.

The area of low risk to the northwest is largely driven by fuel type. Light fuel loadings of intermixed trees are broken up with non-burnable areas. This area also has a very low historic fire occurrence density.

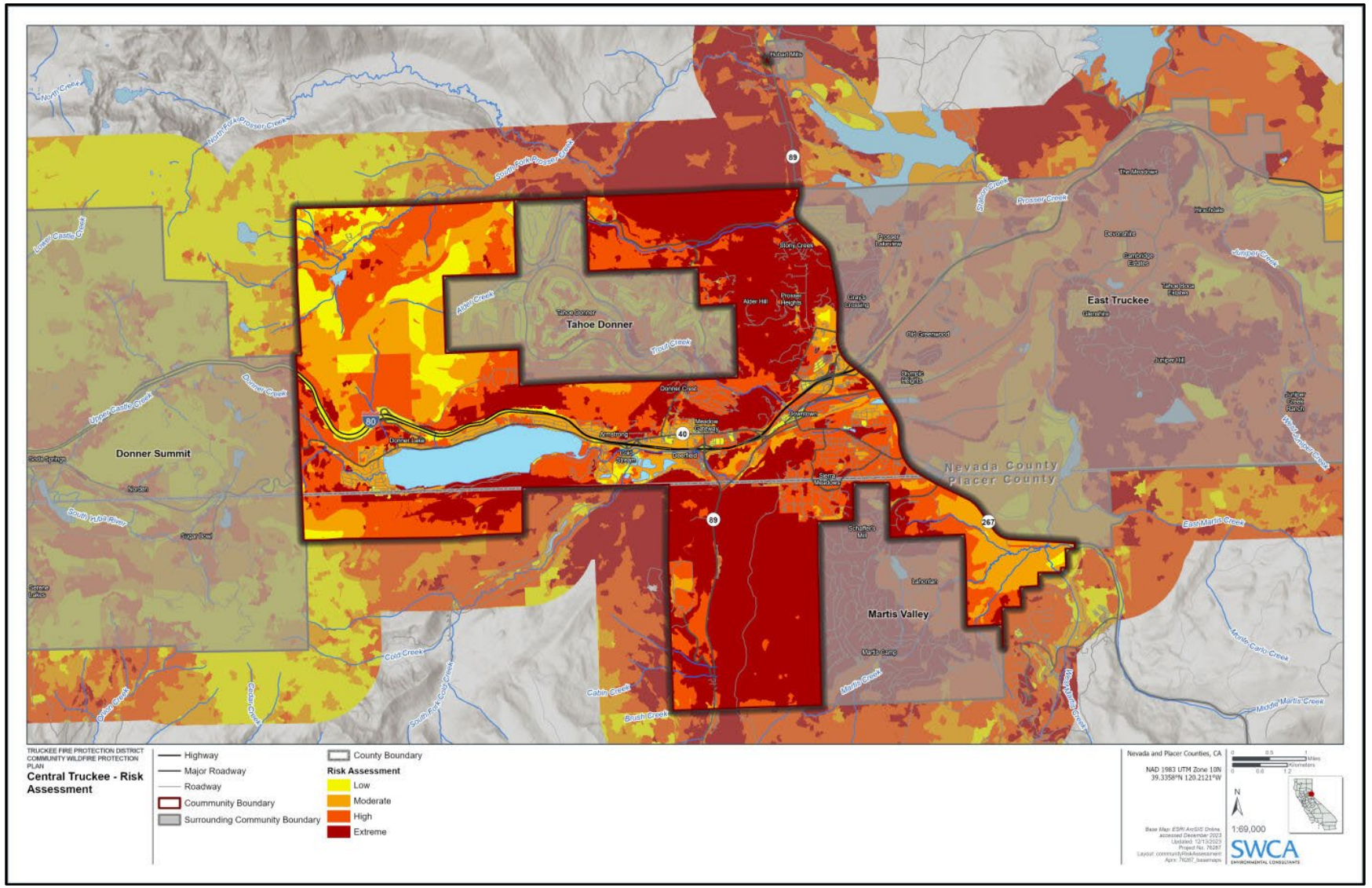


Figure 4.4. Central Truckee risk assessment.

Note: Risk assessment maps show the level of risk relative to other parts of the analysis area; it's not a model of expected fire behavior, but a classification of values at risk from wildfire.

TAHOE DONNER

The Tahoe Donner community has the lowest wildfire risk in comparison to the other communities in the planning area although there are still pockets rated extreme and high (Figure 4.5). The Tahoe Donner community is mostly surrounded by mixed conifer timber stands that have an understory shrub component; grasses and both conifer and some hardwood litter contribute to the surface fuel loading. Unlike many other areas, Tahoe Donner is considered a WUI Intermix in the core area of the community because of the prevalence of homes and structures; however, part of Tahoe Donner is classified as WUI Defense where there is more contiguous vegetation. Some features of the WUI Intermix, such as roads and other nonburnable surfaces, and areas where there is too little fuel to carry wildfire, help make wildland fuels discontinuous, which can moderate fire behavior and aid in suppression efforts. This area has varied SARAs, such as critical access roads, high-use recreation areas, transmission lines, and natural resources, among others.

Although Tahoe Donner has departed from the historic fire return interval for the area (that is, less frequent wildfires than the ecosystem historically experienced), there have been extensive fuels reduction efforts that have reduced the fuel loading and modified remaining fuels, such as an increased canopy base height and reduced surface fuel loads. The recent fuels reduction efforts and low fire occurrence density (reflected in the minimal fire history in the area since approximately 1970) have resulted in a low burn probability and conditional flame length. The modeled low fire behavior contributes to the lower wildfire risk rating compared to other communities in the planning area. However, it is key that the reduced fuel loads and fuel modification from the recently completed fuels treatments are maintained to help moderate future fire behavior in the event of a wildfire start.

Tahoe Donner is in a CAL FIRE LRA designated Very High FHSZ. While a similar rating classification system, there are notable differences; the SWCA risk assessment considers additional metrics and uses a different methodology (see CAL FIRE Fire Hazard Severity Zones). A FHSZ does not consider risk, only wildfire hazards. It should be noted that areas immediately adjacent to the Tahoe Donner community boundary, as defined in this CWPP, are classified as significant wildfire risk (Figure 4.2).

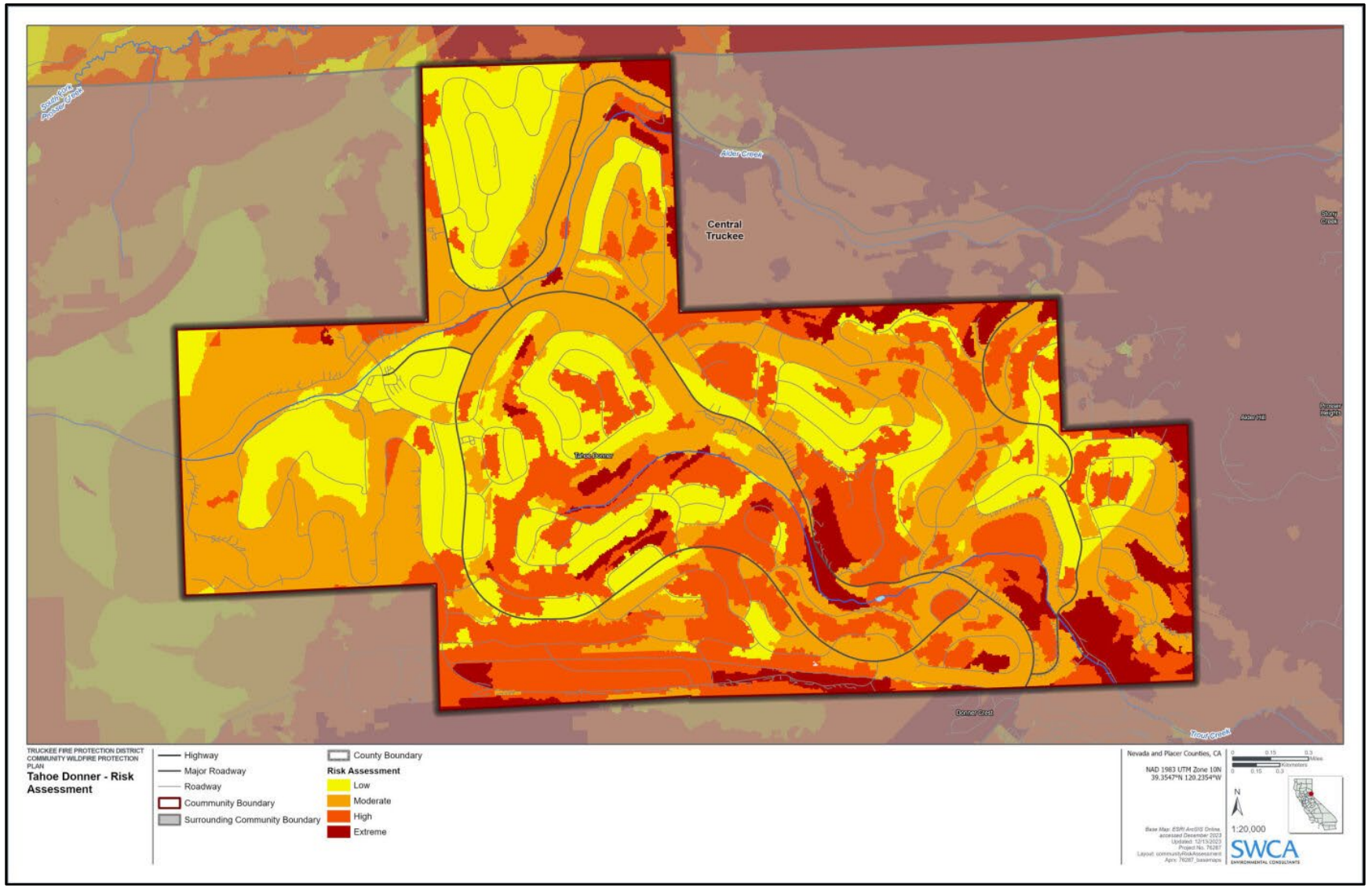


Figure 4.5. Tahoe Donner risk assessment.

Note: Risk assessment maps show the level of risk relative to other parts of the analysis area; it's not a model of expected fire behavior, but a classification of values at risk from wildfire.

MARTIS VALLEY

The extreme risk to the majority of the Martis Valley community comes from a combination of high fire occurrence, high departure from historic fire return intervals, and fuel types—areas of continuous grass and shrubs—that have potential for extreme fire behavior (Figure 4.6). There are also pockets of a high number of SARAs, and wildfire suppression would be more difficult in much of this area because of terrain and access. Martis Valley is in a CAL FIRE SRA designated Very High and High FHSZ.

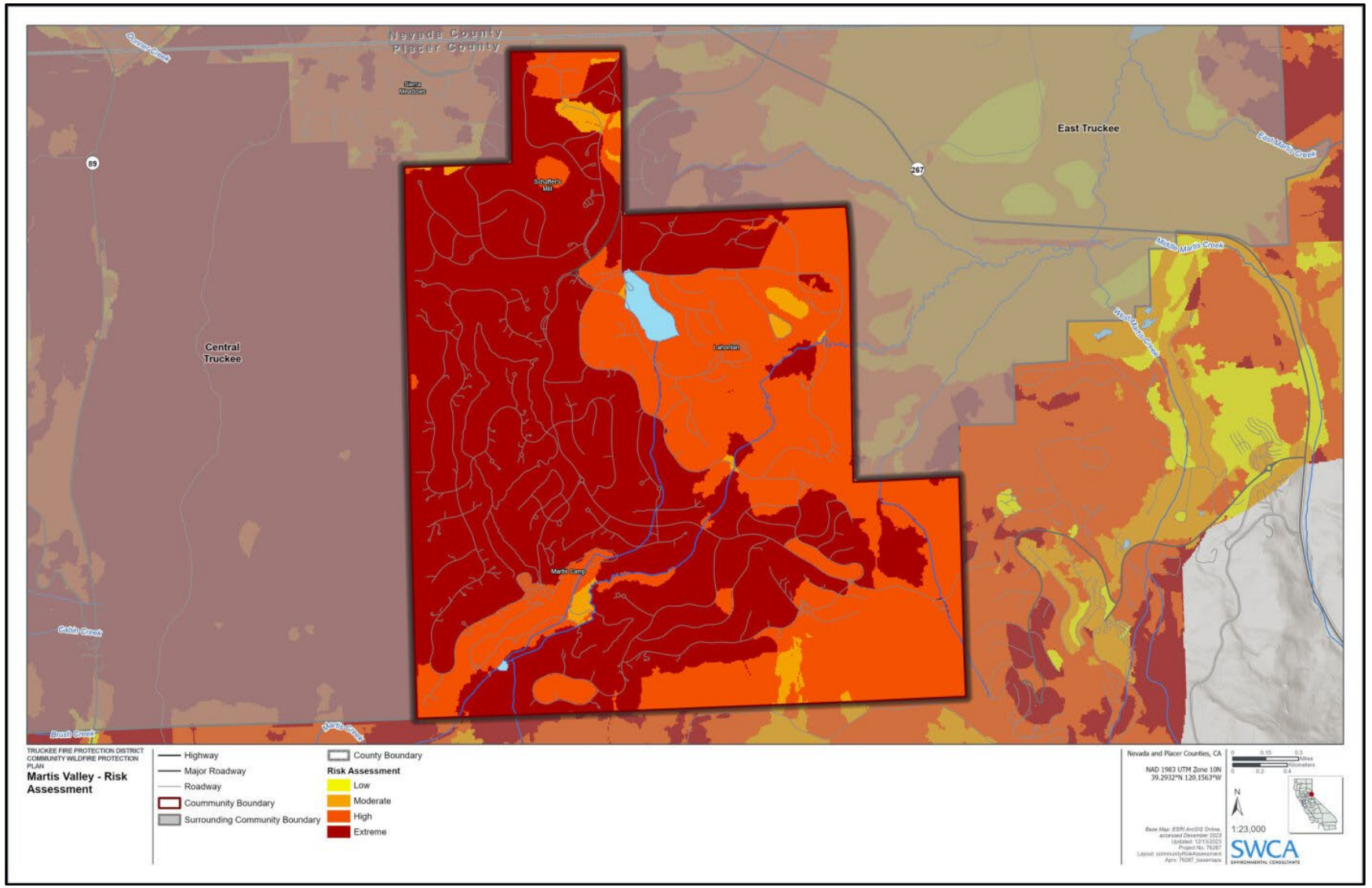


Figure 4.6. Martis Valley risk assessment.

Note: Risk assessment maps show the level of risk relative to other parts of the analysis area; it's not a model of expected fire behavior, but a classification of values at risk from wildfire.

EAST TRUCKEE

Similar to the Donner Summit community, the risk to East Truckee is driven largely by the mixed-conifer fuel type (Figure 4.7). The areas of most extreme risk are heavily correlated with a closed canopy conifer with thick shrub understory, which makes suppression efforts slow and difficult. Other factors are the mid-range canopy-base height, which promotes a ground fire transitioning to crown fire, as well as a high flame length and burn probability. The red area on the northernmost extent of this community is also influenced by a high fire occurrence density. The entire East Truckee area has a high departure from the historic fire return interval. Areas that show as low risk are a non-burnable fuel type, mostly rock screes and natural fuel breaks (as opposed to human development).

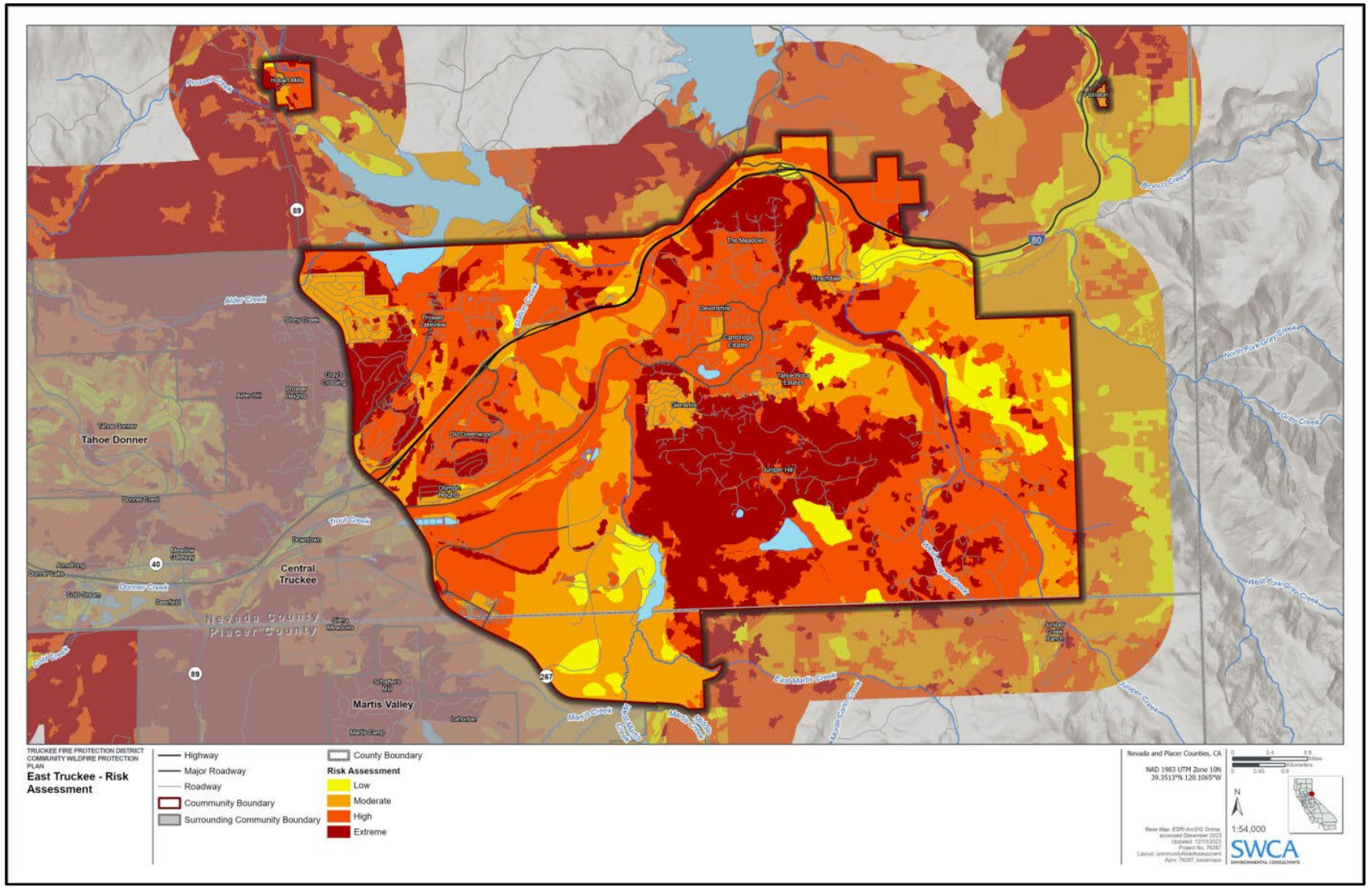


Figure 4.7. East Truckee risk assessment.

Note: Risk assessment maps show the level of risk relative to other parts of the analysis area; it's not a model of expected fire behavior, but a classification of values at risk from wildfire.

CAL FIRE FIRE HAZARD SEVERITY ZONES

In accordance with Public Resources Code (PRC) 4201-4204, CAL FIRE maintains FHSZ data for SRA land. The FHSZs use scientific data to assign a hazard score based on the fuels (vegetation), predicted flame length, fire history, terrain, and local weather of an area (CAL FIRE 2022c, 2023b). These zones reflect the likelihood of a fire occurring in an area and the potential behavior using three classifications: moderate, high, and very high. Figure 4.8 shows the FHSZs for the planning area.

FHSZs are similar to, yet distinct from, SWCA's risk assessment classification on the landscape. FHSZs evaluate hazard, not risk. In addition, SWCA's risk assessment considers SARAs and additional fire environment metrics, such as fire return interval departure and burn probability. There is often overlap of analogous ratings from the FHSZs and the risk assessment as the two methodologies use many of the same metrics. Thus, while FHSZs help guide the community fire planning and mitigation process by assessing hazards, the CWPP enhances the "hazard only approach" by considering the hazard and risk interaction across the landscape. Overall, the risk assessment from SWCA matches closely with the CAL FIRE FHSZs. One notable exception is the CA-89 corridor south of I-80. That block was identified as extreme by SWCA and Truckee Fire, but low by the FHSZ. This is most likely due to the slash component of a fuels treatment that was done after the last iteration of the CAL FIRE FHSZ.

The FHSZs are currently undergoing an update process; the approved 2022 updates are publicly available via an online viewer https://calfire-forestry.maps.arcgis.com/apps/webappviewer/index.html?id=988d431a42b242b29d89597ab693d008 (CAL FIRE 2022c).

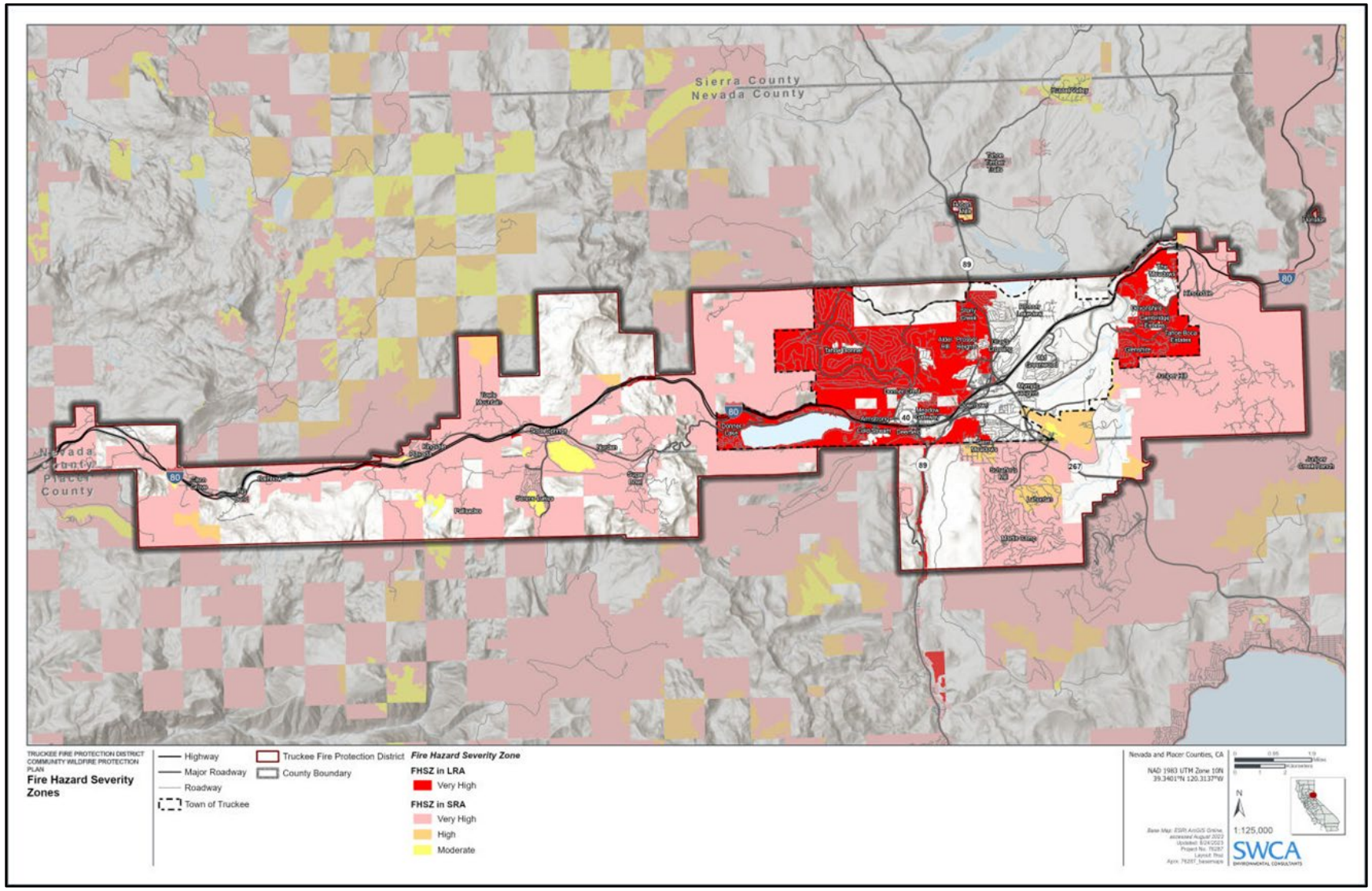


Figure 4.8. CAL FIRE FHSZs.

*FHSZ data comes from publicly available CAL FIRE datasets and may not include local adjustments to LRA land.

COMMUNITY DEFENSIBLE SPACE ASSESSMENTS

Truckee Fire has set a goal to complete a 3-year inspection cycle of defensible space for property owners and has contracted with Fire Aside to provide detailed and customized defensible space and home hardening assessments at the parcel level in the planning area. To date, over 10,000 parcels have been assessed at least once, and since 2022, more than 13,400 inspections have been completed in the planning area. While these parcel assessments were not an input of the comprehensive risk assessment, they help provide a holistic picture of the current situation and continued mitigation measures for property owners to increase defensible space, home-hardening, and overall wildfire resilience in the community. Below are summaries of the data from Fire Aside parcel assessments by the five communities. Table 4.2 also includes a summary of the positive and negative attributes of a community as they relate to defensible space and home-hardening measures. Supporting defensible space and home hardening measures are outlined in the recommendation tables in Chapter 5.

DONNER SUMMIT

Many homes in this community are equipped with features that reduce or mitigate the wildfire risk. Roofing in this community is generally metal and lacks gutters, as opposed to highly flammable wood shingle roofs. Approximately 90% of homes have multi-pane and/or tempered windows, and 0.1% of homes have combustible fences attached to the structure. Only 40% of major vegetation issues were found in Zone 0 (the closest zone to the home), and roadways are generally clear of obstructing vegetation.

Aspects of the community that could be improved include setting back firewood at least 30 feet from homes and using ember-resistant tarps for protection as well as upgrading vents greater than 1/8 inch to vents that prevent ember entry. Tree maintenance was found to be the top vegetation need for 50% of the homes in this community. Activities that would benefit these areas include spacing, limbing, and removing dead trees. Wood plank siding and softwood decks are also common in the community and pose an increased wildfire risk.

CENTRAL TRUCKEE

Some features in this community that reduce the risk of wildfire were identified. Most homes in this community either lack gutters or have covered metal gutters. Most of the roofs are made of metal or Class A asphalt. The majority of windows are multi-pane and/or tempered.

Potential upgrades were identified that might help reduce the risk of wildfire. Unenclosed eaves are very prevalent in areas of this community. Homes in this community also have a higher rate of leaf litter on the roof. Vents greater than 1/8 inch are more common than vents that prevent ember entry. This community could decrease the risk of wildfire by converting to enclosed eaves, reducing the amount of leaf litter on the roof, and upgrading to vents that prevent ember entry.

MARTIS VALLEY

Many homes in this community are equipped with fire-resistant materials. Most roofing material is metal or Class A asphalt. Ember-resistant or compliant vents are five times more common in this community than non-compliant vents. These features work together to mitigate wildfire risk.

Wood siding occurs on over 50% of homes in this community. Replacing the wood plank siding with noncombustible material could help mitigate the risk of wildfire. Additionally, tree maintenance is needed on over 35% of the homes in this community. Tree maintenance activities include spacing, limbing, and removing dead trees.

TAHOE DONNER

The majority of homes in this community have certain features that mitigate wildfire risk. Gutters can pose a wildfire risk by catching dry debris that makes the home susceptible to wildfire. Most homes in this community lack gutters or have covered metal gutters. Roofs in this community are generally made of metal or Class A asphalt, and most windows are multi-pane and /or tempered.

Homes in this community could further reduce the risk of wildfire by upgrading certain features. Many homes in this community have unenclosed eaves. A relatively high prevalence of homes have leaf litter on the roof. Vents greater than 1/8 inch were more common than vents that prevent ember entry. By upgrading to closed eaves, reducing the amount of leaf litter on the roof, and upgrading to vents that prevent ember entry, the community would further reduce the risk of wildfire.

EAST TRUCKEE

Many homes in this community are equipped with features that mitigate the risk of wildfire. The majority of homes either have no gutters or covered metal gutters. The majority of roofs are made of metal or Class A asphalt, and most homes have multi-pane and/or tempered windows.

Some features were identified that might reduce the risk of wildfire. Vents greater than 1/8 inch are more common than vents that prevent ember entry. Many decks in this community have exposed space, which can increase the risk of wildfire. Over 50% of the homes in this community need tree maintenance, including limbing, spacing, and removing dead trees. Combustible fences are also a common feature of many homes in this community. Upgrading vents and enclosing decks to prevent ember entry, routinely carrying out tree maintenance activities, and upgrading fences to noncombustible materials would help reduce the risk of wildfire in this community.[3]

[3] "Enclosing decks" refers to the home hardening process of replacing wood with non-combustible materials, and installing metal lashing where the deck meets the home to prevent embers from entering.

Table 4.2. CAR Ratings from Fire Aside Community Defensible Space Assessments

Community	Risk Rating	Positives	Negatives
Central Truckee	2.1 (High)	• Vast majority of homes either have no gutters or, when present, are metal and covered • Majority of roofs are metal or Class A asphalt • Majority of windows are multi-pane and/or tempered	• Unenclosed eaves are much more prevalent • Higher prevalence (10%–20%) of homes had leaf litter on the roof • Vents greater than 1/8 inch are five times more common than vents that prevent ember entry
Donner Summit	1.6 (Moderate)	• Predominantly metal roofs with no gutters to catch pine needles • 90% of homes have multi-pane and/or tempered windows • 0.1% of homes have combustible fences attached to the structure • Roadways are clear of obstructing vegetation • Only 40% of major veg issues were found in Zone 0	• Vents greater than 1/8 inch are five times more common than vents that prevent ember entry • Tree-related work (spacing, limbing, and removing dead trees) are the top vegetation needs found on 50% of homes • Firewood is commonly stored within 30 feet of structures and not protected with ember-resistant tarps • Wood plank siding and softwood decks are prevalent in the community
East Truckee	2.3 (High)	• Vast majority of homes either have no gutters or, when present, are metal and covered • Majority of roofs are metal or Class A asphalt • Majority of windows are multi-pane and/or tempered	• Vents greater than 1/8 inch are more common than vents that prevent ember entry • Significant number of decks with exposed space (not enclosed for ember entry) • Tree work (limbing, spacing, removal of dead trees) needed at over 50% of homes • Combustible fences attached to structure are five times more common that resilient fencing
Martis Valley	-1.4 (Low)	• Roof types are dominated by metal and Class A asphalt • Ember-resistant or complaint vents are five times more common than non-compliant vents	• Tree-related work (spacing, limbing, and removing dead trees) are the top vegetation needs found on over 35% of homes • Wood plank siding is present on over 50% of homes

Community	Risk Rating	Positives	Negatives
Tahoe Donner	1.5 (Moderate)	• Vast majority of homes either have no gutters or, when present, are metal and covered • Majority of roofs are metal or Class A asphalt • Majority of windows are multi-pane and/or tempered	• Unenclosed eaves are much more prevalent • Higher prevalence (10%–20%) of homes had leaf litter on the roof • Vents greater than 1/8 inch are five times more common than vents that prevent ember entry

Note: The community defensible space assessments conducted include data from 2022–2023; not all parcels and structures in the communities were surveyed, while others were surveyed more than once. The findings present average conditions for each community surveyed. A metric was developed by including the number of preventive measures subtracted from the number of violations found divided by the number of properties in each community surveyed. Under 0 = Low (more preventative measures than violations), 0–2 = Moderate, 2+ = High. Violations include broad categories such as construction materials of houses, state of vegetation and defensible space, hazardous material storage, and others. Due to data collection of the same parcels over multiple years, it is possible that the same violation and/or same preventative measure could have been counted more than once for a given parcel.

RISK ASSESSMENT INPUTS DEFINITION

LAND TENDER

Land Tender is a decision-support, monitoring, and reporting platform that uses high-quality data and scientific models to help land managers plan landscape treatments and prepare wildfire mitigation plans as WUI increases. The software identifies natural and built assets that may be at high risk for wildfire and is able to quantify the benefits of specific restoration actions. Land Tender uses models to compare different scenarios over time, weighing the tradeoffs of different plans. This allows land managers to prioritize their restoration efforts in areas that are predicted to benefit the most from certain actions. The software also takes into consideration the financial costs of different proposed plans. Over time, Land Tender can be used to monitor current conditions and adapt to variable situations as existing conditions and objectives change, ultimately with the goal of reducing fire severity and maximizing ecological benefits. Land Tender also provides an interactive, collaborative interface that supports multi-jurisdictional planning (Vibrant Planet 2023).

FUEL MODELS

Fuels are classified using Scott and Burgan's (2005) Standard Fire Behavior Fuel Model classification system. Wildland fuels are grouped into fuel types based on the primary fuel that carries the fire: non-burnable (NB), grass (GR), grass-shrub (GS), shrub (SH), timber litter (TL), timber understory (TU), and slash-blowdown (SB).

Table 4.3 provides a description of each fuel type, and Figure 4.9 shows the fuel model classification on the landscape.

Table 4.3. Fuel Model Classification for Truckee CWPP Planning Area

1.	**Nearly pure grass and/or forb type (Grass)**
i.	**GR1:** Grass is short, patchy, and possibly heavily grazed. Spread rate moderate, flame length low. 0.1% cover in TFPD, 377 acres.
ii.	**GR2:** Moderately coarse continuous grass, average depth about 1 foot. Spread rate high, flame length moderate. 1% cover in TFPD, 1,053 acres.
2.	**Mixture of grass and shrub, up to about 50% shrub cover (Grass-Shrub)**
i.	**GS1:** Shrubs are about 1 foot high, low grass load. Spread rate moderate, flame length low. 0.1% cover in TFPD, 55 acres.
ii.	**GS2:** Shrubs are 1–3 feet high, moderate grass load. Spread rate high (20–50 chains/hour); flame length moderate (4–8 feet); fine fuel load (2.1 tons/acre). 33% cover in TFPD, 26,653 acres.
3.	**Shrubs cover at least 50% of the site; grass sparse to non-existent (Shrub)**
i.	**SH2:** Moderate shrub load, depth about 1 foot, no grass fuels present. Spread rate low to moderate; flame length low to moderate; 1% cover in TFPD, 900 acres.
ii.	**SH3:** Moderate shrub load, possibly with pine overstory or herbaceous fuel. Spread rate low, flame length low. <0.1% cover in TPFD, 10 acres.
iii.	**SH4:** Low to moderate shrub and litter load, possibly with pine overstory, fuel bed depth about 3 feet. Spread rate high, flame length moderate. 0.5% cover in TFPD, 372 acres.

iv.	**SH5:** Heavy shrub load, depth 4–6 feet. Spread rate very high, flame length very high. 0.3% cover in TFPD, 2,377 acres.
4.	**Grass or shrubs mixed with litter from forest canopy (Timber-Understory)**
i.	**TU1:** Low load of grass and/or shrub with litter. Spread rate low, flame length low. 2% cover in TFPD, 1,852 acres.
ii.	**TU5:** High load conifer litter with shrub understory. Spread rate moderate, flame length moderate. 22% cover in TFPD, 17,522 acres.
5.	**Dead and downed woody fuel (litter) beneath a forest canopy (Timber Litter)**
i.	**TL1:** Light to moderate load, fuels 1–2 inches deep. Spread rate very low, flame length very low. 0.6% cover in TFPD, 467 acres.
ii.	**TL2:** Low load, compact. Spread rate very low, flame length very low. 2% cover in TFPD, 1,427 acres.
iii.	**TL3:** Moderate load. Spread rate very slow, flame length low. 3% cover in TFPD, 2,031 acres.
iv.	**TL4:** Moderate load. Spread rate very slow, flame length low. 8% cover in TFPD, 6,275 acres.
v.	**TL5:** High load conifer litter. Spread rate slow, flame length low. 0.1% cover in TFPD, 67 acres.
vi.	**TL6:** Moderate load. Spread rate moderate, flame length low. 6% cover in TFPD, 4,863 acres.
vii.	**TL7:** Heavy load, includes larger-diameter downed logs. Spread rate low, flame length low. 2% cover in TFPD, 1,893 acres.
viii.	**TL8:** Moderate and compact long needle load, may include small amount of herbaceous load. Spread rate moderate, flame length low. 1% cover in TFPD, 1,109 acres.
ix.	**TL9:** Very high load broadleaf litter, heavy needle-drape in otherwise sparse shrub layer. Spread rate moderate, flame length moderate. 1% cover in TFPD, 830 acres
6.	**Activity fuel or debris from wind damage (slash)**
i.	**SB1:** Fine fuel loading is high, weighed toward the 1–3-inch diameter class. Spread rate moderate, flame length moderate. 2% cover in TFPD, 1,894 acres.
7.	**Insufficient wildland fuel to carry wildland fire under any condition (Non-burnable)**
i.	**NBs:** Insufficient wildland fuel to carry wildland fire. 15% cover in TFPD, 11,702 acres

Notes: Based on Scott and Burgan's (2005) 40 Fuel Model System.

HISTORIC FIRE OCCURRENCE (DENSITY)

Historic fire is the documented record (1908–2022 for the planning area) of past wildfires within a specific area and time frame. It includes data about when and where fires occurred, size (acres), intensity, and impacts. Analyzing historic fire occurrence is crucial for understanding a region's fire history, assessing future fire risk, and informing wildfire management strategies (Figure 4.10).

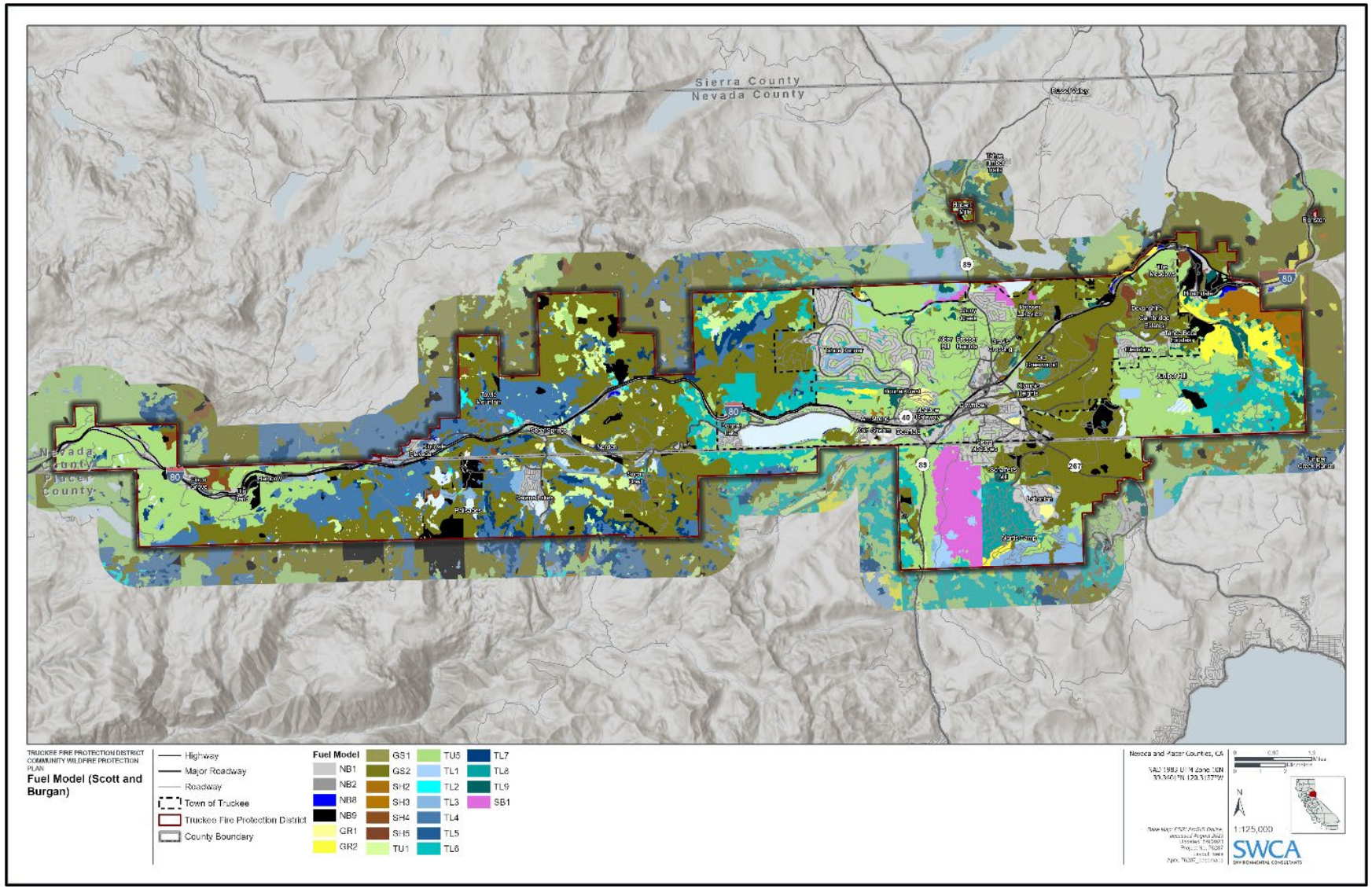


Figure 4.9. Scott and Burgan (2005) fuel models within the CWPP planning area.

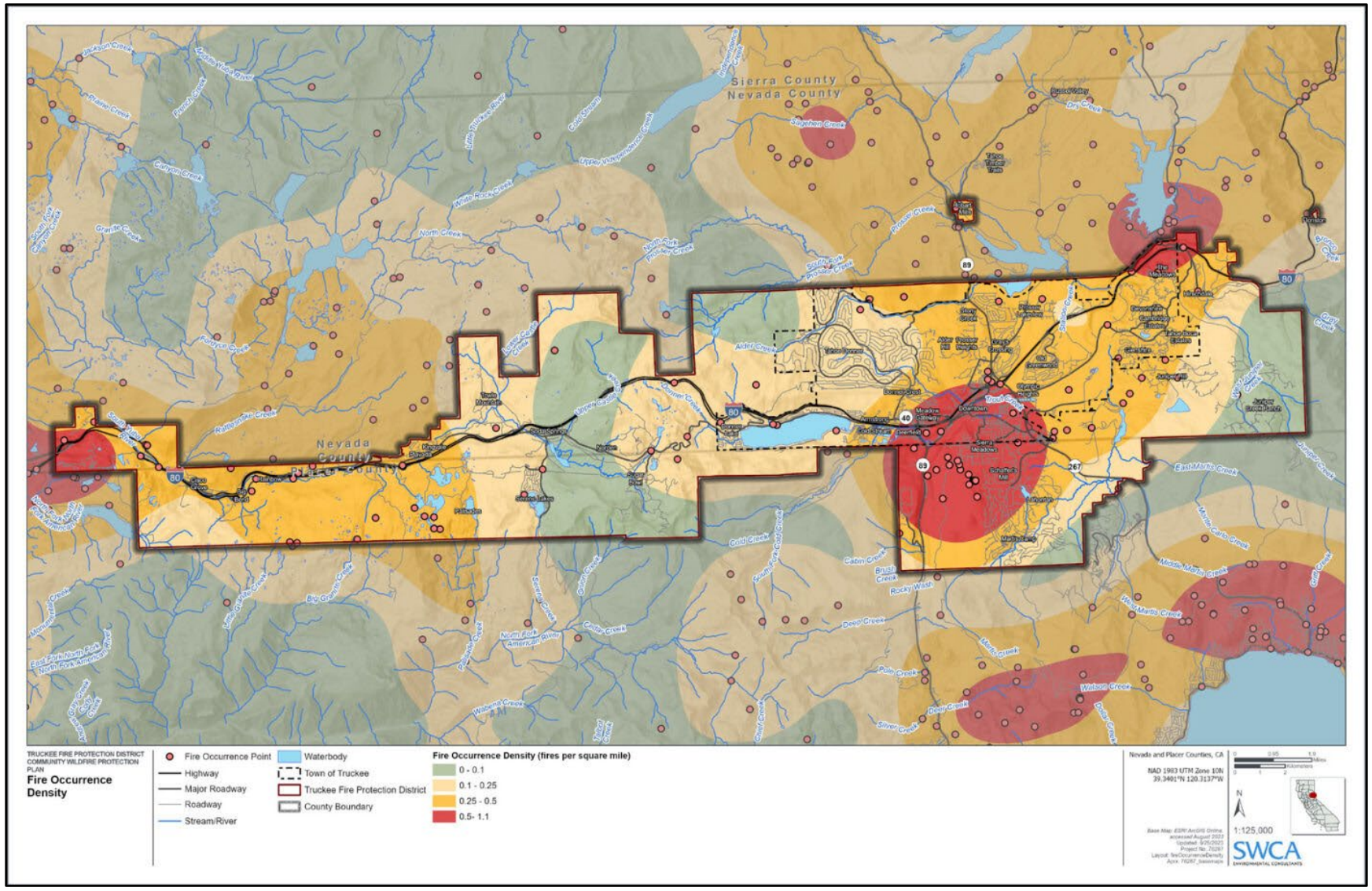


Figure 4.10. Fire occurrence density (fire history) in the planning area.

FIRE RETURN INTERVAL DEPARTURE – CONDITION CLASS

Fire return interval departure shows how the timing and frequency of wildfires in an area has changed compared with historical patterns. This is classified into six condition classes; when the condition class is positive, it means fires are happening more frequently on the landscape than they used to, which can be due to various factors like human activities, climate change, or land management practices. Conversely, a negative condition class indicates fires are occurring less often on the landscape. Condition Class 1 signifies a low departure (0%–33%), Condition Class 2 a moderate departure (34%–66%), and Condition Class 3 a high departure (67%–100%) (Figure 4.11).

TREE CANOPY BASE HEIGHT

Tree canopy base height refers to the lowest point of a forested area where the canopy of trees begins. It determines the vertical extent of vegetation that can carry a surface fire into the tree crowns, which can lead to more intense and difficult-to-control wildfires. Figure 4.12 illustrates the range of crown fire activity from surface fire (in grass-dominated areas) to passive and active crown fire (in timber-dominated fuels). In the risk assessment model, tree canopy base height is inversely weighted: the lower the height the higher the risk, as this is more likely to transition from a surface fire to a crown fire.

CONDITIONAL FLAME LENGTH

Flame lengths are determined by fuels, weather, and topography. Flame length is a particularly important component of the risk assessment because it relates to potential crown fire (particularly important in timber areas) and suppression tactics. Direct attack is usually limited to when flame lengths are less than 4 feet, and indirect suppression tactics when flame lengths exceed 4 feet. Additionally, engines and other heavy equipment, including aviation resources, are often necessary for suppression tactics when flame lengths exceed 4 feet.

BURN PROBABILITY

This is the likelihood that a given point on the landscape will burn if there is an ignition source. Burn probabilities consider the size and frequencies of past fires that occurred on a given landscape as well as the rate of spread based on available fuel types and weather conditions (e.g. wind). While burning structures and other materials (vehicles and ornamental vegetation) can ignite additional combustible materials in the WUI, particularly when structures are not well separated, only wildland fire fuels were considered in this model (Maranghides et al. 2022; Suzuki and Manzello 2019). Any suppression actions taken in the event of a fire are also not factored into this metric. Burn probability combined with conditional flame length creates the “Fire” metric as shown in Figure 4.13.

SUPPRESSION DIFFICULTY INDEX

The difficulty that firefighters will have in controlling a wildfire on-the-ground can be expressed as the Suppression Difficulty Index (SDI) (Figure 4.14). It considers fire behavior, terrain, fuels, accessibility, and fire control line production rates in various fuel types. It does not factor in additional benefits from aerial resources. This metric was not used in the Risk Assessment but helps show a better story and predict ‘problem areas.’

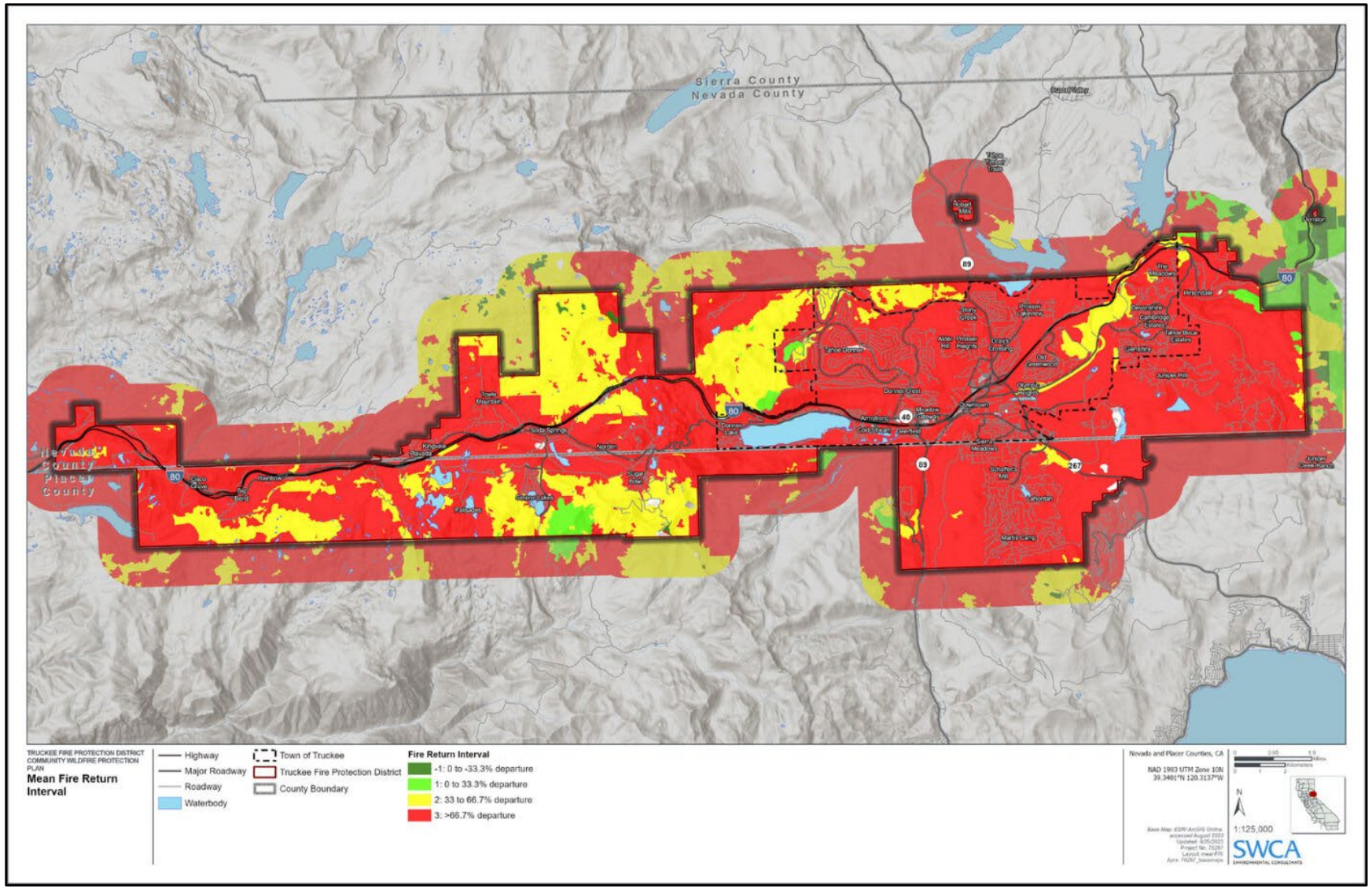


Figure 4.11. Mean fire return interval departure (condition class) for the planning area.

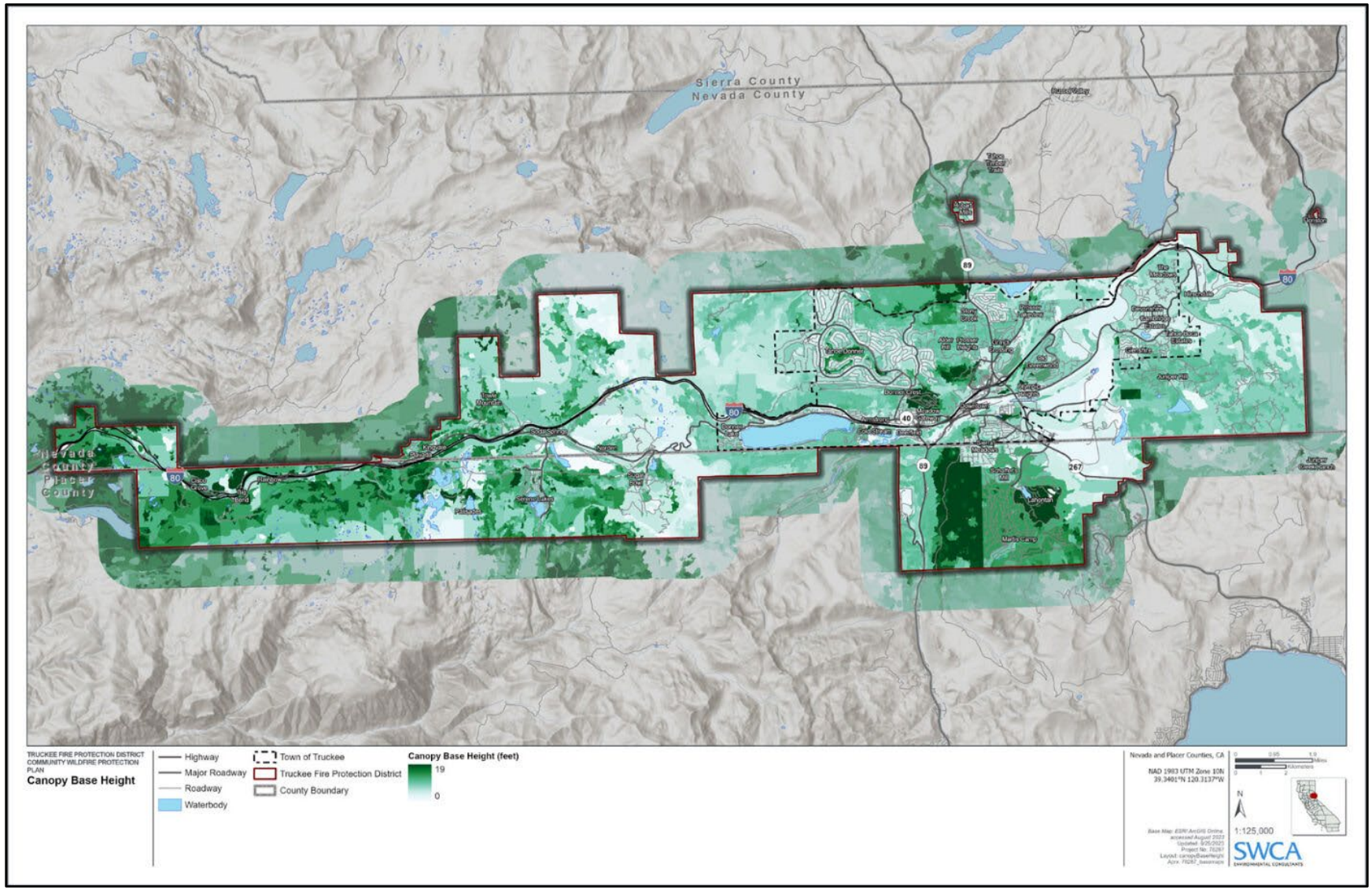


Figure 4.12. Canopy base height in the planning area.

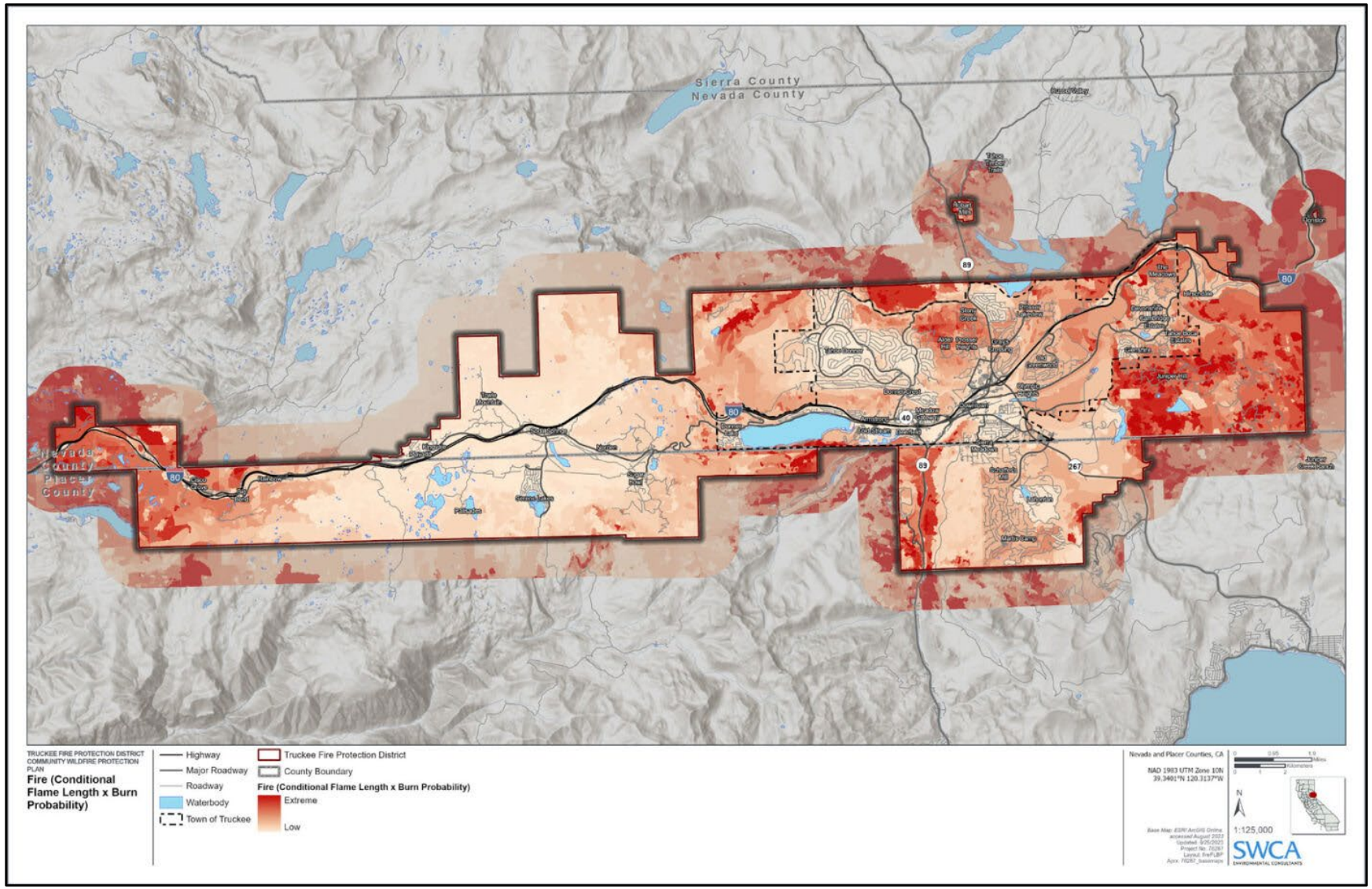


Figure 4.13. "Fire" metric, a combination of burn probability and conditional flame length, in the planning area.

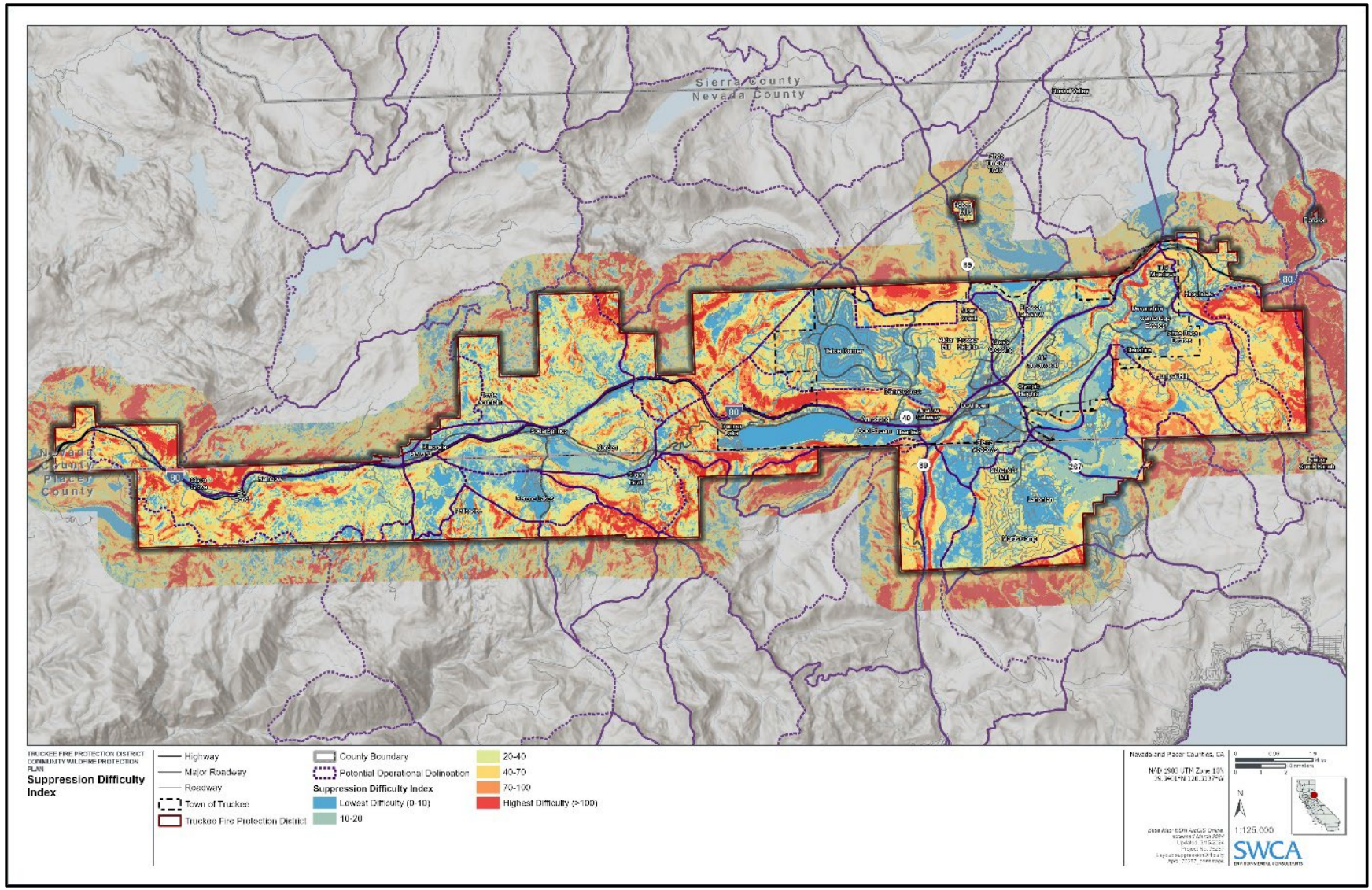


Figure 4.14. Suppression Difficulty Index (SDI) of the planning area.

WILDLAND-URBAN INTERFACE

WUI is the transition zone between the natural and human environments. Values in the WUI are at greater risk of wildfire due to increased fuel loadings, inaccessibility, and control difficulty when compared with strictly urban areas. Statewide, the WUI area has increased by over 2,000 square kilometers from 2010 to 2020, the Sierra Nevada being an area specifically mentioned for major increase in new housing and encroachment (Li et al. 2022). The project team worked concurrently with Truckee Fire for the creation of this unique dataset, as shown in Figure 1.2.

In this CWPP, the WUI is broken down into three zones. The WUI Intermix is a 250-foot buffer around structures. Subdivision boundaries were manually corrected to create a contiguous layer. WUI Defense is an additional quarter mile from the Intermix, and a 500 foot buffer on both sides of major roadways. WUI Threat, is an additional 1 ¼ mile buffer from the WUI Defense. The total WUI area is therefore more than a 1.5-mile total buffer.

STRATEGIC AREAS, RESOURCES, AND ASSETS

Most of the data for analysis came from Vibrant Planet's Stewardship Atlas dataset (Vibrant Planet 2023). It combines geospatial topography, biophysical, ecological, social, economic, climactic, and predictive variables to create a robust dataset. Not every area will have every attribute, but local knowledge can be substituted in those cases; review and input from the Project Team and Stakeholder Group during the CWPP process ensured local knowledge was incorporated into the SARA dataset. Figures 4.15 and 4.16 show identified SARAs in the planning area. For more information on SARAs, see Chapter 3.

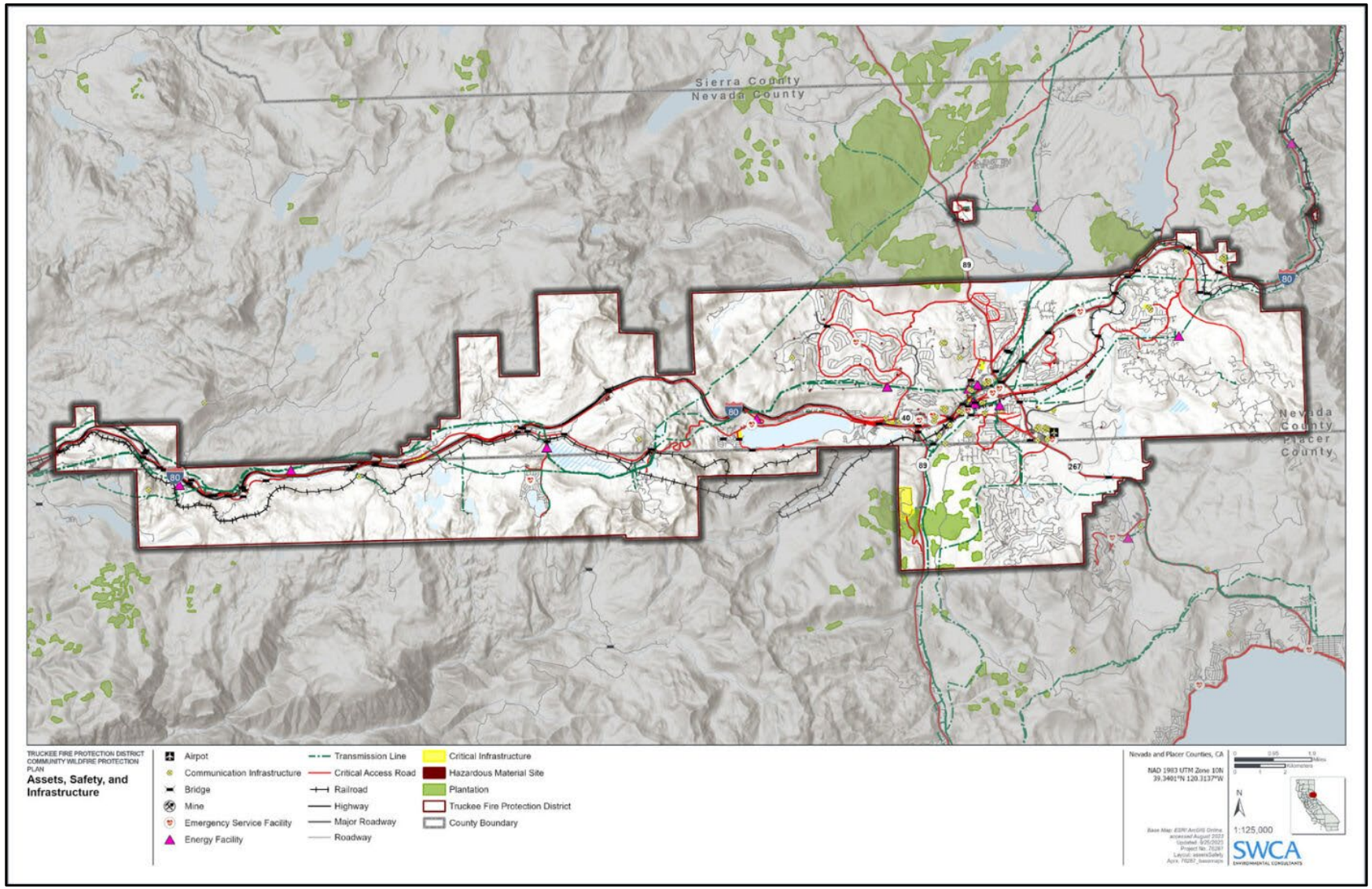


Figure 4.15. Assets, safety, and infrastructure SARAs for the planning area.

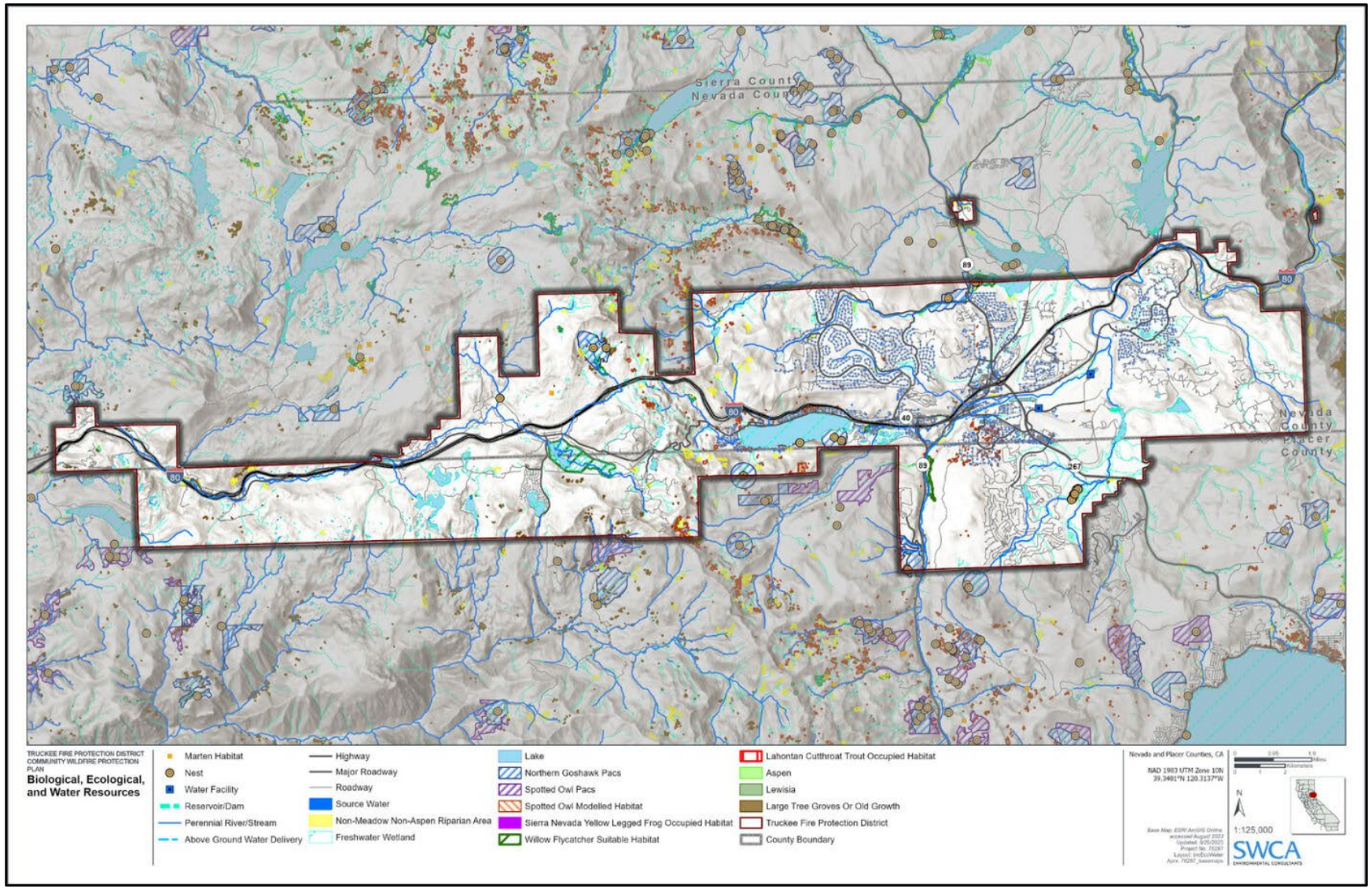
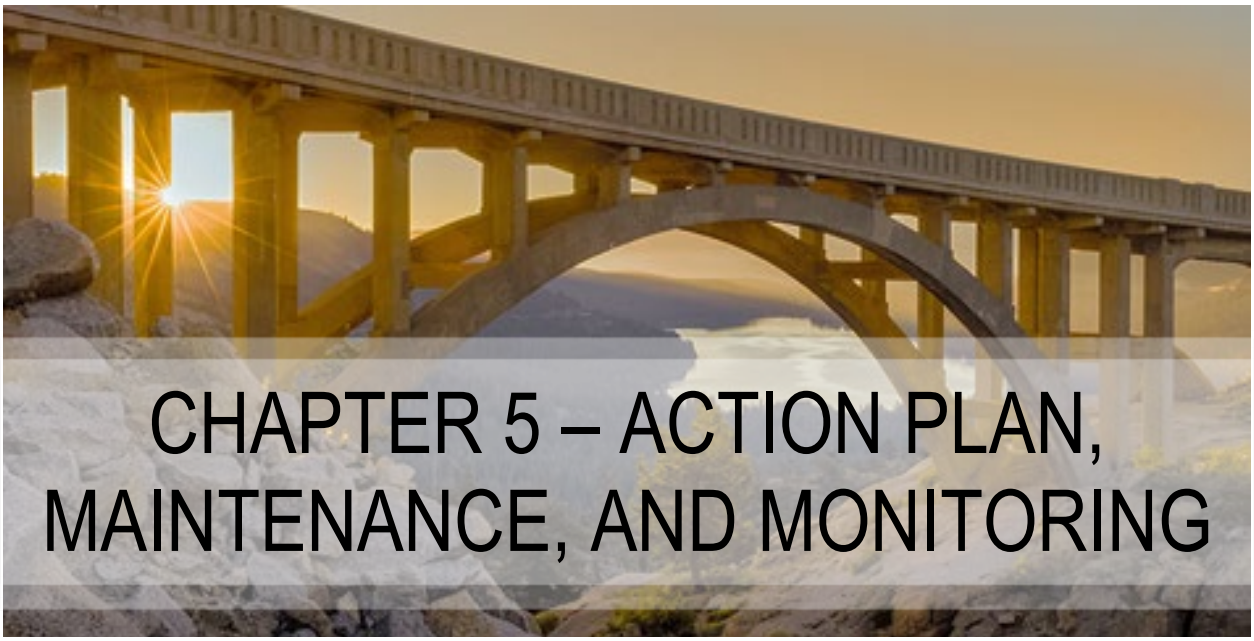


Figure 4.16. Biological, ecological, and water resource SARAs for the planning area.



CHAPTER 5 – ACTION PLAN, MAINTENANCE, AND MONITORING

This chapter provides project recommendations and implementation guidance for different mitigation measures, or the CWPP "action plan." While this is not an exhaustive list, it was developed by Truckee Fire, the Project Team, stakeholders, and the public.

In addition to the recommendations listed in this chapter, recognizing wildfire mitigation, preparedness, and resilience means being prepared both pre- and post-fire. Post-fire response and rehabilitation information can be found at readyforwildfire.org or on the project Story Map.

This plan has been aligned with the Cohesive Strategy and its Phase III Western Regional Action Plan by adhering to the nationwide goal:

> *"To safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire."* (Forests and Rangelands 2014:3).

Thus, CWPP recommendations have been structured around the three main goals of the Cohesive Strategy: restoring and maintaining landscapes, fire-adapted communities, and wildfire response. Many of the recommendations listed can be implemented at the property owner or community level. Projects requiring large-scale support can be prioritized based on the risk assessment and prioritized projects discussed below.

Recommendation matrices are used throughout this chapter to serve as the first step of a comprehensive action plan for implementation; the matrices include a description of the action, provide the reasoning for the action, and identify a lead party. Recommendations have been aligned with the strategies in the 2021 California's Wildfire and Forest Resilience Action Plan (California Forest Management Task Force 2021) wherever possible.

COHESIVE STRATEGY GOAL 1: RESTORE AND MAINTAIN RESILIENT LANDSCAPES

Goal 1 of the Cohesive Strategy and the Western Regional Action Plan is to Restore and Maintain Landscapes: Landscapes across all jurisdictions are resilient to fire and other disturbances in accordance with management objectives.

> *"Sustaining landscape resiliency and the role of wildland fire as a critical ecological process requires a mix of actions that are consistent with management objectives. [WRCS] will use all available methods and tools for active management of the landscape to consider and conserve a diversity of ecological, social, and economic values. [WRCS] will coordinate with all partners and seek continued stakeholder engagement in developing market-based, flexible, and proactive solutions that can take advantage of economies of scale. All aspects of wildland fire will be used to restore and maintain resilient landscapes. Emphasis will be placed on protecting the middle lands near communities."* (Western Regional Strategy Committee [WRSC] 2013:14).

In this CWPP, recommendations to restore and maintain resilient landscapes focus on vegetation management and hazardous fuels reduction, both implementation and other actions, to support on-the-ground treatments.

ONGOING, PLANNED, AND PROPOSED FUELS TREATMENTS IN TRUCKEE

As previously stated, fuels treatments are an effective means of reducing fire risk to communities in the WUI. Treatments such as mastication, thinning, prescribed burning, and dead tree and shrub removal serve to reduce fuel loading and fuel continuity, which will diminish potential fire behavior. For example, reducing ladder fuels minimizes transmission of fire from the surface into the crowns, and tree thinning increases the distance between tree crowns, which helps to reduce the potential for crown fires and extreme fire behavior. In addition, fuels treatments enhance firefighter safety and increase the efficiency of fire suppression actions. Fuels treatments by a property owner aid in defensible space (see Goal 2: Fire-Adapted Communities for more information).

Within the planning area there are currently over 13,000 acres of proposed, ongoing (implementation), and completed fuels treatments across multiple jurisdictions and partners; Measure T will provide additional fuels treatment opportunities in the planning area (see Recommendations for Hazardous Fuels Reduction). The Tahoe National Forest land to the north and south of the planning area has an active fuels program with many projects completed, in progress (implementation), or planned for the future which enhance the fuels treatments, both on National Forest land and other land, within the planning area. Figure 5.1 and Table 5.1 show fuels treatments that are planned, completed, or in progress in and around the planning area on a variety of jurisdictions. With most of the planning area in a fire deficit (Figure 4.11) implementation and maintenance of fuels treatments will continue to be of vital importance. In a mixed-conifer stand, it takes only 15 years after treatment for woody fuel loading to return to pre-treatment levels (Morici and Baily 2021); thus, maintenance treatments need to occur more frequently to prevent returning to the previous fuel loading and vegetation condition. Additionally, North et al. (2021) found in the Sierra Nevada range that a mechanical fuels treatment could provide an "anchor" from which

prescribed fires could be initiated to treat larger areas at less cost. This would allow managers to get a "foothold" in an area through mechanical treatments, then treat a much larger area with prescribed fire. For the most up -to -date maps and information on fuels treatments within the planning area click here. See the USFS website and the Federal Register for the latest information on planned or ongoing actions on adjacent Federal land.

Table 5.1. Acres of Planned, In-Progress, and Completed Fuels Treatments Across all Jurisdictions from 2016 through Present.

Fuels Treatment Status	Acres in Planning Area	Total Acres
Planned	2,445	20,228
Implementation	296	22,564
Completed	11,129	21,427
Total	13,870	64,219

Figure 5.1 also includes potential operational delineations (PODs) from the Tahoe National Forest; PODs are spatial units defined by potential fire control features, such as strategic roads or ridge tops, that aid fire managers in wildfire pre-planning and fuels treatment work. PODs support landscape-scale work by spatially defining a unit by ecological characteristics, identified risks, management opportunities, and desired conditions. PODs can be leveraged across jurisdictional boundaries to increase landscape-scale and collaborative work. To learn more about PODs click here.

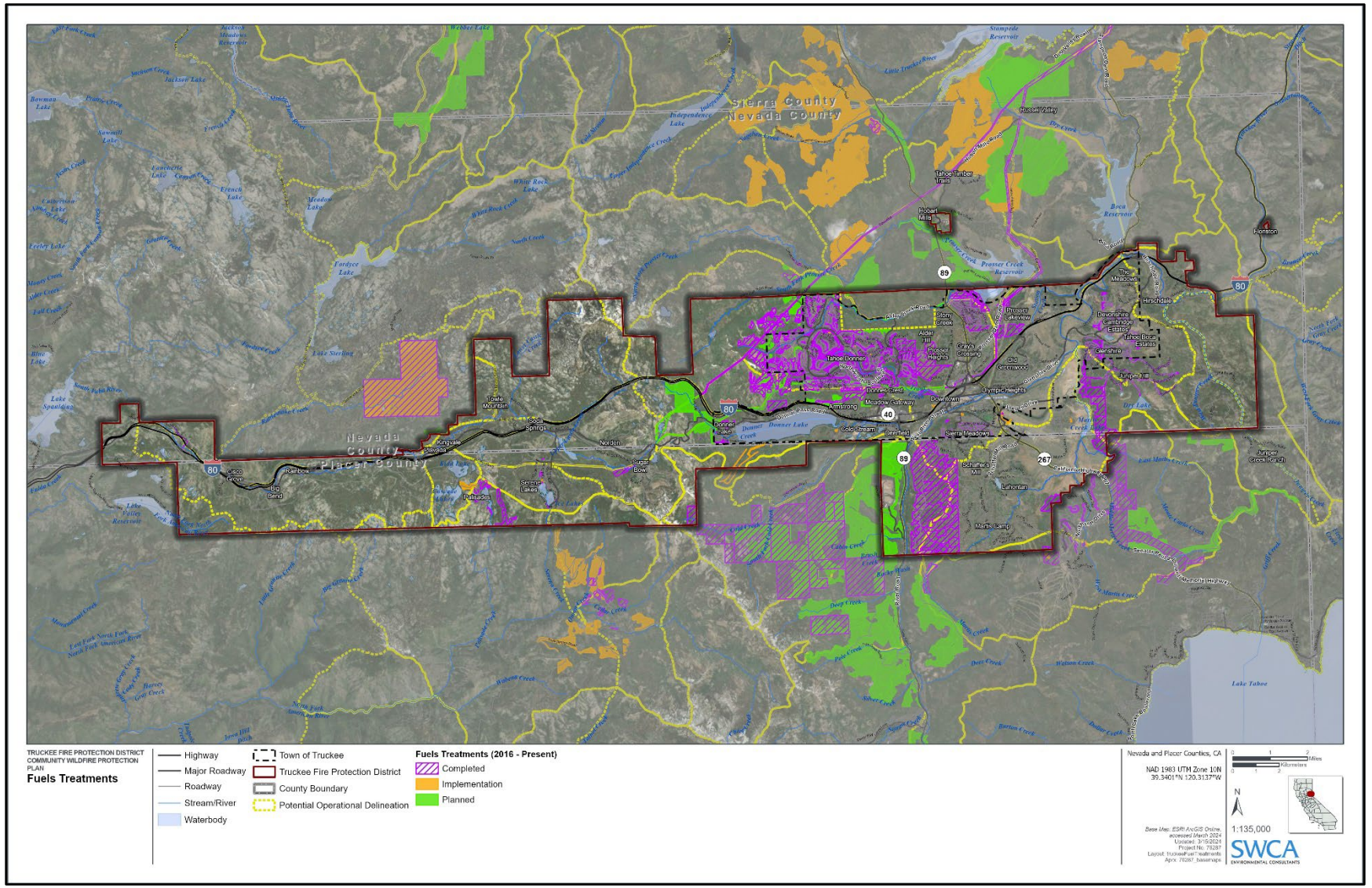


Figure 5.1. Current completed, in implementation, and planned fuels treatments across all jurisdictions from 2016 through present.

Note: Figure 5.1 does not include additional potential fuels treatments funded by Measure T and prioritized through the CWPP process.

LAND TENDER SCENARIOS – FUELS TREATMENTS

Fuels should be modified with a strategic approach to reduce the threat that high-intensity wildfires pose to lives, property, and other values. Fuels treatment methodologies differ depending on whether they are designed to protect structures (defensible space), are near community boundaries (fuel breaks, cleanup of adjacent open spaces), or in the wildlands beyond community boundaries (larger-scale forest health and restoration treatments). The emphasis of each of these treatment types is unique. Proximate to structures, fuels treatments are small scale, focusing on reducing fire intensity and fire spread rates consistent with Firewise and California Fire Code standards. This is commonly accomplished through mechanical thinning of ladder fuels, removal of ground fuels, and increased tree spacing. Treatments in undeveloped forested areas tend to emphasize larger-scale forest health and increasing resiliency to catastrophic wildfire and other disturbances. Prescribed fire is a landscape scale treatment that can impact large areas quickly. This also serves to reintroduce fire to its natural place in the ecosystem. When applying fuels treatments, every effort should be made to align treatments with the State Forest Action Plan Assessment and Strategy (CAL FIRE 2018) with consideration of all appropriate best management practices, sound science, and funding restrictions.

Treatments should be strategically located in areas to maximize effectiveness of other planned and ongoing projects, while taking resources and constraints into consideration. The Project Team collaboratively worked with Truckee Fire to determine the most strategic fuels treatments with the greatest return on investment[4] within the CWPP planning area (Figure 5.2 and Table 5.2). These priority treatments cross many jurisdictions and address different areas of high fire risk throughout the planning area. Land Tender streamlined stakeholder collaboration during the process while ensuring the CWPP reflects the collaborative's diverse priorities. Harnessing a specialized data curation process led by Vibrant Planet, SWCA, and Truckee Fire, industry-leading wildfire modeling from Pyrologix, and collaborative planning using the decision-support tool, the CWPP prioritizes fuels reduction projects with the highest stakeholder-weighted societal values distilled down to the treatment-unit level. The total consensus scenarios are the potential treatment areas Truckee Fire and the Project Team assigned dependent on specific land use and societal value contexts, such as protecting physical assets or biodiversity. Then, a Land Tender consensus function efficiently identified the highest-priority areas for treatment assuming resource availability constraints.

[4] Return on investment is the opportunity to mitigate risk, or the potential loss, of an identified SARA when exposed to a hazard prior to any management actions. Identification and value of SARAs were determined by the collaborative exercise with Truckee Fire and the Project Team. Return on investment depends on both the value of a SARA in an objective category and the existence and exposure to a hazard.

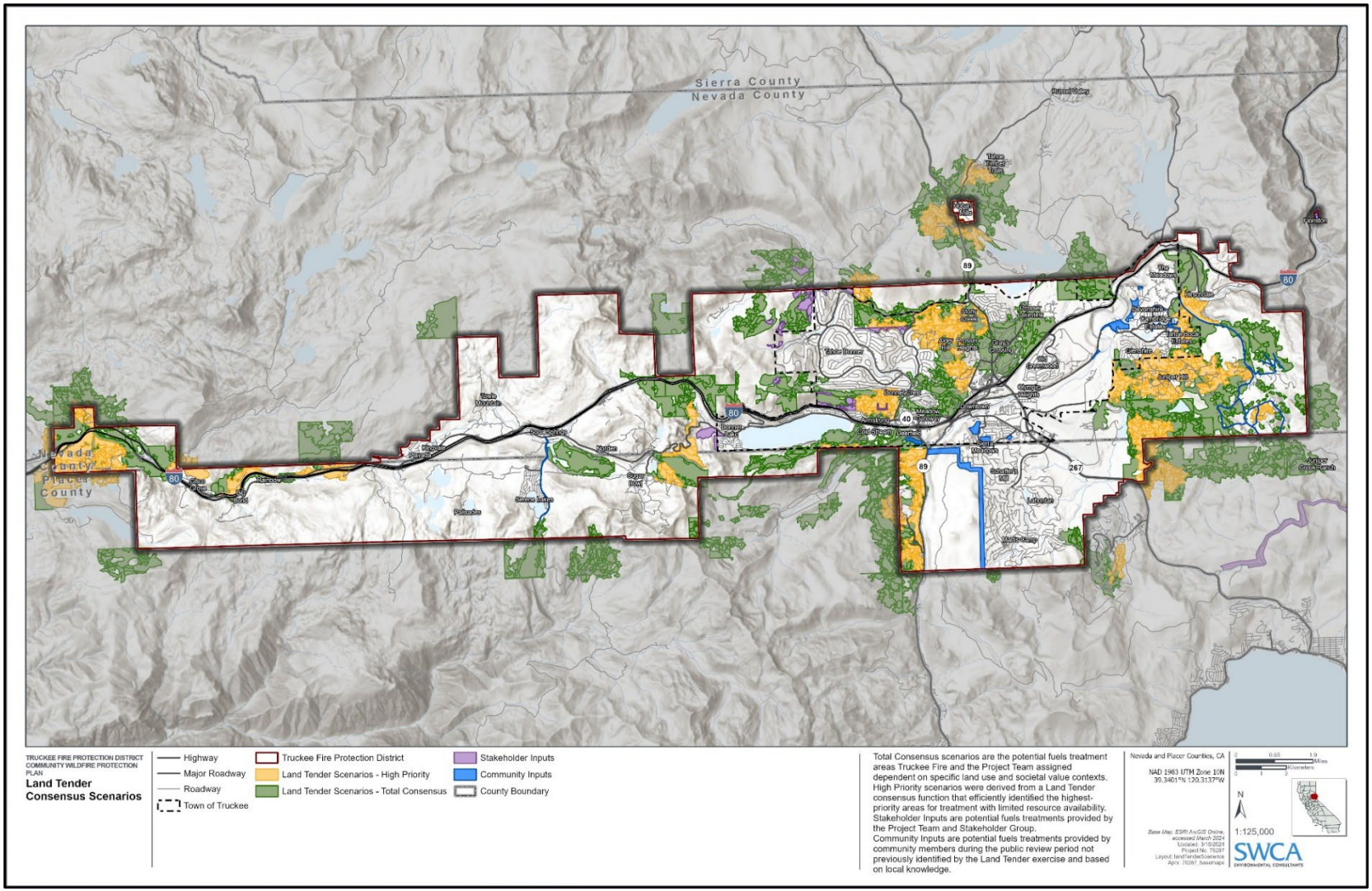


Figure 5.2. Total consensus and prioritized fuels treatments in the planning area.

Note: Total Consensus scenarios (33,763 acres) are the potential fuels treatment areas Truckee Fire and the Project Team assigned dependent on specific land use and societal value contexts. High Priority scenarios (8,263 acres) were derived from a Land Tender consensus function that efficiently identified the highest-priority areas for treatment with resource availability constraints. Stakeholder Inputs (756 acres) are potential fuels treatments provided by the Project Team and Stakeholder Group and Community Inputs (638 acres) are potential fuels treatments provided by community members during the public review period not previously identified by the Land Tender exercise and based on local knowledge.

Table 5.2. Land Tender Total Consensus and High Priority Fuels Treatments across all Jurisdictions in the Land Tender Analysis Area by Fuel Model

Fuel Models by Agency Jurisdiction	Total Consensus Treatment (acres)	High Priority Treatment (acres)
Local Government	**1,342.8**	**608.9**
NB (non-burnable – insufficient fuel)	23.1	-
GS2 (mixture of grass and shrubs)	189.0	55.3
SH2 (shrub cover, sparse grass)	7.2	2.3
TU1 (grass or shrubs mixed with timber litter)	40.7	-
TU5 (grass or shrubs mixed with timber litter)	1,066.7	551.4
TL3 (timber litter)	3.8	-
TL6 (timber litter)	12.2	-
North Fork Association	**20.6**	**-**
SH2 (shrub cover, sparse grass)	7.5	-
TU5 (grass or shrubs mixed with timber litter)	13.1	-
Other Landowners	**15,494.8**	**4,511.9**
NB (non-burnable – insufficient fuel)	1,154.7	185.2
GR1 (nearly pure grass)	3.3	3.3
GR2 (nearly pure grass)	540.1	132.9
GS1 (mixture of grass and shrubs)	1.5	1.5
GS2 (mixture of grass and shrubs)	2,403.0	330.7
SH2 (shrub cover, sparse grass)	40.7	1.2
SH5 shrub cover, sparse grass)	59.4	-
TU1 (grass or shrubs mixed with timber litter)	15.0	-
TU5 (grass or shrubs mixed with timber litter)	7,478.8	3,536.3
TL1 (timber litter)	1.4	-
TL3 (timber litter)	228.9	5.7
TL4 (timber litter)	615.6	26.1
TL5 (timber litter)	9.1	-
TL6 (timber litter)	2,287.5	246.5
TL7 (timber litter)	224.6	10.3
TL8 (timber litter)	1.9	-
TL9 (timber litter)	429.5	32.1
Pacific Gas & Electric	**636.0**	**349.3**
GS2 (mixture of grass and shrubs)	182.9	56.8
TU5 (grass or shrubs mixed with timber litter)	438.9	280.7
TL3 (timber liter)	14.1	11.8

Fuel Models by Agency Jurisdiction	Total Consensus Treatment (acres)	High Priority Treatment (acres)
Sierra Pacific Industries	**3,590.0**	**107.7**
NB (non-burnable – insufficient fuel)	8.2	-
GR1 (nearly pure grass)	8.9	-
GR2 (nearly pure grass)	341.3	-
GS1 (mixture of grass and shrubs)	653.5	-
GS2 (mixture of grass and shrubs)	960.5	-
SH2 (shrub cover, sparse grass)	79.3	-
TU1 (grass or shrubs mixed with timber litter)	6.9	-
TU5 (grass or shrubs mixed with timber litter)	799.9	104.5
TL3 (timber litter)	122.5	-
TL4 (timber litter)	324.0	-
TL6 (timber litter)	234.4	3.1
TL7 (timber litter)	43.9	-
TL9 (timber litter)	6.3	-
State Parks and Recreation	**871.4**	**54.7**
NB (non-burnable – insufficient fuel)	62.2	-
GS2 (mixture of grass and shrubs)	157.8	-
TU1 (grass or shrubs mixed with timber litter)	53.0	-
TU5 (grass or shrubs mixed with timber litter)	307.9	51.6
TL3 (timber litter)	30.3	-
TL4 (timber litter)	15.4	-
TL6 (timber litter)	230.2	3.1
TL7 (timber litter)	9.2	-
TL9 (timber litter)	5.4	-
Truckee Donner Land Trust	**701.9**	**7.0**
NB (non-burnable – insufficient fuel)	21.5	1.5
GS2 (mixture of grass and shrubs)	383.1	5.6
TU1 (grass or shrubs mixed with timber litter)	7.1	-
TU5 (grass or shrubs mixed with timber litter)	42.7	-
TL3 (timber litter)	3.4	-
TL6 (timber litter)	213.5	-
TL7 (timber litter)	30.8	-
US Forest Service	**11,106.8**	**2,623.9**
NB (non-burnable – insufficient fuel)	429.0	193.5
GR1 (nearly pure grass)	10.2	10.2
GR2 (nearly pure grass)	47.6	47.6

Fuel Models by Agency Jurisdiction	Total Consensus Treatment (acres)	High Priority Treatment (acres)
GS1 (mixture of grass and shrubs)	13.4	3.2
GS2 (mixture of grass and shrubs)	2,913.0	416.3
SH4 (shrub cover, sparse grass)	97.7	-
TU1 (grass or shrubs mixed with timber litter)	191.9	106.5
TU5 (grass or shrubs mixed with timber litter)	4,664.4	1,472.2
TL1 (timber litter)	217.6	30.7
TL2 (timber litter)	21.9	-
TL3 (timber litter)	381.2	45.8
TL4 (timber litter)	442.9	32.2
TL6 (timber litter)	832.8	139.0
TL7 (timber litter)	150.0	17.2
TL8 (timber litter)	15.3	-
TL9 (timber litter)	654.5	109.4
SB1 (slash/ blowdown)	23.5	-

Table is based on the Land Tender data and outputs at the time of CWPP publication. Pixels classified as non-burnable may be included in treatment acres due to the spatial resolution of data and Land Tender system processes.

See Table 4.3 or NWCG Surface Fuel Model Descriptions (NWCG 2023) for more information on fuel models.

RECOMMENDATIONS FOR HAZARDOUS FUELS REDUCTION

Table 5.3 provides a list of collaboratively developed recommendations to restore and maintain resilient landscapes throughout the Truckee CWPP planning area. These recommendations include fuels treatment implementation that reduces hazardous fuels and overall fuel loading, as well as actions that support the on-the-ground actions, such as creating community-based prescribed burn associations, providing support on technical forest health topics, and enhancing the seasonal workforce capacity to increase the pace and scale of fuels treatment implementation. This recommendation matrix serves as the action plan for furthering the ongoing, planned, and proposed fuels treatments and the Land Tender scenarios identified above. Some recommendations stem from the Measure T program and funding.

Table 5.3. Recommendations for Restoring and Maintaining Resilient Landscapes

Project ID	Project Description	Lead Agency (Partners and Collaborators)	Approach and Purpose
RL #1	Landscape-scale forest management and fuel reduction treatments	All agencies and land managers	Coordinate multi-jurisdictional and collaborative interagency forest management and fuels treatments on lands managed by local, state, federal, and non-governmental organizations using outputs from this CWPP to inform decision making and priorities. Work to increase collaboration with partner agencies on grant proposals to accomplish this work.
RL #2	Community fuel breaks and fuel reduction	Truckee Fire (project team and stakeholders group)	Use CWPP consensus scenario fuel treatment map to prioritize community fuel breaks and fuel reduction efforts. Work with partners and the community to gain increased support and capacity to implement these strategic and high-priority projects. Ensure landowners understand forestry and their requirement/need to maintain desired forest conditions.
RL #3	Community Wildfire Prevention Grants	Truckee Fire	Provide a local community grant program that makes funding available to private land owners, agencies, non-governmental organizations (NGOs), and other land managers for various different project types that promote wildfire resilience.
RL #4	Provide assistance for residential dead tree removal	Truckee Fire	Develop and implement a dead tree removal assistance program for elderly, disabled, and low-income residents to achieve defensible space compliance and to mitigate public safety hazards.
RL #5	Prescribed burn associations	Resource Conservation Districts/Fire Safe Councils	Establish community or homeowners association (HOA)-level prescribed burn associations to promote fuels reduction and provide education on conducting prescribed burning treatments by private property owners.
RL #6	Fuels treatments technical support	Truckee Fire, Resource Conservation Districts, Fire Safe Councils	Provide technical information, guidance, and answers to questions on technical forest and fuels treatment topics to better support property owners conducting work on private lands.
RL #7	Educational programs on fire as an ecosystem process	All agencies and land managers	Information on the threat of fire, forest management, and the use of prescribed fire will help educate the public and gain support for this type of work.

Note: RL = Resilient Landscapes

Treatments on state-owned lands within the SRA and some local lands will require California Environmental Quality Act (CEQA) compliance. The California Vegetation Treatment Program (CalVTP) is a programmatic, CEQA-compliant environmental impact report (EIR) that addresses over 20.3 million acres of SRA land across the state, and 21,540 acres in the planning area (Figure 5.3). The CalVTP process is not necessarily restricted to the treatable landscape. Lands outside of the treatable area may also qualify with proper paperwork and justification. The CalVTP final programmatic EIR is applicable to projects at least partially on SRA land, including projects on private land, if they receive state or local government grants for vegetation treatment. It should also be noted that CalVTP is not the only option available to comply with CEQA requirements; project-specific exemptions, negative declarations, or mitigated negative declarations may also be employed. See Figure 5.4 for the CEQA process for CalVTP implementation. For more information on the CalVTP program, visit the CalVTP Homepage.

Some proposed fuels treatments may trigger compliance with the National Environmental Policy Act (NEPA) if treatments occur on federal land (which may include Federal Responsibility Area [FRA] land) or have a federal nexus. The appropriate federal agencies would be involved in the NEPA analysis and documentation process. The level of NEPA analysis and documentation (categorical exclusion, environmental assessment, or environmental impact statement) depends on the proposed action's potential to cause significant environmental effects.

When possible, simultaneously planning for the management of multiple resources while reducing fuels will ensure that the land remains viable for multiple uses in the long term. The effectiveness of any fuels reduction treatment depends on the degree of maintenance and monitoring that is employed. Monitoring will also ensure that objectives are being met in a cost-effective manner. For additional details on monitoring, see the Action Plan section below.

Many projects may be eligible for grant funds from local, state, or federal sources. For a list of funding sources, see Table 5.4. Note that this is not an exhaustive list. A federal grants clearinghouse can be found at The Catalogue of Federal Funding Sources, while the State of California Grants Portal helps identify funding sources for wildfire mitigation risk and fuels management.

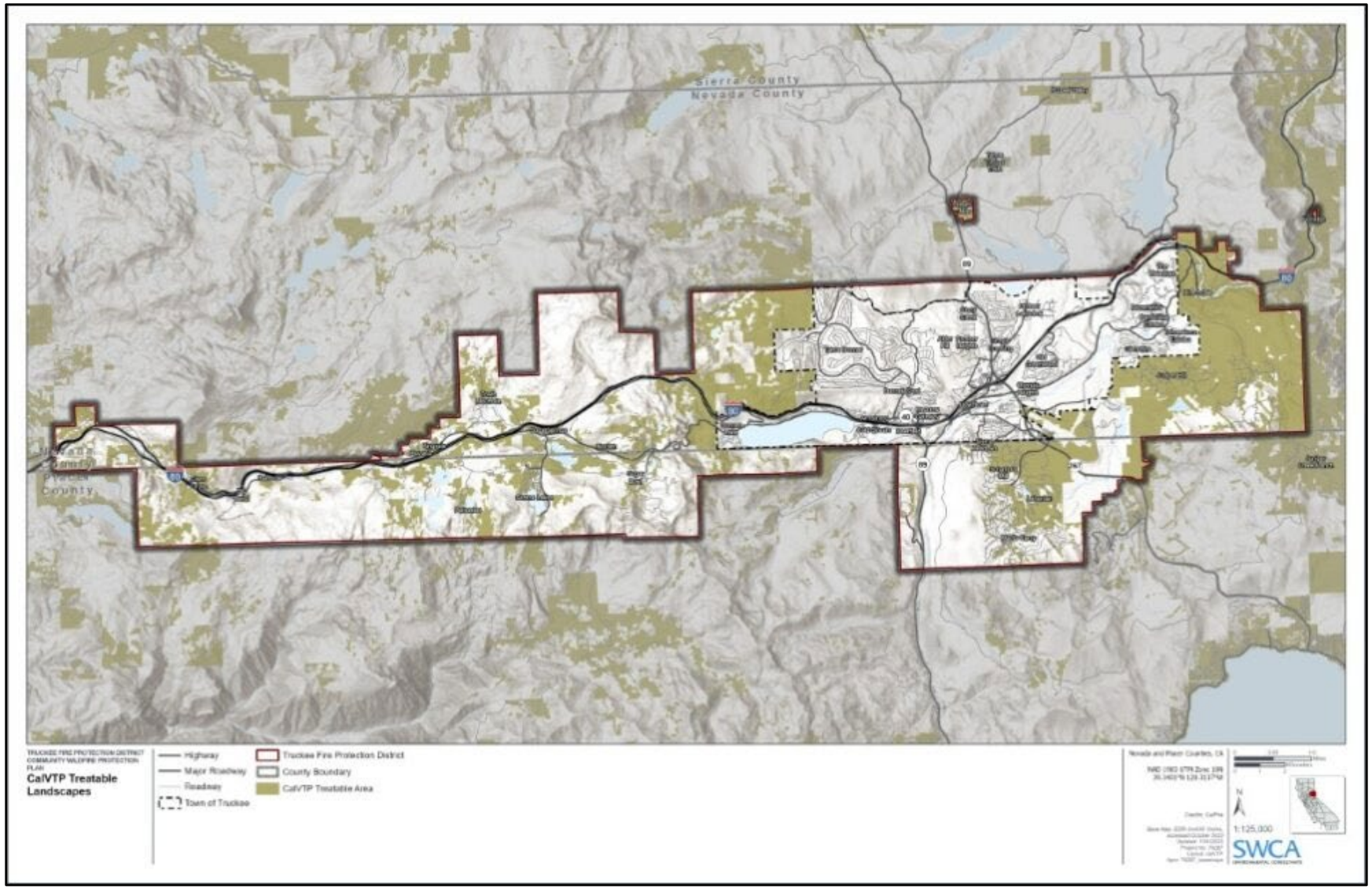


Figure 5.3. CalVTP treatable landscape (21,540 acres) in the planning area.

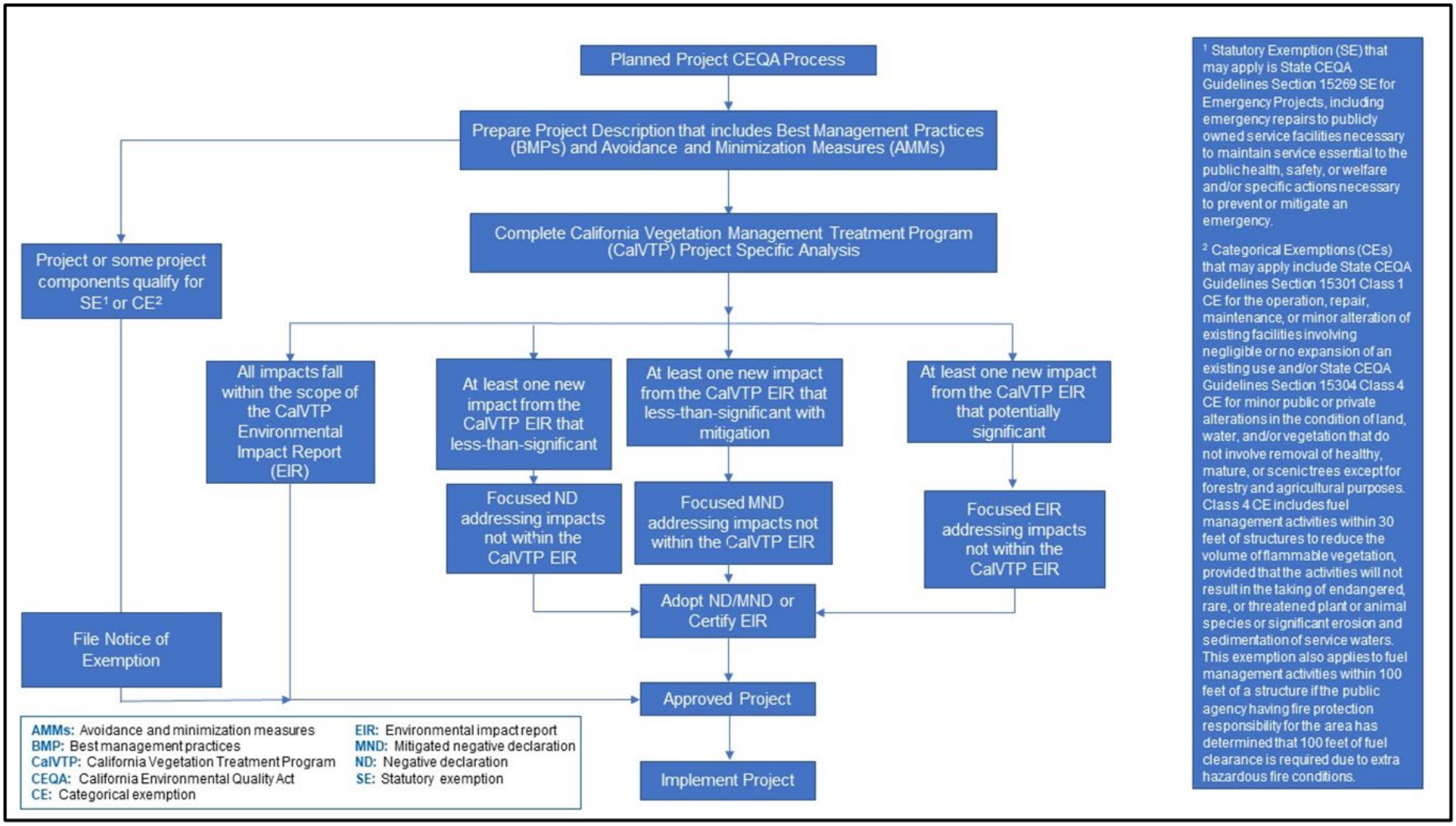


Figure 5.4. CEQA process for CalVTP implementation.

Table 5.4. Additional Funding Sources for Fire Resilience Programs

Funding Source	Program	Program/Grant Description	Link
Federal Emergency Management Agency (FEMA)	Building Resilient Infrastructure and Communities Grant	Supports states, tribes, and territories for hazard mitigation projects	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
FEMA	Hazard Mitigation Grant Program Post Fire	Offers post-fire assistance to help communities after a wildfire	https://www.fema.gov/grants/mitigation/post-fire
FEMA	Fire Management Assistance Grant	Mitigation, management, and control of fires on forests and grasslands	https://www.fema.gov/assistance/public/fire-management-assistance
NRCS	Emergency Watershed Protection Program	Technical and financial assistance to communities to relieve imminent threats after natural disaster	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/
Firewise	Firewise Community Grants	Three-year action plan to identify and prioritize actions for homeowners to reduce ignition risk to homes	https://www.nfpa.org/education-and-research/wildfire/firewise-usa/become-a-firewise-usa-site/program-benefits
USFS	Community Wildfire Defense Grant Program	Funding for development and maintenance of a CWPP	https://www.fs.usda.gov/managing-land/fire/grants
USFS	Cross-Boundary Wildfire Mitigation Program	Aides in efforts for developing resilient landscapes, fire adapted communities, and reducing wildfire risk	https://www.fs.usda.gov/detail/r9/workingtogether/grants/?cid=FSEPRD898823
CAL FIRE	Forest Health Grants	Restoration and reforestation activities to reduce communities from wildfire risk	https://www.fire.ca.gov/what-we-do/grants/forest-health
CAL FIRE	Forest Legacy Grants	Protects important forests from conversion to non-forest	https://www.fire.ca.gov/what-we-do/grants/forest-legacy
CAL FIRE	California Forest Improvement Program	Encourages management for high-quality timber, economic benefits, and protection	https://www.fire.ca.gov/what-we-do/grants/california-forest-improvement
CAL FIRE	Wildfire Prevention Grants	Local projects that protect, engage, and educate individuals and communities	https://www.fire.ca.gov/grants/fire-prevention-grants/
CAL FIRE	Wildfire Resilience and Forestry Assistance Grant (Proposition 68)	Supports conservancy of wildlands and protection from wildfire	https://www.grants.ca.gov/grants/proposition-68-grant-program/
CAL FIRE	Wildfire Resilience Block Grant	Assists nonindustrial forests with wildfire resilience through technical and financial support	https://www.fire.ca.gov/what-we-do/natural-resource-management/wildfire-resilience

Funding Source	Program	Program/Grant Description	Link
California Fire Foundation	California Fire Foundation Grants Program	Addresses local prevention, preparedness, mitigation, and resiliency	https://www.cafirefoundation.org/programs/fireprevention/
Sierra Nevada Conservancy	Wildfire Recovery and Forest Resilience Directed Grant Program	Planning and implementation of forest health projects that promote wildfire recovery	https://sierranevada.ca.gov/grants/wildfire-recovery-and-forest-resilience/
Wildlife Conservation Board	WCB Continuous Grant	Financial and technical support for projects that improve forest health or reduce wildfire danger	https://wcb.ca.gov/Grants
California Department of Conservation	Regional Forest and Fire Capacity Program	Funding for creating fire-adapted communities and landscapes	https://www.conservation.ca.gov/dlrp/grant-programs/Pages/Regional-Forest-and-Fire-Capacity-Program.aspx
Truckee Fire	Community Wildfire Prevention Grant Program	Fuels reduction program in the Truckee WUI	https://www.truckeefire.org/grants

COHESIVE STRATEGY GOAL 2: FIRE-ADAPTED COMMUNITIES

Goal 2 of the Cohesive Strategy/Western Regional Action Plan is: Fire-Adapted Communities: Human populations and infrastructure can withstand wildfire without loss of life and property. The basic premise of this goal is:

> *"Preventing or minimizing the loss of life and property due to wildfire requires a combination of thorough pre-fire planning and action, followed by prudent and immediate response during a wildfire event. Post-fire activities can also speed community recovery efforts and help limit the long-term effects and costs of wildfire. CWPPs should identify high-risk areas and actions residents can take to reduce their risk. Fuels treatments in and near communities can provide buffer zones to protect structures, important community values and evacuation routes. Collaboration, self-sufficiency, acceptance of the risks and consequences of actions (or non-action), assisting those who need assistance (such as the elderly), and encouraging cultural and behavioral changes regarding fire and fire protection are important concepts. Attention will be paid to values to be protected in the middle ground (lands between the community and the forest) including watersheds, viewsheds, utility and transportation corridors, cultural and historic values, etc."* (WRSC 2013:15).

In this CWPP, recommendations for fire-adapted communities include public education and outreach actions and actions to reduce structural ignitability.

RECOMMENDATIONS FOR PUBLIC EDUCATION AND OUTREACH

Just as environmental hazards must be mitigated to reduce the risk of fire loss, so do human hazards. Lack of knowledge, lack of positive actions (e.g., failing to create adequate defensible space), and negative actions (e.g., keeping large amounts of flammable debris and rubbish on the property) all contribute to increased risk of loss in the WUI.

Most residents in the WUI understand the risk that wildfire poses to their communities. However, it is important to continually engage the community as a partner to expand wildfire mitigation options across land ownership (McCaffrey 2004, 2020; McCaffrey and Olsen 2012; Winter and Fried 2000).

Methods to improve public education could include providing workshops at demonstration sites showing Firewise landscaping techniques or fuels treatment projects; organizing community cleanups to remove green waste; publicizing availability of government funds for treatments on private land; and, most importantly, improving communication between property owners and local land management agencies to improve and build trust, particularly since the implementation of fuels treatments and better maintenance of existing treatments needs to occur in the interface between public and private land.

Truckee Fire provides the community with webpages containing resources for recommendations for implementing defensible space on one's property and various home hardening strategies such as clearing vegetation around homes and structures. In addition, they offer free defensible space inspections and reports.

RECOMMENDATIONS FOR REDUCING STRUCTURAL IGNITABILITY

Table 5.5 provides a list of community-based recommendations to reduce structural ignitability that should be implemented throughout the Truckee CWPP planning area. These recommendations came from discussions with the Project Team and Stakeholder Group during monthly meetings. Reduction of structural ignitability depends largely on public education, which provides homeowners the information they need to take responsibility for protecting their own properties. Carrying out fuels reduction treatments on public land may only be effective in reducing fire risk to some communities. The Casualty Actuarial Society compared the impact of individual and community-level mitigation on individual homeowner risks and found that "the model indicates that all mitigation measures reduce the individual risk, but individual home mitigation – which individual homeowners' control – can have a bigger impact than any community mitigation alone" (Casualty Actuarial Society 2023). If homeowners have failed to provide mitigation efforts on their own land, the risk of home ignition remains high, and firefighter lives are put at risk when they carry out structural defense.

Preparing for wildland fire by creating defensible space around the home is an effective strategy for reducing structural ignitability as discussed under Cohesive Strategy Goal 1: Restore and Maintain Landscapes. Studies have shown that burning vegetation beyond 120 feet of a structure is unlikely to ignite that property through radiant heat (Butler and Cohen 1996), but fire bands that travel independently of the flaming front have been known to destroy houses that had not been impacted by direct flame impingement. Hardening the home in any way to ignition from embers, including maintaining vent coverings and other openings, is also strongly advised to protect a home from structural ignitability. Managing the landscape around a structure by removing weeds and debris within a 30-foot radius and keeping the roof and gutters of a home clean are two maintenance measures proven to limit combustible materials that could provide an ember bed and ignite the structure. In essence, reducing structural ignitability and creating defensible space are key to protecting homes from the potential loss and damage due to intense wildfires, such as the 2022 Mosquito Fire.

Pertinent information regarding recent legislation related to Goal 2 of the Cohesive Strategy is provided below, and in Table 1.1.

Table 5.5. Recommendations for Creating Fire-Adapted Communities (Public Education and Reducing Structural Ignitability)

Project ID	Project Description	Lead Agency (Partners and Collaborators)	Approach and Purpose
FAC #1	Maintain and expand Greenwaste Programming	Truckee Fire, Counties, Town	Continue to support residential green waste removal efforts. Allow all residents to put defensible space-generated waste for curbside pickup of small woody material. Consider more solutions for pine needles.
FAC #2	Property owner defensible space	Truckee Fire, Communities (HOAs, Firewise)	Educate public on importance of defensible space and local ordinances. Encourage compliance through enforcement of STRs, new development, property transfer, insurance requirements, and properties with egregious fire hazards.
FAC #3	Firewise and home hardening measures	Truckee Fire, HOAs, Firewise	Educate property owners to get involved in home hardening and Firewise activities, as well as renters.
FAC #4	Rebate Program for home hardening upgrades	Truckee Fire	Eligible residents may apply for home hardening rebate/assistance. Eligible residents can schedule a defensible space inspection, complete the upgrades, and schedule a reinspection or submit photos and then are able to request a rebate.
FAC #5	Homeowners association (HOA)/neighborhood communication	Truckee Fire, HOAs, Firewise communities	Increased communication to HOAs and Firewise neighborhoods will help explain available resources and ensure the community stays informed.
FAC #6	Defensible space assistance for elderly, disabled, and low-income residents	Truckee Fire	Develop and implement an assistance program for elderly, disabled, and low-income residents to achieve defensible space compliance.
FAC #7	Community technical assistance	Truckee Fire	Create a “FACT” sheet and flowchart that provides residents with resources for project development and maintenance, and also allows residents to know what assistance they qualify for and how to apply.
FAC #8	Seasonal workforce capacity	Truckee Fire	Increase seasonal workforce to facilitate increased education, inspections, and accountability to property owners.
FAC #9	Create organizational chart	Truckee Fire (project team and stakeholders group)	Develop an organizational chart for associations, local government, and other entities that will reduce duplication of effort on engagement.
FAC #10	Wildfire preparedness media campaigns	Truckee Fire (project team and stakeholders group)	• More easily accessible resources will help the public learn how to harden homes and prepare for wildfire. • Emergency preparedness, evacuation readiness, and go-bags.

FAC #11	Multi-language resources	Truckee Fire (project team and stakeholders group)	Produce material in both English and Spanish that can be shared at community events and sent directly to the homeowners.
FAC #12	Enforcement and support	Truckee Fire (project team and stakeholders group)	• More stringent code regulations for defensible space in HOAs • More funding sources for property owners • More funding resources for low-income areas • Mechanism for maintaining/upkeep for storage, defensible space, etc. • Increased education for property owners on specific defensible space and home hardening measures, including materials to use, explaining terminology, showing defensible space examples
FAC #13	Communication and Outreach	Truckee Fire, Town, Local law enforcement	• Identify evacuation routes • Cohesive digital app that provides information and status update on emergencies, wildfires, evacuations, and prescribed burns • Financial support for Community Organizations Active in Disasters • Determine alternative outlet besides cell service. • Identify evacuation plans ahead of time • Wireless Emergency Alert support • Improve awareness of grants, rebates, and insurance discounts both for property owners and HOAs
FAC #14	CWPP team or charter	Truckee Fire (project team and stakeholders group)	Establish a working collaborative group that meets semi-regularly to champion this CWPP and maintain coordinated working efforts and grant applications

Note: FAC = Fire Adapted Communities

COHESIVE STRATEGY GOAL 3: WILDFIRE RESPONSE

Goal 3 of the Cohesive Strategy/Western Regional Action Plan is Wildfire Response: All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions:

> *"A balanced wildfire response requires integrated pre-fire planning with effective, efficient, and coordinated emergency response. Pre-fire planning helps tailor responses to wildfires across jurisdictions and landscape units that have different uses and management objectives. Improved prediction and understanding of weather, burning conditions, and various contingencies during wildfire events can improve firefighting effectiveness, thereby reducing losses and minimizing risks to firefighter and public health and safety. Wildfire response capability will consider the responsibilities identified in the Federal Response Framework. Local fire districts and municipalities with statutory responsibility for wildland fire response are not fully represented throughout the existing wildland fire governance structure, particularly at the NWCG, NMAC, and GACC levels"* (WRSC 2013:15).

This section provides recommended actions that property owners and communities could undertake before an incident to aid emergency resources during wildfire response in the event of an incident.

RECOMMENDATIONS FOR IMPROVING FIRE RESPONSE CAPABILITIES

Informing and empowering the public so they can reduce the impact to fire departments is essential because these resources are often stretched thin due to limited personnel. Property owners can take preventative measures that will help improve structure identification and firefighter access during an incident. Increasing awareness and knowledge to enhance community preparedness is another key factor in supporting local fire departments in fire response, particularly educating residents about emergency notifications and evacuation protocols so that residents can safely evacuate an area while emergency responders prepare to protect life and property.

Table 5.6 provides recommendations for preventative measures by property owners to help improve firefighter response in the event of an incident.

Table 5.6. Recommendations for Safe and Effective Wildfire Response

Project ID	Project Description	Lead Agency (Partners and Collaborators)	Approach and Purpose
WR #1	Improve address visibility for emergency response	Town and Counties (Truckee fire, HOAs, Firewise)	Make street signs and house numbers highly visible to ensure first responders can arrive quickly to the proper address. HOAs and the Town can require this.
WR #2	Increase communication and public relations capacity	Truckee Fire (Project Team and Stakeholders Group)	Expand capacities through positions or consultants for public outreach, communications, public alerts, and collaboration.
WR #3	Critical infrastructure defensible space	Truckee Fire (Infrastructure owners)	Using the CWPP consensus scenario map, work with owners of critical infrastructure to prioritize fuels reduction adjacent to critical infrastructure and emergency service areas.
WR #4	Fuels treatments along evacuation routes	Town, Counties, CALTRANS, Communities, Truckee Fire	Design and implement projects that address ingress and egress issues. Remove brush, dead trees, and ladder fuels along critical evacuations routes to keep fire intensity low in the event of an evacuation.
WR #5	Communication tools	Truckee Fire, Counties, Town	• Create a cohesive digital app where agencies can put updates of emergencies, wildfires, and evacuations, as well as prescribed burns nearby. • Spread awareness on 211 Connecting Point, a 24/7 resource for emergency and non-emergency situations and information. • Create focused communication for out-of-town residents, visitors, and Spanish speaking individuals.
WR #6	Expand early fire detection systems	Truckee Fire, Town	Consider expanding early fire detection systems in the Town and communities (e.g. cameras).
WR #7	Non-Resident education	Truckee Fire, Town, Counties	Improve awareness and notification of developing emergency situations to area visitors (non-residents).
WR #8	Educate citizens about disaster preparedness for hazards that could impact the community. Train citizens in basic disaster response skills.	Truckee Fire	Citizens are trained in fire safety, light search and rescue, team organizations, and disaster medical operations. This builds a more educated community through outreach and education.

Note: WR = Wildfire Response

ACTION PLAN

The preceding recommendation matrices (Tables 5.3, 5.5, and 5.6) represent the first step in the process of developing an action plan and an assessment strategy that identifies specific actions, roles and responsibilities, funding needs, and timetables for completing highest-priority projects. It is an important step in organizing the implementation of the Truckee CWPP. It is the next step after collaborative input and recommendations. The recommendations in Tables 5.3, 5.5, and 5.6 are aligned with the three Cohesive Strategy Goals and list actionable items rooted in collaborative discussions with a lead agency and collaborative partners as applicable, and the purpose. Some of these recommendations are program level, and some project level; the development of specific fuels treatment prescriptions, including final unit boundaries, is one of several future steps when involved parties are ready for on-the-ground implementation. Some of the identified recommendations stem from or expand upon the Measure T program funds; remaining recommendations will qualify for at least one of the funding sources in Table 5.4. While all projects are “high priority” for the agencies and communities to improve wildfire mitigation and resilience, Truckee Fire and the Project Team recognized resource constraints (funding, personnel, equipment, time, environmental compliance processes, etc.) and chose not to rate recommendations in the matrices by priority level. As such, timelines for specific recommendations were not developed.

All stakeholders and signatories to this CWPP desire worthwhile outcomes. It is also known that risk reduction work on the ground, for the most part, is often not attainable in a few months—or even years—and typically requires scheduled maintenance (e.g., annual, semiannual, etc.). The amount of money and effort invested in implementing a plan such as this requires that there be a means to describe, quantitatively and/or qualitatively, whether the goals and objectives expressed in this plan are being accomplished according to expectations.

Monitoring and reporting contribute to the long-term evaluation of changes in ecosystems, as well as the knowledge base about how natural resource management decisions affect both the environment and the people who live in it. Tracking completion of fuels treatments is key to accountability and success of the CWPP. Furthermore, as the CWPP evolves over time, there may be a need to track changes in policy, requirements, stakeholder changes, and levels of preparedness. Any of these can be significant for future revisions and/or addendums to the CWPP to keep it a “living document.”

It is recommended that project monitoring be a collaborative effort. There are many resources for designing and implementing community based, multi-party monitoring that could support and further inform a basic monitoring program for the CWPP (Egan 2013). Multi-party monitoring involves a diverse group consisting of community members, community-based groups, regional and national interest groups, and public agencies. Using this multi-party approach increases community understanding of the effects of restoration efforts and trust among restoration partners. Multi-party monitoring may be more time-consuming due to the collaborative nature of the work; therefore, a clear and concise monitoring plan must be developed.

Table 5.7 identifies monitoring strategies for various aspects of all categories of CWPP recommendations and the effects of their implementation, both quantifiable and non-quantifiable, for assessing the progress of the CWPP and increase sustainability of projects. It must be emphasized that these strategies are 1) not exhaustive and 2) dependent on available funds and personnel to implement them.

Table 5.7. Recommended Monitoring Strategies

Strategy	Task/Tool	Lead	Remarks
Project tracking system	Online web app to track hazardous fuels projects spatially, integrating wildfire risk layer to show progress toward wildfire hazard and risk reduction. The web app would include attribute tables that outline project details	Truckee Fire	Interactive tool will be easily updated and identify areas that require additional efforts
Photographic record (documents pre- and post-fuels reduction work, evacuation routes, workshops, classes, field trips, changes in open space, treatment type, etc.)	Establish field GPS location; photo points of cardinal directions; keep photos protected in archival location	Project Team member	Relatively low cost; repeatable over time; used for programs and tracking objectives
Number of acres treated (by fuel type, treatment method)	GPS/GIS/fire behavior prediction system	Project Team member	Evaluating costs, potential fire behavior
Number of home ignition zones/defensible space treated to reduce structural ignitability	GPS	Homeowner	Structure protection
Number of residents/citizens participating in any CWPP projects and events	Meetings, media interviews, articles	Project Team member	Evaluate culture change objective
Number of homeowner contacts (brochures, flyers, posters, etc.)	Visits, phone	Agency representative	Evaluate objective
Number of jobs created	Contracts and grants	Project Team member	Evaluate local job growth
Education outreach: number, kinds of involvement	Workshops, classes, field trips, signage	Project Team member	Evaluate objectives
Emergency management: changes in agency response capacity	Collaboration	Agency representative	Evaluate mutual aid
Codes and policy changes affecting CWPP	Qualitative	Project Team	CWPP changes
Number of stakeholders	Added or dropped	Project Team	CWPP changes
Wildfire acres burned, human injuries/fatalities, infrastructure loss, environmental damage, suppression, and rehabilitation costs	Wildfire records	Project Team	Compare with 5- or 10-year average

FUELS TREATMENT MONITORING

It is important to evaluate whether fuels treatments have accomplished their defined objectives and whether any unexpected outcomes have occurred.

The strategies outlined in this section consider several variables:

- Do the priorities identified for treatment reflect the goals stated in the plan? Monitoring protocols can help address this question.
- Can there be ecological consequences associated with fuels work? Items to consider include soil movement and/or invasive species encroachment post-treatment. Relatively cost-effective monitoring may help reduce long-term costs and consequences.
- Vegetation will grow back. Thus, fuel break maintenance and fuels modification in both the home ignition zone and at the landscape scale require periodic assessment. Monitoring these changes can help decision-makers identify appropriate treatment intervals.
- Monitoring for all types of fuels treatment is recommended. For example, in addition to monitoring mechanical treatments, it is important to carry out comprehensive monitoring of burned areas to establish the success of pre-fire fuels reduction treatments on fire behavior, as well as monitoring for ecological impacts, repercussions of burning on wildlife, and effects on soil chemistry and physics. Adaptive management is a term that refers to adjusting future management based on the effects of past management. Monitoring is required to gather the information necessary to inform future management decisions. Economic and legal questions may also be addressed through monitoring. In addition, monitoring activities can provide valuable educational opportunities for students.

The monitoring of each fuels reduction project would be site-specific, and decisions regarding the timeline for monitoring and the type of monitoring to be used would be determined by the project. The most important part of choosing a fuels project monitoring program is selecting a method appropriate to the people, place, and type of project. Several levels of monitoring activities meet different objectives, have different levels of time intensity, and are appropriate for different groups of people. They include the following:

Minimum—Level 1: Pre- and Post-project Photographs

Appropriate for many individual homeowners who conduct fuels reduction projects on their properties.

Moderate—Level 2: Multiple Permanent Photo Points

Permanent photo locations are established using rebar or wood posts, GPS-recorded locations, and photographs taken on a regular basis. Ideally, this process would continue over several years. This approach might be appropriate for more enthusiastic homeowners or for agencies conducting small-scale, general treatments.

High—Level 3: Basic Vegetation Plots

A series of plots can allow monitors to evaluate vegetation characteristics such as species composition, percentage of cover, and frequency. Monitors then can record site characteristics such as slope, aspect, and elevation. Parameters would be assessed pre- and post-treatment. The monitoring agency should establish plot protocols based on the types of vegetation present

and the level of detail needed to analyze the management objectives. This method is appropriate for foresters or other personnel monitoring fuel treatments on forested lands.

Intense—Level 4: Basic Vegetation Plus Dead and Downed Fuels Inventory

The protocol for this level would include the vegetation plots described above but would include more details regarding fuel loading. Crown height or canopy closure might be included for live fuels. Dead and downed fuels could be assessed using other methods, such as Brown's transects (Brown 1974), an appropriate photo series (Ottmar et al. 2000), or fire monitoring (Fire Effects Monitoring and Inventory System [FIREMON]) plots. This method is ideal for foresters or university researchers tracking vegetation changes in forested lands.

IMPLEMENTATION

The Truckee CWPP makes recommendations for prioritized fuels reduction projects, measures to reduce structural ignitability and improve defensible space, methods for carrying out public education and outreach, and preventative property owner measures. Implementation of projects must be tailored to the specific project and will be unique to the location depending on available resources and regulations. The greatest fire risk mitigation could be achieved through the joint actions of individual property owners, tribes, and local, state, and federal governments. The value of CWPPs is in providing a framework for collaboration between the public, governments, agencies, and other entities to develop solutions and strategies for wildfire management and mitigation. Additionally, the structure of this plan is designed to allow for easy updates in the future so that the collaborators have a current plan and recommendations.

As previously mentioned, the Land Tender results guided the prioritization of fuels reduction projects in the planning area, while other risk reduction recommendations came from collaborative sessions with the Project Team and stakeholders. Implementation of fuels reduction projects will be further guided by required planning documents and regulatory compliance and current on-the-ground conditions.

CWPP EVALUATION

CWPPs are intended to reduce the risk from wildfire for a community and surrounding environment. Over time, communities change and expand, laws are amended, vegetation grows back, and wildlands evolve. As such, the risk of wildfire to communities is constantly changing and the plans and methods to reduce risk must be dynamic to keep pace with the changing environment.

It is recommended that the CWPP be evaluated on an annual basis, which should be completed by convening the existing Project Team so that all entities contribute to the evaluation. The CWPP document and planning goals and objectives should be updated annually, based on findings from the evaluation. The story map and hub site are avenues to easily share CWPP updates and changes to the public and stakeholders.

Four general steps can be used to evaluate the CWPP:

1. Identify objectives: What are the goals identified in the plan? How are they reached? Is the plan performing as intended?
    i. Structural ignitability
    ii. Fuel treatments
    iii. Public education and outreach

iv. Multi-agency collaboration

v. Emergency response

2. Assess the changing environment: How have population characteristics and the wildfire environment changed?
    i. Population change
        a. Increase or decrease
        b. Demographics
    ii. Population settlement patterns
        a. Distribution
        b. Expansion into the WUI
    iii. Vegetation
        a. Fuel quantity and type
        b. Drought and disease impacts
3. Review action items: Are actions consistent with the plan's objectives?
    i. Check for status, i.e., completed/started/not started
    ii. Identify completed work and accomplishments
    iii. Identify challenges and limitations
    iv. Identify next steps
4. Assess results: What are the outcomes of the action items?
    i. Multi-agency collaboration
        a. Who was involved in the development of the CWPP?
        b. Have partners involved in the development process remained involved in the implementation?
        c. How has the planning process promoted implementation of the CWPP?
        d. Have CWPP partnerships and collaboration had a beneficial impact on the community?
    ii. Risk assessment
        a. How is the risk assessment utilized to make decisions about fuel treatment priorities?
        b. Have there been new wildfire-related regulations?
        c. Are at-risk communities involved in mitigating wildfire risk?
    iii. Hazardous fuels
        a. How many acres have been treated?
        b. How many projects are cross-boundary?
        c. How many residents have participated in creating defensible space?
    iv. Structural ignitability
        a. Have there been updates to fire codes and ordinances?
        b. How many structures have been lost to wildfire?
        c. Has the CWPP increased public awareness of structural ignitability and reduction strategies?

v. Public education and outreach
    a. Has public awareness of wildfire and mitigation strategies increased?
    b. Have residents been involved in wildfire mitigation activities?
    c. Has there been public involvement?
    d. Have vulnerable populations been involved?

vi. Emergency response
    a. Has the CWPP been integrated into relevant plans (e.g., hazard mitigation or emergency operations)?
    b. Is the CWPP congruent with other hazard mitigation planning efforts?
    c. Has availability and capacity of local fire departments changed since the CWPP was developed?

TIMELINE FOR UPDATING THE CWPP

The HFRA allows for maximum flexibility in the CWPP planning process, permitting the Project Team to determine the time frame for updating the CWPP. The Project Team members are encouraged to meet on an annual basis to review the project list, discuss project successes, and strategize regarding project implementation funding. It is suggested that the evaluation framework above be used annually to make plan updates, and a more formal revision be made on the fifth anniversary of signing and every 5 years following.

REFERENCES

Abrahamson, I. 2014. *Arctostaphylos manzanita*. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at: https://www.fs.usda.gov/database/feis/plants/shrub/arcman/all.html. Accessed February 2023.

Baldwin, C.K., F. Wagner., and U. Lall. 2003. Rocky Mountain/Great Basin Regional Climate-Change Assessment. Page 240 in Report of the U.S. Global Change Research Program. Utah State University.

Brown, J.K. 1974. *Handbook for Inventorying Downed Woody Material*. Gen. Tech. Rep. No. GTR-INT-16. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Brown, P.T., H. Hanley, A. Mahesh, C. Reed, S.J. Strenfel, S.J. Davis, A. K. Kochanski, C.B. Clements. 2023. Climate warming increases extreme daily wildfire growth risk in California. *Nature*, *621*(7980).

Butler, B.W., and J.D. Cohen. 1996. An Analytical Evaluation of Firefighter Safety Zones. 12th Fire and Forest Meteorology Conference, Lorne, Australia, 1996.

California Board of Forestry and Fire Protection (BOF). 2022. Subdivision Survey Report for Truckee Fire. Version 1.8

California Department of Fish and Wildlife. 2021. Science: Wildfire Impacts. Available at: https://wildlife.ca.gov/Science-Institute/Wildfire-Impacts. Accessed February 2023.

California Department of Forestry and Fire Protection (CAL FIRE). 2018. California's Forest and Rangelands 2017 Assessment. Available at: https://frap.fire.ca.gov/media/4babn5pw/assessment2017.pdf. Accessed February 2023

———. 2019. Strategic Fire Plan. Available at: https://www.paperturn-view.com/cal-fire-communications/strategicplan2019-final?pid=MjU253660. Accessed August 2023.

———. 2021. CAL FIRE Vegetation Management Program. Available at: https://www.fire.ca.gov/what-we-do/natural-resource-management/vegetation-management-program. Accessed February 2023.

———. 2022a. Nevada-Yuba-Placer Unit 2022 Strategic Fire Plan. https://osfm.fire.ca.gov/media/d13dygtr/2022-nevada-yuba-placer-sierra-sutter-unit-fire-plan.pdf. Accessed July 2023.

———. 2022b. 2021 Incident Archive. Available at: https://www.fire.ca.gov/incidents/2021/. Accessed February 2023.

———. 2022c. Frequently Asked Questions About: 2022 Fire Hazard Severity Zones. Available at: https://osfm.fire.ca.gov/media/fmcgpc2z/2022-fhsz-faqs-july-2022.pdf

———. 2023a. 2022 Incident Archive. Available at: https://www.fire.ca.gov/incidents/2022/. Accessed March 2023.

———. 2023b. Fire Hazard Severity Zones (FHSZ). Available at: https://osfm.fire.ca.gov/divisions/community-wildfire-preparedness-and-mitigation/wildfire-preparedness/fire-hazard-severity-zones/#fhszfaq. Accessed February 2023.

California Department of Insurance. 2022. Safer from Wildfires. Available at: https://www.insurance.ca.gov/01-consumers/200-wrr/Safer-from-Wildfires.cfm. Accessed July 2023.

California Governor's Office of Planning and Research (CA GOPR). 2020. Fire Hazard Planning Technical Advisory. Available at: https://www.opr.ca.gov/docs/20201109-Draft_Wildfire_TA.pdf. Accessed February 2023.

California Office of Governor. 2020. California, U.S. Forest Service Establish Long-Term Strategy to Manage Forests and Rangelands. Available at: https://www.gov.ca.gov/2020/08/13/california-u-s-forest-service-establish-shared-long-term-strategy-to-manage-forests-and-rangelands/. Accessed February 2023.

———. 2021. Forest Management Task Force. California's Wildfire and Forest Resilience Action Plan. Available at: https://wildfiretaskforce.org/wp-content/uploads/2022/04/californiawildfireandforestresilienceactionplan.pdf. Accessed September 2023.

———. 2022. Governor's Task Force Launches Strategic Plan to Ramp Up Wildfire Mitigation with Prescribed Fire Efforts. Available at: https://www.gov.ca.gov/2022/03/30/governors-task-force-launches-strategic-plan-to-ramp-up-wildfire-mitigation-with-prescribed-fire-efforts/#:~:text=Based%20on%20a%20collaborative%20effort%20of%20the%20state%E2%80%99s,1%20million%20acres%20annually%20in%20California%20by%202025. Access April 2023.

CALVEG. 2008. Vegetation Descriptions North Sierran Ecological province, CALVEG Zone 3. Available at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_046269.pdf. Accessed December 2023.

California Wildfire and Forest Resilience Task Force. 2022. Sierra Nevada Regional Resource Kit. Available at: https://wildfiretaskforce.org/sierra-nevada-regional-resource-kit/. Accessed March 2024.

Casualty Actuarial Society. 2023. Mitigation that Matters: A Wildfire Case Study. Available at:https://ar.casact.org/mitigation-that-matters-a-wildfire-case-study/. Accessed February 2023.

Congressional Research Service (CRS). 2023. Wildfire Statistics. Available at: https://sgp.fas.org/crs/misc/IF10244.pdf. Accessed June 2023.

Egan, D. 2013. Monitoring- Organizing a Landscape-Scale Forest Restoration Multi-Party Monitoring Program. 38pp. Available at: https://openknowledge.nau.edu/id/eprint/2501/1/Dubay_C_etal_2013_HandbookBreakingBarriers3.pdf. Accessed February 2023.

Estes, B., and S. Gross. 2020. Tahoe National Forest Climate Trends Study. USDA Region 5 Ecology Program.

Fire Research and Management Exchange System. 2021. Applied Wildland Fire Behavior Research and Development. Available at: https://www.frames.gov/applied-fire-behavior/home. Accessed February 2023.

Forests and Rangelands. 2014. The National Strategy: The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy. Available at: https://www.forestsandrangelands.gov/documents/strategy/strategy/CSPhaseIIINationalStrategyApr2014.pdf. Accessed February 2023.

———. 2021. The National Strategy. Available at: https://www.forestsandrangelands.gov/strategy/thestrategy.shtml. Accessed February 2023.

———. 2023. National Cohesive Wildland Fire Management Strategy Addendum Update. Available at: https://forestsandrangelands.gov/documents/strategy/natl-cohesive-wildland-fire-mgmt-strategy-addendum-update-2023.pdf. Accessed October 2023

Iglesias, V., J.K. Balch, and W.R. Travis. 2022. U.S. fires became larger, more frequent, and more widespread in the 2000s. *Science Advances* 8(11). https://doi.org/10.1126/sciadv.abc0020.

Interagency Fuel Treatment Decision Support System. 2021. About Map Values - Highly Valued Resources or Assets (HVRAs). Available at: https://iftdss.firenet.gov/firenetHelp/help/pageHelp/content/30-tasks/qwra/mapvalues/hvraabout.htm. Accessed February 2023.

Keeley, J.E., and A.D. Syphard. 2016. Climate change and future fire regimes: examples from California. *Geosciences* 6(3):37.

Ladris. 2022. Ladris Enterprise AI. Available at: https://www.ladris.com/enterprise. Accessed October 2023.

LANDFIRE. 2022. Existing Vegetation Type layer. LANDFIRE 2.3.0. U.S. Department of Interior, Geological Survey, and U.S. Department of Agriculture. Available at: https://landfire.gov/getdata.php. Accessed August 2023.

Li, S. and T. Banerjee. 2021. Spatial and temporal pattern of wildfires in California from 2000 to 2019. *Scientific Reports* 11(1):8779.

Li, S., V. Dao, M. Kumar, P. Nguyen, and T. Banerjee. 2022. Mapping the wildland-urban interface in California using remote sensing data. *Scientific Reports* 12(1)5789

Lutz, J.A., J.W. Van Wagtendonk, A.E. Thode, J.D. Miller, and J.F. Franklin. 2009. Climate, lightning ignitions, and fire severity in Yosemite National Park, California, USA. *International Journal of Wildland Fire* 18:765–774.

Maranghides, A., E.D. Link, S. Hawks, J. McDougald, S.L. Quarles, D.J. Gorham, and S. Nazare. 2022. WUI Structure/Parcel/Community Fire Hazard Mitigation Methodology. National Institute of Standards and Technology. NIST Technical Note 2205.

McAffee, S.A., A.Z. Csank, M. Lachniet, A.A. Mensing, C.A. Millar, D. Rhode, and D.H. Thomas. 2022. Understanding Nevada's Current Drought in Historical and Paleoclimatic Context. *Journal of the Nevada Water Resources Association*, Winter 2022.

McCaffrey, S.M. 2004. Fighting fire with education: what is the best way to reach out to homeowners? *Journal of Forestry* 102:12–19.

———. 2020. What motivates Homeowners to Mitigate Fire Risk? Lessons from Social Science [conference presentation]. Bill Lane Center for the American West, Virtual Wildfire Series: Wildfire management during COVID. https://www.youtube.com/watch?v=3dmbenV-ZsM. Accessed February 2023.

McCaffrey, S.M., and C.S. Olsen. 2012. Research Perspectives on the Public and Fire Management: A Synthesis of Current Social Science on Eight Essential Questions. Northern Research Station GTR -104. Available at: https://www.firescience.gov/projects/06-4-1-26/project/06-4-1-26_gtr_nrs104.pdf. Accessed February 2023.

Morici, K.E., and J.D. Bailey. 2021. Long-term effects of fuel reduction treatments on surface fuel loading in the Blue Mountains of Oregon. *Forests* 12(10):1306.

National Interagency Fire Center. 2021. Suppression Costs. Available at: https://www.nifc.gov/fire-information/statistics/suppression-costs. Accessed February 2023.

National Interagency Fuels, Fire, and Vegetation Technology Transfer (NIFTT). 2010. Interagency Fire Regime Condition Class (FRCC) Guidebook. Version 3.0. Available at: https://www.landfire.gov/frcc/documents/FRCC_Guidebook_2010_final.pdf. Accessed December 2023.

National Institute of Standards and Technology (NIST). 2022. WUI Structure/Parcel/Community Fire Hazard Mitigation Methodology. Available at: https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.2205.pdf. Accessed July 2023.

National Wildfire Coordinating Group (NWCG). 2021. Fire Behavior Field Reference Guide. PMS 437. Available at: https://www.nwcg.gov/publications/pms437. Accessed July 2023.

———. 2022. NWCG Glossary of Wildland Fire, PMS 205. Available at: https://www.nwcg.gov/glossary/a-z/sort/p%3Fcombine%3Dprescribed%2520fire. Accessed February 2023.

North, M., A. Brough, J. Long, B. Collins, P. Bowden, D. Yasuda, J. Miller, and N. Sugihara. 2015. Constraints on mechanized treatment significantly limit mechanical fuels reduction extent in the Sierra Nevada. *Journal of Forestry* 113(1):40–48.

North, M.P, R.A. York, B.M. Collins, M.D. Hurteau, G.M. Jones, E.E. Knapp, L. Kobziar, H. McCann, M.D. Meyer, S.L. Stephens, R.E. Tompkins, and C.L. Tubbesing. 2021. Pyrosilviculture needed for landscape resilience of dry western United States forests *Journal of Forestry* 119(5).

Ottmar, R., R. Vihnanek, and J. Regelbrugge. 2000. Wildland Fire in Ecosystems: Effects of Fire on Fauna. Vol. 1. Gen. Tech. Rep. RMRS-GTR-42. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Pierce, G., C.J. Gabbe, and A. Rosser. 2022. Households living in manufactured housing face outsized exposure to heat and wildfire hazards: evidence from California. *Natural Hazards Review* 23(3).

Ready. 2021. Community Emergency Response Team. Available at: https://www.ready.gov/cert. Accessed February 2023.

Rothermel, R.C. 1983. *How to Predict the Spread and Intensity of Forest and Range Fires*. Gen. Tech. Rep. INT-143. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Scott, J.H., and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. Available at: https://www.resolutionmineeis.us/sites/default/files/references/scott-burgan-2005.pdf. Accessed August2023.

Sherlock, J., N. Sugihara, and A. Shlisky. 2005. Mixed Conifer- North Slope. Fire regimes of the conterminous United States. Available at: https://www.fs.usda.gov/database/feis/pdfs/PNVGs/California/R1MCONns.pdf. Accessed August 2023.

Simpson, L. 2005. R1RFWF Red Fir / White Fir. Fire regimes of the conterminous United States. https://www.fs.usda.gov/database/feis/pdfs/PNVGs/California/R1RFWF.pdf. Accessed August 2023.

Society of American Foresters (SAF). 2004. Preparing a Community Wildfire Protection Plan: A Handbook for Wildland Urban Interface Communities. Sponsored by Communities Committee, National Association of Counties, National Association of State Foresters, Society of American Foresters, and Western Governors' Association. Available at: https://gacc.nifc.gov/gbcc/dispatch/wy-tdc/documents/information/education-prevention/cwpphandbook.pdf. Accessed March 2023

Stephens, S. and N. Sugihara. 2018. "Fire Management and Policy Since European Settlement". Fire in California's Ecosystems (2nd edition). Edited by J. Van Wagtendonk. University of California Press.

Suzuki, S., and S. Manzello. 2021. Ignition vulnerabilities of combustibles around houses to firebrand showers: further comparison of experiments. *Sustainability* 13(4).

Theobald, D. M., and W. H. Romme. 2007. Expansion of the US wildland-urban interface. *Landscape and Urban Planning*. 83:340-354.

Town of Truckee. 2020. Climate Ready Truckee: A Climate Change Adaptation Plan. Available at: https://www.keeptruckeegreen.org/sustainability-projects/climate-planning/. Accessed December 2023.

Town of Truckee. 2023. Town of Truckee 2040 General Plan. Available at https://www.truckee2040.com/documents. Accessed August 2023.

Town of Truckee Community Development Department. 2021. 2022 CBC Chapter 7A and CRC Section R337 – Wildland-Urban Interface (WUI) Fire Conformance Checklist. Available at: https://www.townoftruckee.com/home/showpublisheddocument/8385/638079918766670000. Accessed July 2023.

Truckee Fire. 2021. Measure T Community Wildfire Preventions Implementation Plan. Available at: https://static1.squarespace.com/static/5a8daffbbe42d684f619597e/t/622b9ead137f180d6bba41dc/1647025838311/Measure+T+Implementation+Plan+and+Budget+Summary_Approved+11-16-2021.pdf. Accessed September 2023.

———. 2023a. Fire Stations. Available at https://www.truckeefire.org/fire-stations. Accessed August 2023.

———. 2023b. Emergency Alerts and Evacuation Information. Available at https://www.truckeefire.org/emergency-evacuation-guide. Accessed September 2023.

———. 2023c. Truckee Fire Protection District. Available at https://www.truckeefire.org/. Accessed December 2023.

U.S. Census Bureau. 2022. Quick Facts: Truckee town, California. Available at: https://www.census.gov/quickfacts/truckeetowncalifornia. Accessed July 2023.

U.S. Climate Data. 2023. Truckee California. Available at: https://www.usclimatedata.com/climate/truckee/california/united-states/usca1163. Accessed August 2023.

U.S. Department of Agriculture (USDA). 2005. Terminology and Definitions Associated with Revegetation. Available at: https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/wapmctn6333.pdf. Accessed February 2023.

———. 2022. Invasive Species. Available at: https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/operational-activities/sa_invasive/ct_invasive_species1. Accessed November 2023U.S. Department of the Interior and U.S. Department of Agriculture (USDA). 2001. Urban Wildland Interface Communities within Vicinity of Federal Lands that are at High Risk from Wildfire. Federal Register 66(3):751–777.

U.S. Fire Administration (USFA). 2021a. What is the WUI? Available at: https://www.usfa.fema.gov/wui/what-is-the-wui.html. Accessed February 2023.

———. 2021b. Fire-Adapted Communities. Available at: https://www.usfa.fema.gov/wui/communities/. Accessed February 2023.

U.S. Forest Service (USFS). 2012. Information from LANDFIRE on fire regimes of California oak woodlands. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available at: www.fs.usda.gov/database/feis/fire_regimes/CA_oak_woodlands/all.html. Accessed March 2023.

———. 2023. Wildfire Risk to Communities: Truckee CA. Available at https://wildfirerisk.org/explore/overview/06/06057/0600080588/. Accessed August 2023.

———. n.d.(a). Prescribed Fire. Available at: https://www.fs.usda.gov/detail/sierra/landmanagement/?cid=stelprdb5442511#:~:text=Prescribed%20fires%20can%20be%20ignited%20when%20weather%20and,conditions%20that%20will%20minimize%20smoke%20in%20sensitive%20areas. Accessed March 2023.

———. n.d.(b). What is the Wildland Urban Interface? Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_053107.pdf. Accessed March 2023.

———. n.d.(c). Fire in chapparal ecosystems. Available at: https://www.fs.usda.gov/psw/topics/fire_science/ecosystems/chaparral.shtml#:~:text=Chaparral%20vegetation%20is%20well%20adapted,first%20few%20years%20after%20fire. Accessed February 2023.

U.S. Geological Survey. 2021. What is an invasive species and why are they a problem? Available at: https://www.usgs.gov/faqs/what-invasive-species-and-why-are-they-a-problem?qt-news_science_products=0#qt-news_science_products. Accessed February 2023.

Vibrant Planet. 2022. Tahoe National Forest Supplemental Technical Report. Unpublished report.

———. 2023. Land Tender by vibrant planet: A platform for landscape restoration. Available at: https://www.vibrantplanet.net/landtender. Accessed September 8, 2023.

Westerling, A.L. 2016. Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring. Available at: http://ulmo.ucmerced.edu/pdffiles/16RSTB_Westerling.pdf. Accessed February 2023.

Westerling, A.L., B.P. Bryant, H.K. Preisler, T.P. Holmes, H.G. Hidalgo, T. Das, and S.R. Shrestha. 2011. Climate change and growth scenarios for California wildfire. *Climatic Change* 109.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and earlier spring increase in western U.S. Forest wildfire activity. *Science* 313(5789):940–943.

Western Regional Strategy Committee (WRSC). 2013. Western Regional Action Plan. Available at: https://www.forestsandrangelands.gov/documents/strategy/rsc/west/WestRAP_Final20130416.pdf. Accessed February 2023.

Winter, G., and J.S. Fried. 2000. Homeowner perspectives on fire hazard, responsibility, and management strategies at the wildland-urban interface. *Society and Natural Resources* 13:33–49.

Wooten, G. 2021. Fire and fuels management: Fire and fuels management: Definitions, ambiguous terminology and references. Available at: https://www.nps.gov/olym/learn/management/upload/fire-wildfire-definitions-2.pdf. Accessed February 2023.

GLOSSARY

Aspect: Cardinal direction toward which a slope faces in relation to the sun (National Wildfire Coordinating Group [NWCG] 2022).

Active Crown Fire: Where surface and crown fire energy are linked, meaning that the surface fire intensity is sufficient to ignite tree crowns, and fire spread and intensity in the tree crowns encourages surface fire spread and intensity (NWCG 2021). **Passive crown fire** occurs where surface fire intensity is sufficient to ignite individual or groups of tree crowns, but it does not readily spread in the crowns.

Available Fuel: That portion of the total fuel that would actually burn under various environmental conditions. This may be surface fuel or canopy fuel (NWCG 2022).

Backfire or Burn Out: Fire intentionally set along the inner edge of a fireline to consume the fuel in the path of a wildfire or change the direction of force of the fire's column (NWCG 2022).

Biomass: Organic material. Also refers to the weight of organic material (e. g. biomass roots, branches, needles, and leaves) within a given ecosystem (Wooten 2021).

Burn Severity: Burn severity relates to soil heating, large fuel and duff consumption, consumption of the litter and organic layer beneath trees and isolated shrubs, and mortality of buried plant parts (NWCG 2022).

Canopy: The layer that contains the crowns of the tallest vegetation, typically above 20 feet and thus trees (NWCG 2022).

Chain: Unit of measure in land survey, equal to 66 feet (20 m) (80 chains equal 1 mile). Commonly used to report fire perimeters and other fireline distances (NWCG 2022).

Climate Adaptation: Adaptation is an adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (California Governor's Office of Planning and Research [CA GOPR] 2020).

Climate Change: A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (CA GOPR 2020).

Community Assessment: An analysis designed to identify factors that increase the potential and/or severity of undesirable fire outcomes in wildland-urban interface (WUI) communities (SWCA).

Communities at Risk (CARs): Defined by the Healthy Forests Restoration Act of 2003 (HFRA) as "Wildland-Urban Interface Communities within the vicinity of federal lands that are at high risk from wildfire."

- CAL FIRE expanded on this definition for California including all communities (regardless of distance from federal lands) for which a significant threat to human life or property exists as a result of a wildland fire event. California uses the following three factors to determine at risk communities: 1) high fuel hazard, 2) probability of a fire, and 3) proximity of intermingled wildland fuels and urban environments that are near fire threats (CA GOPR 2020).

Community Emergency Response Team (CERT): The CERT program educates volunteers about disaster preparedness for the hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical

operations. CERT offers a consistent, nationwide approach to volunteer training and organization that professional responders can rely on during disaster situations, allowing them to focus on more complex tasks (Ready 2021).

Community Wildfire Protection Plan (CWPP): A planning document that seeks to reduce the threat to life and property from wildfire by identifying and mitigating wildfire hazards to communities and infrastructure located in the WUI. Developed from the HFRA, a CWPP addresses issues such as wildfire response, hazard mitigation, community preparedness, or structure protection (SWCA).

Contained: The status of a wildfire suppression action signifying that a control line has been completed around the fire, and any associated spot fires, which can reasonably be expected to stop the fire's spread (NWCG 2022).

Control Line: An inclusive term for all constructed or natural barriers and treated fire edges used to control a fire (NWCG 2022).

Controlled: The completion of control line around a fire, any associated spot fires, and any interior unburned islands; burned out any unburned area adjacent to the fire side of the control lines; and cooled down all hot spots that are immediate threats to the control line, until the lines can reasonably be expected to hold under the foreseeable conditions (NWCG 2022).

Cover Type: The type of vegetation (or lack of it) growing on an area, based on cover type minimum and maximum percent cover of the dominant species, species group or non-living land cover (such as water, rock, etc.). The cover type defines both a qualitative aspect (the dominant cover type) as well as a quantitative aspect (the abundance of the predominant features of that cover type) (Wooten 2021).

Creeping Fire: Fire with a low flame and slow rate of spread (NWCG 2022).

Dead Fuel Moisture: The moisture content of dead (not living) fuels. Categorized into different size classes by time lag: 1 hour, 10 hour, 100 hour, and 1000 hour (SWCA).

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared, or reduced to slow the spread of wildfire toward or from a structure. The design and distance of the defensible space is based on fuels, topography, and the design/materials used in the construction of the structure (SWCA).

- In California, Public Resources Code (PRC) Section 4291, "defensible space" refers to a 100-foot perimeter around a structure in which vegetation (fuels) must be maintained in order to reduce the likelihood of ignition. This space may extend beyond property lines, or 100 feet as required by State law as well as local ordinances, rules, and regulations (CA GOPR 2020).

Duff: The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles, and leaves and immediately above the mineral soil (NWCG 2022).

Evacuation: The temporary movement of people and their possessions from locations threatened by wildfire (SWCA).

Federal Responsibility Area (FRA): A term specific to California, designating areas where the federal government is responsible for fire response efforts. These areas include lands under federal ownership (CA GOPR 2020).

Fire-Adapted Community: A fire-adapted community collaborates to identify its wildfire risk and works collectively on actionable steps to reduce its risk of loss. This work protects property and increases the safety of firefighters and residents (U.S. Fire Administration [USFA] 2021a).

Fire Behavior: The manner in which fuel ignites, flame develops, and fire spread and exhibits other related phenomena as determined by the interaction of fuels, weather, and topography (Fire Research and Management Exchange System 2021).

Fire Environment: The surrounding conditions, influences, and modifying forces of topography, fuel, and weather that determine fire behavior (NWCG 2022).

Fire Frequency: A general term referring to the recurrence of fire in a given area over time (NWCG 2022).

Fire Hazard: Fire hazard is the potential fire behavior in an area, given the type(s) of fuel present – including both the natural and built environment – and their combustibility (CA GOPR 2020). It is the fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control (NWCG 2022).

Fire Hazard Severity Zones: Fire hazard severity zones are defined based on vegetation, topography, and weather (temperature, humidity and wind), and represents the likelihood of an area burning over a 30- to 50-year time period without considering modifications such as fuel reduction efforts. In California, CAL FIRE maintains fire hazard severity zone (FHSZ) data for the entire state. There are three classes of fire hazard severity ratings within FHSZs: moderate, high, and very high (CA GOPR 2020).

Fire History: The chronological record of the occurrence of fire in an ecosystem or at a specific site. The fire history of an area may inform planners and residents about the level of wildfire hazard in that area (SWCA).

Fireline Intensity: The rate of heat release per unit time per unit length of fire front. The primary unit is Btu per second per foot (Btu/sec/ft) of fire front. Combined with residence time, can loosely determine burn/fire severity (NWCG 2022).

Fire Prevention: Activities such as public education, community outreach, planning, building code enforcement, engineering (construction standards), and reduction of fuel hazards that is intended to reduce the incidence of unwanted human-caused wildfires and the risks they pose to life, property or resources (CA GOPR 2020).

Fire Regime: Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or ecosystem (NWCG 2022).

Fire Regime Condition Class: Depiction of the degree of departure from historical fire regimes, possibly resulting in alternations of key ecosystem components. These classes categorize and describe vegetation composition and structure conditions that currently exist inside the Fire Regime Groups. The risk of loss of key ecosystem components from wildfires increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk) (NWCG 2022).

Fire Regime Group: A classification of fire regimes into a discrete number of categories based on frequency and severity. The national, coarse-scale classification of fire regime groups commonly used includes five groups: I - frequent (0-35 years), low severity; II - frequent (0-35 years), stand replacement severity; III - 35-100+ years, mixed severity; IV - 35-100+ years, stand replacement severity; and V - 200+ years, stand replacement severity (NWCG 2022).

Fire Return Interval: Number of years between two successive fires in a designated area (NWCG 2022).

Fire Risk: "Risk" takes into account the intensity and likelihood of a fire event to occur as well as the chance, whether high or low, that a hazard such as a wildfire will cause harm. Fire risk can be determined by identifying the susceptibility of a value or asset to the potential direct or indirect impacts of wildfire hazard events (CA GOPR 2020).

Flame Length: The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity (NWCG 2022).

Fuel Break: A natural or human-made change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled (NWCG 2022).

Fuel Characteristics: Factors that make up fuels such as compactness, loading, horizontal continuity, vertical arrangement, chemical content, size and shape, and moisture content (NWCG 2022).

Fuel Continuity: The degree or extent of continuous or uninterrupted distribution of fuel particles in a fuel bed thus affecting a fire's ability to sustain combustion and spread. This applies to aerial fuels as well as surface fuels (NWCG 2022).

Fuel Depth: The average distance from the bottom of the litter layer to the top of the layer of fuel, usually the surface fuel (NWCG 2022).

Fuel Loading: The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area, such as tons per acre. This may be available fuel (consumable fuel) or total fuel and is usually dry weight (NWCG 2022).

Fuel Model: Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified (NWCG 2022).

Fuel Modification/Treatment: Manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling and burning) NWCG 2022). Treatments may be manual by hand, mechanical with heavy equipment, chemical application, or through prescribed fire or prescribed herbivory (SWCA).

Hazard: A "hazard" can be defined generally as an event that could cause harm or damage to human health, safety, or property (CA GOPR 2020).

Highly Valued Resources and Assets: Landscape features that are influenced positively and/or negatively by fire. Resources are naturally occurring, while Assets are human made (Interagency Fuel Treatment Decision Support System 2021).

Incident: An occurrence either human-caused or natural phenomenon, that requires action or support by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources. A wildfire is an example of one kind of incident (NWCG 2022).

Invasive Species: An introduced, nonnative organism (disease, parasite, plant, or animal) that begins to spread or expand its range from the site of its original introduction and that has the potential to cause harm to the environment, the economy, or to human health (U.S. Geological Survey 2021; U.S. Department of Agriculture [USDA] 2022).

Ladder Fuels: Fuels that provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning (NWCG 2022).

Litter: The top layer of forest floor, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles; little decomposition (NWCG 2022).

Live Fuel Moisture Content: Ratio of the amount of water to the amount of dry plant material in living plants (NWCG 2022). Live fuel moisture varies by plant and species type and seasonally.

Local Responsibility Area (LRA): A term specific to California, designating areas where the local government is responsible for wildfire protection. The LRA includes incorporated cities, cultivated agricultural lands, and portions of the desert. LRA fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government (CA GOPR 2020).

Mutual Aid: Assistance in firefighting or investigation by fire agencies, without regard for jurisdictional boundaries (NWCG 2022).

Native Revegetation: The process of replanting and rebuilding the soil of disturbed land (e.g., burned) with native plant species (USDA 2005).

Native Species: A species that evolved naturally in the habitat, ecosystem, or region as determined by climate, soil, and biotic factors (USDA 2005).

National Cohesive Strategy: The National Cohesive Wildland Fire Management Strategy is a strategic push to work collaboratively among all stakeholders and across all landscapes, using best science, to make meaningful progress toward three goals:

- Resilient Landscapes
- Fire-Adapted Communities
- Safe and Effective Wildfire Response

Vision: To safely and effectively extinguish fire when needed; use fire where allowable; manage our natural resources; and as a nation, to live with wildland fire (Forests and Rangelands 2021).

Prescribed Burning: Any fire ignited by management actions under specific, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. Usually, a written, approved prescribed fire plan must exist, and National Environmental Policy Act (NEPA) requirements must be met, prior to ignition (U.S. Forest Service [USFS] n.d.(a)).

Rate of Spread: The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually, it is expressed in chains or acres per hour for a specific period in the fire's history (NWCG 2022).

Resilience: Resilience is the capacity of any entity – an individual, a community, an organization, or a natural system – to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience (CA GOPR 2020).

Resilient Landscape: Landscapes or ecosystems that resist damage and recover quickly from disturbances (such as wildland fires) and human activities (Forests and Rangelands 2014).

Slope Percent: The ratio between the amount of vertical rise of a slope and horizontal distance as expressed as a percentage; 100 feet of rise to 100 feet of horizontal distance equals 100% (NWCG 2022).

State Responsibility Area (SRA): A term specific to California, designating areas where the state has financial responsibility for wildland fire protection. Incorporated cities and lands under federal ownership are not included in the SRA. Lands under federal ownership are in the federal responsibility area (CA GOPR 2020).

Surface Fire: Fire that burns debris on the surface, which includes dead branches, leaves, and low vegetation (NWCG 2022).

Vulnerable Community: Vulnerable communities experience heightened risk and increased sensitivity to natural hazard and climate change impacts and have less capacity and fewer resources to cope with, adapt to, or recover from the impacts of natural hazards and increasingly severe hazard events because of climate change. These disproportionate effects are caused by physical (built and environmental), social, political, and/ or economic factor(s), which are exacerbated by climate impacts. These factors include, but are not limited to, race, class, sexual orientation and identification, national origin, and income inequality (CA GOPR 2020).

Wildfire: A "wildfire" can be generally defined as any unplanned fire in a "wildland" area or in the WUI (CA GOPR 2020).

Wildland Fuels (fuels): Fuel is the material that is burning. It can be any kind of combustible material, especially petroleum-based products, and wildland fuels. For wildland fire, it is usually live, or dead plant material, but can also include artificial materials such as houses, sheds, fences, pipelines, and trash piles. In terms of vegetation, there are six wildland fuel types (Fuel Type: An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance to control under specified weather conditions). The six wildland fuel types are (NWCG 2021):

- Grass
- Shrub
- Grass-Shrub
- Timber Litter
- Timber-Understory
- Slash-Blowdown

Wildland-Urban Interface (WUI): The WUI is the zone of transition between unoccupied land and human development. It is the line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels (USFA 2021b). In the absence of a CWPP, Section 101 (16) of the Healthy Foresters Restoration Act defines the WUI as "(I) an area extending ½ mile from the boundary of an at-risk community; (II) an area within 1 ½ miles of the boundary of an at-risk community, including any land that (1) has a sustained steep slope that creates the potential for wildfire behavior endangering the at-risk community; (2) has a geographic feature that aids in creating an effective fire break, such as a road or ridge top; or (3) is in condition class 3, as documented by the Secretary in the project-specific environmental analysis; (III) an area that is adjacent to an evacuation route for an at-risk community that the Secretary determines, in cooperation with the at-risk community, requires hazardous fuels reduction to provide safer evacuation from the at-risk community." A CWPP offers the opportunity to establish a localized definition and boundary for the WUI (USFS n.d.(b)).

In this CWPP, the WUI is broken down into three zones. The WUI Intermix is a 250-foot buffer around structures. Subdivision boundaries were manually corrected to create a contiguous layer. WUI Defense is an additional quarter mile from the Intermix, and a 500 foot buffer on both sides of major roadways. WUI Threat, is an additional 1 ¼ mile buffer from the WUI Defense. The total WUI area is therefore more than a 1.5-mile total buffer.

Nevada County Resource Conservation District (2024)

https://www.ncrcd.org/

Community Wildfire Protection Plan (CWPP) Annex

Annex: Strategic Plan for Nevada County Resource Conservation District (NCRCD)

Introduction

Nevada County, nestled in the Sierra Nevada Mountains, faces significant challenges such as wildfire threats, agricultural sustainability, and climate resilience. The Nevada County Resource Conservation District (NCRCD) aims to address these challenges through proactive measures, ensuring a resilient, sustainable, and prosperous future for the community.

Mission Statement

Our mission is to promote responsible resource management within our jurisdiction through education, leadership, technical assistance, and project facilitation.

Our vision is to educate and assist landowners and land managers in establishing a balance between a high-quality rural environment, a diverse biological landscape, and a healthy economy for the community.

Goals

1. **Carbon Sequestration, Biomass Removal, and Wood Product Utilization**

Reforestation and restoration of degraded lands

- Promotes biodiversity and ecosystem recovery.
- Enhances carbon sequestration and mitigates climate change impacts.

Biomass removal to reduce wildfire fuels.

- Reduces wildfire risk and improves forest health.
- Protects infrastructure by lowering wildfire hazards.

Promote wood product utilization for economic and environmental benefits.

- Supports local economies through sustainable wood products utilization.
- Encourages the sustainable use of forest resources.

Collaborate with experts to develop innovative solutions.

- Fosters collaboration for innovative landscape resilience solutions.

2. **Wildfire Mitigation and Resilience**

Conduct fuels reduction projects, including mechanical thinning and livestock grazing.

- Directly reduces wildfire risk.

- Helps maintain healthy forest ecosystems.

Implement prescribed fire programs.
- Use of controlled burns to manage fuel loading as a maintenance tool.
- Promotes natural fire regimes and fire adapted landscape.

Develop and deliver educational programs on wildfire risks, prevention measures, and the benefits of prescribed fire.
- Educates and prepares the community for wildfire risks.
- Informs best practices for wildfire prevention and management.

Enhance emergency preparedness for wildfire events.
- Improves community readiness and response capabilities.
- Ensures infrastructure can withstand and recover from wildfires.

Foster fire-adapted communities through advisory visit programs and community engagement.
- Engages communities in proactive fire risk management.
- Builds fire-adapted communities.

Invest in early warning systems and firefighting equipment.
- Enhances technological and physical capacity to combat wildfires.

4. Climate Resilience Actions

Invest and promote the creation of micro-ponds throughout the county.
- Supports water storage, wildlife habitat, and microclimate regulation.
- Enhances local climate adaptation and water security for fire resources.

Enhancing wildlife habitat and natural working lands management.
- Promotes biodiversity and sustainable land use.
- Improves ecosystem services and creates a fire-adaptive landscape.

Fostering Forest Health strategic planning through collaboration and stakeholder involvement.
- Engages stakeholders in long-term forest resilience planning.
- Ensures comprehensive and adaptive management strategies.

Ensure water security is available to all entities in need throughout the county.
- Provides reliable water resources for all community members.
- Ensures sustainable water infrastructure.

5. Social and Cultural Well-Being

Public Health, advocating for mental health awareness in times of disasters, before and after.
- Supports mental health and well-being in disaster-prone areas.
- Promotes policies for mental health support.

Public engagement in natural resource knowledge.
- Enhances community awareness and involvement in resource management.

- Encourages stewardship and sustainable practices.

Environmental Justice and the fair allocation of resources to everyone in the county.

- Ensures equitable access to resources and opportunities.
- Supports policies that promote fairness and equity.

Strategic Initiatives

1. **Livestock Grazing and Prescribed Fire**

Livestock Grazing

- Implement Targeted Grazing Programs: Develop and initiate grazing programs to manage vegetation and reduce wildfire fuels, collaborating with local ranchers and farmers to ensure effectiveness.
- Rotate Grazing Areas: Establish a rotational grazing schedule to prevent overgrazing and promote soil health.
- Establish Grazing Agreements: Create formal agreements with local stakeholders to secure participation and outline responsibilities.
- Monitor and Adjust Practices: Regularly assess the effectiveness of grazing programs and adjust strategies as needed to optimize outcomes.

Prescribed Fire

- Conduct Controlled Burns: Implement prescribed fire programs to manage vegetation and reduce wildfire risk, following best practices and safety protocols.
- Develop Burn Plans: Work with fire management experts to create detailed burn plans, ensuring coordination with grazing activities for comprehensive fuel reduction.
- Community Education: Inform the public about the benefits of prescribed fire through workshops, informational sessions, and outreach materials.

2. Biochar Usage for Mine Restoration and Soil Health

- Mitigate Erosion and Contamination: Apply biochar to areas affected by historical mining to reduce erosion, runoff, and soil contamination.
- Enhance Soil Structure and Water Retention: Utilize biochar to improve soil structure, water retention, and overall soil health, thereby supporting plant growth in degraded areas.
- Monitor Long-Term Impacts: Conduct long-term monitoring and assessments to evaluate the effectiveness of biochar applications on soil health and ecosystem recovery.
- Support Biochar Research: Partner with research institutions to advance knowledge on biochar production and application techniques, ensuring best practices are utilized.

2. **Carbon Sequestration and Ecosystem Health**

- Integrate Carbon Sequestration: Promote reforestation, afforestation, and agroforestry practices to enhance carbon sequestration and improve ecosystem health.

- Explore Funding and Partnerships: Seek funding opportunities and establish partnerships for carbon offset programs to support and expand carbon sequestration initiatives.

4**. Recreation and Tourism Utilization**

- Promote Responsible Tourism**:** Encourage sustainable tourism practices that highlight and preserve the county's natural and cultural heritage. Educate tourists on wildfire risks, prevention measures, and responsible behavior in fire-prone areas to reduce the likelihood of human-caused wildfires.
- Maintain Recreational Infrastructure: Ensure that trails, scenic spots, and other recreational facilities are well-maintained and accessible to the public. Ensure ingress-egress routes are well established within high population recreation areas.

Alignment with Goals

Agricultural Stewardship and Land Management: Through livestock grazing and biochar usage, we enhance soil health, water quality, and biodiversity while supporting local economies and community resilience.

Carbon Sequestration, Biomass Removal, and Wood Product Utilization: Our initiatives for carbon sequestration and ecosystem health align with goals to promote biodiversity, mitigate climate change, and support sustainable economic practices.

Wildfire Mitigation and Resilience: Implementing livestock grazing and prescribed fire programs directly addresses wildfire mitigation, reducing risks and fostering fire-adapted communities.

Climate Resilience Actions: All initiatives contribute to broader climate resilience, enhancing local adaptation and water security, and improving ecosystem services.

Social and Cultural Well-Being: Promoting responsible tourism and recreational activities, along with community education and events, strengthens community ties, supports mental health, and ensures equitable resource allocation.

Integrating wildfire mitigation and prevention into recreation and tourism initiatives helps build a culture of awareness and responsibility. By promoting responsible tourism, maintaining fire-safe recreational infrastructure, and leveraging community events for educational purposes, Nevada County can enhance its wildfire resilience while supporting a thriving and sustainable tourism sector.

Project ID	Project Description	Method	Timeline For Action	Monitoring/Sustainability	Resources/Funding Sources Available
1	Fuels Reduction and Fire Prevention	Mechanical Thinning, Livestock Grazing	Ongoing	Regular assessments, adaptive management	CAL FIRE, WCB
2	Prescribed Fire Training/ Implementation	Training Programs, Controlled Burns	Annually, ongoing	Performance reviews, community feedback	USDA, CAL FIRE
3	Community Wildfire Education Programs	Workshops, school programs	Quarterly	Survey evaluations, attendance records	Local grants, NCRCD
4	Fire Adapted Communities Initiative	Advisory Visits, Community meetings.	Quarterly	Community engagement metrics, wildfire incident reports	CALFSC, Local funding
5	Early Warning Systems Enhancement	Technology upgrades, equipment procurement	1-2 years	System performance tests, incident response times	Federal Grants, Local Government, Private companies
6	Reforestation and Afforestation Projects	Tree Planting, habitat restoration	3-5 years	Tree survival rates, carbon sequestration measurements	Conservation organizations, grants
7	Biomass Removal and Utilization	Harvesting, bioenergy production	Ongoing	Fuel load reductions, biomass utilization establishments	WCB, WNC, CAL FIRE, USDA
8	Carbon Sequestration Research and Development	Biochar production, soil carbon enhancement	2-4 years	Research publications, carbon storage data	Research institutions, federal grants, SAL FIRE
9	Recreational Infrastructure Maintenance and Improvement	Trail maintenance, interpretive signage, community events	Ongoing	Visitor satisfaction surveys, trail usage statistics	Local tourism board, Recreation funds, CA State Parks and Rec
10	Wetland and Riparian Restoration	Wetland Restoration, Riparian Buffer Creation	3-5 years	Water quality tests, biodiversity indices	Environmental grants, partnerships
11	Micro-Pond Initiative	Creation of micro-ponds for water storage	Ongoing	Metric of success on pond creation and proximity to HFZ, and Ag communities	CAL FIRE, USDA, DOC, WCB

12	Community Resilience and Well-being Programs	Mental health support, community building activities	Ongoing	Participant feedback, community health metric	Health departments, community organizations, NCOES
13	Landscape-Scale Restoration Initiatives	Comprehensive habitat restoration projects	5-10 years	Ecosystem health assessments, long term monitoring	Federal and state conservation funds
14	Innovative Water Conservation Techniques	Drip irrigation, rainwater harvesting	1-3 years	Water usage metrics, crop yields	Water agencies, agricultural grants
15	Collaborative Research and Development Projects	Partnerships with universities, research intuitions	Ongoing	Research outcomes, implementation of findings	Academic grants, research funding

Short-term Metrics (Less than 5 years)

- **Improved community awareness and preparedness for wildfires:** Enhances community resilience and readiness by ensuring residents understand wildfire risks and prevention measures.
- **Enhanced adoption of sustainable agricultural practices:** Promotes soil health, water quality, and economic resilience, reducing the likelihood of wildfires caused by agricultural activities.
- **Enhanced Forest health and Community Resilience:** Contributes to ecological and community resilience by maintaining healthy forests that are less prone to severe wildfires.
- **Increased participation in recreational activities:** Supports community engagement and use of natural spaces, promoting a connection to the environment and awareness of wildfire risks.

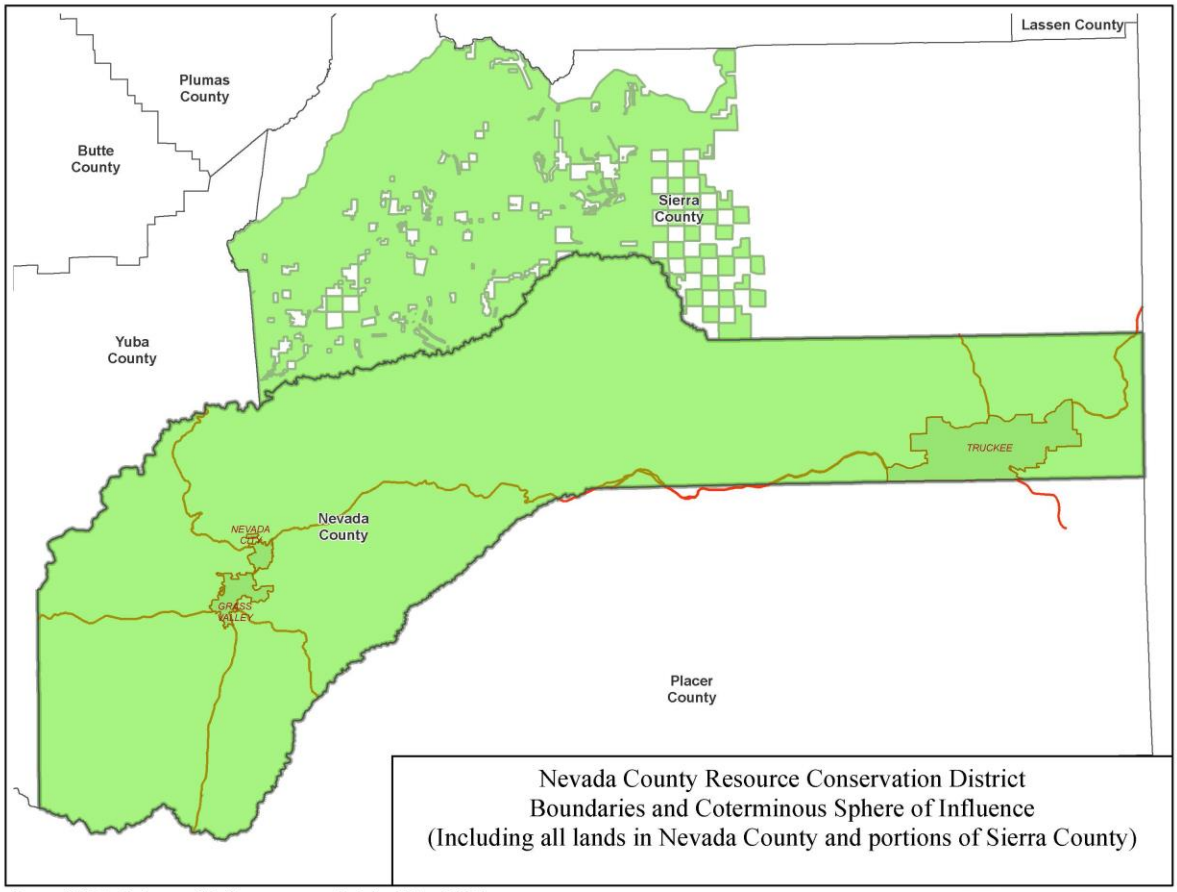
Long-term Metrics (Over 10 years)

- **Significant reduction in wildfire risks:** Achieves core objectives of wildfire mitigation and resilience through comprehensive management practices and community involvement.
- **Sustainable agricultural practices entrenched in the community:** Ensures long-term sustainability in farming practices, minimizing wildfire risks associated with agricultural land use.
- **Increased carbon sequestration and improved ecosystem health:** Enhances climate resilience and ecological health, reducing the severity and frequency of wildfires through better-managed landscapes.

- **Recreation integrated into wildfire awareness:** Fosters a healthier, more engaged community that values and protects its natural spaces, contributing to overall wildfire mitigation efforts.

Conclusion

By implementing this strategic plan, Nevada County can enhance its resilience to wildfires, promote sustainable agricultural practices, and increase community wellbeing. This plan, as an annex to the Community Wildfire Protection Plan, will help ensure a resilient and thriving future for Nevada County. Integrating wildfire mitigation and prevention measures across all strategic initiatives ensures the community is well-prepared, proactive, and adaptive in the face of wildfire threats.



From LAFCo Sphere of Influence report dated May 2020

Figure 2

Grass Valley Wildfire Hazard and Risk Assessment (2024)

https://www.cityofgrassvalley.com/sites/main/files/file-attachments/final_grass_valley_wildfire_hazard_and_risk_assess_013024.pdf

Wildfire Hazard and Risk Assessment

City of Grass Valley, California

JANUARY 2024

Prepared for:

GRASS VALLEY FIRE DEPARTMENT
125 East Main Street
Grass Valley, California 95945
Contact: Chief Mark Buttron

Prepared by:

DUDEK

853 Lincoln Way, Suite 105
Auburn, California 95603
Contact: Scott Eckardt, RPF
Matthew Crockett, Fire Protection Planner

Printed on 30% post-consumer recycled material.

Table of Contents

SECTION **PAGE NO.**

TABLES

FIGURES

APPENDIX

Executive Summary

The potential for damaging wildfire exists within the assessment area (City of Grass Valley, the City Sphere of Influence, and the area within 1.5 miles of the City and its Sphere of Influence), as highlighted through regional fire and ignition history, existing vegetation types and fuels composition, terrain, local climate, and the proximity of structures and infrastructure to wildland vegetation. Approximately 63% of the assessment area is classified as a wildland urban interface or wildland urban intermix. These are areas where structures and other development meet or intermingle with wildland vegetation. Vegetation conducive to ignition and wildfire spread exists throughout the assessment area, presenting risks to human life, safety, and property.

To evaluate the extent of potential wildfire impacts in the assessment area, a Wildfire Hazard and Risk Assessment was conducted using wildfire hazard and risk modeling tools. Modeling was conducted by combining spatial data sets that influence wildfire risk to the community. While wildfire hazard represents the existing wildfire environment and potential wildfire behavior occurring in that environment, wildfire risk is the intersection of wildfire hazard and resources or assets that could be impacted by fire. Wildfire hazard in areas adjacent to developed areas (structure locations) was used as the basis for determining community wildfire risk. Based on the results of this Wildfire Hazard and Risk Assessment, areas of High, Very High, and Extreme relative risk cover approximately 77% of developed areas within the assessment area.

This report summarizes Dudek's modeling and assessment efforts and includes a discussion of the assessment area's fire environment, including terrain, vegetation and fuels, weather, and fire history, in addition to model inputs and model results. The model results map and identify regions categorized as Low to Extreme relative wildfire risk, highlighting areas where approaches could be implemented to reduce wildfire risk to the community. A description of potential wildfire risk reduction approaches is also provided.

INTENTIONALLY LEFT BLANK

1 Assessment Area Description

1.1 Location

The assessment area encompasses 34,210 acres in western Nevada County, California (Figure 1). The assessment area includes the entirety of the City of Grass Valley (3,986 acres), the City Sphere of Influence (6,051 acres), and the area within 1.5 miles of the City and its Sphere of Influence (24,173 acres). The City of Nevada City borders the assessment area to the northeast. Unincorporated County areas surround the remaining portions of the assessment area. Highway 49 bisects the assessment area from north to south. State Route 20 and Highway 174 (Colfax Highway) bisect the assessment area from east to west.

1.2 Terrain

The assessment area is topographically diverse and includes features such as ridges, valleys, saddles, and canyons with significant differences in elevation, slope, and aspect. Each of these features affects fire behavior and alters how fire moves across the landscape. Generally, elevation in the assessment area gradually increases when moving from west to east, following the west slope of the Sierra Nevada Mountain range. The urban core of the City of Grass Valley exhibits flat to moderate slopes, with steeper areas generally located near the City's boundaries. Steep canyons and drainages exist within the assessment area, notably within the Deer Creek, Wolf Creek, South Fork Wolf Creek, and Slate Creek canyons. These canyons can facilitate wildfire spread toward urbanized areas due to continuous fuel beds, steeper slopes, and funneling of winds. Topography of the assessment area is presented graphically in Figure 2.

Terrain affects wildfire movement and spread. Steep terrain typically results in faster upslope fire spread due to the pre-heating of uphill vegetation. Flat areas typically result in slower fire spread when absent of windy conditions. Topographic features, such as saddles, canyons, and chimneys (land formations that collect and funnel heated air upward along a slope), may form unique circulation conditions that concentrate or funnel winds and accelerate fire spread. For example, fire generally moves slower downslope than upslope. Terrain may also buffer, shelter, or redirect winds away from some areas based on canyons or formations on the landscape. Saddles occurring at the top of drainages or ridgelines may facilitate the movement of wildfire from one canyon to the next. Various terrain features can also influence fire behavior, as summarized in Table 1.

Table 1. Effects of Topographic Features on Fire Behavior

Topographic Feature	Effect
Narrow Canyon	Surface winds follow canyon direction, which may differ from the prevailing wind; wind eddies/strong upslope air movement expected, which may cause erratic fire behavior; radiant heat transfer between slopes facilitates spotting/ignition on opposite canyon side.
Wide Canyon	Prevailing wind direction not significantly altered; aspect significant contributor to fire behavior. Wide canyons are not as susceptible to cross-canyon spotting except in high winds.
Box Canyon/ Chute	Air is drawn in from canyon bottom; strong upslope drafts. No gaps or prominent saddles to let heated air escape. Fires starting at the canyon bottom can move upslope very rapidly due to a chimney-like preheating of the higher-level fuels and upslope winds.

Table 1. Effects of Topographic Features on Fire Behavior

Topographic Feature	Effect
Ridge	Fires may change direction when reaching ridge/canyon edge; strong air flows likely at ridge point; possibility for different wind directions on different sides of the ridge. Ridges experience more wind. Fires gain speed and intensity moving toward a ridge. Fires burning at a ridge can exhibit erratic fire behavior. Strong air flows can cause a whirling motion by the fire. As the wind crosses a ridge it usually has a leeward eddy where the wind rolls around and comes up the leeward side.
Saddle	Potential for rapid rates of fire spread; fires push through saddles faster during upslope runs. Winds can increase when blowing through saddles due to the funneling effect of the constricted pass. On the other side, winds will slow, but erratic winds potentially occur at the saddle due to eddies.

Sources: NFPA 2011; Teie 1994

1.3 Vegetation and Fuels

The majority of the assessment area has been mapped as having woodland or forest cover. Urban areas represent 12% of the assessment area, concentrated in the urban core of the City of Grass Valley, and surrounding residential neighborhoods and commercial districts. Vegetation coverage for the assessment area is summarized in Table 2 and presented graphically in Figure 3. The following sections describe the dominant vegetation communities in the assessment area, including information about their relative wildfire hazard.

Table 2. Assessment Area Vegetation Communities

Vegetation Community	Total Acreage	Percent of Assessment Area
Montane Hardwood	13,592	40%
Sierran Mixed Conifer	9,276	27%
Urban	3,939	12%
Blue Oak Woodland	2,869	8%
Ponderosa Pine	1,540	5%
Annual Grassland	1,030	3%
Montane Hardwood-Conifer	1,000	3%
Barren	60	<1%
Blue Oak-Foothill Pine	194	1%
Closed-Cone Pine-Cypress	4	<1%
Cropland	95	<1%
Juniper	2	<1%
Lacustrine	27	<1%
Mixed Chaparral	482	1%
Montane Riparian	15	<1%
Pasture	1	<1%
Valley Oak Woodland	2	<1%
Wet Meadow	3	<1%

Source: Sierra Nevada RRK 2023

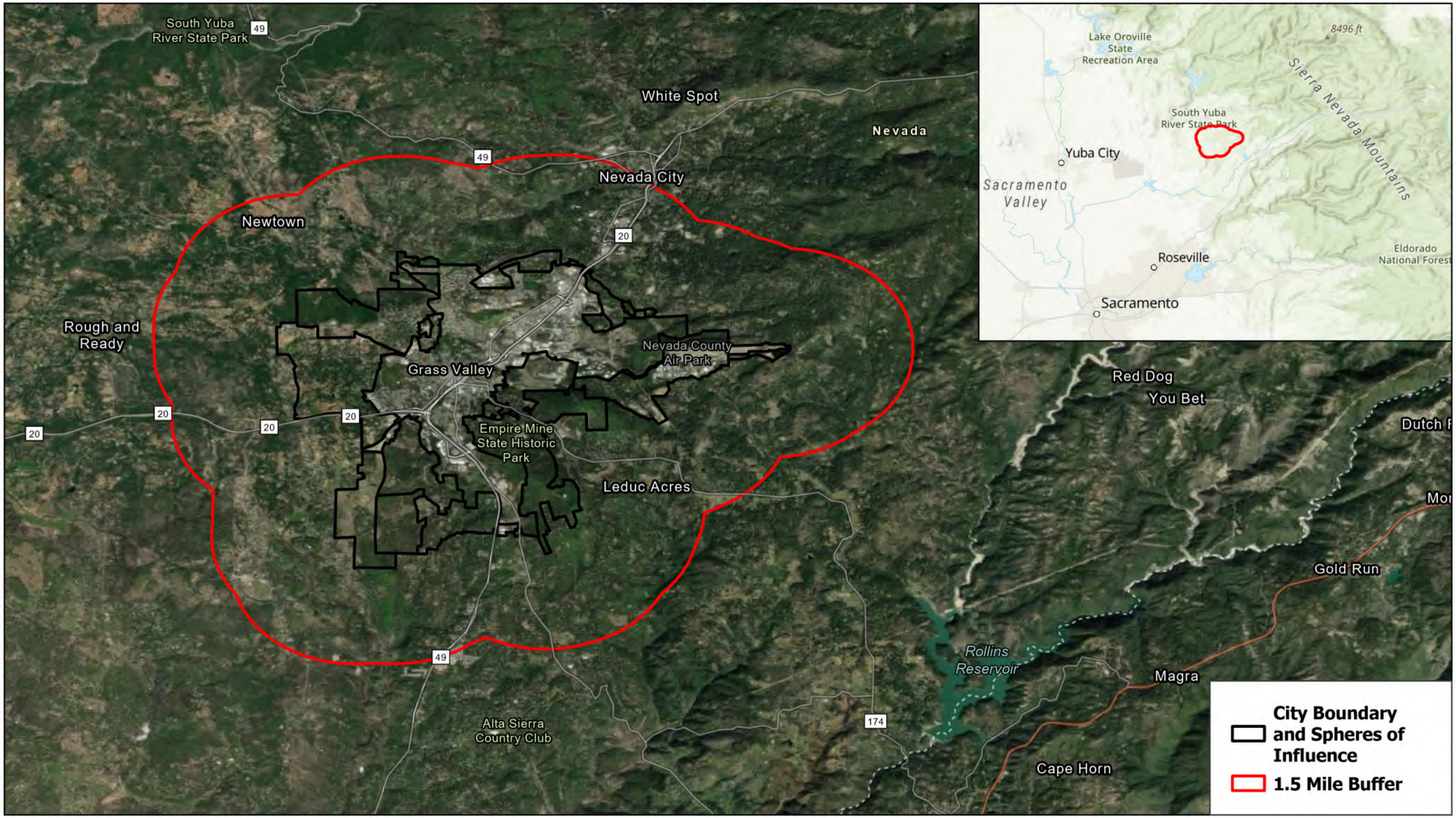
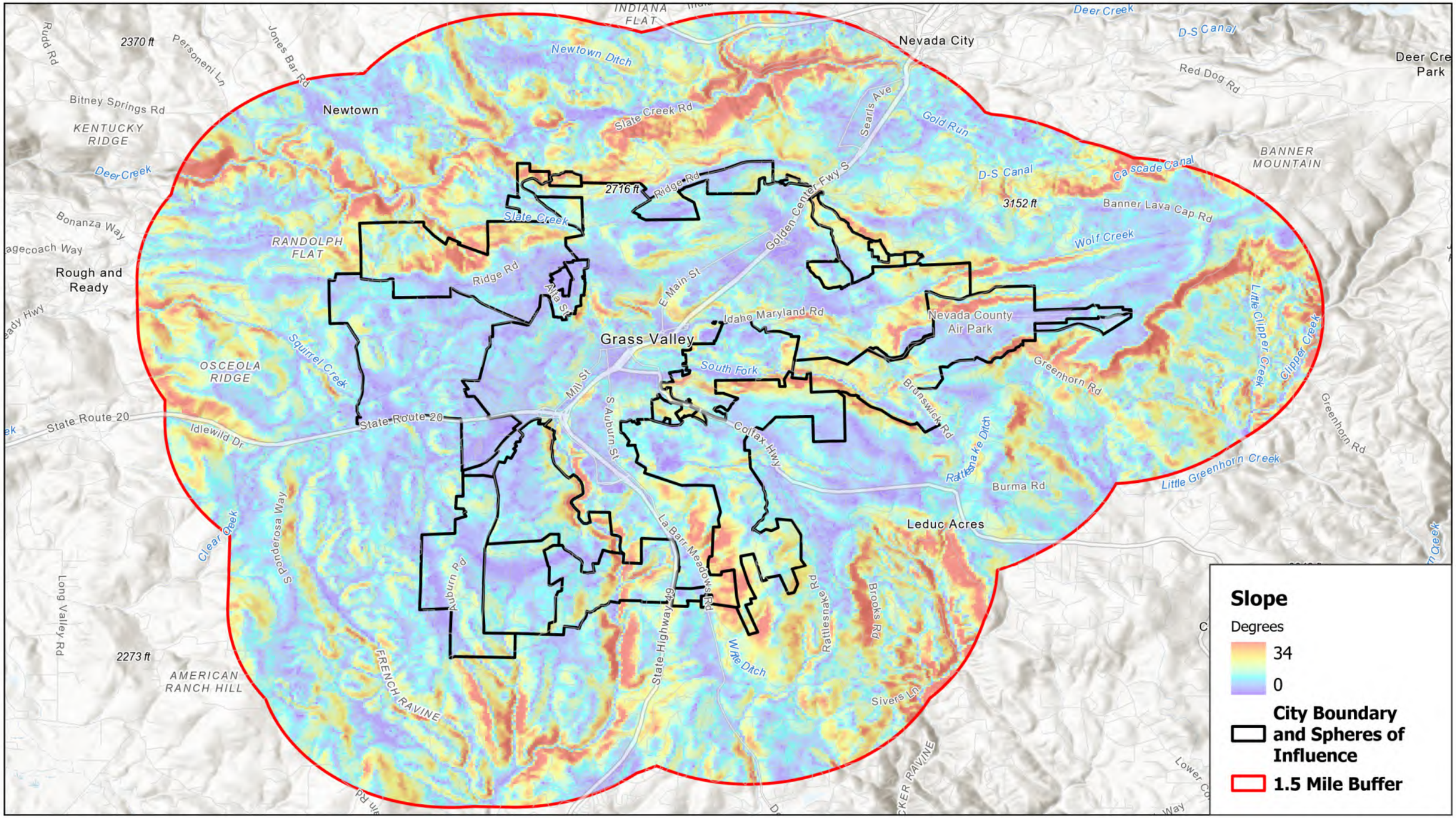


Figure 1. Assessment Area Location



DUDEK

Figure 2. Assessment Area Terrain

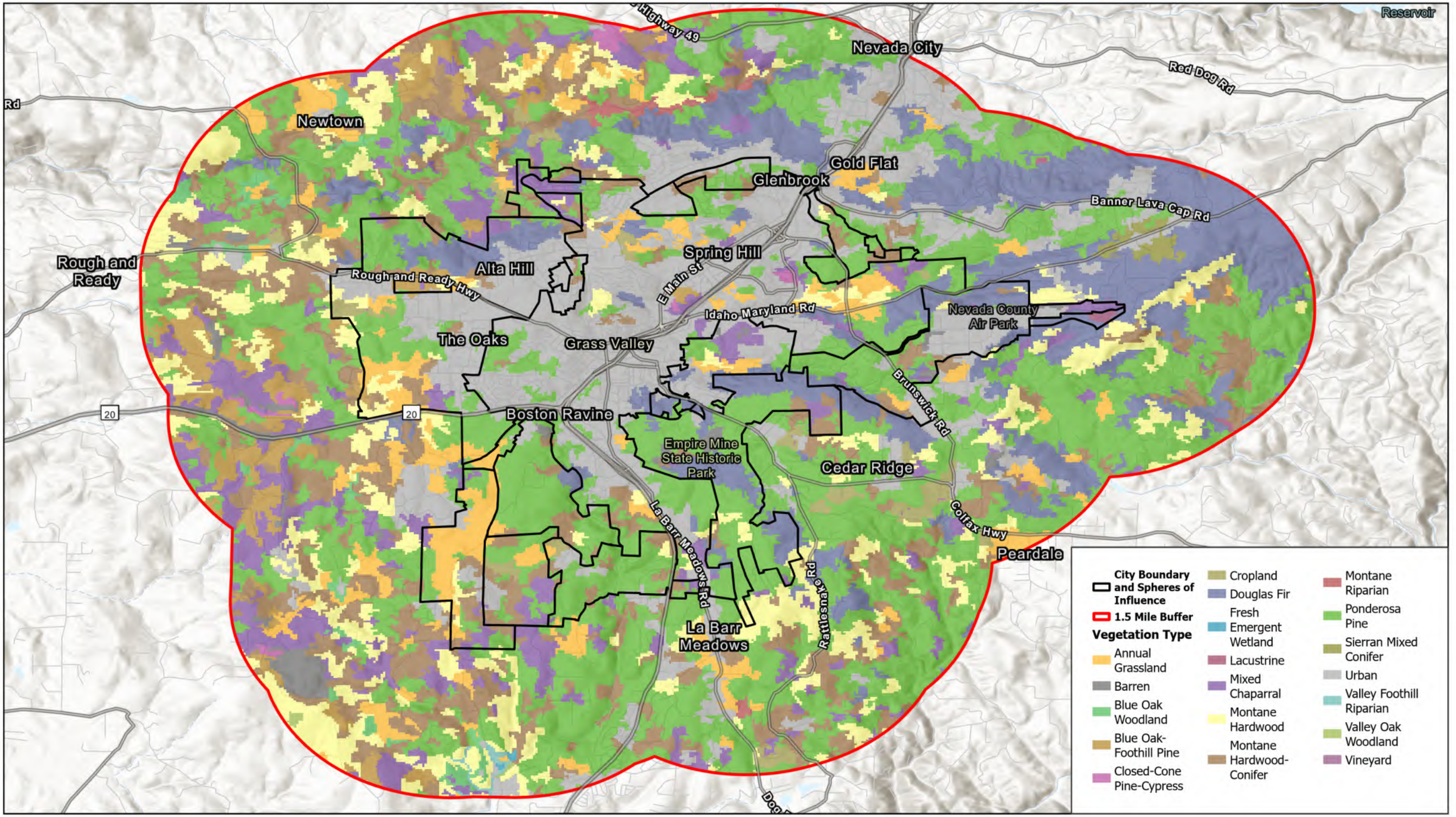


Figure 3. Assessment Area Vegetation

Montane Hardwood and Montane Hardwood-Conifer

Montane Harwood and Montane Hardwood-Conifer represent 43% of the assessment area. These vegetation communities are largely represented by oak and conifer species including canyon live oak, interior live oak, California black oak, ponderosa pine, Jeffrey pine, gray pine, incense cedar, and Douglas-fir. Montane Hardwood-Conifer vegetation incudes a greater composition of conifer species. Shrubs such as manzanita, poison oak, coffeeberry, and ceanothus may also be present in these vegetation types, although poorly developed. Herbaceous vegetation is generally sparse but is often more prevalent in open canopy stands. The reduction of fire as an ecosystem process in these vegetation communities allows for an accumulation of fuels that had previously been consumed during regular, low-intensity fires. These vegetation types are often highly productive and lead to a build-up of woody vegetation in the understory, including significant increases in dead and downed woody material and ladder fuels connecting ground vegetation to tree canopies. As a result, some stands are more susceptible to severe, crown-consuming wildfires.

Sierran Mixed Conifer

Sierran Mixed Conifer represents 27% of the assessment area. Sierran Mixed Conifer is largely represented by conifer species such as ponderosa pine, Jeffrey pine, sugar pine, incense cedar, and Douglas-fir. California black oaks are also commonly found in this vegetation type. These forests have a multilayered structure and are influenced by factors such as fire, climate, topography, historical management, and soils. The canopies of forested stands are often closed and have multiple layers with almost complete canopy cover overlap (Rundel et al. 1977). Shrubs often grow in the lower layer when there are gaps in the canopy and include species such as deer brush, manzanita, chinquapin, tan oak, bitter cherry, mountain whitethorn, gooseberry, rose, and mountain misery (Kosco 1980). Wildfire behavior in Sierran Mixed Conifer vegetation is highly dependent on forest structure and fuels characteristics. Wildfire hazard is generally highest in stands with minimal crown separation and high accumulations of ladder fuels that can facilitate surface to crown fire transition. Other factors such as drought and forest pests and disease can increase wildfire hazard due to reduced fuel moisture and the increased amount of dead and dying trees.

Blue Oak Woodland

Blue Oak Woodland represents 8% of the assessment area. Blue oak is the dominant species, comprising 85 to 100 percent of the trees present. Trees are generally scattered, although canopies may be closed on better quality sites favorable to tree production. Shrubs may be present but are rarely extensive. Typical understory is composed of annual grasses and forbs. As such, wildfire behavior in Blue Oak Woodland is typically dependent on the structure of understory vegetation. Wildfires may move quickly through flashy surface fuels; however, fuel loads are generally low and typically do not promote high flame lengths.

Grassland

Grassland areas represent 3% of the assessment area. Grasses are fine fuels that are loosely compacted with a low fuel load. Grasses have a high surface-area-to-volume ratio, requiring less heat to remove fuel moisture and raise the fuel to ignition temperature. They are also subject to early seasonal drying in late spring and early summer. Live fuel moisture content in grasses typically reaches its low point in early summer, and grasses begin to cure soon after. Due to these characteristics, grasses have the potential for a high rate of spread, rapid ignition, and facilitation of extreme fire behavior. Their low overall fuel loads typically result in faster-moving fires with lower flame lengths and heat output.

Untreated grasses can spread a fire into other adjacent surface fuel types (e.g., shrubs, small trees) or facilitate surface-to-crown fire transition where grasses exist beneath tree canopies.

Urban

Urban land cover represents 12% of the assessment area. Fire burning in undeveloped areas can pass to urban areas through the presence of flammable or non-maintained landscape or ornamental vegetation. The characteristics and presence of urban vegetation significantly impact the potential for wildfires and their spread within urban environments. The type, density, and condition of vegetation in urban areas influence the availability of fuel for fires. When urban areas contain dense and highly flammable vegetation like dry grasses, shrubs with volatile oils, or trees with combustible foliage, the risk of fires igniting and spreading rapidly increases. Additionally, the accumulation of dead leaves, branches, and plant debris contributes to fuel loads and elevates fire hazard. Urban vegetation also influences the ignition and spotting potential of wildfires. Wind-carried embers and burning debris can ignite new fires in urban areas, especially when highly flammable vegetation is near structures. This raises the risk of embers landing on or near buildings, leading to fire spread within urban areas and an increased likelihood of structure ignitions.

1.4 Weather

The assessment area is generally characterized by a Mediterranean climate with hot, dry summers followed by cool, wet winters. Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will ignite more readily and burn more intensely. Thus, during periods of drought, the threat of wildfire increases (County of Nevada 2017).

Winds can be significant at times in the assessment area and drive wildfire spread. While less common, north/northeast winds in Nevada County can occur during hot, dry conditions, which can lead to “red flag” days indicating extreme fire danger. In addition to wind speed, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides (County of Nevada 2017). Predominate winds are from the southwest but commonly become north to northeast following weather system changes. The regional prevailing weather pattern is a diurnal wind pattern. This results in a daytime wind from the south/southwest (up-canyon), and nighttime winds from the north/northeast (down-canyon). During the summer season, diurnal winds can be slightly stronger than the winds during the winter season due to greater pressure gradient forces. These winds can contribute to fire hazards when appropriate conditions exist for wildfire ignition and spread. Surface winds can also be influenced locally by terrain variations. The varied terrain of the assessment area also affects wind velocity and patterns. Annually, fire weather conditions often become critical in late July through October.

It should be noted, however, that microclimates exist due to the diversity in elevation and aspects within the assessment area. As such, conditions are variable on a daily and seasonal basis throughout the assessment area. Microclimatic conditions can greatly affect fire hazards and would need to be considered when determining vegetation treatments and implementation timing. Such conditions are often not captured in weather station datasets or recorded in easily referenced weather almanacs but are usually well known to locals, land managers, and local fire agency personnel.

1.4.1 Climate Change

According to the Sierra Nevada Region Report for California's Fourth Climate Assessment (Dettinger et al. 2018), wildfire is expected to increase in frequency and intensity within the Sierra Nevada region as a result of climate change. Effects of climate change including increased temperatures, higher likelihood of severe weather events including heat waves and dry lightning storms, and reduced precipitation and snowpack. These effects are expected the increase wildfire severity. Overall, the region is expected to become dryer, reducing fuel and air moisture content over longer periods of time. This is likely to exacerbate wildfire severity as conditions would be more favorable to extreme wildfire behavior. Reduced precipitation is also expected to increase tree mortality in the region leading to an increased accumulation of hazardous fuels.

1.5 Fire Hazard Severity Zones

Fire Hazard Severity Zones (FHSZs) are geographical areas designated pursuant to California Public Resources Code Sections 4201 through 4204; they are classified as Very High, High, or Moderate in State Responsibility Areas, or as Local Responsibility Area Very High FHSZ designated pursuant to California Government Code Sections 51175 through 51189. California Public Resources Code Sections 4201–4204 and Government Code Sections 51175–51189 direct the California Department of Forestry and Fire Protection (CAL FIRE) to map areas of significant fire hazard based on fuels, terrain, weather, and other relevant factors. The resulting FHSZs define the application of various mitigation strategies to reduce the risk associated with wildland fires (OSFM 2023). The model used to determine the extent of FHSZs is based on an analysis of potential fire behavior and fire probability predicated on the frequency of fire weather, ignition patterns, expected rate of spread, ember (brand) production, and past fire history (OSFM 2023). Structures built in FHSZs are subject to more stringent fire-hardening requirements than those that are not. The FHSZ classifications for State Responsibility Area (SRA) and Local Responsibility Area (LRA) lands in the assessment area are provided in Figure 4 and Tables 3 and 4.

Table 3. FHSZ Classifications in State Responsibility Area of Assessment Area

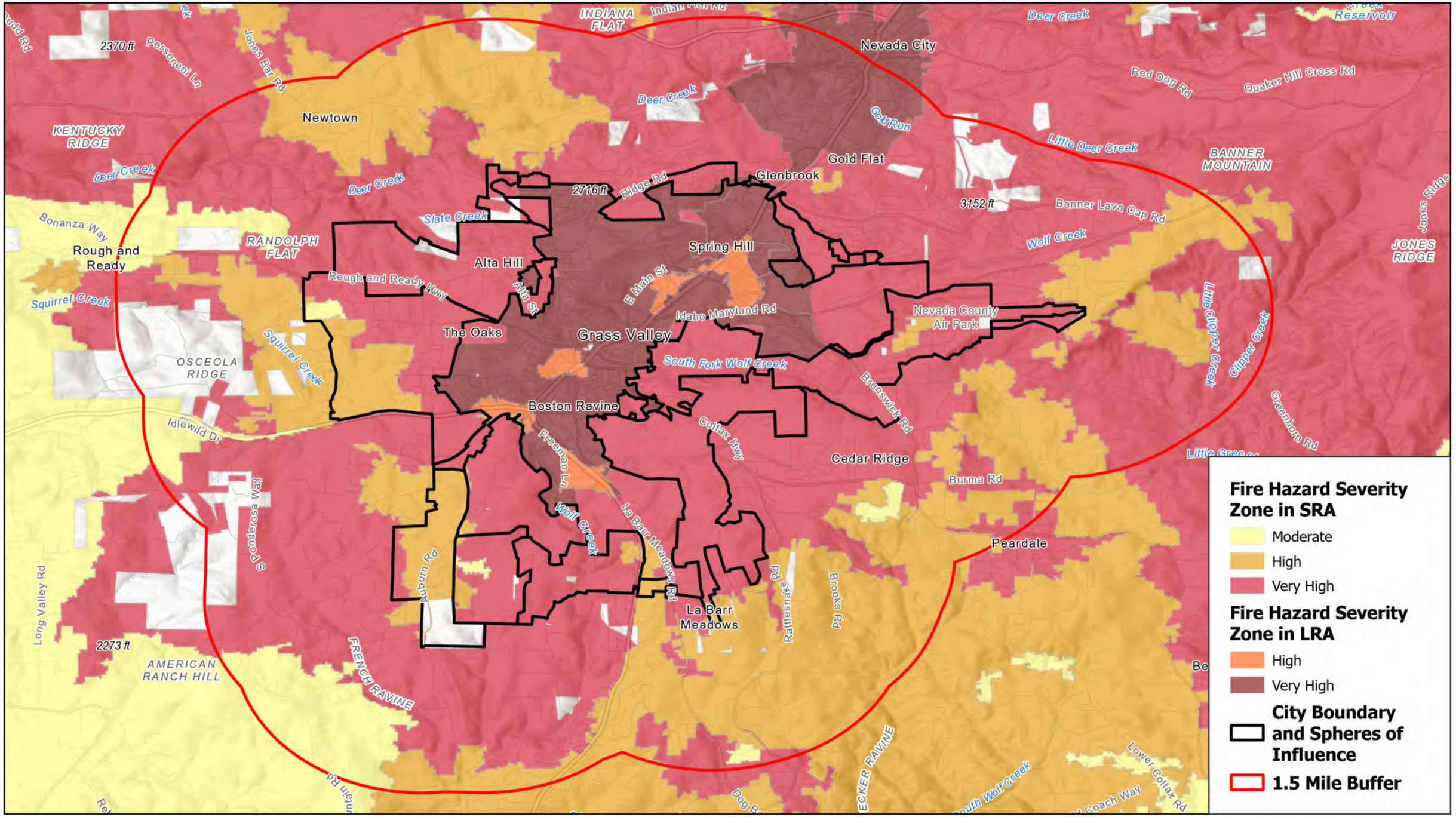
FHZS Classification	Acres in Assessment Area	Percent of Assessment Area
Very High	21,345	62%
High	7,290	21%

Source: CAL FIRE 2023a

Table 4. FHSZ Classifications in Local Responsibility Area of Assessment Area

FHZS Classification	Acres in Assessment Area*	Percent of Assessment Area
Very High	2,558	7%

Source: CAL FIRE 2023b
*Includes a portion of the Nevada City FHSZ in LRA



DUDEK

Figure 4. Assessment Area Fire Hazard Severity Zones

1.6 Fire and Ignition History

Fire history can provide an understanding of a variety of factors related to fires, including frequency, type and behavior, most vulnerable community areas, and significant ignition sources, among others. One important use for this information is as a tool for pre-planning. It is advantageous to know which areas may have burned recently and therefore may provide a tactical defense position, what type of fire burned in the area, and how a fire may spread. CAL FIRE's Fire and Resource Assessment Program (FRAP) summarizes fire perimeter data from the late 1800s to 2022 (fires over 10 acres in size).

According to this data set, eight wildfires have occurred within the assessment area (Table 5 and Figure 5). Most recently in August 2021, the human-caused Bennet Fire burned 50 acres near East Bennet Road and resulted in mandatory evacuations. The Jones Fire in August 2020 burned 706 acres and destroyed over 20 structures after lighting strikes ignited the fire approximately 1 mile southwest of the South Yuba River Bridge. Other recent fires in the assessment area include the arson-caused Auburn Fire in 2016 which was started near South Auburn Street burning 28 acres and threatening nearby structures, and the McCourtney Fire in 2017 which ignited along McCourtney Road and burned 76 acres just north of Quail Valley Country Club.

Although considerable numbers of historical wildfires have occurred in proximity to the assessment area, the relatively low number of historical wildfires within the assessment area suggests that the vegetation within undeveloped and non-maintained areas has likely matured and accumulated a significant amount of dead and dying material, which results in increased fuel loads that can contribute to high-severity wildfire.

Table 5. Historical Wildfires within the Assessment Area

Year	Fire Name	Total Acreage
1916	Unnamed	3,923
1951	Rattlesnake	586
1994	Trauner	536
2016	Auburn	24
2017	Rex	12
2017	McCourtney	76
2020	Jones	706
2021	Bennett	50

Source: CAL FIRE 2023c

An analysis of wildfire ignition data can also help to understand where ignitions are occurring and inform wildfire mitigation project development. The National Interagency Fire Occurrence dataset contains a spatial database of wildfires that occurred in the United States from 1992 to 2020 using wildfire records were acquired from the reporting systems of federal, state, and local fire organizations (Short 2023). Wildfire ignition data from 2020 to 2023 was obtained from the Wildfire Incident Locations database for incidents reported to the Integrated Reporting of Wildland Fire Information (IRWIN) system (NIFC 2023). Between 1992 and 2023, 831 wildland fire ignitions have been recorded within the assessment area. These are visually presented in Figure 6. Ignitions generally occur along main roadways (Highways 20, 49, and 174, Idaho Maryland Road, Brunswick Road, McCourtney Road, and South Auburn Street), near the Nevada County Air Park, and in vegetation proximate to residential areas.

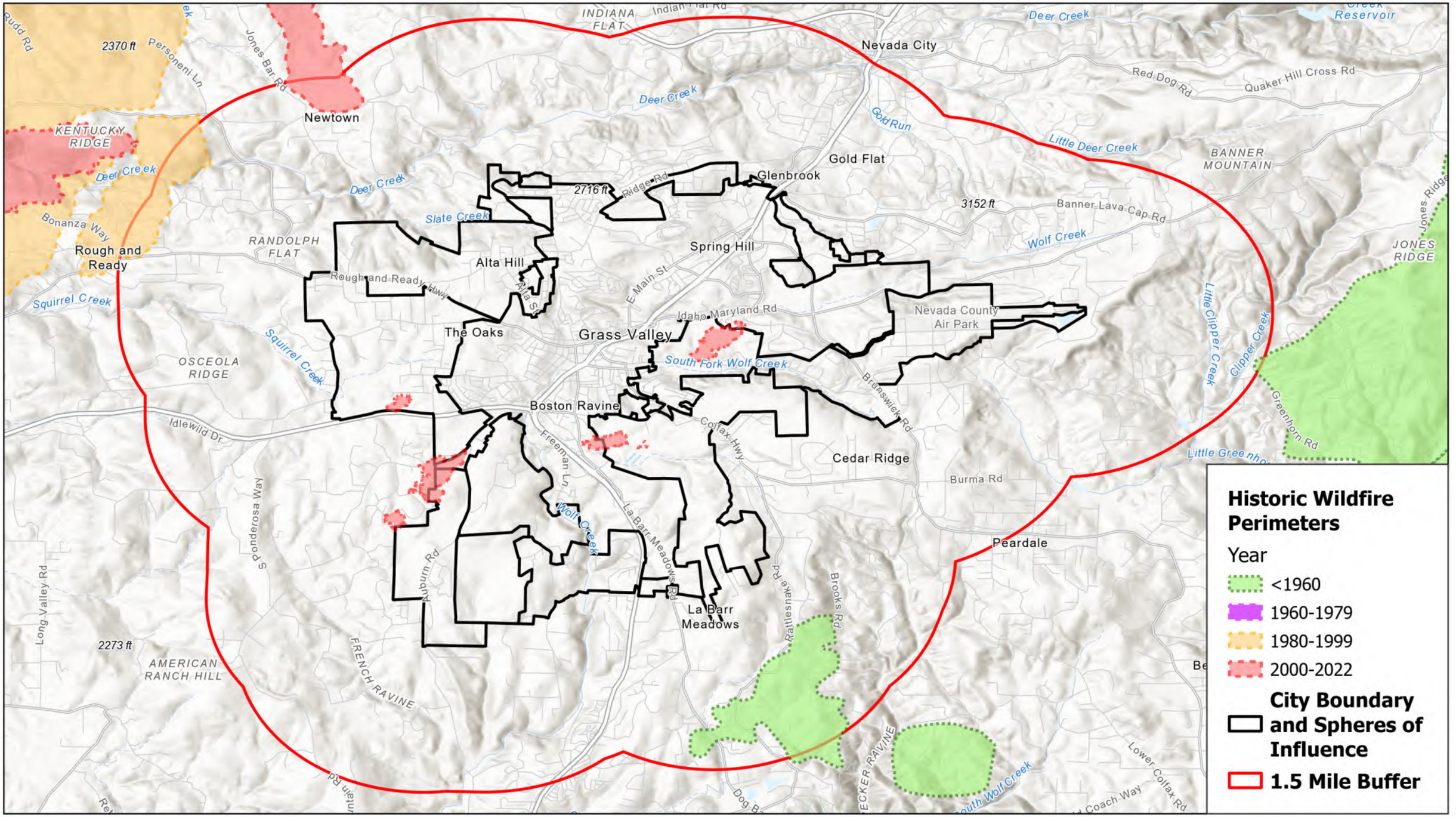


Figure 5. Assessment Area Fire History

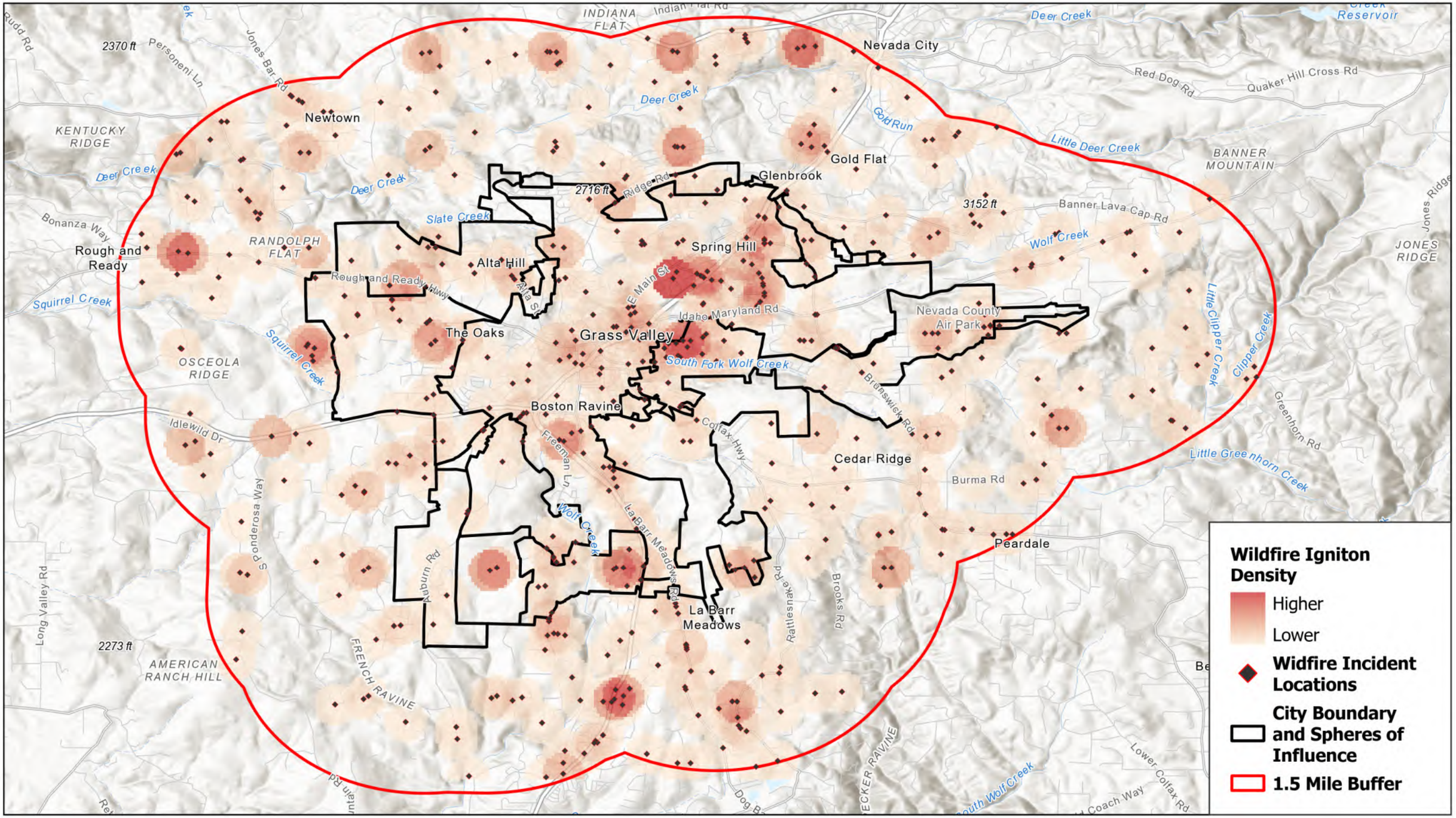


Figure 6. Assessment Area Wildfire Ignition Locations

1.7 Wildland Urban Interface/Intermix

The wildland urban interface (WUI) is an area in which wildfire risk mitigation projects may be conducted to reduce wildland fire threats to communities at risk. The pattern of development and land use within the assessment area creates conditions that can be described as either a wildland urban interface or a wildland urban intermix. The wildland urban interface/intermix has been mapped (Sierra Nevada RRK 2023). Table 6 presents the acreage of land in each classification for the assessment area. These are visually presented in Figure 7. Both conditions present advantages and disadvantages with respect to reducing wildfire risk, as described in the following sections.

Table 6. Wildland Urban Interface/Intermix in the Assessment Area

Wildland/Urban Type	Acres in Assessment Area	Percent of Assessment Area
Interface	3,930	11%
Intermix	17,799	52%
Non-WUI	12,485	36%

Source: Sierra Nevada RRK 2023

1.7.1 Wildland Urban Interface

The area where urban development occurs within 1.5 miles of an area of vegetation measuring at least 5 square kilometers (and with at least 75% vegetation) would be characterized as a wildland urban interface (Interface or WUI) (Sierra Nevada RRK 2023). The wildland fire risk associated with WUI areas includes propagation of fire via house-to-house fire spread, landscaping-to-house fire spread, or ember intrusion. For Grass Valley, the WUI is concentrated within the downtown core, along Highway 49, and in more densely develop neighborhoods near the downtown core.

Advantages and disadvantages associated with WUI areas are provided below.

WUI Advantages

- Community water supply systems in place
- Multiple homes accessed by a single road.
- Emergency equipment protects multiple assets at once.
- Houses usually only exposed to flammable fuels on one side.

WUI Disadvantages

- High housing density
- Congested roads during emergencies
- Limited options if the community water systems fail.

1.7.2 Wildland Urban Intermix

Intermix areas are those where housing and vegetation intermingle. In an intermix area, wildland vegetation is continuous, and more than half of the land area is vegetated with combustible fuels (Sierra Nevada RRK 2023). The wildland fire risk associated with intermix areas includes vegetation-to-house fire spread or ember intrusion. For Grass Valley, the intermix is located along the edges of the WUI and in less densely developed neighborhoods

(Sunset View, The Oaks, Glenbrook, Bennett Road, Freeman Road, Allison Ranch Road, and near Empire Mine State Historic Park).

Advantages and disadvantages associated with intermix areas are provided below.

Intermix Advantages

- Low housing density
- Diversity in water supply systems

Intermix Disadvantages

- Increased risk to firefighters
- Emergency equipment can only protect single assets.
- Delayed emergency equipment response times due to the following:
  - Rural roads (single lane, windy, heavy fuel loading)
  - Long driveways
- Congested roads during emergencies
- Diversity in water supply systems
- Houses surrounded by vegetation.

1.8 At-Risk Community

The Healthy Forest Restoration Act of 2003 identifies at-risk communities as an area:

> (A) that is comprised of—
>
> (i) an interface community as defined in the notice entitled ‘‘Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire’’ issued by the Secretary of Agriculture and the Secretary of the Interior in accordance with title IV of the Department of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed. Reg. 753, January 4, 2001); or
>
> (ii) a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land.
>
> (B) in which conditions are conducive to a large-scale wildland fire disturbance event; and
>
> (C) for which a significant threat to human life or property exists as a result of a wildland fire disturbance event.

In addition to this definition, the California Office of the State Fire Marshal maintains a list of Communities at Risk. The National Fire Plan directs funding to be provided for projects designed to reduce the fire risks to communities. These high-risk communities identified within the WUI were published in the Federal Register in 2001 and include those communities neighboring federal lands. The City of Grass Valley is identified as a Community at Risk in the Federal Register.

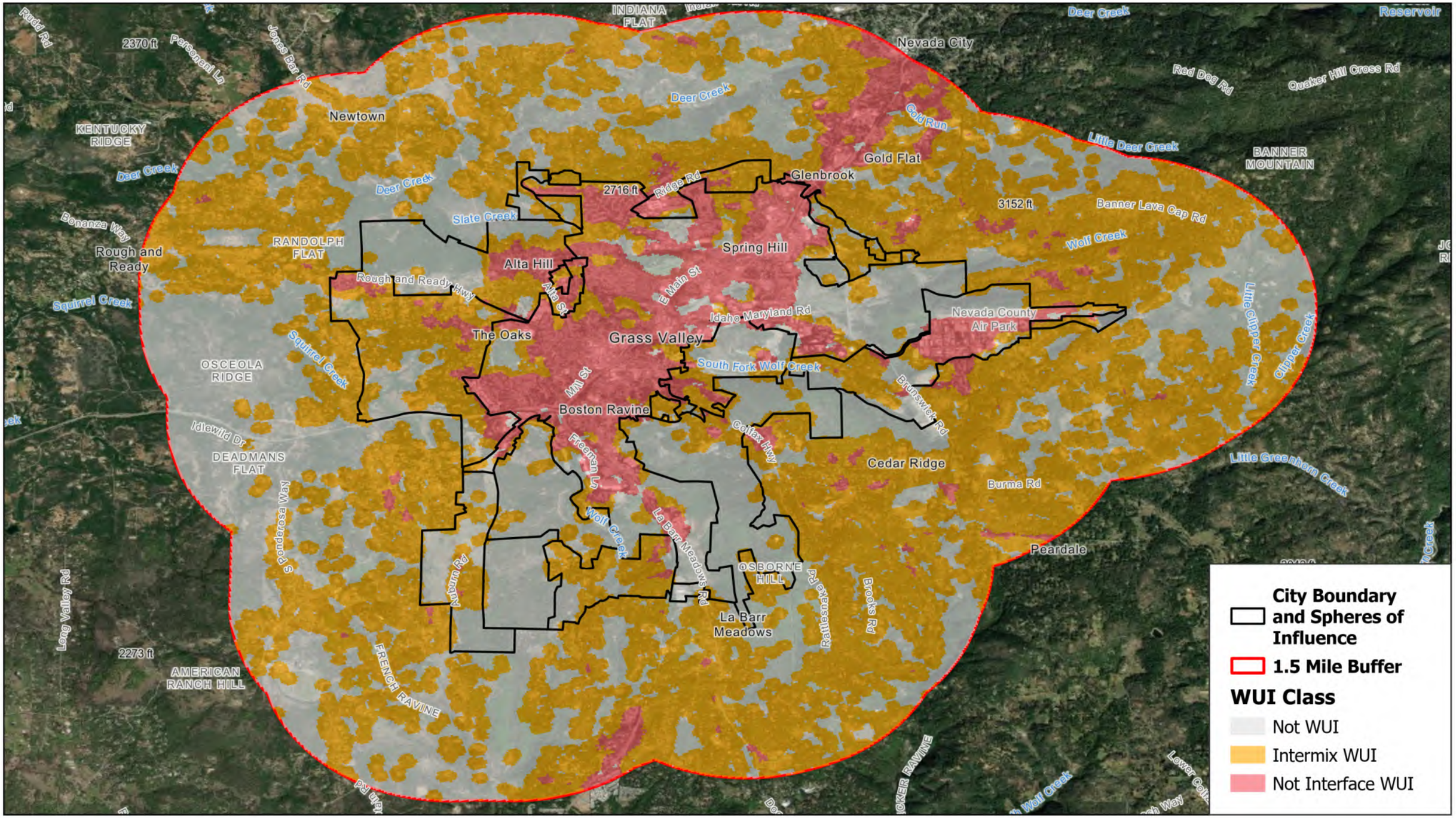


Figure 7. Assessment Area Wildland Urban Interface

2 Hazard and Risk Assessment

A focused wildfire hazard and risk assessment was conducted for the assessment area to identify areas of relatively higher wildfire risk and potential areas for future wildfire risk mitigation efforts. This assessment was conducted in a geographic information systems (GIS) environment and involved analyzing and processing several GIS data sets as well as modeling potential fire behavior within the assessment area. All GIS analysis was conducted in a 30-meter raster environment. The wildfire hazard and risk assessment was conducted in two distinct steps:

- **Hazard Assessment:** The hazard assessment component involved evaluating six different wildfire-related data sets. It also included modeling potential fire behavior for the assessment area to evaluate flame length and crown fire potential, used as metrics to evaluate extreme fire behavior.

- **Risk Assessment:** The risk assessment component involved evaluating the hazard assessment data sets in relation to community areas. This involved evaluating and processing structure location data to map the development area. It also included ranking and weighting the hazard data sets based on their relative contribution to wildfire risk. The result was a new composite wildfire risk GIS map layer for the assessment area.

The following sections outline the assessment approach, identify input data layers, and summarize the assessment results.

2.1 Hazard Assessment

2.1.1 Extreme Fire Behavior

Several wildfire types exist, as summarized below:

- **Ground Fire:** A fire burning on the ground that consumes organic material beneath surface litter (NWCG 2023).
- **Surface Fire:** A fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation (NWCG 2023).
- **Crown Fire:** A fire that has burned upward from the ground and into the tree canopy. There are three types of crown fires:
  - **Passive Crown Fire:** A crown fire in which individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained except for short periods. Passive crown fire encompasses a wide range of crown fire behavior from the occasional torching of an isolated tree to a nearly active crown fire. Also called torching (Scott and Reinhardt 2001).
  - **Active Crown Fire:** A crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread. Also called running and continuous crown fire (Scott and Reinhardt 2001).
  - **Independent Crown Fire:** A crown fire that spreads without the aid of a supporting surface fire (Scott and Reinhardt 2001).

Another component of fire behavior is spotting, the transfer of fire brands (embers) ahead of a fire front which can ignite smaller vegetation fires (NWCG 2023). These smaller fires can burn independently or merge with the main fire. Spotting can also result in structural ignitions when transported embers reach a receptive fuel bed (e.g., combustible roofing), especially in wind-driven fires. Structure fires as well as vegetation-fueled fires can generate fire brands. Additionally, landscape features like ridges can dramatically affect fire behavior by changing prevailing wind patterns, funneling air, and increasing wind speeds, thereby intensifying fire behavior.

Each of the aforementioned fire types may occur within the assessment area, depending on site-specific conditions. Fire behavior is the manner in which a wildland fire reacts to weather, fuels, and topography. The difficulty of controlling and suppressing a wildfire is typically determined by fire behavior characteristics, such as rate-of-spread, fireline intensity, torching, crowning, spotting, fire persistence, and by resistance to control (NWCG 2023). Extreme fire behavior is that which precludes methods of direct control (e.g., flame lengths 8 feet and greater), behaves unpredictably and erratically, and typically involves high spread rates, crowning and/or spotting, the presence of fire whirls, and a strong convective column (NWCG 2023).

Fire behavior characteristics are an important component in understanding fire risk and fire agency response capabilities. Flame length—the length of the flame of a spreading surface fire within the flaming front—is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews et al. 2008). While it is a somewhat subjective and nonscientific measure of fire behavior, it is extremely important to fireline personnel when evaluating fireline intensity, and is worth considering as an important fire variable (Rothermel 1993). Fireline intensity is a measure of heat output from the flaming front and also affects the potential for a surface fire to transition to a crown fire. The information in Table 7 presents an interpretation of flame length and its relationship to fire suppression efforts.

Table 7. Fire Behavior Interpretation

Flame Length	Fireline Intensity	Interpretation
Under 4 feet	Under 100 BTU/ft/s	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 feet to 8 feet	100–500 BTU/ft/s	Fires are too intense for a direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 feet to 11 feet	500–1,000 BTU/ft/s	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11 feet	Over 1,000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at the head of fire are ineffective.

Source: Roussopoulos and Johnson 1975.
Note: BTU/ft/s = British thermal units per foot per second.

Fire behavior in the assessment area was modeled using the Interagency Fuel Treatment Support System (IFTDSS) using the Landscape Fire Behavior tool. Landscape Fire Behavior in IFTDSS is driven by FlamMap, a fire behavior mapping and analysis software application that computes potential fire behavior characteristics over an entire landscape under constant weather and fuel moisture conditions input by the user. The fire behavior analysis did not incorporate burn probability. The 2022 LANDFIRE data set (embedded in the IFDTSS software application) was used to represent the terrain (elevation, slope, and aspect) and the vegetation/fuel for the assessment area.

From a wildfire behavior modeling perspective, the assessment area exhibits characteristics that result in inaccuracies in the LANDFIRE Landscape file, specifically fuel model designations. LANDFIRE fuel models are determined through satellite imagery and are generally most accurate when representing large continuous tracts of natural vegetation. The assessment area includes patches of natural vegetation intermixed with structures and urbanized areas. When analyzing the default LANDFIRE landscape fuels data, it was noted that many areas of natural vegetation were not recognized due to their proximity to urbanized areas (and were therefore mapped as non-vegetation). The converse was also evident, as many urban areas were assigned vegetative fuel models even though the ground surface is non-burnable. This is due to the considerable amount of urban vegetation in the assessment area and the 30-meter scale of the LANDFIRE mapping data.

The 2019 National Land Cover Database (NLCD) was used to modify the fuel model layer for the assessment area to better represent fuel models in urbanized areas. The NLCD is created in cooperation with the Multi-Resolution Land Characteristics Consortium, a partnership of federal agencies that produce nationally consistent land cover datasets for the United States. The NLCD includes an impervious surfaces layer, which allows for the identification of urban ground cover, including paved areas and structures.

Landscape fire behavior was modeled using the inputs provided in Table 8, consistent with modeling efforts conducted for Nevada County's Community Wildfire Protection Plan update effort.

Table 8. Fire Behavior Modeling Weather and Fuel Moisture Inputs

Input	Value
Wind Speed	20 mph
Default Wind Azimuth	45 degrees
Wind Flow Type	Downslope
1-hour Fuel Moisture	3%
10-hour Fuel Moisture	5%
100-hour Fuel Moisture	8%
Live Herbaceous Fuel Moisture	30%
Live Woody Fuel Moisture	60%
Foliar Moisture Content	100%
Crown Fire Calculation Method	Scott and Reinhardt 2011

Landscape fire behavior modeling outputs (flame length and crown fire type) were utilized to identify areas anticipated to experience extreme fire behavior. Modeled flame length and crown fire types are presented in Figures 8 and 9, respectively. Areas with modeled flame lengths greater than or equal to 8 feet were aggregated with areas where crown fires were modeled to create a GIS layer representing extreme fire behavior for the assessment area. Areas of extreme fire behavior are presented in Figure 10.

2.1.2 Ember Load

It is estimated that up to 90% of structure losses from wildfire are caused by embers rather than the main fire front (IBHS 2020). Ember load quantifies the relative number of airborne embers that may fall onto an area from a nearby wildfire. Ember load relates to spotting distance, which quantifies the distance airborne embers may travel from their source. Ember load data was obtained from the Conditional Ember Load Index dataset created by Pyrologix (Pyrologix 2021). This data set incorporates surface and canopy fuels characteristics, climate, and topography to

determine the relative amount of embers landing per pixel in a 30-meter raster environment. This dataset does not account for burn probability. Figure 11 presents the Ember Load layer for the assessment area.

2.1.3 Hazardous Fuels

Hazardous fuels are excess woody materials on the ground or in the forest understory or canopy that can increase the severity of a wildfire. When proximate to communities, hazardous fuels can promote extreme wildfire conditions that can overpower wildfire suppression efforts and result in substantial damages. Hazardous fuels data was obtained from the Total Fuel Exposed to Fire dataset. This dataset exists within the Regional Resource Kit for the Sierra Nevada Region, a data hub provided by the California Wildfire and Forest Resilience Task Force. This dataset quantifies the sum of standing dead fuels, ladder fuels, and dead and down fuels, represented as the total amount of biomass available to contribute to the extreme fire intensity and spread rates that lead to high severity fire (Sierra Nevada RRK 2023). Figure 12 presents the Proximity to Hazardous Fuels layer for the assessment area.

2.1.4 Wildfire Suppression Difficulty

The wildfire Suppression Difficulty Index (SDI) is a spatial data layer that considers the effect of terrain, fuels, anticipated fire behavior during extreme fire weather conditions, firefighter line production rates, and proximity to roads and trails (access) in rating the relative difficulty in performing fire suppression activities. The data is categorized into six classes, ranked from lowest to highest difficulty. The SDI dataset was obtained from Pyrologix and the USDA Forest Service's Contemporary Wildfire Hazard Across California (USFS 2019). Figure 13 presents the SDI for the assessment area.

2.1.5 Urban Tree Canopy Cover

Urban vegetation can contribute to the transmission of wildfires from natural vegetation to developed regions. During intense wildfires, embers that land in urban vegetation can result in additional fire starts within communities, even if they are located a significant distance away from the primary fire front. Some tree species (e.g., conifers) have characteristics that may make them highly flammable, including the production of needle or leaf litter and peeling bark, or the presence of volatile oils and resins. Dense urban tree canopies, particularly those comprised of conifer species, can increase the liklihood of crown fire within urban areas.

Urban tree canopy cover was obatined from the USA NLCD Tree Canopy Cover database which displays the proportion of the land surface covered by trees fror the years 2011-2021 (USFS 2023). Figure 14 presents the urban tree canopy cover for the assessment area.

2.1.6 Ignition Density

As described in Section 1.6, the assessment area frequently experiences vegetation fires, with 831 ignitions occurring between 1992 and 2023. Using the ignition data for the assessment area, a density analysis was performed to determine areas with high ignition density. These areas are presented in Figure 15.

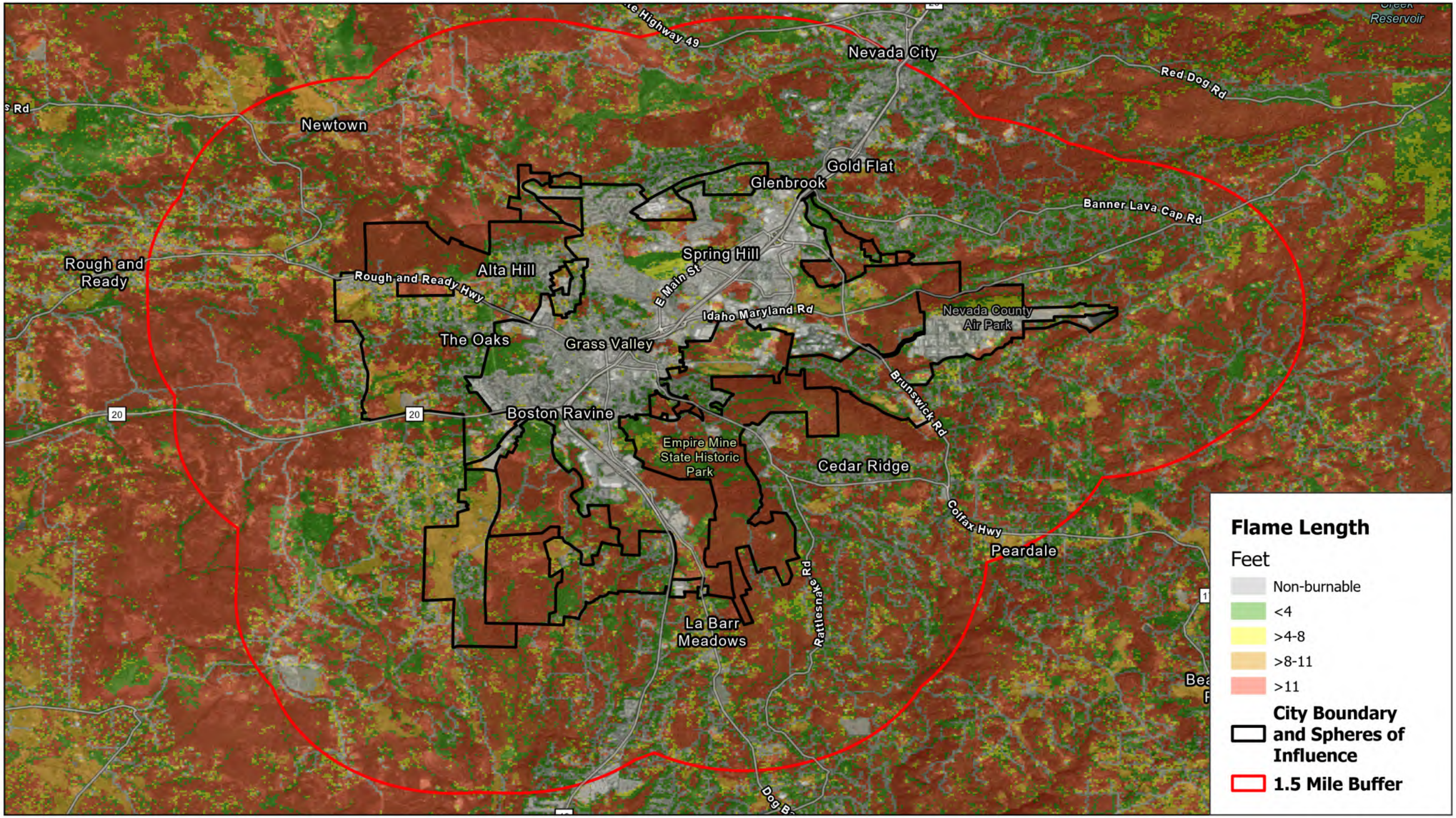


Figure 8. Assessment Area Flame Length

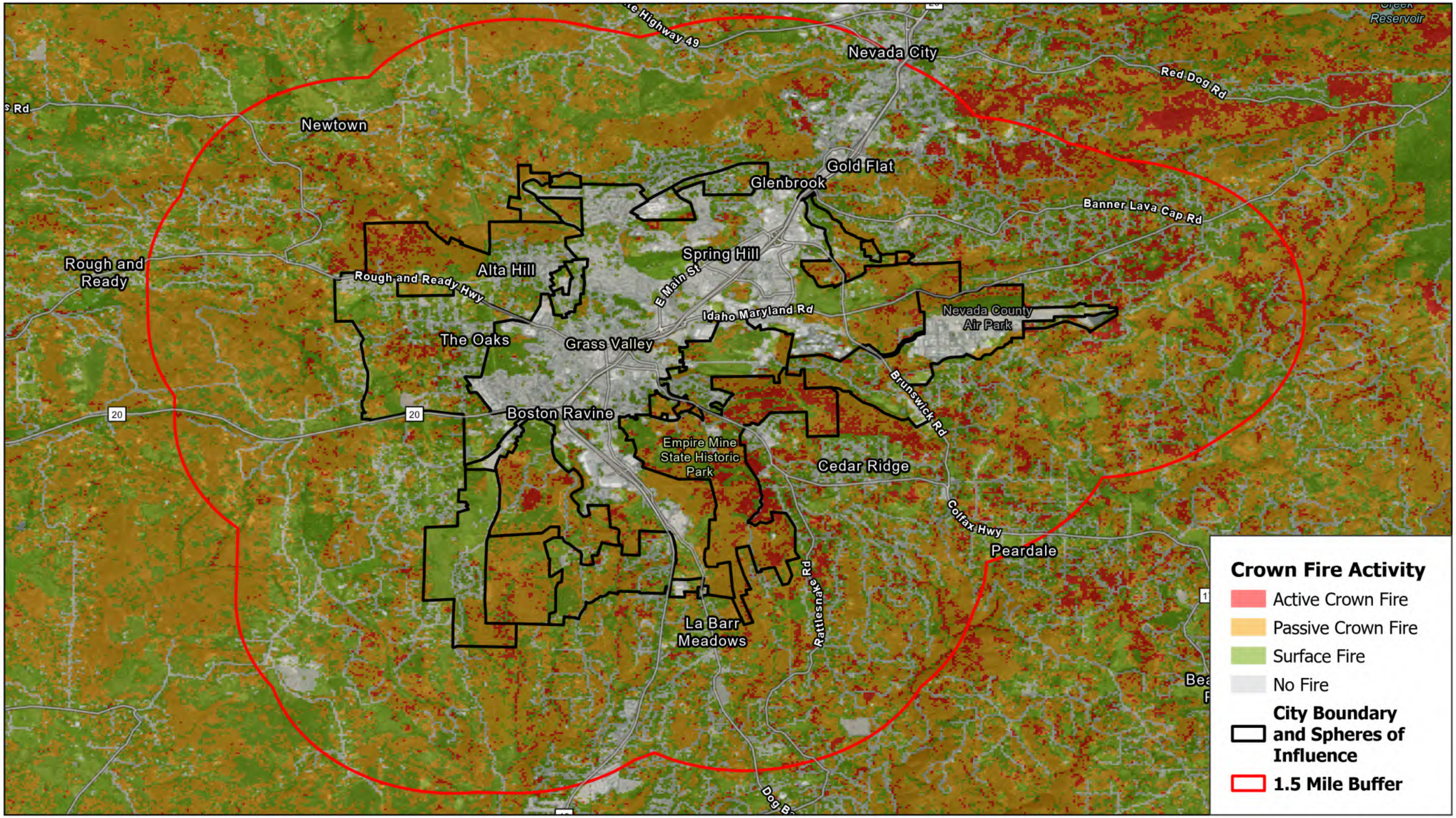
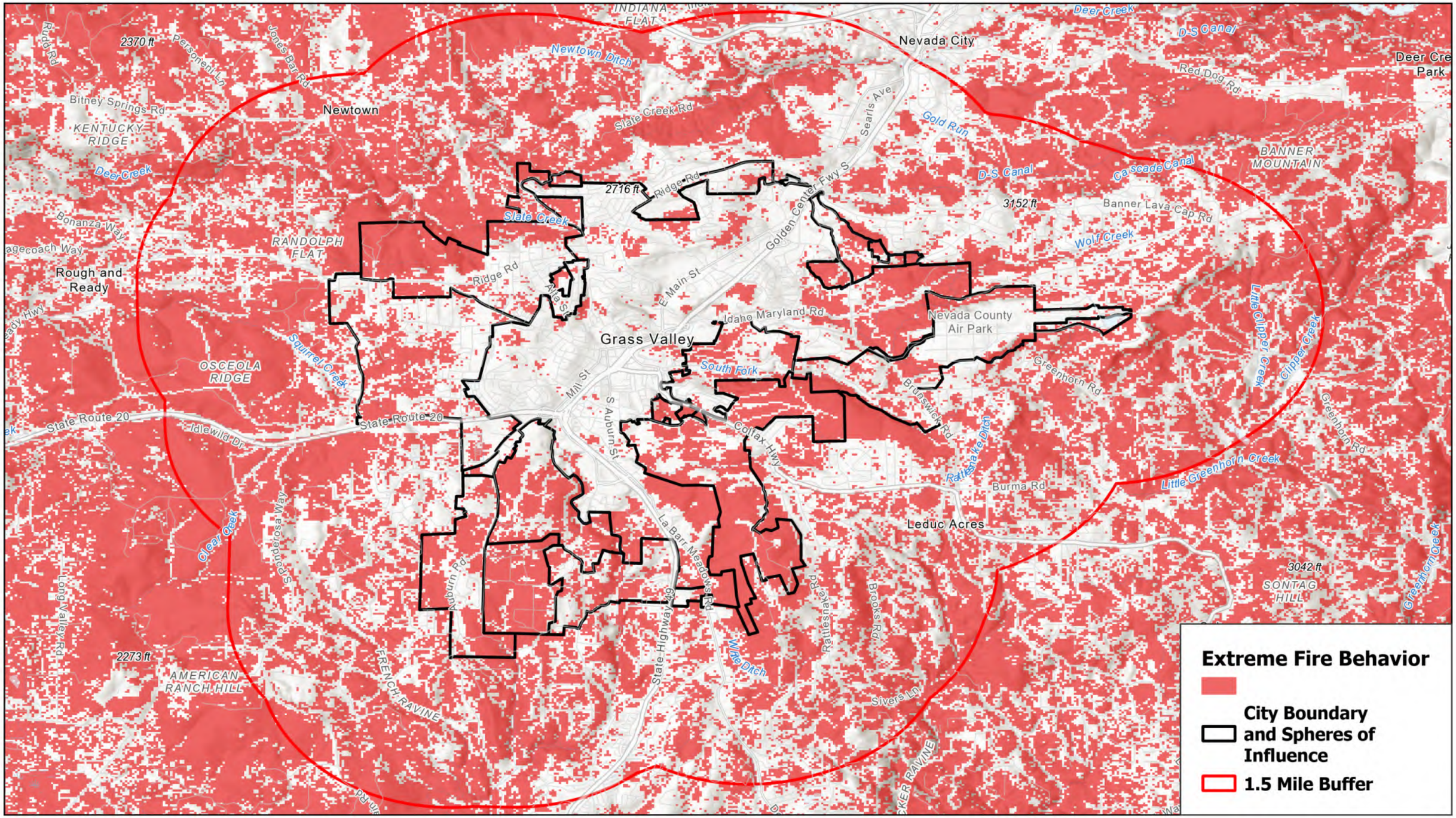


Figure 9. Assessment Area Crown Fire Type



DUDEK

Figure 10. Assessment Area Modeled Extreme Fire Behavior

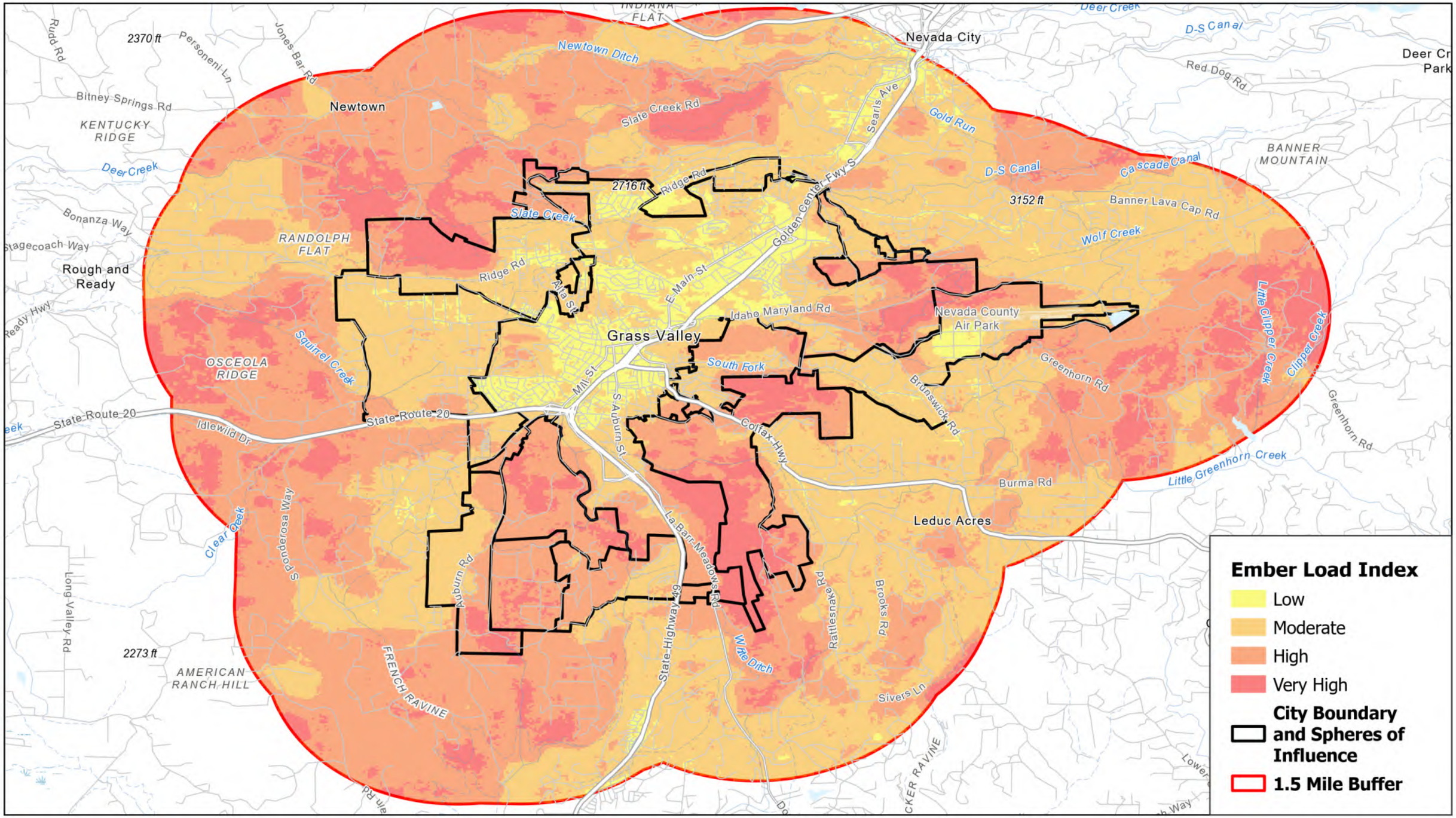


Figure 11. Assessment Area Ember Load Index

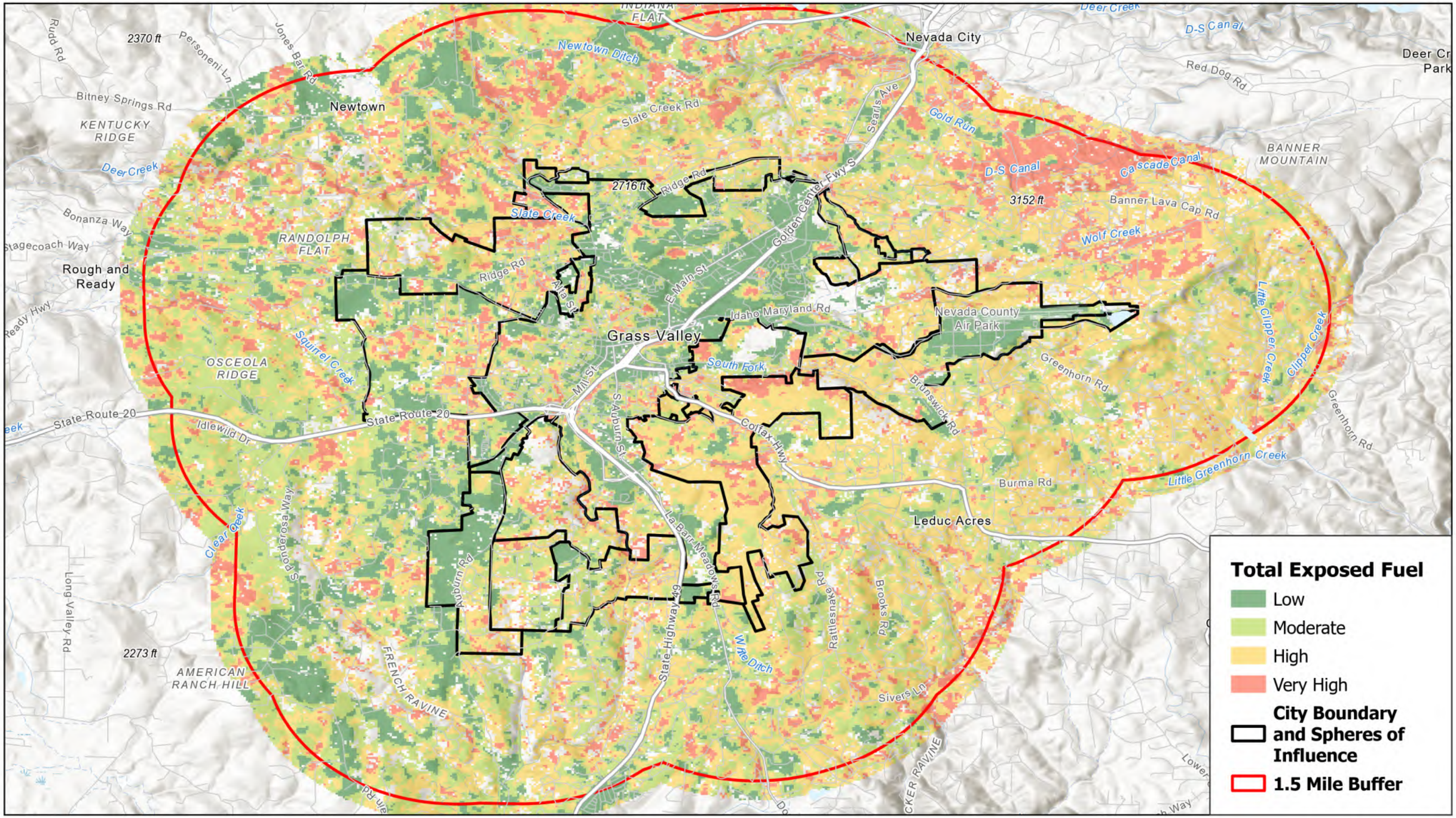


Figure 12. Assessment Area Exposed Fuel

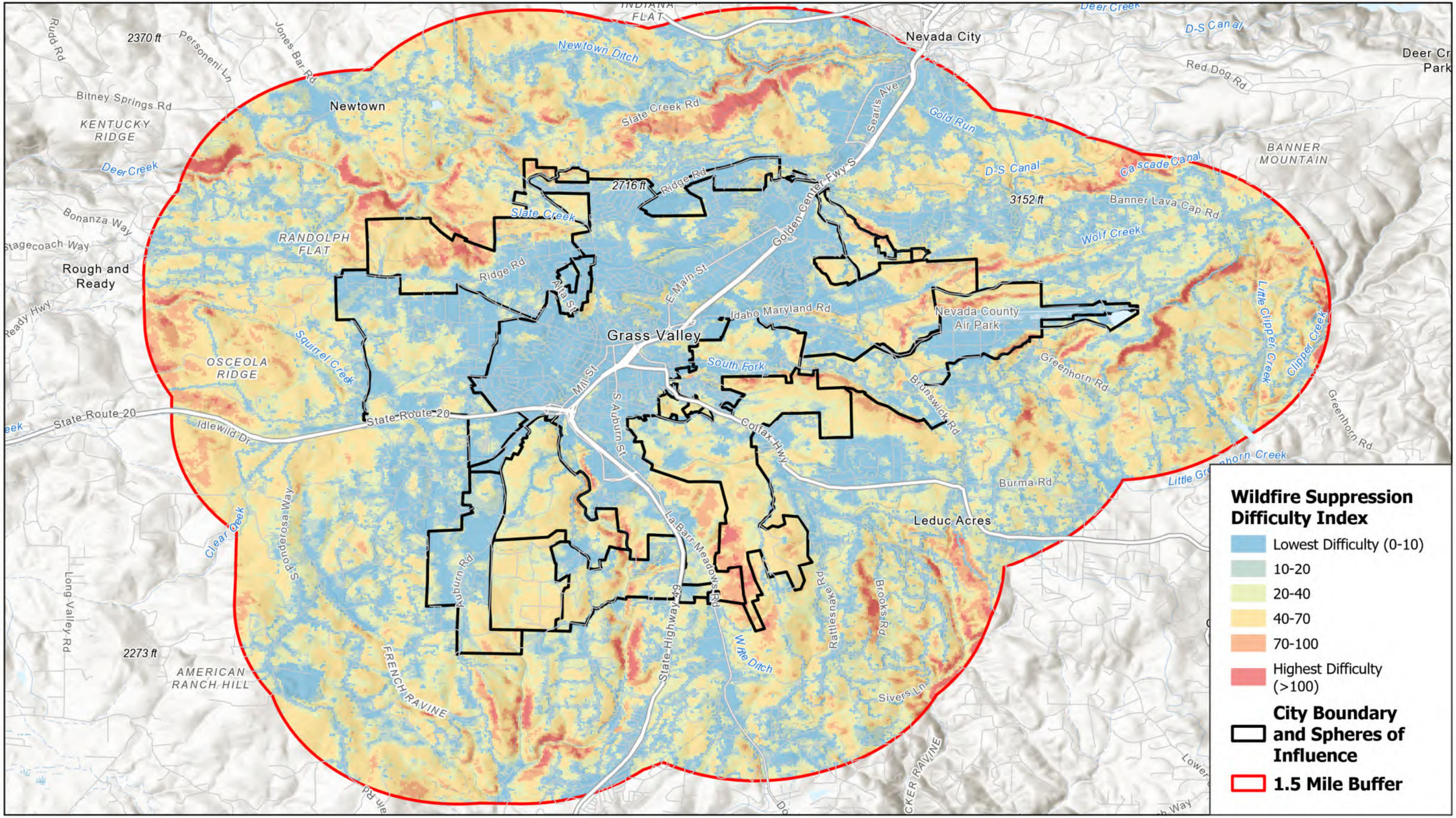


Figure 13. Assessment Area Wildfire Suppression Difficulty

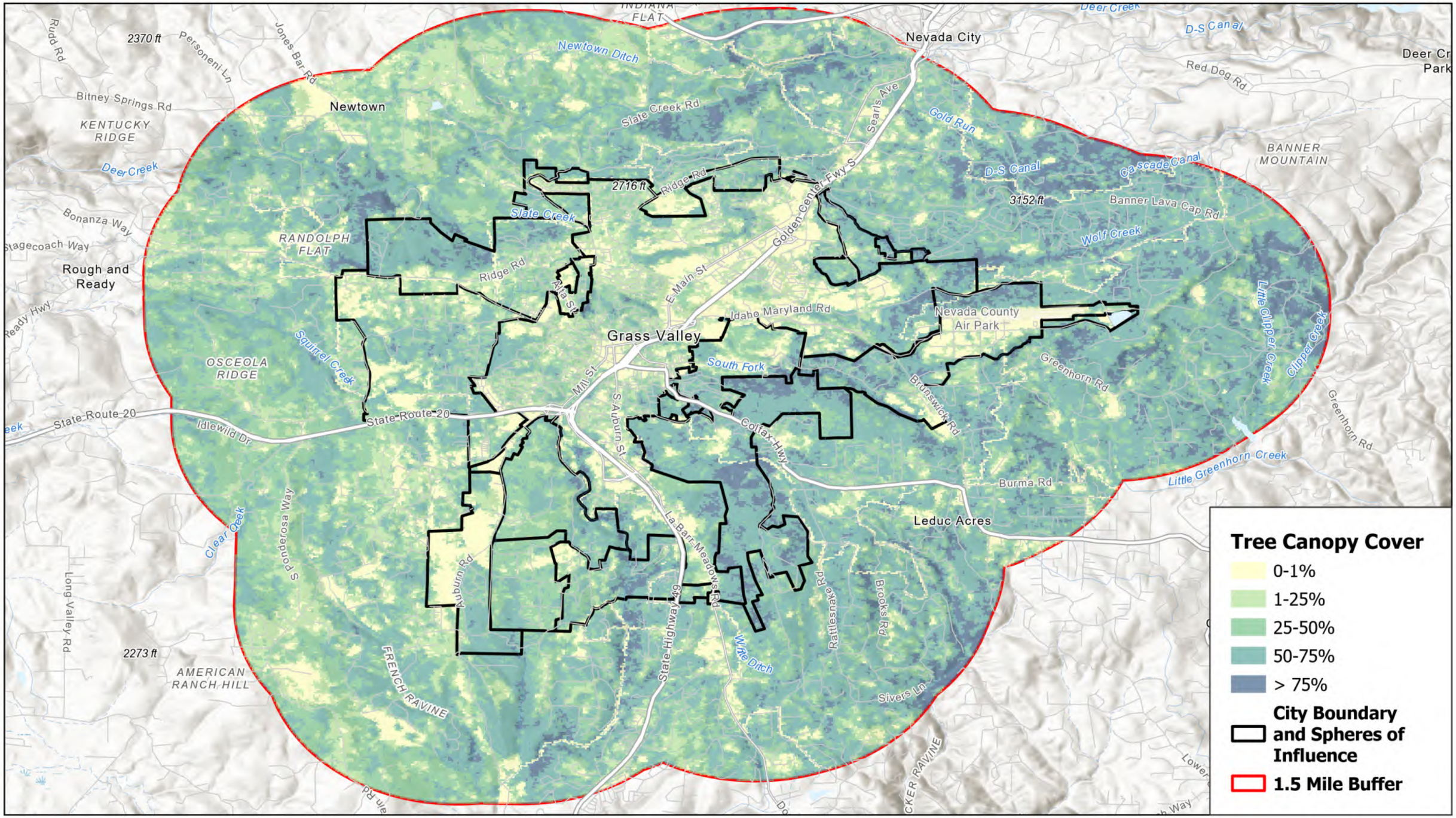


Figure 14. Assessment Area Tree Canopy Cover

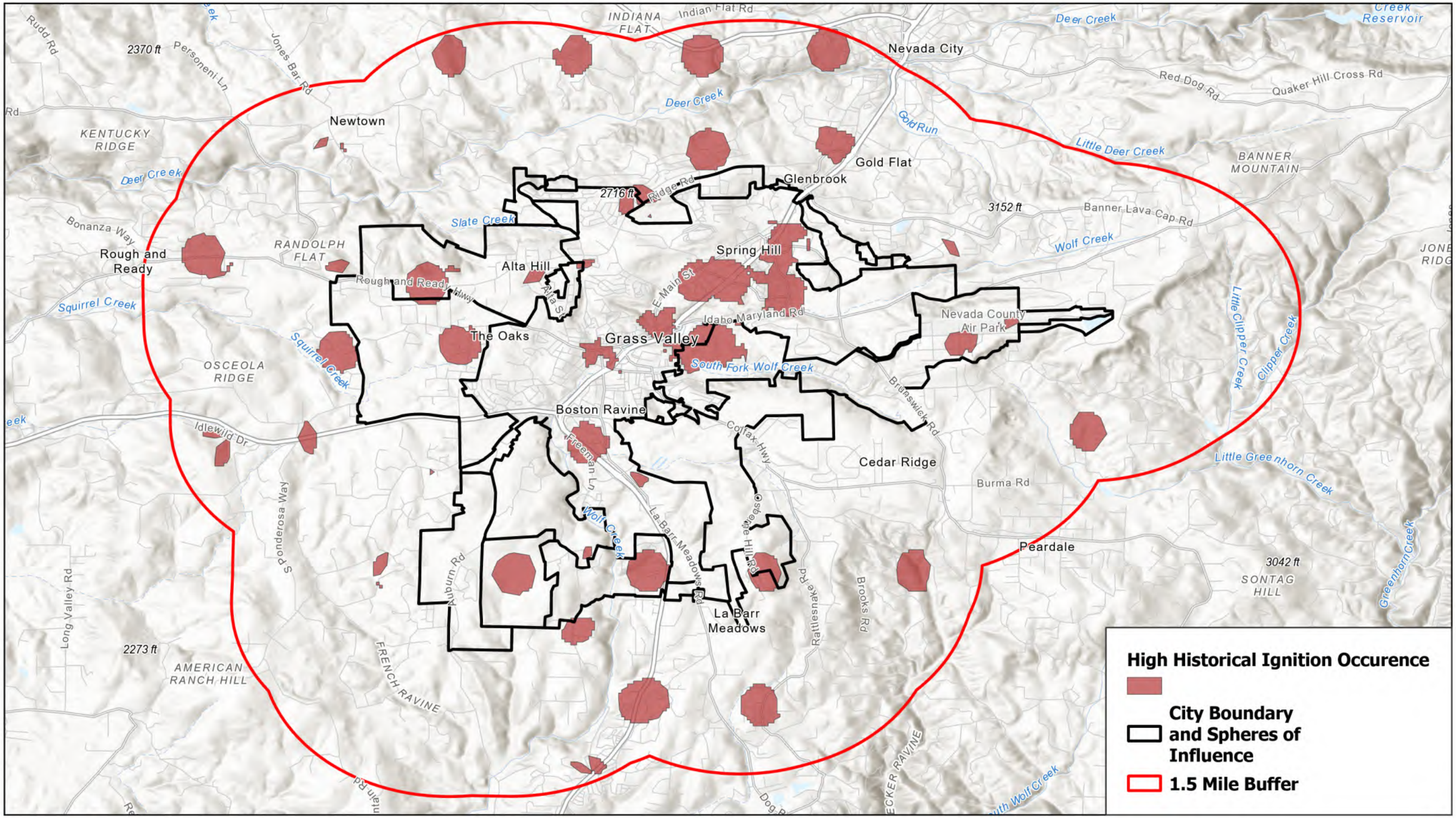


Figure 15. Assessment Area High Historical Ignition Locations

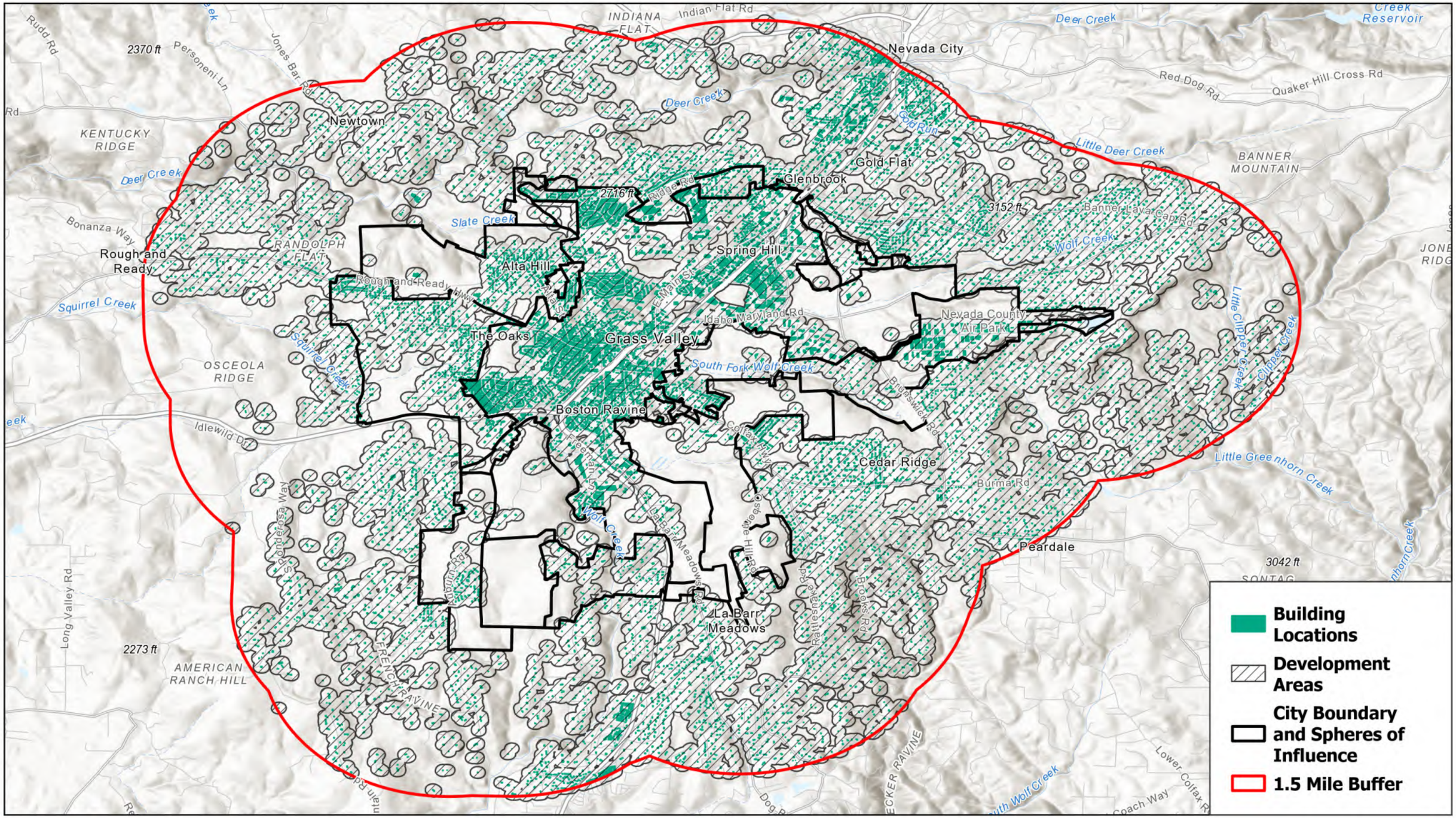
2.2 Risk Assessment

Wildfire risk for the assessment area focused on risk to developed areas, specifically, the area occupied by and adjacent to buildings (structures). To evaluate wildfire risk in the assessment area, the hazard input data sets (described above) were further analyzed and processed in GIS, as described below:

- The assessment area's development area (structure locations) was mapped and delineated.
- Hazard data set values were assigned a scale ranking value (between 1-4, where 1 represented lowest relative risk and 4 represented highest relative risk) to further refine their contribution to wildfire risk to developed areas (e.g., extreme fire behavior proximate to developed areas received a scale ranking of 4 and extreme fire behavior further from developed areas received a ranking of 1). A ranked GIS data layer was generated for each.
- Ranked hazard data set layers were assigned a weighting value of 1-4 (where 1 represented lowest relative risk to developed areas and 4 represented highest relative risk to developed areas). A weighted GIS data layer was generated for each.
- A GIS overlay analysis procedure was run on all the weighted GIS data layers to generate a single Composite Wildfire Risk layer for the assessment area. The Composite Wildfire Risk layer represents risk to developed areas and was categorized into five relative risk ratings. The risk ratings are relative, meaning the categories were assigned according to the maximum and minimum risk ratings observed throughout the assessment area.

2.2.1 Development Areas

Accurate mapping of developed areas was needed to effectively identify areas that are subject to risks from wildfire. Building footprint mapping data (Microsoft 2022) was used to determine the development area within the assessment area. This dataset is a collection of high-quality building footprints generated using AI and computer vision techniques. Building footprints were clipped to the assessment area boundary then visually compared with digital aerial imagery in a GIS to confirm data accuracy. No building footprint omissions or errors were observed during the visual assessment. Building footprints were then buffered by 300 feet using GIS tools to create the development area layer. The development area represents the area of land within 300 feet of structures, inclusive of building footprints. Development areas within the assessment area are presented in Figure 16.



DUDEK

Figure 16. Assessment Area Building and Development Areas

2.2.2 Extreme Fire Behavior

Areas with modeled flame lengths greater than or equal to 8 feet were aggregated with areas where crown fires were modeled to create a GIS layer representing extreme fire behavior for the assessment area. The extreme fire behavior areas data was then buffered outward to 1,000 feet. Finally, this data was assigned a relative risk ranking value between 1 and 4 based on buffer distance and a new GIS layer (Proximity to Extreme Fire Behavior layer) was created. Table 9 presents the assigned relative risk ranking values.

Table 9. Development Area Proximity to Extreme Fire Behavior Ranking

Buffer Distance	Assigned Ranking Value
<200 feet	4
>200-350 feet	3
>350-1,000 feet	2
>1,000 feet	1

2.2.3 Ember Load

The Conditional Ember Load Index dataset was clipped to the development area boundary. This data was then assigned a relative risk ranking value between 1 and 4 based on the percent of maximum ember observed within development areas, and a new GIS layer (Ember Load layer) was created. Table 10 presents the assigned relative risk ranking values.

Table 10. Conditional Ember Load Index Ranking

Ember Load Classification	Assigned Ranking Value
Low (<25%)	1
Moderate (25-50%)	2
High (50-75%)	3
Very High (>75%)	4

2.2.4 Hazardous Fuels

This dataset was clipped to the assessment area and hazardous fuels ranked in the 75th percentile and greater were selected. The selected hazardous fuels data was then buffered outward to 1,000 feet. Finally, this data was assigned a relative risk ranking value between 1 and 4 based on buffer distance and a new GIS layer (Proximity to Hazardous Fuels layer) was created. Table 11 presents the assigned relative risk ranking values.

Table 11. Development Area Proximity to Hazardous Fuels Ranking

Buffer Distance	Assigned Ranking Value
<200 feet	1
>200-350 feet	2
>350-1,000 feet	3
>1,000 feet	4

2.2.5 Wildfire Suppression Difficulty

This dataset was clipped to the development area and relative risk ranking values between 1 and 4 were assigned based on the data set ranges. A new GIS layer (Wildfire Suppression Difficulty layer) was created. Table 12 presents the assigned relative risk ranking values.

Table 12. Wildfire Suppression Difficulty Ranking

Wildfire Suppression Difficulty Range	Assigned Ranking Value
0-20 (Lowest Difficulty)	1
>20-40	2
>40-100	3
>100 (Highest Difficulty)	4

2.2.6 Urban Tree Canopy Cover

This dataset was clipped to the development area and relative risk ranking values between 1 and 4 were assigned based canopy cover percentage. A new GIS layer (Urban Tree Canopy Cover layer) was created. Table 13 presents the assigned relative risk ranking values.

Table 13. Urban Tree Canopy Cover Ranking

Canopy Cover Percentage	Assigned Ranking Value
0-25%	1
>25-50%	2
>50-75%	3
>75-100%	4

2.2.7 Ignition Density

Areas representing higher historical ignition occurrences were extracted and assigned a ranking value of 4. All other areas were not assigned a risk score. A new GIS layer (Ignition Density layer) was created.

2.2.8 Composite Wildfire Risk

To develop the Composite Wildfire Risk layer for developed areas, the initial step was to assign weighting values to each ranked fire hazard layer (discussed in previous sections). As with the scale ranking, the weighting values used were between 1 and 4, where 1 represented lowest relative risk and 4 represented highest relative risk. Weighting value assignments for each ranked hazard data layer are presented in Table 14.

Table 14. Fire Hazard Data Layer Weighting Values

Ranked Hazard Data Layer	Weighting Value
Proximity to Extreme Fire Behavior	4
Ember Load	3
Proximity to Hazardous Fuels	2
Wildfire Suppression Difficulty	1.5
Urban Tree Canopy Cover	1
Ignition Likelihood	1

Following the assignment of weighting values, all six weighted data layers were overlayed in a GIS to create the Composite Wildfire Risk layer for developed areas. This layer was then classified into five Relative Risk Rating categories, as presented in Table 15.

Table 15. Composite Wildfire Risk Layer Classifications

Percent of Maximum	Relative Risk Rating
Minimum Value	Low
5th Percentile	Moderate
20th Percentile	High
60th Percentile	Very High
>60th Percentile	Extreme

It should be noted that the risk ratings presented in Table 15 are relative, and risk scores are assigned according to the maximum and minimum risk scores observed throughout the assessment area. For example, areas mapped as Low and Moderate risk may be subject to impacts from wildfire especially considering risk associated with airborne embers. However, these impacts were modeled to be less severe than those modeled and rated as High to Extreme. The Composite Wildfire Risk layer for developed areas within the entire assessment area is presented in Figure 17. Additionally, the Composite Wildfire Risk layer for developed areas was clipped to the City of Grass Valley and the City Sphere of Influence boundary. A map depicting this layer is presented in Figure 18. Finally, a map depicting the Composite Wildfire Risk layer for developed areas clipped to the City of Grass Valley and the City Sphere of Influence boundary and representing only Very High and Extreme relative risk ratings is presented in Figure 19.

2.3 Model Results

Relative wildfire risk results for developed areas within the entire assessment area are presented in Table 16. Areas of High, Very High, and Extreme relative risk cover 19,428 acres, or 77% of developed areas. Alone, areas classified as Extreme risk cover 9,124 acres, or 36% of developed areas. Low and Moderate risk areas encompass 1,835 acres, roughly 8% of the developed area.

Table 16. Relative Risk Ratings for Developed Areas within the Assessment Area

Relative Risk Rating	Acres	Percent of Assessment Area
Low	149	<1%
Moderate	1,686	7%
High	3,370	13%
Very High	6,934	28%
Extreme	9,124	36%
Non-developed Area	12,207	15%

Relative wildfire risk results for developed areas only within the City of Grass Valley and the City Sphere of Influence are presented in Table 17. Areas of High, Very High, and Extreme relative risk cover 527 acres, or 36% of development areas within the City and City Spheres of Influence. Areas classified as Extreme relative risk account for 1,613 acres, or 16% of development areas in this area. Low and Moderate risk areas encompass 1,405 acres, roughly 14% of this area.

Table 17. Relative Risk Ratings for Developed Areas within the City of Grass Valley and the City Sphere of Influence

Relative Risk Rating	Acres	Percent
Low	122	1%
Moderate	1,284	13%
High	1,071	11%
Very High	1,843	19%
Extreme	1,613	16%
Non-developed Area	3,924	40%

Generally, Low and Moderate relative risk areas exist within the urbanized core of the City, with higher risk areas commonly observed along the perimeter edges of the City. Areas of special concern within the City and the City Spheres of Influence include areas with high concentrations of Very High and Extreme relative wildfire risk. These areas are presented graphically in Figure 19 and listed below:

- Communities surrounding Condon Park
- The area near Doris Drive, Hill Street, Washington Street, and Bragg Avenue
- The Empire Mine State Historic Park area, including developed areas north and west of the park
- The Oaks community area
- Communities near East Bennett and Brunswick Roads
- Communities near Bubbling Wells Road
- The community north of Dorsey Drive and immediately east of Highway 20
- Communities near the Slate Creek drainage
- Communities near Crestview Drive, Smith Road, Elder Drive, near Ellens and Wolf Creek

- Communities near Manor Drive, Glenbrook Drive, and Apple Avenue

Wildfire hazard in the assessment area and its corresponding wildfire risk is dynamic and influenced by multiple factors, such as terrain, vegetation and fuels, weather conditions, and developed area proximity to areas presenting high wildfire hazard. Wildland urban interface/intermix areas exist extensively, covering 63% of the assessment area. These areas experience the highest relative risk from wildfire due to their proximity to vegetation conducive to wildfire ignition and spread. As described, extreme wildfire behavior is anticipated to occur in many areas throughout the assessment area, influenced by steep terrain and heavy fuel loads. Additionally, the assessment area is subject to frequent wildfire ignitions and has experienced several wildfires in recent years including the Bennett, Jones, and McCourtney Fires.

As discussed, 77% of development areas within the assessment area were classified as either High, Very High, or Extreme relative wildfire risk. Therefore, it is recommended that the community take a proactive approach to wildfire risk reduction, especially those located in the areas identified above. A list of potential wildfire risk reduction approaches is also provided in Section 3.

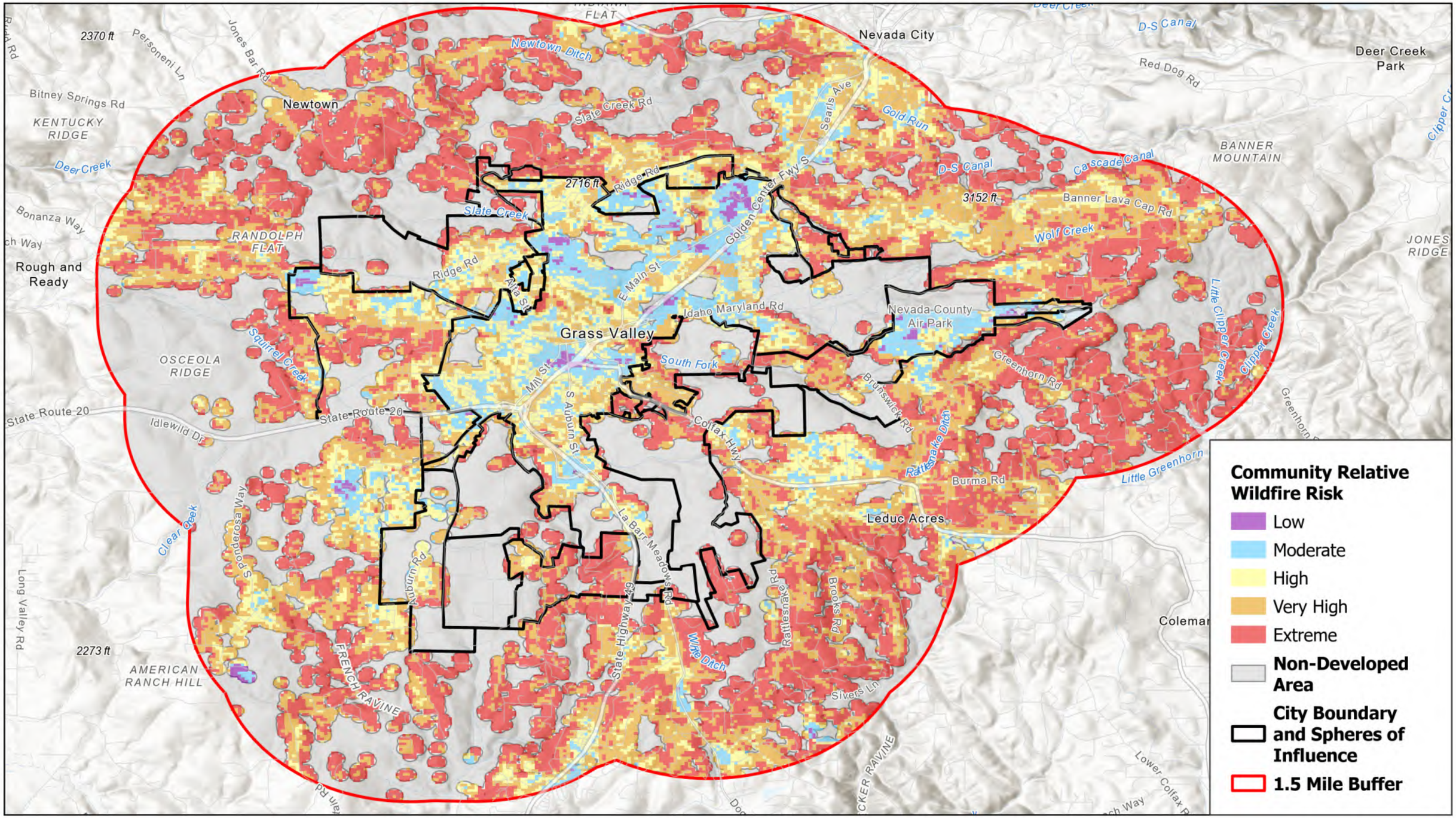
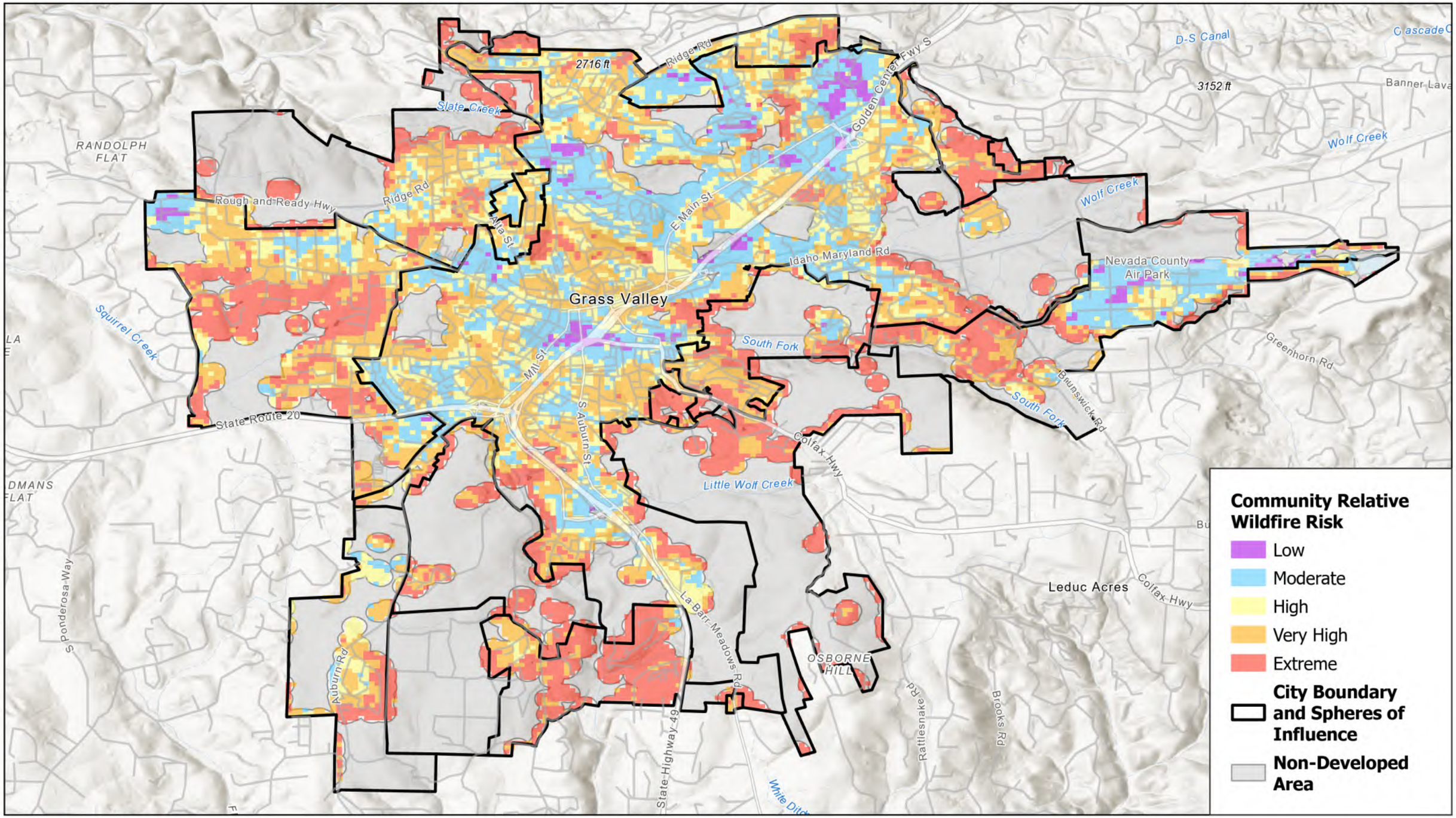


Figure 17. Assessment Area Community Relative Wildfire Risk



DUDEK

Figure 18. Grass Valley and Spheres of Influence Community Relative Wildfire Risk

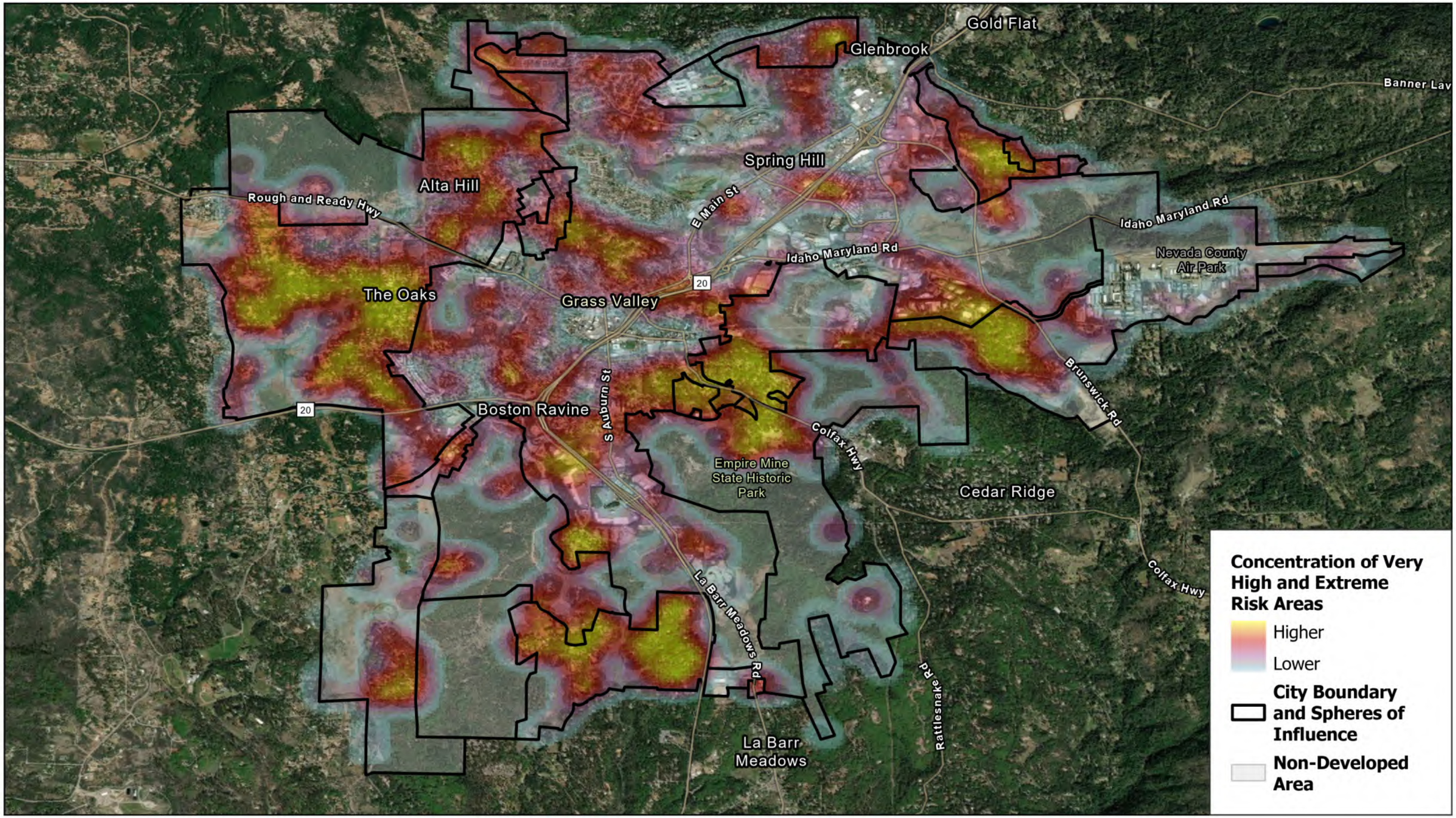


Figure 19. Grass Valley Areas of Very High and Extreme Relative Wildfire Risk

3 Potential Wildfire Risk Reduction Approaches

The following sections identify potential approaches that can be implemented to reduce wildfire risk to the community. Further analysis and detailed planning, permitting, environmental review, and community outreach regarding specific projects may be necessary.

3.1 Reducing Structural Ignitability

Terrain, vegetation, and climatic conditions in the assessment area combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires. There are two main components to reducing structural ignitability: structural hardening and defensible space. The following sections identify actions that can be implemented by homeowners on private properties to reduce the potential for structure ignitions.

3.1.1 Structural Hardening

The main way in which structures ignite is via direct fire exposure (flame impingement, convection, radiation) or via ember exposure (Maranghides et al. 2022). To reduce structural ignitability, efforts need to address direct fire and ember exposure (Maranghides et al. 2022). Addressing structural ignition potential is an effective mitigation strategy for preventing wildfires and increasing WUI ignition resistance (Zhou 2013). Research has found that structural characteristics, especially roofing, play a significant role in reducing structural vulnerability to fire and the likelihood of burning (Bracmort and Gorte 2012; Kolden and Henson 2019; Manzello et al. 2011; Zhou 2013). Further, reducing a structure's likelihood of ignitions reduces the risk for individual homeowners and the risk associated with fire spreading to other homes and wildland areas (Mockrin et al. 2020).

Although fire-resistant construction standards are mandatory for new buildings in the assessment area, hardening of existing structures is voluntary. Hardening of the homes and other structures to enhance survivability during a wildfire would include retrofitting the most vulnerable home features, including roofs, vents, eaves and soffits, windows, walls, decks, rain gutters, patio covers, chimneys, garages, and fences. Adopting mandatory home hardening provisions of building and fire codes is problematic because existing, nonconforming structures were typically approved and built to the codes in effect at the time of construction. A burning structure contributes to wildfire spread via radiant heat generation (to nearby structures) and ember generation (to downwind structures). Retrofits to existing structures can reduce fire risk, and some cost-sharing and grant programs are available to offset costs. Resources for hardening structures can be found on the following websites:

- Wildfire Home Retrofit Guide
- Protect Your Property from Wildfire
- Prepare for Wildfire
- Low Cost Retrofit List
- Preparing Your Home

3.1.2 Defensible Space

Reducing structure exposure to wildfire is also achieved via vegetation management in defensible space areas. The following three zones are identified for defensible space areas. Recommendations for management actions that can be taken by homeowners in each of these zones can be found on Grass Valley's website at https://www.cityofgrassvalley.com/post/defensible-space.

- **Zone 0 (0–5 feet):** Zone Zero, sometimes referred to as the "Ember Resistant Zone," is the area nearest the house and includes the surfaces of the structure itself, vegetation, equipment, outdoor furniture, toys, or anything else that can be ignited by embers. No vegetation or combustible items are recommended within this zone to avoid ignitions from windblown embers landing on or near the structure. Clear soil, rocks, gravel, or concrete should be used instead of landscape mulch or wood chips. This area is especially crucial since research from the Insurance Institute for Business and Home Safety (IBHS) shows that the first 0 to 5 feet around the house has the greatest impact on reducing the risk of losing a home to wildfire.
- **Zone 1 (5–30 feet):** Zone 1, sometimes referred to as the "Home Protection Zone," extends from 5 feet from the structure to 30 feet. This zone should be designed to create and maintain a landscape that, if ignited, will not transmit fire to the home. This includes having a minimum planting zone with low density planting to medium density planting as you move farther away from the structure. Depending upon the type of wildland vegetation in the area and the steepness of the slope, this zone should have an area at least 30 feet wide (50 feet for slopes above 20%) that is lean, clean, and green. Trees should be spaced to allow minimum 10' clearance to structure at full maturity.
- **Zone 2 (30–100 feet):** Zone 2, sometimes referred to as the "Reduced Fuel/Thinning Zone," extends from 30 feet to at least 100 feet. This zone also serves as a connection to the natural environment in promoting habitat restoration while eliminating continuous, dense vegetation, to decrease the energy and speed of a wildfire. To help with this function, vegetation should not be removed to the bare soil, and use of heavy equipment on hillsides should be avoided as they can cause soil erosion and mudslides.

3.2 Vegetation Management

Vegetation management actions outside of defensible space areas may be conducted by fire and land management agencies for the purposes of wildfire risk reduction. A list of potential vegetation management practices is provided below. Project type (e.g., roadside fuel reduction, shaded fuel break, invasive species treatment), location, and treatment prescriptions would need to be determined and planned to meet overall project objectives. Coordination with agencies and landowners and completion of environmental review and agency permitting would also be necessary.

- **Grazing.** Grazing is a method of using livestock to reduce fine fuel loading of live herbaceous growth, shrubs, and new growth of trees. Livestock, such as goats or sheep, browse on grasses, forbs, shrubs, and fresh growth of young trees, thereby removing vegetation from the overall fine fuel load of the site. Grazing is effective in managing fine fuels and preventing the expansion of brush into grasslands. Livestock have different grazing habits, and not all livestock are ideally suited for grazing treatments. Most livestock, with the exception of goats, do not consume live or dead, tough, woody plant material in significant quantity because this material is generally unpalatable. Additionally, livestock does not effectively create fuel breaks, but is well-suited to initiate access to a site for hand crews or to maintain new annual growth.

- **Manual Treatments.** Manual techniques involve pruning, cutting, or removing trees or other forest vegetation by hand or manual equipment. Manual treatments involve removing dead wood, piling material, lopping and scattering, and spreading chips/mulch. Lopping and scattering is the process of breaking down vegetative material into smaller pieces, usually with a chainsaw, and scattering (as opposed to concentrating) the material across the treatment area. Manual treatment is most effective in small treatment areas or areas with difficult access where using heavy equipment is infeasible. Manual treatment also allows for selective management or targeted vegetation removal and is typically used in conjunction with other techniques. Proper hand crew training and supervision is necessary to reduce danger to workers using sharp tools on steep and/or unstable terrain, or where other environmental hazards exist. Hand tools include chain saws, shovels, Pulaski hoes, McLeod fire tools, line trimmers, weed wrenches, pruning shears, and loppers. Personal protection equipment typically includes long pants and long-sleeved shirts, gloves, safety goggles, hard hats, chaps, and sturdy boots.
- **Mechanical Treatments.** Mechanical practices include all methods employing motorized heavy equipment to remove or alter vegetation. Mechanical practices rearrange vegetation structures; compact or chip material; and move material to landings, staging areas, or burn piles. Mechanical equipment typically uses rubber tires or tracks, although skids and cables are also used. In some instances, two or more pieces of equipment work in concert to achieve a management standard. Mechanical equipment includes masticators, tractors, skid-steers, chippers, mowers, grinders, crushers, and skidders. Mechanical treatments are commonly used to create fuel breaks, which are wide strips of land where vegetation management has occurred so that wildfires burning into them can be more easily controlled. Fuel breaks are not intended to stop fire spread, especially where embers can be transported via strong winds over the fuel break, but rather to modify fire behavior and enhance firefighting capabilities.
- **Prescribed Fire.** Prescribed fires reduce fuel volume through combustion and are permitted under specific regulations when conditions permit adequate combustion and fire control. Prescribed fires use planned activities with low- to moderate-intensity fire and defined goals. Prescribed fires are performed in conjunction with specific land management objectives, such as reducing fuel loads, increasing overall forest or habitat health, and/or protecting communities from wildfire (USDA 2022). Prescribed fires can accomplish land management objectives to control undesirable vegetation, prepare sites for harvesting/seeding, control plant pathogens and pests, improve wildlife habitat, improve plant production or quality, remove debris, restore ecological sites, and maintain native plans diversity and composition. Prescribed fires can occur in small, designated areas or over larger expanses. Two types of prescribed fire, pile burning and broadcast burning, are often implemented in conjunction with manual treatment and mechanical treatment methods as a means of treating vegetative debris, or to enhance effectiveness in advance of an herbicide treatment.
- **Chemical Techniques.** Chemical applications use herbicides to kill vegetation or prevent growth and are typically used in combination with other fuel reduction treatments. Herbicides do not remove vegetation from treatment areas; therefore, dead plant material remains without further treatment (except in cases where pre-emergent herbicides are used to control annual plants). Herbicide application is typically performed by hand and may include sponging, spraying, or dusting chemicals onto undesirable vegetation. Hand application provides flexibility and is ideally suited for small treatment areas. Roadside herbicide application may employ a boom affixed to or towed behind a vehicle. Herbicide application requires specific storage, training, and licensing to ensure safe use.

3.3 Community Outreach and Education

Community outreach and education is an important component in community wildfire hazard reduction efforts. Such efforts increase the community's knowledge and awareness of wildland fire, can assist in prevention and preparedness efforts, and are an important component in planning and implementing vegetation management projects. Following are examples of community outreach programs:

- **Ready, Set, Go!:** The Ready Nevada County website (https://readynevadacounty.org/) breaks down wildfire preparedness into three actions—Ready, Set, Go—with resources provided for approaching each action. The County provides a handbook of these actions at:

  https://www.nevadacountyca.gov/DocumentCenter/View/44617/2022-Ready-Nevada-County-Handbook-PDF
- **City of Grass Valley Emergency Preparedness Guide:** This brochure provides general guides and best practices for emergency preparedness, particularly wildfire emergencies. Topics covered include emergency planning, defensible space and vegetation management, and evacuation planning. This educational brochure can be downloaded at the following link:

  https://www.cityofgrassvalley.com/sites/main/files/file-attachments/emergency_prep_brochure_2019_grs_v.5.pdf?1582814072
- **Nevada County Emergency Preparedness Toolkit:** The County compiled a toolkit that residents may visit to find educational resources related to wildfire preparedness topics: Emergency Preparedness, Emergency Alerts, Defensible Space Resources, Wildfire Research Fact Sheets, and a YouTube playlist of informational videos from Ready Nevada County. https://www.nevadacountyca.gov/2792/Preparedness-Toolkit
- **Ready Nevada County Dashboard**: This dashboard an interactive informational tool to be used before, during and after a major event. This tool provides real time updates on Red Flag Warnings, Evacuation Warning & Order Areas, Community Reverse 911 messages, weather, Public Safety Power Shutoff information and more:

  https://nevcounty.maps.arcgis.com/apps/MapSeries/index.html?appid=dfae8e3b36e3455bbf9dcc865349e72e
- **CodeRED:** CodeRED is an opt-in notification system used by the County of Nevada to notify residents in an emergency. These alerts may be received as text, email, landline, cell phone, and TTY. Message and data rates may apply to sent and/or received texts. Interested residents may opt-in at:

  https://public.coderedweb.com/CNE/en-US/CA8B57E20D17.
- **Genasys Protect (formerly Zonehaven):** The City of Grass Valley and Nevada County adopted Genasys Protect (formerly Zonehaven) to provide specific, timely and accurate information regarding evacuations. Genasys Protect divides geographic regions into smaller zones, based on several factors, and is accessible online. CodeRED is Nevada County's Emergency Alert System and has the capacity to relay evacuation information during a wildfire event. Community members can access Genasys Protect online to view current evacuation orders by zone using the interactive map feature accessible at the following link:

  https://protect.genasys.com/zones/US-CA-XNE-GRS-E222?z=13.184711644240117&latlon=39.22087118546949%2C-121.04232317608148
- **Defensible Space Inspection Request**—The County and Ready Nevada County jointly administer the County's Defensible Space Inspection Program to educate residents on defensible space requirements and home hardening principles. Embers are the number one cause of structure ignition during wildfire, and a

coupled approach of creating effective defensible space with focused home hardening retrofits can increase a structures likelihood of surviving a wildfire. Property owners or occupants can request a defensible space inspection by going to https://nevadacounty.jotform.com/231176343180046

- **Red Flag Warnings.** A Red Flag Warning means that critical fire weather conditions are either occurring now or will shortly. A combination of strong winds, low relative humidity, and warm temperatures can create extreme fire behavior. The National Weather Service provides daily fire weather forecasts in coordination with local fire agencies. The Red Flag Warning program enables firefighting agencies to manage critical resources and prepare appropriate suppression responses for protecting life and property. Red Flag Warnings are typically issued within 24 hours of an impending critical fire weather event. Residents can sign up for Sever Weather Alerts at:

  https://www.weather.gov/enterprise/

- **Firewise Communities.** The Firewise USA recognition program,[1] administered by the National Fire Protection Association, promotes collaboration within communities to organize and improve the ignition resistance of homes and communities. Communities can receive a Firewise Community designation through the California Office of the State Fire Marshal's Community Wildfire and Preparedness and Mitigation Division. In addition to financial support for conducting risk reduction projects, homeowners living within a Firewise Community are qualified to receive insurance discounts with the California Fair Plan. Thirteen Firewise Communities existing within or partially within the City or the City Sphere of Influence.

3.4 Additional Wildfire Risk Reduction Approaches

The following techniques may minimize ignition potential, reduce risks to assessment area assets and resources, and/or alter vegetation conditions within suitable areas identified in this assessment as demonstrating high fire probability:

- **Post-Fire Vegetation Management**: Treatment in burned areas to promote forest canopy re-growth. Work may include removal or treatment of dead/dying trees, brush, and exotic or invasive weeds or other vegetation.
- **Reforestation/Tree Planting**: Planting trees or shrubs to achieve management goals may include restoration of degraded areas, wind flow alteration, ember defense, and increased ground surface shading.
- **Invasive Species Removal**: Removal and treatment of invasive plants that displace native species and/or increase fire hazards via high fuel loading rates or increased ignitability and flammability.
- **Fire Road Maintenance**: Minor grading or natural material resurfacing to ensure fire agency apparatus can drive on existing fire access roads.
- **Roadside fuel management:** vegetation management along key roadways that may be needed during evacuations and are exposed to natural fuel beds should be treated to reduce the potential that the roadway is compromised by fire. Thinning and selective plant removal, from 50 to 100 feet wide on both edges of key evacuation routes in high fire burn probability areas is prudent.
- **Ignition and Spread Prevention:** Modifications including flashy fuel treatment, restoration, ignition-resistant mat installation, and use restrictions (e.g., no parking).

[1] https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA

- **Structural Hardening**: Efforts to reduce structure ignition via radiant heat, direct flame impingement, or ember intrusion (e.g., installation of dual-pane windows, replacement of combustible roof materials, installation of ember-resistant attic vents).
- **Community Outreach**: Public education and engagement to raise wildfire risk awareness and encourage wildfire risk reduction efforts (e.g., maintenance of defensible space, participation in chipper programs).
- **Utility Hardening/Undergrounding**: Moving overhead powerlines below ground, or retrofitting overhead power line networks to minimize arcing, conductor contact, and other hazards.
- **Patrols**: Patrolling fire hazard areas to deter, detect, and report fire starts.
- **Inspection/Monitoring**: Conducting defensible space or structural hardening inspections or monitoring open space areas for trespass or fire activity.
- **Chipper Program**: Providing chippers to incentivize fuels reduction and defensible space maintenance work on residential properties.
- **Infrastructure**: Equipment purchase, installation, permitting, and maintenance intended to alert the communities about wildfires (e.g., fire detection cameras), or provide data to fire managers (e.g., remote automated weather stations).

INTENTIONALLY LEFT BLANK

4 References

Andrews, P.L., C.D. Bevins, and R.C. Seli. 2008. "BehavePlus Fire Modeling System, Version 3.0: User's Guide." USDA Forest Service General Technical Report RMRS-GTR-106 Ogden, Utah.

Bracmort, K and R. Gorte. 2012. "Federal Funding for Wildfire Control and Management" [PDF]. Updated February 13, 2012. Congressional Research Service Report RL33990. Accessed September 2022. https://crsreports.congress.gov/product/pdf/RL/RL33990

CAL FIRE. (California Department of Forestry and Fire Protection). 2023a. Fire and Resource Assessment Program. GIS Data Set: FHSZ in SRA. https://hub-calfire-forestry.hub.arcgis.com/datasets/CALFIRE-Forestry::fhsz-in-sra/explore

CAL FIRE. 2023b. Fire and Resource Assessment Program. GIS Data Set: FHSZ in LRA. https://hub-calfire-forestry.hub.arcgis.com/datasets/CALFIRE-Forestry::fhsz-in-lra/explore?location=37.178126%2C-120.206150%2C7.05

CAL FIRE. 2023c. Fire and Resource Assessment Program. GIS Data Set: Fire Perimeters. https://hub-calfire-forestry.hub.arcgis.com/datasets/CALFIRE-Forestry::california-fire-perimeters-1950/explore.

County of Nevada. 2017. "Nevada County Local Hazard Mitigation Plan Update. August 2017." Accessed September 20, 2023. https://www.nevadacountyca.gov/DocumentCenter/View/19365/Nevada-County-LHMP-Update-Complete-PDF

Dettinger, Michael, Holly Alpert, John Battles, Jonathan Kusel, Hugh Saford, Dorian Fougeres, Clarke Knight, Lauren Miller, Sarah Sawyer. 2018. Sierra Nevada Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-004. https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-004_SierraNevada_ADA.pdf

IBHS (Insurance Institute for Business and Home Safety). 2020. "Embers Cause Up to 90% of Home & Business Ignitions During Wildfire Events". https://ibhs.org/ibhs-news-releases/embers-cause-up-to-90-of-home-business-ignitions-during-wildfire-events/

Kosco, B. H. 1980. Combining forage and timber production in young-growth mixed conifer forest range Ph.D. Dissertation, Univ. of California, Berkeley.

Kolden, C.A. and C. Henson. 2019. "A socio-ecological approach to mitigating wildfire vulnerability in the wildland urban interface: a case study from the 2017 Thomas fire." *Fire. 2*(1), 9.

Manzello, S.L., S.H. Park, S. Suzuki, J.R. Shields, and Y. Hayashi. 2011. "Experimental investigation of structure vulnerabilities to firebrand showers." *Fire Safety Journal.* 46(8), 568–578.

Maranghides, A., E. Link, S. Nazare, S. Hawks, J. McDougald, S. Quarles, and D. Gorham. 2022. "WUI Structure/Parcel/Community Fire Hazard Mitigation Methodology" [PDF]. National Institute of Standards and Technology, U.S. Department of Commerce. NIST Technical Note 2205. March 2022. Accessed September 29, 2022. https://doi.org/10.6028/NIST.TN.2205

Microsoft. 2022. Microsoft Building Footprints. https://hub.arcgis.com/datasets/esri::microsoft-building-footprints-features/about.

Mockrin, M.H., H.K. Fishler, and S.I. Stewart. 2020. "After the fire: Perceptions of land use planning to reduce wildfire risk in eight communities across the United States." *International Journal of Disaster Risk Reduction*. 45, 101444.

NFPA (National Fire Protection Association). 2011. "Understanding Fire Behavior in the Wildland/ Urban Interface." Accessed December 11, 2023. https://youtu.be/pPQpgSXG1n0.

National Interagency Fire Agency (NIFC), 2023. *Wildland Fire Incident Locations*. https://data-nifc.opendata.arcgis.com/search?tags=Category%2Chistoric_wildlandfire_opendata

NWCG (National Wildfire Coordinating Group). 2023. "NWCG Glossary of Wildland Fire, PMS 205." Accessed December 2023. https://www.nwcg.gov/glossary/a-z

OSFM (Office of the State Fire Marshal). 2023. Fire Hazard Severity Zones. https://osfm.fire.ca.gov/what-we-do/community-wildfire-preparedness-and-mitigation/fire-hazard-severity-zones

Pyrologix. 2021. Contemporary wildfire hazard across California. https://pyrologix.com/reports/Contemporary-Wildfire-Hazard-Across-California.pdf

Rothermel, R.C. 1993. *How to Predict the Spread and Intensity of Forest and Range Fires.* General Technical Report INT-143. Ogden, Utah: U.S. Forest Service, Intermountain Forest and Range Experiment.

Roussopoulos, P.J., and V.J. Johnson. 1975. *Help in Making Fuel Management Decisions*. Research Paper NC-112. St. Paul, Minnesota: U.S. Forest Service, North Central Forest Experiment Station.

Rundel, P. W., D. T. Gordon, and D. J. Parsons. 1977. Montane and subalpine vegetation of the Sierra Nevada and Cascade Ranges. Pages 559-599 In M. G. Barbour and J. Major, eds. Terrestrial vegetation of California. John Wiley and Sons, New York.

Scott, J., and E. Reinhardt. 2001. *Assessing Crown Fire Potential by Linking Models of Surface and Crown Fire Behavior*. Research Paper RMRS-RP-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. September 2001. https://www.fs.usda.gov/rm/pubs/rmrs_rp029.pdf.

Short, Karen C. 2023. Spatial wildfire occurrence data for the United States, 1992-2020 [FPA_FOD_20221014]: 6th edition. Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2013-0009.6. Accessed 12/19/23.

Sierra Nevada Regional Resource Kit (RRK). 2023. Online at: https://rrk.sdsc.edu/snv

Teie, W.C. 1994. *Firefighter's Handbook on Wildland Firefighting: Strategy, Tactics, and Safety*. Rescue, California: Deer Valley Press.

USDA (U.S. Department of Agriculture). 2022. *Wildfire Crisis Strategy*. U.S. Forest Service, U.S. Department of Agriculture. FS-1187a. January 2022. https://www.fs.usda.gov/sites/default/files/Confronting-Wildfire-Crisis.pdf.

USFS (U.S. Forest Service). 2019. Contemporary Wildfire Hazard Across California. https://www.frames.gov/catalog/63727

USFS. 2023. Tree Canopy Cover Datasets. https://data.fs.usda.gov/geodata/rastergateway/treecanopycover/#table1

Zhou, A. 2013. "Performance evaluation of ignition-resistant materials for structure fire protection in the WUI." In *Proceedings of the 13th International Conference and Exhibition on Fire and Materials (Fire and Materials 2013).* San Francisco, California. pp. 355–366.

INTENTIONALLY LEFT BLANK

Appendix A
Photograph Log

Photo 1. Brush and ladder fuels within a portion of Condon Park.

Photo 2. Brush and ladder fuels within a portion of Condon Park, near adjacent structures.

Photo 3. Dense forest adjacent to the Grass Valley Wastewater Treatment Plant, a critical City facility.

Photo 4. Thinned/treated forest on the opposite side of Allison Ranch Road from the Grass Valley Wastewater Treatment Plant.

Photo 5. Standing dead trees resulting from the 2016 Auburn Fire (from South Auburn Street).

Photo 6. Heavy roadside vegetation along East Empire Street, across from Empire Mine State Historic Park.

Photo 7. Standing dead trees resulting from the 2021 Bennett Fire (from East Bennett Road).

Photo 8. Standing dead trees resulting from the 2021 Bennett Fire (from Whispering Pines Lane).

Photo 9. Ladder fuels on undeveloped parcels along Whispering Pines Lane.

Photo 10. Dense roadside vegetation along Glenwood Road.

Photo 11. Vegetation behind houses in the Morgan Ranch neighborhood.

Photo 12. Dense and dying vegetation in the drainage below houses on Jan Road and Hill Street.

Nevada City CWPP (2024)

(plan preparation underway)

https://www.nevadacityca.gov/271/Community-Wildfire-Protection-Plan-CWPP