



Appendix B:

Health and Safety Element Background Report

Revised Draft - Summer 2026

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INTRODUCTION

Purpose and Content

The Lake County Health and Safety Element is a State-mandated document that identifies potential natural and human-caused hazards that could affect Lake County's unincorporated areas, including its residents, businesses, and services. The Background Report establishes a framework for anticipating these hazards and preparing the community to minimize exposure to these risks.

This Background Report discusses how and where hazards affect the county and its residents, provides information on past hazard events, outlines current programs and regulatory frameworks in place to reduce hazard impacts, and examines future conditions including potential climate change impacts. The information serves as the foundation for developing goals, policies, and implementation actions in the updated General Plan Safety Element.

The key hazards considered relevant to Lake County are:

- Agriculture and Forestry Pests and Diseases
- Airport Hazards
- Drought
- Emergency Preparedness and Response
- Extreme Temperature
- Flood Hazards
- Geologic and Seismic Hazards
- Hazardous Materials
- Human Health Hazards
- Severe Weather
- Wildfires [and Wildfire Smoke](#)

The Health and Safety Element includes a discussion for each hazard and identifies goals and policies. The policies in the Health and Safety Element guide the actions of County staff, developers, and policy makers necessary to achieve the goal. These policies are carried out by corresponding strategies, which are specific tasks the County will undertake.

The Lake County General Plan Health and Safety Element is one of several plans that address community safety and related topics. Therefore, this plan should be consistent with other local plans to minimize conflicts between documents and ensure that the County has a unified strategy to address public safety and resilience issues. The Health and Safety Element incorporates information, technical analyses, and policies from these other documents where appropriate to help support this consistency.

The air, lands, and waters of Lake County hold profound cultural, historical, and spiritual significance to local Tribes, including those with ancestral and contemporary ties to Clear Lake and its surrounding watershed. The County acknowledges that effective health and safety planning must reflect collaborative relationships with Tribal governments to ensure that hazard mitigation, emergency preparedness, and climate adaptation efforts respect and protect Tribal Cultural Resources, traditional ecological knowledge, and community well-being.

Relationship With Other Local Plans

Lake County General Plan (2008)

The 2008 Lake County General Plan provides a comprehensive policy framework through 11 elements that address different community issues: Land Use (LU); Housing (HE); Public Facilities and Services (PFS); Transportation and Circulation (T); Health and Safety (HS); Noise (N); Open Space, Conservation and Recreation (OSC); Geothermal Resources (GR); Water Resources (WR); Agricultural Resources (AR); and Aggregate Resources Management (included as appendix). Together, these elements guide the County's physical development, resource management, and safety planning.

The Health and Safety Element provides policy direction for safety and resilience that complement the intent and policies of other General Plan elements. Key relationships exist between the Health and Safety Element and other elements of the General Plan regarding how land uses are determined in areas prone to natural hazards, the regulations on development in these areas, and how hazards are reduced for existing development. For example, the Open Space, Conservation, and Recreation Element considers how hazards affect recreational infrastructure while recognizing that open spaces can provide natural hazard buffers. The Housing Element connection ensures future development is protected from hazards and adaptable to climate change. Transportation Element consistency is essential for evacuation planning, with State Route (SR-) 20, SR-29, SR-53, SR-175, and SR-281 serving as primary evacuation routes for county residents and visitors. The Water Resources Element addresses flood control and emergency water supply considerations. The General Plan is designed as an integrated, internally consistent document so that all elements work together to guide development and resource management decisions.

Lake County Local Hazard Mitigation Plan

Lake County's Office of Emergency Services (OES) prepared the 2023 Local Hazard Mitigation Plan in accordance with the federal Disaster Mitigation Act of 2000 and FEMA's hazard mitigation assistance guidance. The Local Hazard Mitigation Plan serves as the County's comprehensive strategy to reduce or eliminate long-term risks to life and property from natural hazards through specified actions. The Local Hazard Mitigation Plan examines natural hazards of concern, including wildfire, earthquake, aquatic biological hazards, drought, flood, levee failure, dam failure, severe weather (extreme heat and storms), and tree mortality. These hazards were analyzed through extensive collaboration between County departments, incorporated cities, Tribal Nations, fire districts, special districts, and other governmental and community partners, with significant public input gathered through surveys, public information sessions, and community meetings.

Though the Safety Element and Local Hazard Mitigation Plan address similar issues, the Safety Element provides broad, long-term policy direction, and the Local Hazard Mitigation Plan focuses on specific, often shorter-term mitigation actions to protect lives, property, and natural systems. The current Local Hazard Mitigation Plan, as certified by FEMA, is incorporated into this Safety Element by reference, as permitted by California Government Code Section 65302.6. The complete plan is available online at the Lake County Sheriff's Office website: <https://lakecountyca.gov/924/OES-Plans>www.lakesheriff.com/about/oes/hmp.

Community Profile

Lake County is centrally located in the north-central part of California, directly north of the San Francisco Bay Area. It is surrounded by the counties of Glenn, Colusa, Yolo, Napa, Sonoma, and Mendocino. Access to the county is primarily provided by SR-29 traveling north from Napa County, SR-175 and SR-20 traveling east from Mendocino County, and SR-20 traveling west from Colusa County. The county covers an area of approximately 1,329 square miles, 73 square miles of which consist of water, most notably Clear Lake, which is the largest natural lake wholly within California. The county is home to a diverse set of ecosystems and habitats due to the diverse topography, ranging from Mount Konocti, a 4,305-foot volcano, to Cache Creek and Putah Creek that flow into the Sacramento River. Volcanic features such as the Clear Lake Volcanic Field have shaped the topography into a series of mountains and valleys, forming numerous lakes and forests throughout the landscape.

The land in Lake County is owned and managed by a mix of federal, Tribal, State, and local governments, nonprofits, and private individuals and organizations. The U.S. Forest Service owns the largest portion of land through the Mendocino National Forest. The federal Bureau of Land Management and State of California own and manage several open space areas, such as Cow Mountain Recreation Management Area, Boggs Mountain Demonstration State Forest, and Clear Lake State Park. Though not a government entity, the Lake County Land Trust manages public lands throughout the county, including several preserves, Monitor Island, and the Rodman Nature Center. Locally, Lake County, the City of Clearlake, and the City of Lakeport own and manage land in the unincorporated and incorporated areas of the county. The following sections provide community profiles of each of these three local jurisdictions.

The unincorporated county areas are connected by SR-20, SR-53, SR-29, SR-175, and SR-281, with other major roads such as Butts Canyon Road, Morgan Valley Road, and Scotts Valley Road connecting the more rural areas of the unincorporated county. Transit service is limited in the county, with Lake Transit providing bus service around Clear Lake and between unincorporated communities in southern Lake County.

Land uses in the unincorporated county are rural in nature but vary widely: from agricultural lands outside of communities; to parks and open spaces surrounding Clear Lake, Lake Pillsbury, and Indian Valley Reservoir; to residential and commercial areas in communities such as Cobb, Lucerne, and North Lakeport. The agricultural land uses support the thriving agriculture economy, with major crops including wine grapes and pears, livestock such as cattle, cannabis, and timber. The parks and open space areas

Tribal Lands in Lake County

Lake County is home to seven federally recognized Tribes, which directly descend from the Pomo, Wappo, Wintun, and Lake Miwok people that have historically inhabited the Clear Lake area for over 11,800 years. These Tribes include Big Valley Band of Pomo Indians, Elem Indian Colony of the Sulphur Bank Rancheria, Habematolel Pomo of Upper Lake, Koi Nation of Northern California, Middletown Rancheria of Pomo Indians of California, Robinson Rancheria Pomo Indians of California, and Scotts Valley Band of Pomo Indians. Many of these Tribes have developed economic ventures to achieve self-sufficiency and the Lake County Tribal Health consortium provides medical services to both the tribal and non-tribal Lake County community. More information is available online: <https://www.lakecountycalifornia.gov/1524/History-of-Lake-County-Pomo-Indians>.

provide a foundation for a robust outdoor recreation and tourism economic sector, especially in the summer months. Visitors travel to the county to participate in water recreation activities on Clear Lake, hiking and bicycling on the nearby State and federal lands and camping at the dozens of tent and recreation vehicle campsites across the county. Agricultural lands and the geothermal areas of southern Lake County also support agritourism and resort activities. The commercial and residential areas of the unincorporated county host local businesses and services for both residents and visitors.

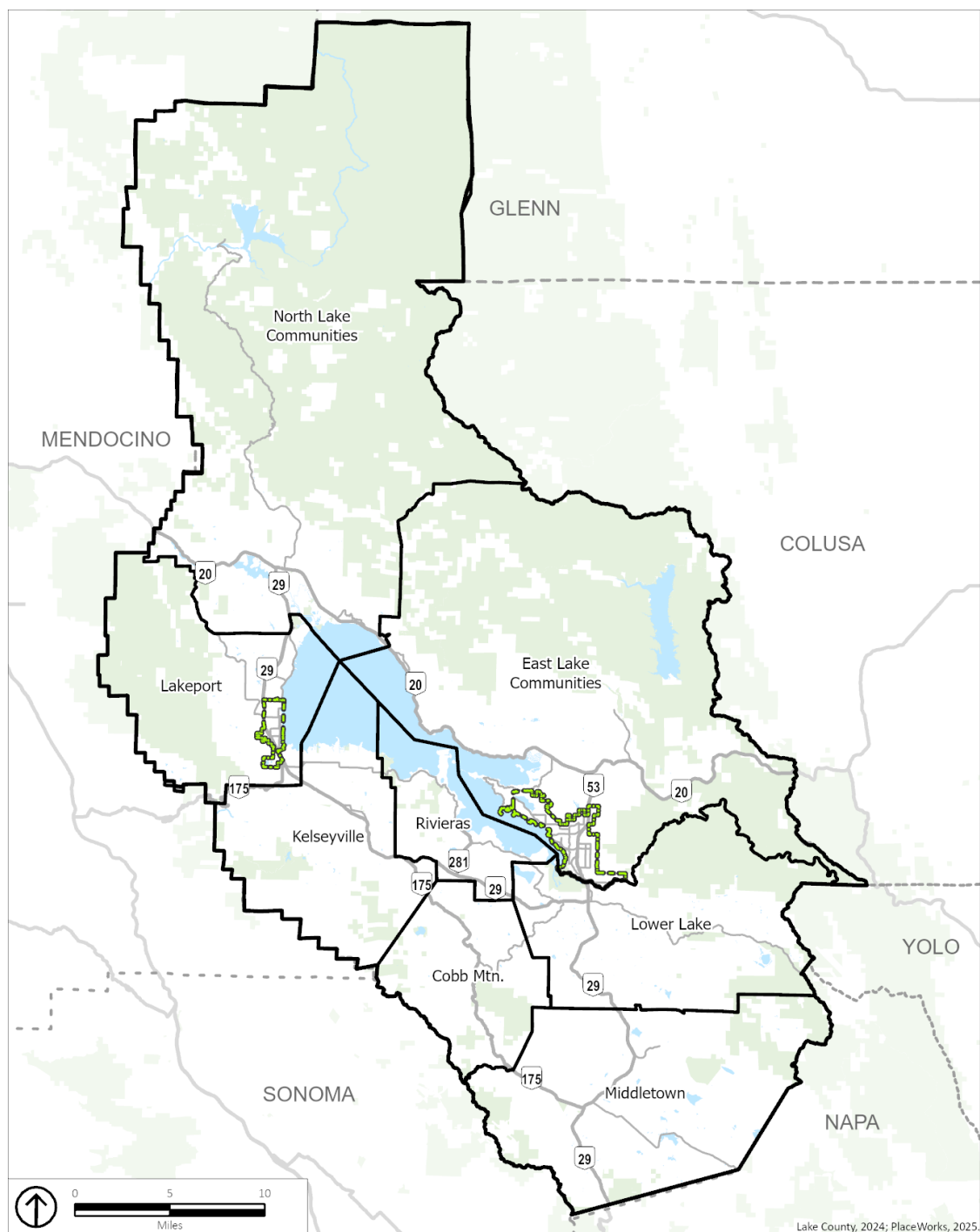
The socioeconomic and demographic profile of Lake County presents a population with unique social and economic characteristics. According to the 2022 American Community Survey, unincorporated Lake County is home to 46,398 people with a median age of 44 years and a median household income of approximately \$56,260. The population includes a significant proportion of older adults (65 years and older), who make up 25 percent of the community, while children under the age of 18 account for 21 percent. Despite the consistent agriculture and tourism economy, the unincorporated county faces notable challenges, including a poverty rate of 17 percent, and 21 percent of the population living with a disability. Transportation and connectivity issues are also prominent: 9 percent of residents lack access to a vehicle, and 19 percent of households have no internet access. Housing insecurity is also a challenge, with 290 individuals experiencing homelessness and 26 percent of households living in rental accommodations. Lake County divides the unincorporated areas into eight local planning areas, as shown on **Figure B-1**: Cobb Mountain Area, Kelseyville Area, Lakeport Area, Lower Lake Area, Middletown Area, Rivas Area, East Lake Communities Area, and North Lake Communities Area. Each of these areas features distinct communities supporting residential, agricultural, recreational, and commercial activities that serve residents and visitors throughout the county.

Clear Lake

Clear Lake is the largest natural freshwater lake entirely in California, covering approximately 68 square miles. It is also one of the oldest lakes in North America, estimated to be around 2.5 million years old. This unique geologic and ecologic setting supports diverse wildlife, including large populations of endemic fish, such as the Clear Lake hitch (*Lavinia exilicauda ch*). The lake's shallow waters promote rich plant life, which in turn sustains various species of birds and other wildlife. The Clear Lake watershed also includes wetlands that filter sediments and nutrients, thus enhancing water quality and supporting biodiversity.

Clear Lake is a cornerstone of the local economy, particularly through tourism. The lake attracts thousands of visitors annually for activities such as fishing, boating, and swimming. In peak seasons, especially during summer fishing events, the influx of tourists significantly boosts local businesses in hospitality and retail as well as agritourism activities in the surrounding areas. Clear Lake also provides much of the county with drinking water, including the City of Lakeport, City of Clearlake, and several unincorporated communities along the shore of the lake.

Figure B-1 Local Area Plan Boundaries



- Planning Area Boundary
- Other County
- City Boundary Line
- Parks and Open Space

Climate Vulnerability

Climate Change Overview

Climate change is the long-term shift in average weather patterns globally, characterized by significant alterations in temperature and precipitation patterns over extended periods—typically decades or longer. As global temperatures continue to rise, communities experience more frequent and intense natural hazards, including heatwaves, storms, floods, droughts, and wildfires. These events often happen simultaneously, creating compounding effects that can amplify their impacts on communities.

Primary climate change stressors affecting Lake County include increasing temperatures and shifts in precipitation patterns. These primary climate stressors contribute to a range of secondary climate stressors, or hazards, affecting the county, including agriculture and forestry pests and diseases, drought, extreme temperatures, human health hazards, flooding, landslides, severe weather, and wildfire and smoke. When multiple climate hazards are simultaneous, such as droughts amplifying wildfire risk or extreme heat exacerbating water scarcity, the impacts on Lake County's communities, infrastructure, and natural systems can be particularly severe. These changes will continue to affect the frequency, intensity, and distribution of hazards throughout the unincorporated areas of the county in the coming decades.

Cascading and Compounding Effects

Cascading Effects: When an extreme event causes a series of secondary events that are larger than the initial impact.

Compounding Effects: When multiple hazards or drivers occur simultaneously, amplifying their collective impact.

Source: IPCC. 2019. Extremes, Abrupt Changes and Managing Risk.

Vulnerability Analysis Results

California Government Code requires safety elements to include a vulnerability assessment that looks at how people, buildings, infrastructure, and other key community assets might be affected by climate change. Lake County conducted a comprehensive Climate Vulnerability Analysis (**General Plan Appendix D**) to evaluate how climate change hazards could harm the unincorporated areas of the county and the cities of Clearlake and Lakeport. This assessment, prepared in accordance with the *California Adaptation Planning Guide* (2020), analyzes climate vulnerability, which is the degree to which people, buildings, infrastructure, and other systems are susceptible to harm from climate change and associated hazards.

The Climate Vulnerability Analysis considers threats from eight relevant climate hazards, listed above, and the vulnerability of various different population groups and community assets to each of these hazards. Each population or asset received a score of low, medium, or high vulnerability for each climate-related hazard. The results indicate that wildfire and smoke are responsible for the greatest number of vulnerabilities countywide, followed by severe weather, flooding, and drought. The populations facing the greatest risk from climate change are households in poverty, people of color and immigrant communities, people with high outdoor exposure, persons with chronic illnesses and/or disabilities, Tribal communities, and older adults (age 65 or older).

Several key community assets were found to be highly vulnerable. Energy and communication infrastructure and services are vulnerable to hazards that could undermine their foundations or cause damage to power lines, including flooding, landslides, severe weather, and wildfire. This is particularly concerning in more remote areas of the county where there is little redundancy in communication infrastructure. Homes can be damaged or destroyed by wildfires, flooding, landslides, and severe storms, and even if damage is initially minor, resulting mold and mildew growth can render homes uninhabitable. Extreme heat and wildfire smoke can also create dangerous indoor air quality when residents may choose to turn on their air conditioning and let in smoke, or keep windows closed and air conditioning off, creating higher indoor air temperatures.

Transportation infrastructure, including roads, highways, and bridges, is especially vulnerable to hazards like flooding, landslides, severe weather, and wildfire. Damage to transportation networks can block evacuations, delay emergency response, and significantly hinder vital supply deliveries. The agriculture and timber industries can suffer substantial harm and economic losses from agricultural pests and diseases, drought, extreme temperatures, flooding, severe weather, and wildfire smoke, threatening not only food production but the livelihoods of farmers and outdoor workers.

Forests and woodland habitats face high vulnerability due to their overlap with very high fire severity zones and susceptibility to drought, extreme heat, and pests. Weakened and dead forest and woodland habitats can ignite more easily during wildfires, creating devastating wildfires that burn at higher temperatures. Ecosystems struggle to recover from such wildfires because the higher temperatures cause more severe damage to trees, preventing regrowth and sprouting of seedlings. Oak woodlands are at particular risk from sudden oak death, Mediterranean oak borer, and high-intensity wildfires. Water and wastewater treatment, delivery, and collection infrastructure can be damaged and disrupted by drought, flooding, landslides, and wildfires, with impacts ranging from reduced groundwater supply to contaminated drinking water.

The Climate Vulnerability Analysis identified the people and assets in Lake County that are most vulnerable to climate change hazards, which should be prioritized for adaptation and resilience measures. The Health and Safety Element includes goals, policies, and actions informed by these findings to increase community resilience and help lower vulnerability, particularly for populations and assets most at risk. A full description of the vulnerability assessment process and detailed results can be found in the Climate Vulnerability Analysis Report (**General Plan Appendix D**).

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HAZARD PROFILES

Lake County faces a variety of natural and human-caused hazards that can affect public safety, property, and quality of life. This section provides detailed information about the hazards that pose risks to Lake County, including location, extent, historical occurrences, and probability of future events. Each hazard profile integrates climate change considerations, examining how shifting climate patterns may influence the frequency, intensity, and distribution of these hazards over time. This information provides the foundation for understanding Lake County's hazards and developing appropriate policies and programs to reduce risk and enhance community resilience.

Agriculture and Forestry Pests and Diseases

Agriculture and forestry pests and diseases include invasive plant and animal species, insects, and pathogens that can harm Lake County's agricultural lands, forests, and natural ecosystems. These biological threats can significantly impact the county's agricultural economy, which includes major crops like wine grapes and pears as well as cannabis, extensive forest lands, and natural areas. Common agricultural and forestry threats in Lake County include bark beetles, which can cause widespread tree mortality; sudden oak death, a disease affecting oak woodlands in the southwestern part of the county; Mediterranean oak borer that is spreading north and has dispersed throughout most of the county, and various insect pests that target specific crops.¹²

The unincorporated areas of Lake County have a robust agricultural and forestry economy, with agriculture contributing nearly \$102 million in gross production value in 2024 through livestock, wine grapes, pears, and other crops, and the forests provide timber resources, recreation opportunities, and essential ecosystem services.³ Agricultural pests can damage crops by feeding on and destroying plant material, spreading diseases between plants, or competing for resources. Similarly, forestry pests and diseases can cause widespread tree mortality, affecting timber resources and natural forest ecosystems. When these pests and diseases spread unchecked, they can cause substantial economic losses, degrade environmental quality, and threaten the county's agricultural heritage. These pests and diseases not only affect agricultural productivity but can also create secondary hazards—for example, trees killed by bark beetles can increase wildfire fuel loads and pose falling hazards near roads and structures.

Lake County's agricultural and forest ecosystems are closely connected, as many agricultural areas border or intermingle with forested lands, particularly in the foothill regions. This proximity means pests and diseases can readily spread between managed agricultural lands and natural forest areas. For instance, invasive plants can degrade soil quality and compete with native species, while forest diseases can disrupt wildlife habitat and impact watershed health. These cascading effects underscore the importance of comprehensive pest and disease management strategies in maintaining the county's agricultural productivity and ecosystem health.

Past Occurrences

Lake County has experienced several significant agriculture and forestry pest and disease outbreaks in recent years. The following are the most notable.

Agricultural Pest Eradication (2023)

The Lake County Department of Agriculture conducted eradication programs to actively control several significant pests throughout the county in 2023, including the Plumeless Thistle, Purple Starthistle, Skeleton Weed, Dyer's Woad, and Goats Rue. The department also documented several pest detection activities for insect pests including the Mediterranean fruit fly, Asian citrus psyllid, European grapevine moth, glassy-winged sharpshooter, Japanese beetle, melon fruit fly, Oriental fruit fly, spongy moth, and vine mealybug, though none were captured.⁴

Tree Mortality Crisis (2022 to Present)

On May 3, 2022, the Lake County Board of Supervisors declared a local state of emergency due to pervasive tree mortality.⁵ This emergency was triggered by a combination of extreme drought conditions, groundwater depletion, and widespread multi-species bark beetle infestation. According to the United States Forest Service's annual aerial surveys, the estimated number of acres with tree mortality increased from 1,000 in 2019 to 4,600 acres in 2024.⁶

Sudden Oak Death (ongoing)

Lake County is currently designated as a sudden oak death (SOD) quarantine location due to disease in the southwestern portion of the county. This designation requires monthly inspections of nurseries that ship plants outside county boundaries to prevent disease spread.⁷

Mediterranean Oak Borer (2021 to Present)

Detected in Lake County in 2023, the Mediterranean oak borer (*Xyleborus monographus*) is a small ambrosia beetle, it was first detected in Calistoga in 2019 and has since spread northward into Lake County. The beetle has spread quickly, infesting valley oaks (*Quercus lobata*) and blue oaks (*Quercus douglasii*).

Existing Programs and Regulations

Lake County Department of Agriculture

The Lake County Department of Agriculture plays a central role in pest and disease management through several key programs.

- **Annual Crop Report:** Provides detailed monitoring and documentation of agricultural and livestock conditions, including pest and disease impacts. In 2024, the county had a total gross production value of \$140,366,660, with major commodities including wine grapes (\$74,843,331), pears (\$12,917,779), and livestock production (\$7,925,275).

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- **Pest Detection Program:** Implements systematic trapping and surveillance activities to detect invasive species before they become established. The 2024 Crop Report highlights several pest detection and exclusion activities critical to protecting the county's agricultural resources. The Department of Agriculture maintained 571 pest-detection traps throughout the year, resulting in only 1 confirmed detection of Vine Mealybug. These efforts are particularly important for Lake County's agricultural economy.
 - **Pest Exclusion Program:** Conducts inspections of nursery shipments and agricultural products entering the county to prevent the introduction of new pests. This includes managing compliance agreements for businesses shipping agricultural products. The 2024 Crop Report also documents the Department's pest exclusion activities, which included inspecting 3,257 shipments of plant material for quarantine compliance. This comprehensive monitoring and reporting system helps track emerging pest and disease threats while providing valuable data to inform management strategies.
 - **Sudden Oak Death Monitoring:** Oversees monthly inspections of nurseries shipping plants outside the county as part of SOD quarantine requirements.⁸

Tree Mortality Program

In response to widespread tree mortality and following the 2022 local emergency declaration, the County established the Tree Mortality Program. The program focused on the hardest-hit areas of southern Lake County as part of the process to request assistance to mitigate dead and dying trees under the California Disaster Assistance Act from the California Office of Emergency Services. This program coordinated documentation of dead and dying trees near county roadways and evacuation routes, worked with property owners to identify trees on private property, and developed prioritized mitigation activities, to partner with State and federal agencies for funding and technical assistance.⁹

Lake County Resource Conservation District

The Lake County Resource Conservation District provides technical assistance to landowners for pest management, education on integrated pest management practices, coordination of forest health projects, and support for conservation practices that promote resilient agricultural systems.¹⁰

Lake County Code of Ordinances

Lake County maintains several ordinances designed to protect agricultural operations and forest resources:¹¹

- Chapter 3, Article I, *Pests and Diseases*, establishes provisions for pest prevention, control, and abatement to protect agricultural crops and resources.
- Chapter 30, *Grading Ordinance*, includes provisions for vegetation management and forest health.
- Chapter 3, Article IV, *Right to Farm Ordinance*, protects agricultural operations from nuisance complaints related to standard farming practices, including pest management activities.

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- Chapter 21, Article 4, *Regulations for the Agricultural Preserve Zone or “APZ” District*, provides zoning for lands in agriculture preserve and for the conservation and protection of land capable of producing agricultural products.
 - Chapter 21, Article 6, *Regulations for the Timberland Preserve Zone or “TPZ” District*, provides zoning for timberland preserve and the conservation and protection of land capable of producing timber and forest products.

Future Conditions

Likelihood of Future Occurrences

Based on historical data and current trends, agricultural and forestry pests and diseases are considered highly likely to continue, with a 90 to 100 percent chance of occurrence in any given year according to the Local Hazard Mitigation Plan. The combination of the diverse agricultural operations, extensive forested areas, and changing climate conditions creates ongoing vulnerability to pest and disease outbreaks.

Climate Change and Agriculture and Forestry Pests and Diseases

Climate change is expected to significantly increase the frequency and severity of pest and disease outbreaks in Lake County through several mechanisms:

- **Extended Crop Growing Seasons:** Rising temperatures are lengthening growing seasons, allowing pest populations to produce more generations per year and expand their ranges into previously unsuitable areas.¹²
- **Weakened Host Plants:** Climate stressors such as drought and extreme heat can weaken crops and trees, making them more susceptible to pest infestation and disease. This is particularly evident in Lake County's forests, where drought-stressed trees have become more vulnerable to bark beetle attacks.¹³
- **Altered Pest Life Cycles:** Warmer winters are reducing natural pest population controls, allowing more insects to survive through the winter and emerge earlier in spring.¹⁴
- **Ecosystem Disruption:** Extreme weather events can disrupt native plant communities, creating opportunities for invasive species establishment.¹⁵

Increased pest activity is likely to result in higher crop losses, increased pest management cost, potential impacts on crop quality and marketability, greater pressure on native ecosystems and forestlands, and additional stress on already challenged forest health conditions. These disruptions could have significant economic implications for Lake County's agricultural sector.

Airport Hazards

Lake County is served by two public-use airports: Lampson Field Airport, approximately three miles south of the Lakeport city center, and Gravelly Valley Airport near Lake Pillsbury in the Mendocino National Forest. Lampson Field airport is owned by Lake County and operated by the Public Works Department and primarily serves general aviation needs. Lampson Field features a single 3,600-foot asphalt runway and averages about 82 aircraft per week, consisting mostly of general aviation, with some transient general aviation traffic. Approximately 40 aircraft are based at the field, mostly single-engine planes.

Gravelly Valley Airport is a small public facility featuring a 2,240-foot dirt/gravel runway. This airport primarily serves recreational users accessing Lake Pillsbury and the surrounding Mendocino National Forest as well as emergency services when needed. The facility averages fewer than 50 operations annually.

Land near airports face elevated safety risks due to the higher probability of aircraft accidents during takeoff and landing operations. Land and soils near airports may also have higher lead concentrations due to lead formulated aviation gasoline, which is the primary source of lead emissions in the United States today.¹⁶ These areas require special land use considerations to minimize potential hazards to both aircraft operations and people on the ground.

Past Occurrences

According to National Transportation Safety Board records, five incidents have occurred at or near Lake County airports since 2000.

- **March 2003:** A landing aircraft struck a deer on the runway. No injuries to occupants but the aircraft sustained damage.
- **September 2008:** An aircraft crashed shortly after takeoff approximately one mile from the airport. The pilot was seriously injured.
- **July 2016:** A single-engine plane veered off the runway during landing. The pilot and passenger sustained minor injuries.
- **December 2017:** At Gravelly Valley Airport, an aircraft experienced an aerodynamic stall during landing approach, resulting in substantial damage to the fuselage and right wing after a hard landing. No injuries were reported.
- **August 2021:** A small aircraft experienced engine trouble shortly after takeoff and made an emergency landing in a field near the airport. No injuries were reported.

Existing Programs and Regulations

Lake County Airport Land Use Compatibility Plan

The primary mechanism for controlling airport hazards in Lake County is the Lake County Airport Land Use Compatibility Plan, adopted in 1992. The Airport Land Use Compatibility Plan establishes policies and criteria for determining land use compatibility in the vicinity of Lampson Field Airport. These include height restrictions and density limitations for development and requirements for navigation easements in designated safety zones. The plan aims to minimize public exposure to airport-related hazards while ensuring future development remains compatible with airport operations.

Lake County Code of Ordinances

Lake County's Zoning Code includes specific regulations through Article 39, Regulations for the Airport Approach, or "AA" Combining District. This article implements Airport Land Use Compatibility Plan policies by establishing special requirements for development within AA zones. The regulations address structure heights, land use types, and development standards to protect the airport's airspace and maintain safety for both aircraft operations and surrounding properties.

Federal Aviation Administration

The Federal Aviation Administration provides oversight of airport operations and establishes standards for airport safety through Federal Aviation Regulations Part 77, which defines airspace protection criteria, including height restrictions for objects near airports, requirements for marking and lighting obstructions, procedures for aeronautical studies to evaluate potential obstructions, and standards for determining various airspace surfaces.

Future Conditions

Future development in Lake County, particularly in areas surrounding Lampson Field, will need to continue adhering to established airport land use compatibility criteria. The 1992 Airport Land Use Compatibility Plan will require updates to reflect current Federal Aviation Administration standards and address emerging aviation technologies. As the county grows, maintaining appropriate land use patterns around the airport will remain important for protecting both aviation operations and public safety.

The limited scale of operations at Lampson Field suggests that airport hazard exposure will likely remain low. However, changes in aircraft fleet mix, potential facility improvements, or shifts in aviation activity could affect the extent and nature of airport-related hazards. Regular monitoring of airport operations and periodic updates to relevant plans and regulations will help ensure continued safety for both aviation users and nearby communities.

Drought

A drought is when conditions are drier than normal for an extended period, making less water available for people and ecosystems. Unlike other natural disasters, which occur rapidly, droughts develop slowly over multi-year periods, making them difficult to quantify, predict, and prepare for. Drought can be defined in several ways: meteorologically (below-average water supply), agriculturally (inadequate water for crops and livestock), hydrologically (deficiencies in surface and subsurface water), socioeconomically (impacts on health and economy), and ecologically (impacts on natural ecosystems). The severity of any given drought depends on the degree of moisture deficiency, duration, and affected area size. While drought does not typically cause direct structural damage, it can have widespread environmental and economic impacts. In Lake County, potential impacts include agricultural losses (particularly wine grapes and pears), increased well-drilling costs, higher water costs affecting household finances and commercial profits, reduced wildlife habitat, and increased wildfire risk.

Clear Lake, California's largest natural freshwater lake, serves as a critical water source for both agricultural and domestic use. Per the Lake County Hazard Mitigation Plan, approximately 60 percent of Lake County residents depend on Clear Lake as their source of drinking water.¹⁷ During drought conditions, the already shallow lake faces additional challenges, including increased harmful algal blooms (cyanobacteria, known as blue-green algae, a group of photosynthetic bacteria that can cause adverse health impacts) that can strain drinking water quality and infrastructure. Drought can also lead to water use restrictions and inadequate fire suppression supplies. The water rights system in California adds a layer of complexity to drought management for Clear Lake, because water in California is protected for the use and benefit of all Californians and cannot be owned by individuals, governmental agencies, businesses, or groups. The California State Water Resources Control Board issues permits, licenses, and registrations giving individuals and others the right to use water resources for beneficial purposes.

Drought also affects groundwater resources. As groundwater reserves are drawn down and receive less replenishment from precipitation, aquifer levels can drop, resulting in reduced well capacity or dry wells. This can also affect streams, as much of their flow comes from groundwater, especially during summer months. Drought can cause soil to compact and resist water absorption, potentially increasing flooding and erosion risks when rain returns.

Water Supply Providers in Lake County

Water supply in unincorporated Lake County is provided through a network of various water districts and systems. Several independent water districts serve specific communities, including Cal Water's Redwood Valley District (Lucerne), Callayomi County Water District (Middletown), Clearlake Oaks County Water District, and the Upper Lake County Water District that serves multiple communities in the northern part of the county. The Lake County Special Districts Administration oversees six additional water systems serving various subdivisions and communities—the Finley/Lands End, Kelseyville, Kono Tayee, North Lakeport, Soda Bay, and Spring Valley water systems. Outside of these service areas, many rural properties in the unincorporated county rely on private groundwater wells for their water supply.

Drought can also increase Lake County's wildfire susceptibility by drying vegetation and increasing forestry pests and diseases, which can be dangerous for the community given the county's extensive wildland-urban interface areas and history of wildfires. Additionally, the county's tourism and recreation economy relies heavily on Clear Lake's water levels and quality, which can be significantly reduced during drought conditions.

Past Occurrences

Like other areas of California, Lake County has experienced several significant drought periods throughout its history. The following sections describe the most recent prolonged droughts, as identified in the 2023 Local Hazard Mitigation Plan:

1976 to 1977 Drought

This drought period was particularly significant for Lake County. Despite the existence of storage reservoirs, the drought resulted in major reductions of available water supplies throughout the county. Clear Lake reached record low lake levels during this drought period, affecting both water supply availability and recreational activities on the lake.

2014 Drought

Lake County, along with all other California counties, was significantly affected by the statewide drought emergency of 2014. Between January 2014 and January 2015, Lake County was at the D3 level (Extreme Drought), even reaching a D4 (Exceptional Drought) between August and mid-December 2014.¹⁸ This drought led to widespread water conservation measures and affected agricultural production throughout the county.

2020 to 2023

The U.S. Department of Agriculture included Lake County in an April 2020 drought disaster declaration. The drought conditions intensified through 2021, which became the second driest year on record statewide. The drought conditions reached D3 (Extreme Drought) in late September 2020 and remained between D3 and D4 (Exceptional Drought) through late December 2021.¹⁹ The region experienced reduced drought impacts through 2023, reaching a 'No Drought' status in April 2023.²⁰

Existing Programs and Regulations

Lake County Water Resources Department

The Lake County Water Resources Department serves as a key agency in monitoring and managing water resources that can be affected by drought conditions. As stewards of Lake County's watersheds, including Clear Lake, the department conducts critical activities, such as groundwater monitoring, surface water quality monitoring, and watershed management, that help track and respond to drought impacts.

The department's groundwater management program involves monitoring groundwater levels and implementing sustainable management practices. Through the Big Valley Groundwater Sustainability Agency project, the department works to ensure long-term groundwater sustainability, which becomes especially critical during drought periods. Additionally, the department's surface water quality monitoring and environmental education programs help inform the public and decision-makers about drought conditions and their impacts on local water resources.

Lake County Watershed Protection District

The Lake County Watershed Protection District was established in 1951 as the Lake County Flood Control and Water Conservation District under the Flood Control and Water Conservation Act of the State Water Code. The Watershed Protection District operates as a political subdivision of the State of California, administered by the Director of Water Resources who reports to the County Board of Supervisors, which serves as its Board of Directors.

The Watershed Protection District conducts water resource management and infrastructure operations, including administering the National Flood Insurance Program, managing the Municipal Stormwater Program, groundwater management planning, and watershed management planning. The Watershed Protection District maintains essential water infrastructure including 10.5 miles of levees, 13.4 miles of creeks, a groundwater detention structure on Kelsey Creek, and operates the Adobe Creek Reservoir and Highland Creek Reservoir. These activities help monitor water supply conditions and coordinate regional drought response strategies.

Integrated Regional Water Management Plan

The Westside Sacramento Integrated Regional Water Management Plan, updated in 2019, represents a collaborative approach to water resource management across five counties—Lake, Yolo, Colusa, Solano, and Napa. This regional partnership was formed to address shared challenges related to water supply reliability, water quality, flood management, and ecosystem health within the Cache Creek and Putah Creek watersheds, for which Clear Lake is a key water source.

The plan provides a framework through 2040 for more than 70 organizations focused on water supply, land use management, flood management, and ecosystems to work together on regional water management challenges. Key drought-related elements of the plan include:

- Assessment of water supply reliability during average and dry years.
- Recognition that surface water availability decreases could negatively impact both agricultural and municipal users.
- Strategies to maintain or increase water supply reliability.
- Emphasis on conjunctive water management (coordinated use of surface and groundwater sources).
- Monitoring groundwater conditions, particularly during drought periods.

This collaborative regional approach helps coordinate drought response and water management strategies across jurisdictional boundaries within the watershed.

2006 Lake County Groundwater Management Plan

The Lake County Watershed Protection District developed the Lake County Groundwater Management Plan to provide guidance in managing the county's groundwater resources. The plan establishes several key management objectives that are particularly relevant to drought preparedness and response, including maintaining sustainable water supplies, minimizing long-term drawdown of groundwater levels, protecting groundwater quality, and preventing land surface subsidence resulting from groundwater pumping.

The plan covers 13 groundwater basins and source areas throughout Lake County, providing a comprehensive framework for monitoring and managing groundwater resources. Through this plan, the Watershed Protection District works cooperatively with other public entities and local stakeholders to implement effective water resource management programs, which become especially critical during drought conditions. The plan includes monitoring protocols for groundwater levels, quality, and surface water interactions, helping to inform drought management decisions and long-term water supply reliability planning.

Water Conservation Ordinance

Lake County adopted “Water Conservation Ordinance Number 2291” in 1995, which was later expanded through ordinance numbers 2705 (2004) and 2721 (2005) to include additional service areas. The ordinance requires the installation of water-conserving fixtures, including low-flush toilets (1.6 gallons) and low-flow showerheads (2.5 gallons per minute), in properties served by sewer systems maintained by the Lake County Sanitation District. This requirement helps reduce potable water use during both normal operations and drought conditions.

The ordinance mandates retrofit requirements that must be met prior to the closing of escrow on property sales or during renovations that increase floor space by 25 percent or more. While homes built after February 1994 typically already comply due to State requirements, the ordinance ensures older properties are upgraded to meet water conservation standards. These water conservation measures help reduce overall water consumption in the county and build long-term drought resilience.

Emergency Water Supply Planning

Given Lake County's vulnerability to drought and water quality issues, the County works with water districts and other partners to ensure continued water service during emergencies through backup power systems for critical water infrastructure, emergency water distribution plans, coordination with State agencies on water quality monitoring, and planning for alternate water supplies during contamination events. The County also facilitates a Lake County Drought and Low Water Task Force and is developing a drought resiliency plan for state small water systems and domestic wells.

Future Conditions

Likelihood of Future Occurrence

Drought differs from many other natural hazards due to its gradual onset and extended duration. Based on historical information, drought in California, including Lake County, is cyclical and driven by weather patterns. Periods of actual drought with adverse impacts vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought depends on the impact to individual water users of both surface water and groundwater resources. The impacts can be particularly severe in Lake County, as demonstrated in 2021 when at least 30 household drinking water wells were reported to have gone dry, with actual numbers likely being significantly higher.²¹

According to the 2023 Local Hazard Mitigation Plan, historically, there have been five significant droughts in the past 84 years, equating to a drought every 16.8 years on average, or a 6 percent chance of a drought in any given year in Lake County. However, given the multi-year nature of droughts and recent trends, future drought in Lake County is considered likely, with a 10 to 89 percent chance in any given year.

Climate Change and Drought

Climate scientists find that drought conditions are likely to become more frequent and persistent over the 21st century due to climate change.²² Though overall precipitation levels are expected to increase in Lake County, climate change is likely to cause more extreme variations in precipitation patterns, so that very wet and very dry years will both become more common. During drought periods, more intense dry conditions are expected to harden soil and reduce groundwater recharge, causing aquifer levels to drop. When precipitation does return, the hardened soil conditions mean that, instead of infiltrating the soil and percolating into groundwater basins, more water will run off, potentially causing downstream flooding. Higher temperatures will further increase evaporation rates, exacerbating drought conditions. For Lake County specifically, these changes could stress local water resources, particularly affecting water quality issues such as cyanobacterial blooms in Clear Lake.

Emergency Preparedness and Response

Emergency preparedness and response in Lake County involve coordinated efforts between multiple agencies to address natural and human-caused disasters. The Lake County Sheriff's Office of Emergency Services is the primary organization in charge of local emergency management in the county. During non-emergency periods, Office of Emergency Services staff maintain the emergency operations center in a constant state of readiness, coordinate planning and training efforts with participating members of the operational area, conduct public outreach and education, and participate in regional projects through the California Governor's Office of Emergency Services.

The Office of Emergency Services coordinates, manages, and submits applications for emergency preparedness grants, which have provided funds to the operational area, including the Emergency Management Performance Grant and State Homeland Security Grant Program. The office is available 24/7 through the Lake County Sheriff's Office Central Dispatch Center to monitor and respond to emergencies.

Fire protection services in unincorporated Lake County are provided by six fire protection districts—Lake County Fire Protection District, Northshore Fire Protection District, Kelseyville Fire Protection District, Lakeport Fire Protection District, Lake Pillsbury Fire Department, and South Lake County Fire Protection District—along with CAL FIRE, the U.S. Forest Service, and the Bureau of Land Management, which provide wildland fire protection on State and federal lands. These fire service providers deliver essential fire prevention, suppression, and emergency medical services. The fire districts conduct regular fire prevention inspections and educational programs. North Coast Opportunities offers a Community Emergency Response Training (CERT) program. The local Red Cross maintains mutual aid agreements that enable resource sharing during large-scale emergencies. The districts also participate in countywide emergency planning efforts and provide representatives to the Disaster Council.

Operational Area Emergency Coordinators

The Lake County Operational Area Emergency Coordinators forum is a working group of representatives from cities, County departments, State agencies, special districts, utilities, and disaster response organizations that coordinate emergency response efforts, preparedness, training, and disaster recovery activities.

Evacuation Planning and Routes

Evacuation Routes

The county's geography, with Clear Lake at its center and mountainous terrain throughout, creates unique evacuation challenges. Primary evacuation routes follow the shoreline of Clear Lake and valley corridors, with limited alternate routes. This network may need to accommodate both local evacuees and those from neighboring communities during regional emergencies.

Figure B-2 shows the potential evacuation routes throughout the county, although the recommended evacuation routes in any given situation will depend on the specifics of the emergency. Primary emergency evacuation routes in Lake County follow major State highways: SR-20, which traverses east-west along Clear Lake's north shore; SR-29, which runs north-south through the county; SR-53 connecting Clearlake to Lower Lake; and SR-175 connecting Middletown to Lakeport via Cobb. These highways, along with several major County roads including Scotts Valley Road, Butts Canyon Road, Morgan Valley Road, Seigler Canyon Road, and Soda Bay Road (which has its own recent [Evacuation Route Plan](#) completed in 2024) connect to local roads that provide access to communities around Clear Lake and in the more rural areas of the county.²³

All evacuation routes face potential disruption from various hazards, including flooding, wildfire, or geologic events, that may block roadways or damage infrastructure. In the event of widespread disruption to local evacuation routes, remaining routes may become congested, potentially slowing evacuation efforts. This is particularly concerning since Lake County's evacuation routes may also serve as evacuation routes for surrounding counties in some situations. The Lake County Evacuation Study (**General Plan Appendix C**) provides a more detailed description of evacuation route capacity, safety, and viability, and locations under wildfire, flooding, and landslide scenarios.

Evacuation Zones

Lake County uses the Genasys EVAC platform (formerly known as Zonehaven) to manage evacuations during emergencies. The system divides the county into distinct evacuation zones, as shown on **Figure B-3**, allowing emergency managers to issue targeted evacuation orders and communicate specific instructions to affected areas. These pre-established zones help coordinate evacuation efforts between multiple agencies and provide clear geographic boundaries for emergency communications.

Evacuation Constraints

Under California Government Code Section 65302(g)(5), jurisdictions are required to identify residential parcels with access to fewer than two evacuation routes as part of their safety element. **Figure B-4** shows residential parcels with evacuation constraints, including those with fewer than two evacuation routes and those more than a mile away from the nearest evacuation route. **Figure B-5** through **Figure B-7** show these evacuation-constrained parcels overlaid with specific hazard areas—fire hazard severity zones, flood hazard areas, and landslide susceptibility areas, respectively. These maps illustrate that significant portion of evacuation-constrained residential areas coincide with high-risk hazard zones, particularly in the southeastern mountainous regions and along Clear Lake's shoreline communities. This can compound vulnerabilities for residents during emergency situations. Occupants and residents of these parcels may be unable to evacuate quickly in the event of an emergency and are therefore more vulnerable to sudden or fast-spreading emergency conditions such as flash floods and wildfire.

Figure B-2 Lake County Major Evacuation Routes

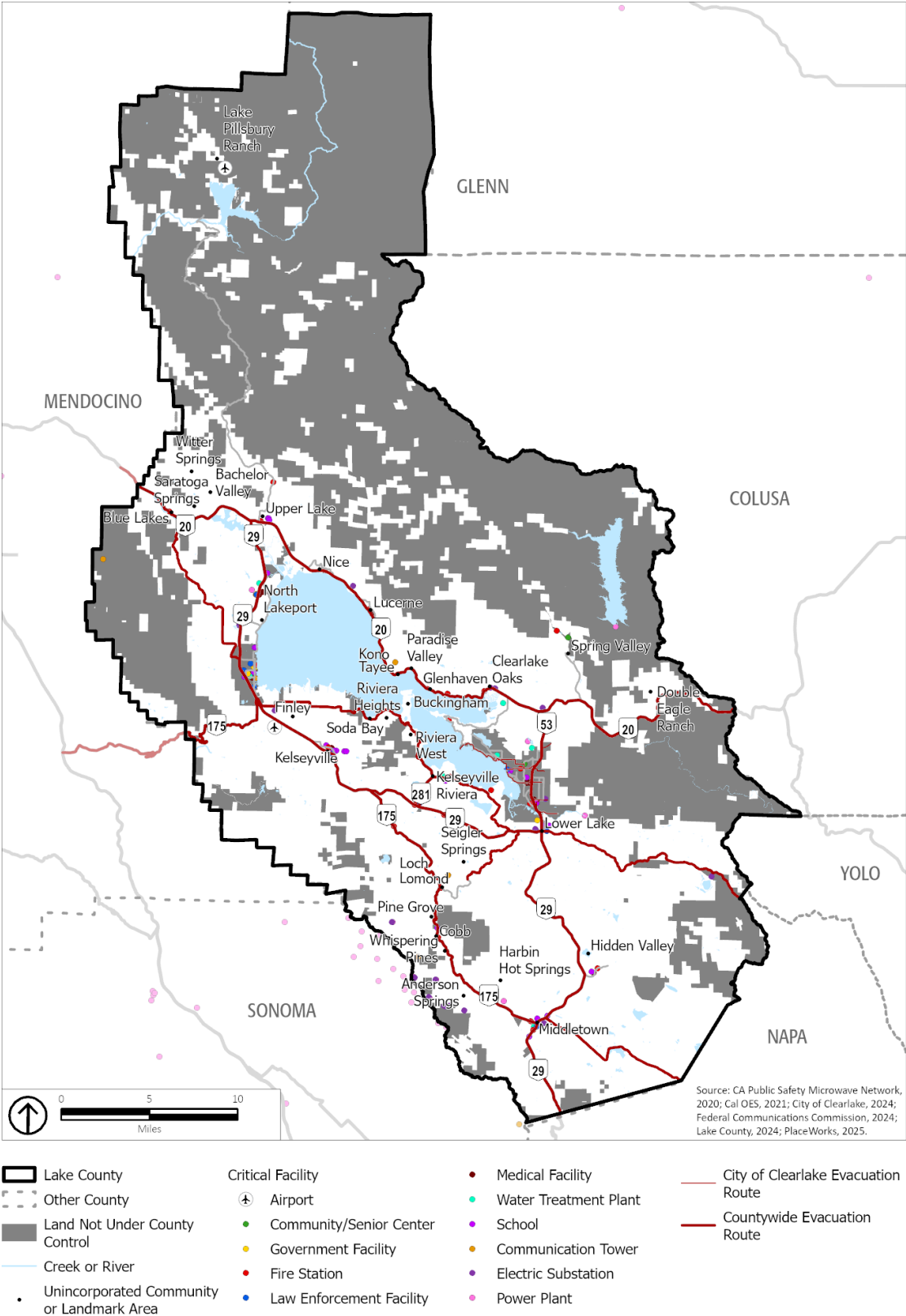


Figure B-3 Genasys Evacuation Zones

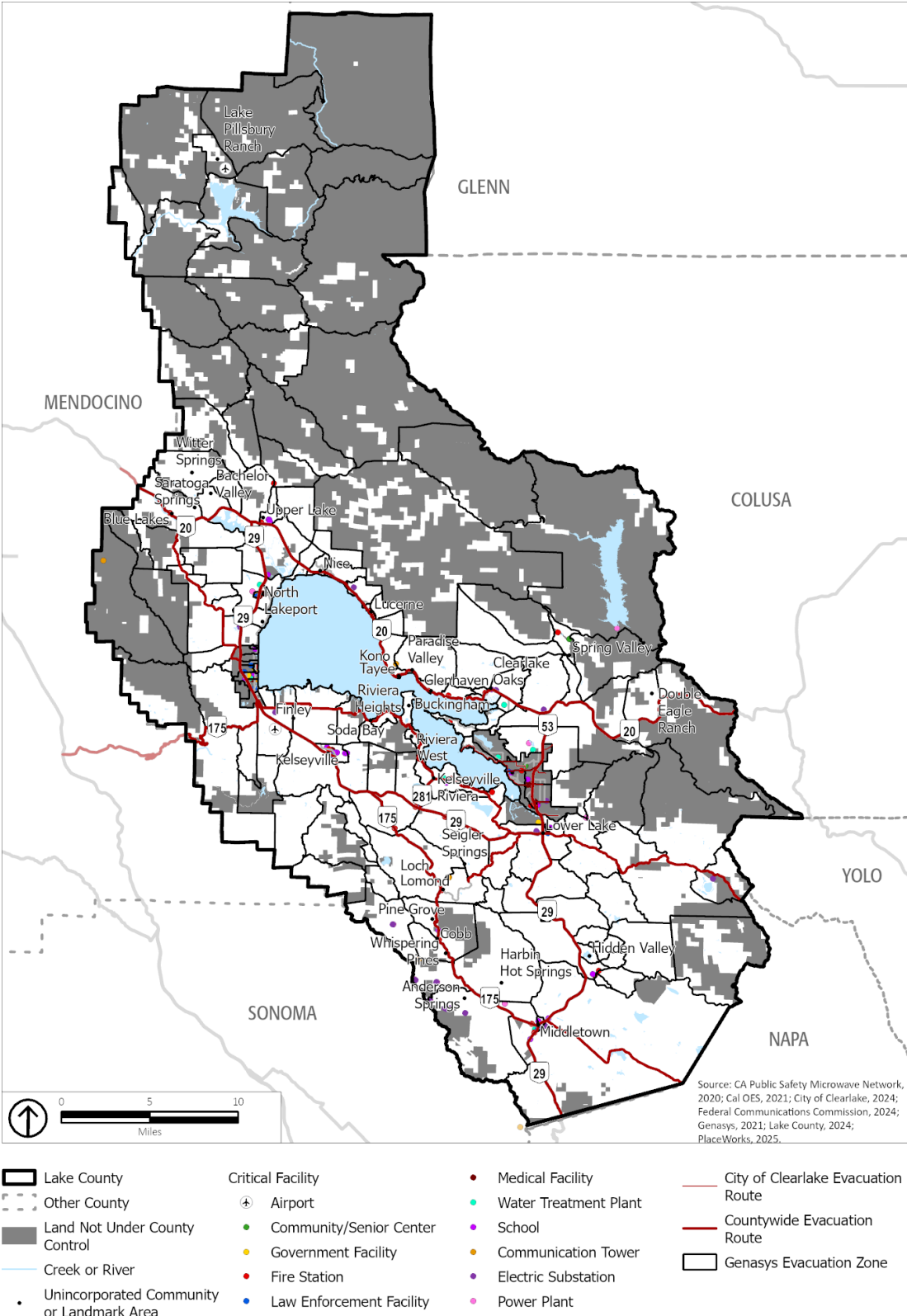


Figure B-4 Evacuation-Constrained Residential Parcels in Lake County

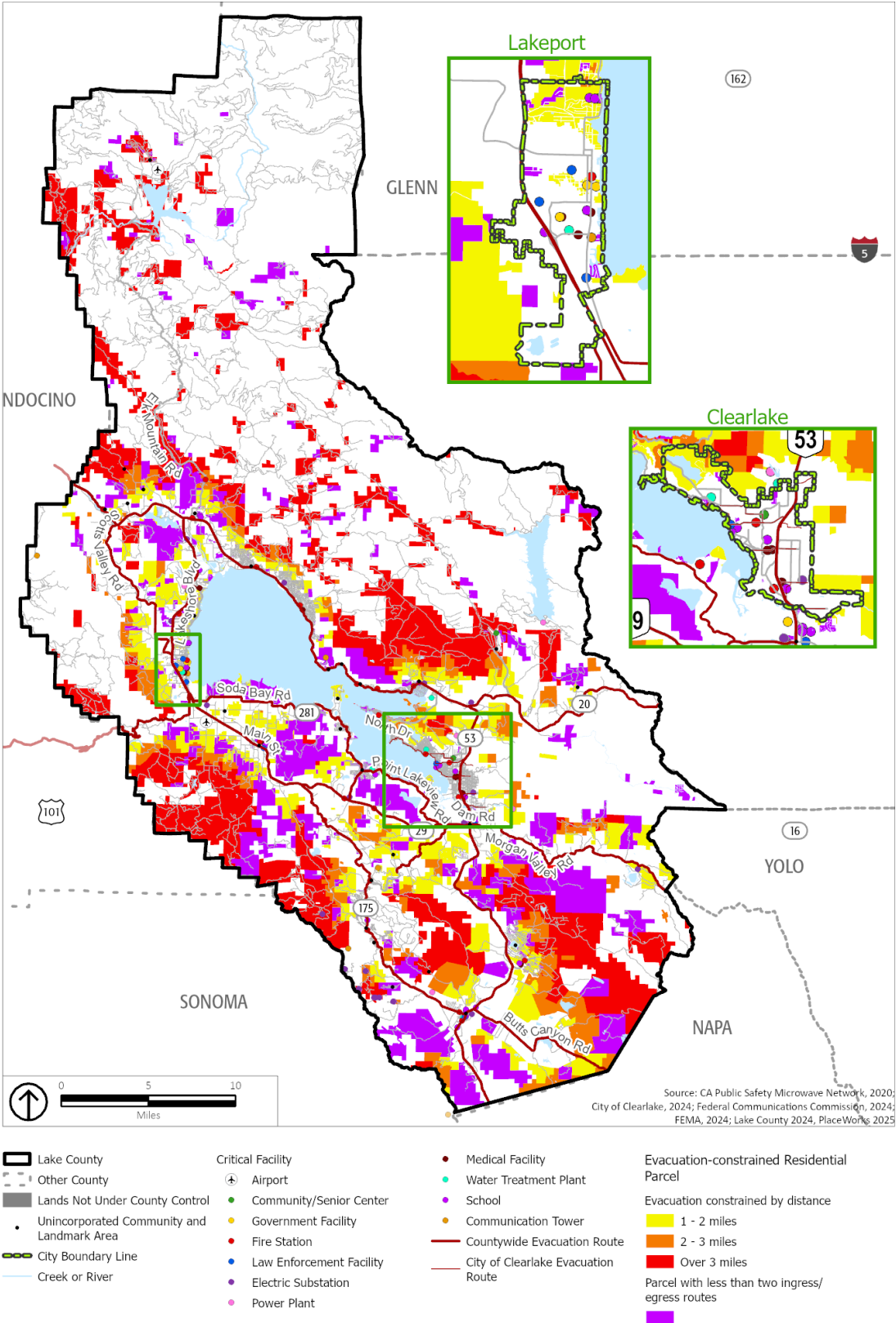


Figure B-5 Evacuation-Constrained Parcels and Fire Hazard in Lake County

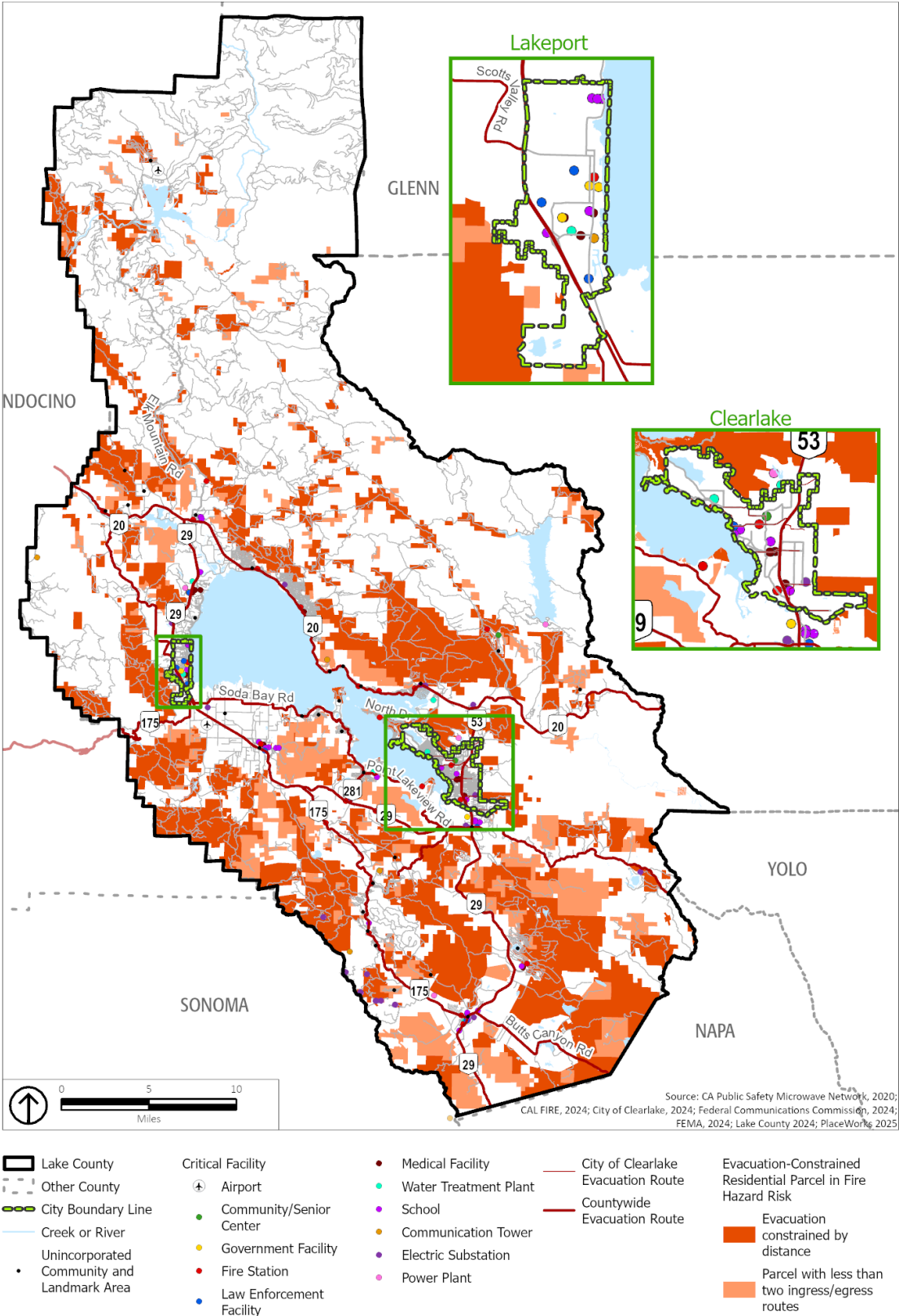


Figure B-6 Evacuation-Constrained Parcels and Flood Hazard in Lake County

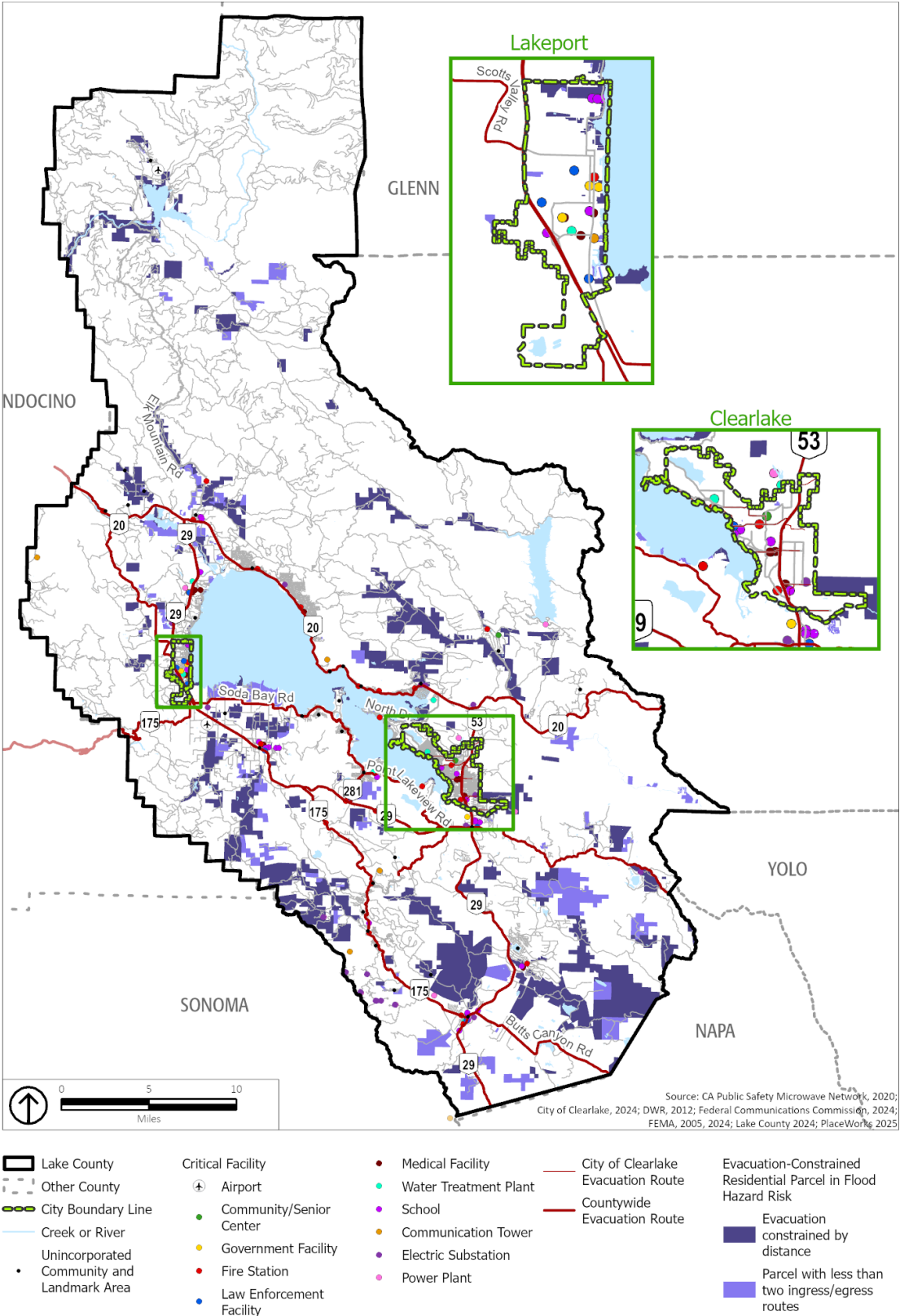
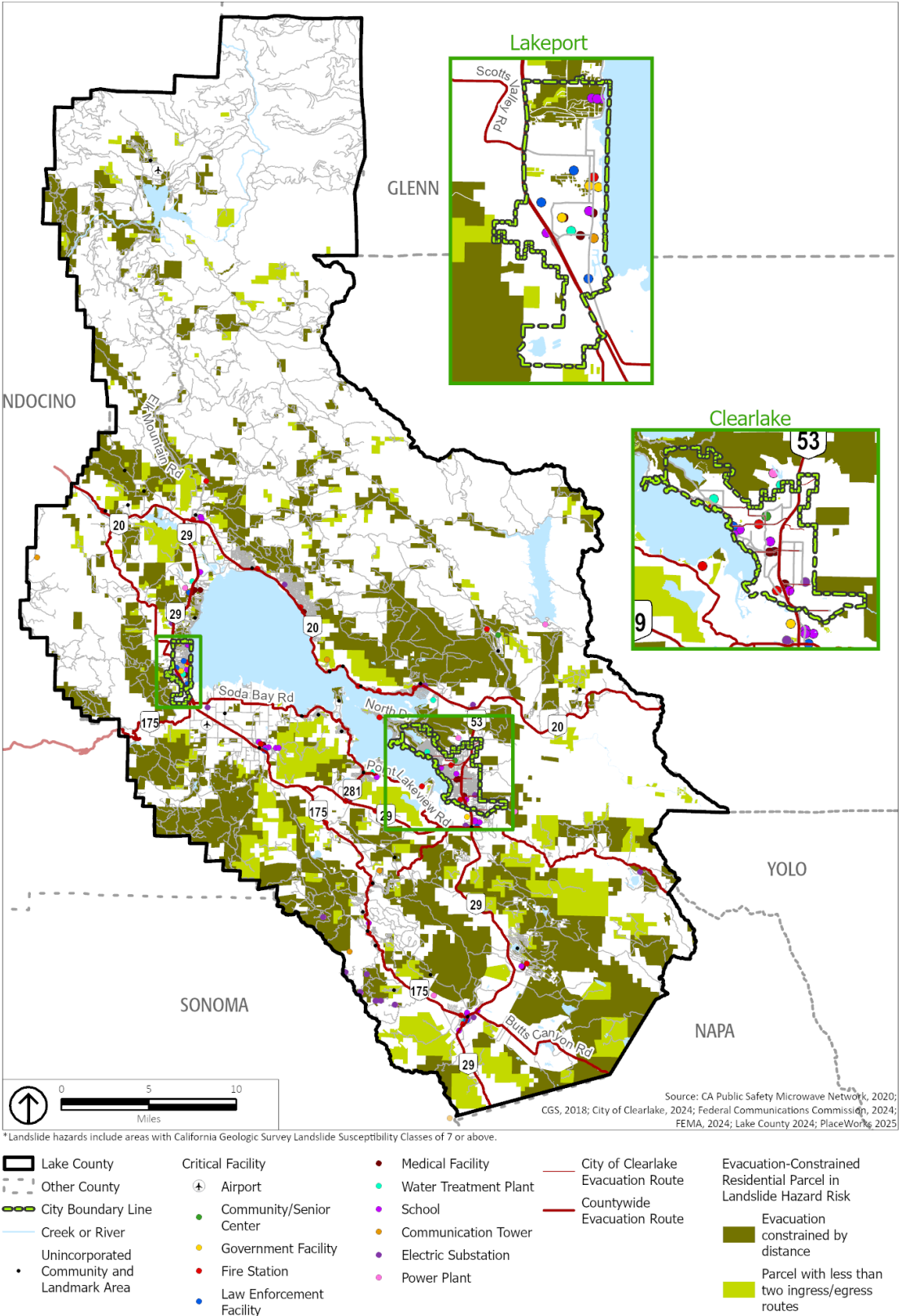


Figure B-7 Evacuation-Constrained Parcels and Landslide Hazard in Lake County



Emergency Alert and Warning Systems

The Lake County Sheriff's Office maintains several systems to alert residents about emergencies and provide critical information. The primary system is LakeCoAlerts, which enables the Sheriff's Office to provide critical information quickly for various situations, including evacuation orders and advisories, shelter in place orders, and urgent incident information such as law enforcement activity or severe weather.

LakeCoAlerts allows residents and businesses to receive alerts for up to five locations through multiple communication methods including text messages (up to two mobile phone numbers), phone calls (up to five numbers), emails (up to two addresses), and TeleType/Telecommunication Devices for the Deaf. Alerts are based on the geographic location of the emergency and the street addresses provided by registrants; they are also available in Spanish. While the system makes every effort to notify residents of emergencies, conditions such as power outages, lack of cell service, busy signals, or caller ID blocking may hinder notification efforts.

In addition to LakeCoAlerts, the Lake County Sheriff's Office uses multiple alert and warning mechanisms depending on the threat and time availability. These include:

- Emergency Alert System
- Integrated Public Alert & Warning System
- California Health Alert Network
- Media broadcast alerts
- Social media notifications
- Rapid field warnings using response personnel

The effectiveness of any warning depends on various factors, including available time, initial notice of threat, time of day, language barriers, and reception challenges for hearing and sight impaired. Warnings are typically issued during emergencies such as flash flooding, public health emergencies, fast-moving wildfires, severe weather conditions, major road closures, evacuations, and potential acts of violence.

Disaster Preparedness

Operational Area Emergency Services Disaster Council

The California Emergency Services Act (California Government Code Section 8610) authorizes counties and cities to create disaster councils. In accordance with this law, Lake County established the Lake County Operational Area Emergency Services Council to develop and recommend emergency and mutual aid plans, agreements, ordinances, and resolutions to the Board of Supervisors. The Council meets quarterly and consists of representatives from the Board of Supervisors, the Sheriff's Office/Office of Emergency Services, Emergency Services Directors from incorporated cities, the Health Services Director, fire district chiefs from unincorporated areas, and representatives from organizations with official emergency responsibilities.

Lake County Operational Area Emergency Coordinators

The Lake County Operational Area Emergency Coordinators are a working group that meets every other month to discuss and coordinate emergency management activities. The group includes representatives from cities, County departments, State agencies, special districts, utilities, and disaster response organizations. The group reviews emergency plans, coordinates training and exercise activities, and develops strategies for addressing emerging threats and hazards. The Emergency Coordinators play a crucial role in maintaining operational relationships between different agencies and ensuring readiness for multi-agency emergency response operations.

Lake County Fire Safe Council

The Lake County Fire Safe Council works to reduce wildfire risk through community education, fuel reduction projects, and evacuation planning. The Fire Safe Council collaborates with fire agencies, community organizations, and private landowners to implement projects identified in the Community Wildfire Protection Plan.

Chipper Program

The Fire Safe Council operates low-cost chipper programs for Lake County residents in South Lake County and Hidden Valley Lake to help create and maintain defensible space around homes and properties. Residents can pile brush and small trees from their defensible space clearing, and the Council's chipper crew will chip the material on-site. The chipped material can then be spread as mulch or removed. This service helps residents comply with defensible space requirements while reducing fuel loads and fire risk in residential areas. In addition to the Fire Safe Council, the Clear Lake Environmental Resource Center provides free chipping services, funded by the United State Department of Agriculture Community Wildfire Defense Grant, to Lake County residents without existing programs. Clear Lake Environmental Resource Center also provides funding to support the South Lake County Fire Safe Council chipping program, the Hidden Valley Homeowner's Association chipping program, and the Konocti Fire Safe Council's chipping program.

Reflect to Protect Program

The Reflect to Protect program provides reflective address signs to Lake County residents at no cost. These highly visible markers help first responders quickly locate properties during emergencies, especially at night or in low visibility conditions. The signs are made of durable materials that meet fire department specifications and include reflective numbers visible from both directions. This program helps improve emergency response times and effectiveness during wildfire events and other emergencies.

Healthcare Emergency Preparedness

Lake County's health system includes two hospitals, Adventist Health Clear Lake and Sutter Lakeside Hospital, that maintain emergency response capabilities. The County Health Services Department coordinates healthcare emergency preparedness through several programs:

- Medical/Health Operational Area Coordinator program.
- Healthcare facility emergency planning coordination.
- Public health emergency response planning.
- Medical countermeasure distribution planning.
- Pandemic response protocols.

Existing Programs and Regulations

Local Hazard Mitigation Plan

Lake County's Office of Emergency Services prepared the 2025 Multi-Jurisdictional Hazard Mitigation Plan in accordance with the federal Disaster Mitigation Act of 2000 and FEMA's hazard mitigation assistance guidance. The Local Hazard Mitigation Plan serves as the County's comprehensive strategy to reduce or eliminate long-term risks to life and property from natural hazards through specified actions.

The Multi-Jurisdictional Hazard Mitigation Plan and Safety Element address similar issues but serve different purposes. The Safety Element provides broad, long-term policy direction, and the Multi-Jurisdictional Hazard Mitigation Plan focuses on specific, often shorter-term mitigation actions to protect lives, property, and natural systems. The Safety Element incorporates the Multi-Jurisdictional Hazard Mitigation Plan by reference, which allows the County to maintain consistency between the two documents while avoiding redundancy. This incorporation enables the Safety Element to build on the detailed hazard analysis and mitigation strategies outlined in the Multi-Jurisdictional Hazard Mitigation Plan while maintaining its focus on long-range policy guidance. When the Multi-Jurisdictional Hazard Mitigation Plan is updated every five years, the incorporation by reference ensures

Lake County Community Organizations Active in Disaster (COAD)

COAD develops and supports partnerships for communication and collaboration among the Lake County community during all phases of disasters. COAD brings together non-profit and faith-based organizations, government agencies, and private sector entities to enhance disaster preparedness, response, and recovery efforts throughout Lake County. The organization provides comprehensive resources including fire recovery assistance to help residents navigate FEMA processes, insurance claims, and financial aid; emergency assistance guidance for food relief and government benefits; and extensive preparedness education and training materials. COAD also coordinates closely with the Lake County Fire Safe Council and maintains the critical preparedness resources available through their website. During disaster events, COAD facilitates member agency support and volunteer coordination, ensuring that community resources are effectively mobilized to assist affected residents.

that the Safety Element remains current with the latest hazard analysis and mitigation strategies without requiring a separate amendment process.

Lake County Emergency Operations Plan

The Lake County Emergency Operations Plan serves as the primary framework for the county's emergency response activities. The plan establishes multi-agency and multi-jurisdictional coordination during emergency operations, assigns functions consistent with Standardized Emergency Management Systems and National Incident Management Systems, and serves as the policy foundation for emergency management in the operational area. The operational area consists of approximately 1,329 square miles—1,256 square miles of land and 73 square miles of water—and includes the central northwest portion of California. The Emergency Operations Plan was developed through extensive collaboration between County departments, incorporated cities, Tribal governments, fire districts, special districts, and other governmental partners. The Lake County Board of Supervisors approved the 2025 Emergency Operations Plan in April of 2025; the County will update the Plan regularly.

The Emergency Operations Plan establishes the emergency management organization's structure, defines roles and responsibilities for various County departments and agencies, and outlines procedures for Emergency Operations Center activation and operation. The plan addresses essential emergency functions including alert and warning, communications, damage assessment, evacuation, public information, and resource management.

The base plan is supplemented by hazard-specific annexes that provide detailed response protocols for flooding, wildfire, severe weather, and hazardous materials incidents. These annexes are regularly updated to reflect changing conditions and lessons learned from previous emergencies. The Emergency Operations Plan also incorporates guidance from State and federal emergency management agencies to ensure consistency with State and federal response frameworks.

Community Emergency Response Team

Lake County Office of Emergency Services supports local Community Emergency Response Team programs that train residents in basic disaster response skills. The program educates volunteers about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety and suppression, light search and rescue operations, team organization, disaster medical operations, and emergency communications.

The Community Emergency Response Team Program offers consistent volunteer training that professional responders can rely on during disaster situations, allowing them to focus on more complex tasks. In the event of a disaster or public safety emergency, Community Emergency Response Team volunteers assist their family and neighbors when first responders are not immediately available to help.

California Fire Safe Regulations

Lake County has adopted the State Fire Safe Regulations, which establish minimum wildfire protection standards for development in the State Responsibility Area. These standards include requirements for roads and evacuation routes, such as minimum road widths, maximum dead-end road lengths, and turnaround requirements to ensure emergency access and civilian evacuation during disasters. The standards apply to all new building construction within State Responsibility Area boundaries.

California Building Code, ~~and California Fire Code, and Wildland-Urban Interface Code~~

Lake County has adopted the California Building Standards Code, including the ~~and California Fire Code and Wildland-Urban Interface Code~~ through Title 25 of the Lake County Code, with local amendments specific to the county's unique conditions and needs. These codes establish minimum requirements to safeguard public health, safety, and general welfare through structural strength, means of egress, stability, access for emergency responders, and other safety measures.

~~The California Fire Code includes specific requirements for emergency planning and preparedness, fire service features, and fire protection systems. Key provisions adopted by Lake County include:~~

- ~~● **Fire Apparatus Access Roads:** Requirements for road width (minimum 20 feet), vertical clearance (minimum 13 feet 6 inches), surface materials, load-bearing capacity, turning radius, and grade. Roads must be designed to accommodate fire apparatus and maintain accessibility during emergencies.~~
- ~~● **Emergency Access and Addressing:** All buildings must have approved address numbers clearly visible from the street, with numbers at least four inches high on contrasting backgrounds. Street and road signs must meet specific visibility and durability standards to ensure emergency responders can quickly locate properties during emergencies.~~
- ~~● **Fire Protection Features:** Requirements for emergency vehicle turnarounds on access roads exceeding 150 feet in length, turnouts on long driveways, and gate standards for properties with controlled access. These features ensure emergency vehicles can efficiently access and maneuver within properties during emergency response.~~

Lake County Mutual Aid Agreements

Lake County maintains several mutual aid agreements that enhance emergency response capabilities. The Fire Chief's Association Mutual Aid Plan, developed in coordination with all six of Lake County's fire districts, enables resource sharing between fire districts both within and outside the county. The Sheriff's Office participates in the California Law Enforcement Mutual Aid System, while Animal Services maintains agreements with animal welfare organizations for emergency assistance.

Lake County is part of California Mutual Aid Region III, one of six mutual aid regions established under the California Emergency Services Act and coordinated through the California Office of Emergency Services. As part of Region III, Lake County can request and provide mutual aid to neighboring counties including Colusa, Glenn, Mendocino, Napa, and Sonoma.

These agreements provide frameworks for requesting and providing emergency assistance between jurisdictions and establish procedures for resource ordering, command and control of mutual aid resources, and cost recovery mechanisms. The mutual aid system helps ensure that additional resources are available when local capabilities are overwhelmed, creating a more resilient emergency response network.

Extreme Temperature

Extreme temperatures, particularly extreme heat, affect Lake County's public health, infrastructure, and environment. Extended periods of extreme heat, known as heat events or heat waves, are particularly dangerous when combined with warm nights that prevent cooling and relief from the heat. California Public Resources Code Section 71410 defines extreme heat as increasing temperatures or other meteorological conditions that could result in any of the following: extreme heat wave, heat health event, or heat watch, warning, or advisory from the National Weather Service, the Office of Emergency Services, or a County health officer, or a proclamation of a state of emergency by the Governor pursuant to Section 8625 of the Government Code. The State's Cal-Adapt database defines extreme heat days as temperatures exceeding 98 percent of historical highs for a given area.²⁴ In Lake County, an extreme heat day occurs when temperatures reach at least 97.1 degrees Fahrenheit countywide.²⁵ A warm night in Lake County occurs when minimum temperatures remain above 55.6 degrees countywide.²⁶ Lake County's average annual maximum temperature is 67.7 degrees Fahrenheit, with historically milder temperatures compared to other California regions.

Heat is one of the deadliest climate-related hazards nationwide, causing increased risk of dehydration, heat-related illnesses, and respiratory issues. This is particularly concerning for vulnerable populations, including older adults, children, outdoor workers, and residents without access to air conditioning. High temperatures can strain electrical systems as increased air conditioning use strains the power grid. Transportation infrastructure can also degrade under extreme heat conditions, leading to service disruptions and damage. Rising temperatures also increase water temperatures in lakes, streams, and other water bodies, which can affect water quality and the plants and wildlife in aquatic ecosystems.²⁷ Additionally, extreme heat can disrupt daily activities and economic productivity, particularly affecting outdoor recreation, agriculture, and other temperature-sensitive industries.²⁸

Extreme cold can also impact Lake County when temperatures fall below normal levels. An extreme cold day occurs when temperatures do not exceed 37.9 degrees countywide.²⁹ Cold temperatures can affect electrical transmission efficiency and, in rare cases, cause power outages and equipment damage.

Past Occurrences

While there have been no FEMA or Cal OES disaster declarations related to extreme heat in Lake County, the National Weather Service Eureka office has issued numerous heat-related advisories and warnings. Between 2020 and 2022, National Weather Service Eureka issued 26 advisories and warnings for Lake County: 18 heat advisories and 8 excessive heat warnings.³⁰

Recent notable extreme temperature events in Lake County follow, as recorded by NOAA's National Centers for Environmental Information Storm Events Database.³¹

June 9 to 11, 2019

An early season heat wave affected Lake County and the surrounding region. The combination of high pressure and offshore flow resulted in record-breaking temperatures. Three fatalities were reported during the heat event: one person died as a direct result of heat-related illness, and two others drowned while attempting to cool down during the heat wave.

July 9 to 11, 2021

An extreme heat event impacted Lake County with daytime highs rising above 100 degrees Fahrenheit. Overnight lows remained unusually warm, particularly across higher elevations, with temperatures between 70- and 80- degrees Fahrenheit in the early mornings. No fatalities were reported during this heat event.

September 1 to 8, 2022

A prolonged and intense heat wave affected much of Northern California, including Lake County. Multiple daily temperature records were broken across the region. The event prompted the National Weather Service to issue excessive heat warnings for much of the area. Communities opened cooling centers to provide relief from the extreme temperatures.

July 14 to 16, 2023

High pressure and offshore flow created dangerous heat conditions across Lake County. Daytime temperatures reached over 100 degrees Fahrenheit in many locations, and overnight lows remained in the 70s, providing little relief. The event triggered heat advisories and prompted the opening of cooling centers throughout the county.

Existing Programs and Regulations

Severe Weather: Extreme Heat Annex and Severe Weather: Heavy Rains, Snow, and Storms Annex of the Emergency Operations Plan

Lake County Office of Emergency Services maintains two severe weather annexes to the Emergency Operations Plan dedicated to extreme temperature and weather events. These annexes coordinate response among County departments, cities, special districts, and community groups during extreme heat incidents.³²

The Emergency Operations Plan establishes key roles for County departments to respond to extreme heat events. Lake County Health Services coordinates hospital and healthcare facility responses and develops public health recommendations. The Department of Social Services coordinates mass care and shelter

with Red Cross and assists vulnerable populations through In-Home Supportive Services and Area Agency on Aging programs.

North Coast Energy Services Programs

The North Coast Energy Services Weatherization Program provides free home weatherization services to low-income Lake County residents, including weather stripping, water heater blankets, attic insulation, and other energy-saving measures that help maintain comfortable temperatures. Income-qualified residents can also receive assistance with utility bills through the Home Energy Assistance Program (HEAP).³³

PG&E Programs

PG&E offers several assistance programs for Lake County residents. The California Alternate Rates for Energy (CARE) Program offers a monthly discount of 20 percent or more on gas and electricity bills to income-qualified households and housing facilities.³⁴ Through its Medical Baseline Program, PG&E provides additional energy allotments at the lowest price to customers who require power for medical devices or have qualifying medical conditions.³⁵ Additionally, PG&E offers payment assistance programs and the Energy Savings Assistance Program, which provides free weatherization services to low-income customers.

CalHeatScore

CalHeatScore is a statewide public health tool developed by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment that provides daily forecasts of extreme heat risk. The tool ranks heat conditions on a scale from 0 to 4 based on ZIP code-level data, combining meteorological forecasts with historical health data to predict the community risk of heat-related illnesses. Lake County residents can use CalHeatScore to access daily updates on their community's heat score, find nearby cooling centers, and receive tailored safety recommendations for vulnerable populations including older adults, children, outdoor workers, and those with chronic health conditions. This tool helps residents plan for extreme heat events and take protective actions to reduce their risk of heat-related illness.

HeatReadyCA.com

[HeatReadyCA.com](https://heatreadyca.com) is a statewide multi-lingual public awareness and education campaign designed to help residents prepare for and stay safe during extreme heat events. The website provides practical safety tips, resources for staying cool, and guidance for creating personalized extreme heat preparedness plans. Lake County residents can access information about recognizing the signs and symptoms of heat-related

Cooling Centers

Lake County does not yet operate formal cooling centers that provide dedicated staffing and backup power for extended stays, but several public facilities serve as informal cooling options during extreme heat events. County residents can find temporary relief from high temperatures at public libraries and Behavioral Health Peer Support Centers during their regular operating hours. These facilities, though not designated cooling centers, provide air-conditioned spaces where community members can escape extreme heat conditions. The American Red Cross Community Adaptation Program in Lake County works with non-governmental organizations to operate cooling centers.

illness, locate cooling centers and air-conditioned public spaces, learn about financial assistance programs for energy bills and home weatherization, and find resources specifically tailored to high-risk groups including seniors, workers, pregnant individuals, and people with chronic illnesses or disabilities.

Future Conditions

Likelihood of Future Occurrence

Extreme heat is an annual occurrence in Lake County and is likely to continue. Due to Lake County's inland location and Mediterranean climate, high temperatures will continue to be more common than cold temperatures.

Climate Change and Extreme Temperature

Climate projections indicate substantial temperature increases for Lake County compared to historical levels, with annual maximum temperatures expected to rise by 3.1 degrees in the near term (2025–2035), 4.7 degrees by midcentury (2035–2064), and 8.1 degrees by late century (2070–2099).³⁶ Similarly, the annual average minimum temperature is expected to increase from its historical average of 37.9 degrees to 40.9 degrees in the near term, 42.3 degrees by midcentury, and 45.9 degrees by late century. These increases will be most pronounced in the Lakeport, Kelseyville, Middletown, Lower Lake, and East Lake Communities Areas, where annual average maximum temperatures could exceed 80 degrees Fahrenheit by 2100.

According to Cal-Adapt, the number of extreme heat days is expected to rise from a historical annual average of 4 days to 12 days in the near term, 20 days by midcentury, and 42 days by late century. Similarly, warm nights are projected to increase from a historical average of 5 nights annually to 19 nights in the near term, 32 nights by midcentury, and 77 nights by late century. These changes will lead to more frequent and intense extreme heat events, with longer duration and less relief from nighttime cooling. The combination of extreme heat days and warm nights can overwhelm a community's adaptive capacity, especially in areas lacking adequate cooling infrastructure.

Extreme temperatures pose significant risks for vulnerable populations, including older adults, people with disabilities, and outdoor workers. During extreme heat events, increased demand for air conditioning can strain electrical systems and lead to power outages. Transportation infrastructure can also degrade under extreme heat. Rising temperatures affect water temperatures in lakes and streams, affecting water quality and aquatic ecosystems, while extreme cold can decrease electrical transmission efficiency and degrade infrastructure. Cold weather events often occur in conjunction with other severe weather conditions like storms and high winds, compounding their impacts and creating additional challenges for emergency response and infrastructure reliability.

Flood Hazards

Flooding is the rising and overflowing of water onto normally dry land. While essential to the region's ecological systems, floods have historically caused substantial damage to structures, landscapes, and utilities as well as creating life-safety issues in Lake County, according to the Local Hazard Mitigation Plan. Flooding in Lake County primarily occurs during the winter and spring months (November through April) when stream systems swell with heavy rainfall.

Lake County's primary source of flooding is Clear Lake and its tributary streams, particularly Scotts Creek, Cole Creek, Kelsey Creek, and Adobe Creek. These creeks not only experience significant flooding themselves but contribute to high lake stages and lakeshore flooding. Clear Lake's limited outlet capacity at Cache Creek, restricted by the natural Grigsby Riffle rock formation, can prolong flood conditions along the lakeshore for up to 90 days.³⁷ Flash flooding from short-duration, high-intensity precipitation events, often during atmospheric rivers, can also occur. Atmospheric rivers are long, narrow regions in the atmosphere that transport concentrated water vapor, often releasing it as heavy rainfall upon making landfall.³⁸ These events can be particularly dangerous as they can occur with little warning, even during drought conditions.

Areas at elevated risk of flooding are divided into 100- and 500-year flood zones, with a 1 percent and 0.2 percent chance, respectively, of flooding in any given year. As shown on **Figure B-8**, flood hazard zones in Lake County primarily follow Clear Lake's shoreline and the county's major waterways. The DWR Awareness 100-year flood zone (shown in dark blue) and FEMA 100-year flood zone (shown in blue) encompass areas immediately adjacent to Clear Lake, particularly around Nice, Lucerne, Clearlake Oaks, and the Clearlake Riviera area. These zones also follow creek corridors, most notably along the waterways near Upper Lake, through Middletown, and in the Coyote Valley area. The FEMA 500-year flood zone (shown in light blue) extends beyond these areas into broader low-lying regions, including parts of Kelseyville and areas east of Upper Lake. The map also indicates the presence of critical facilities within or near these flood-prone areas, including fire stations, medical facilities, and community centers, which could be impacted during flood events. Flooding can be severe and long-lasting, including property damage, infrastructure disruption, and public health hazards due to contaminated water and increased vector breeding grounds. Flooding can also degrade water quality, accelerate soil erosion, and damage ecological resources, as well as create economic impacts such as business interruption, agricultural losses, and increased insurance costs.

Floodplains and Flood Recurrence

According to the Federal Emergency Management Agency, a 100-year floodplain is the area that has a 1 percent (1 in 100) chance of being flooded in any given year. This would also be the area that would flood during a 100-year storm. The 500-year floodplain is the area that has a 0.2 percent (1 in 500) chance of being flooded in any given year due to a 500-year storm.

Figure B-8 FEMA Flood Hazard Zones

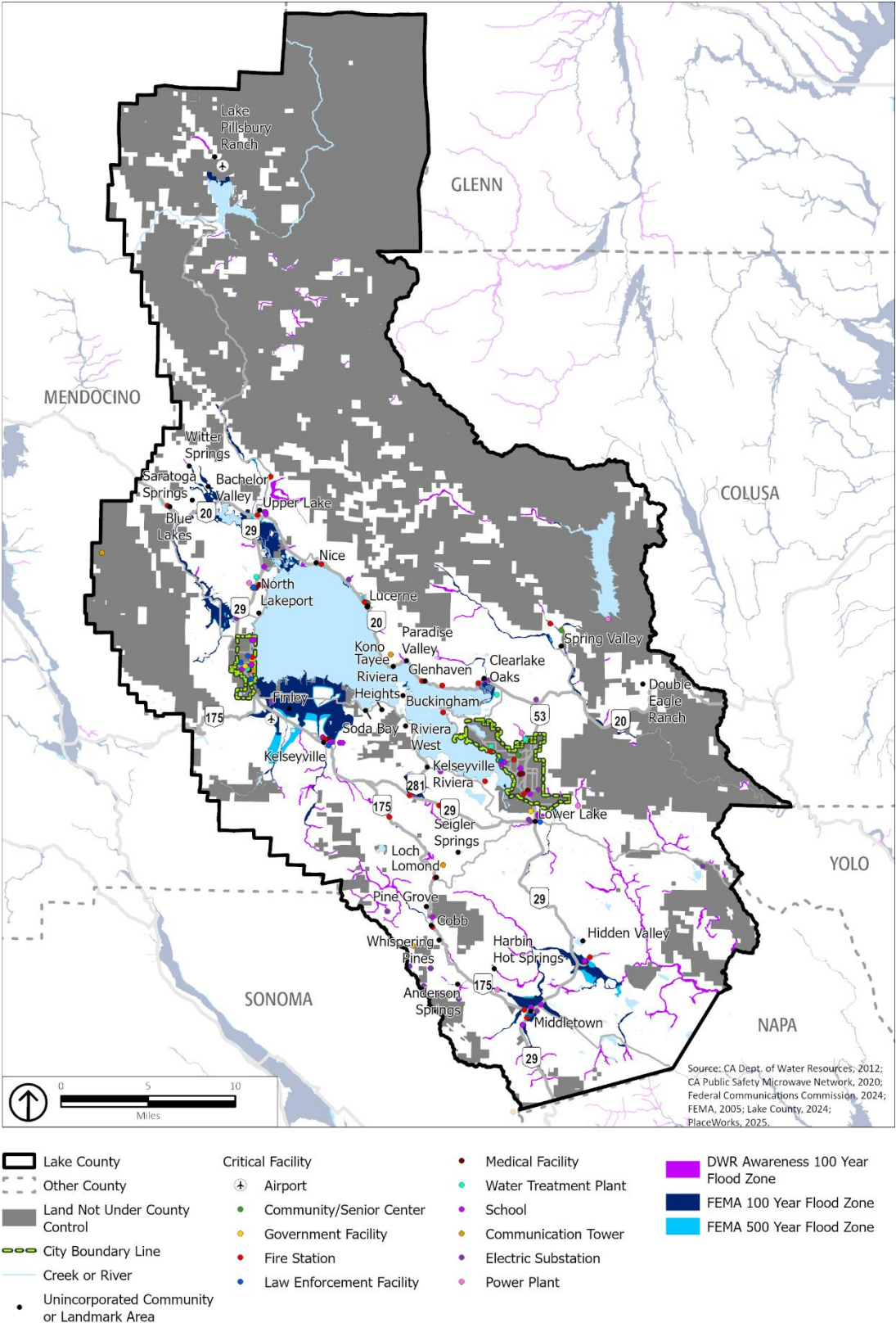
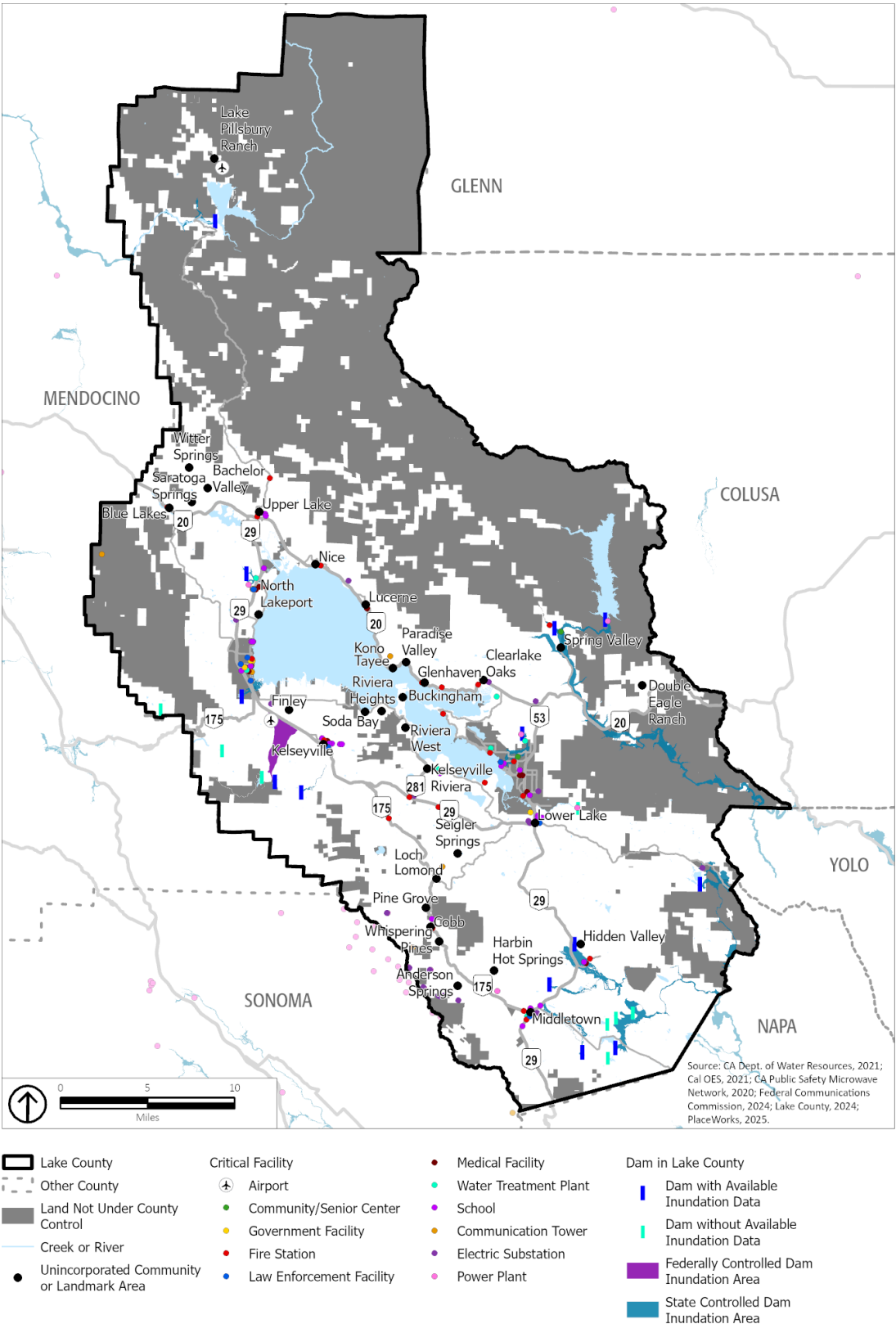


Figure B-9 Dam Inundation Areas



Dam inundation poses an additional flood risk in Lake County. A dam failure is an uncontrolled release of water from a reservoir through a dam because of structural failures or deficiencies in the dam, usually associated with intense rainfall or prolonged flooding. Water pipeline failures can create a similar sudden flood. Dam and pipeline failures can range from minor to catastrophic, potentially harming human life and property downstream from the failure. In addition, ecosystems and habitats can be destroyed by fast-moving floodwaters, debris, and sedimentation from inundation. The county contains several significant dams, including Cache Creek Dam, Indian Valley Dam, Adobe Creek Dam, and Highland Creek Dam. While dam failure is extremely rare, **Figure B-9** shows that areas downstream of dam structures could experience severe flooding in the unlikely event of a failure.

In Lake County, flood control and management is primarily overseen by the Lake County Watershed Protection District, which monitors approximately 10.5 miles of levees along Middle Creek, Alley Creek, Clover Creek, and the Clover Creek Diversion Channel. The U.S. Army Corps of Engineers also maintains one levee (Maintenance Area 17) in the county. These agencies work to reduce flood risks through infrastructure maintenance, monitoring, and emergency response coordination.

Past Occurrences

Lake County has experienced several significant flooding events throughout its history. The following sections describe notable flood events that have affected the unincorporated areas of the county, as described in the Local Hazard Mitigation Plan Update.

February 1998

Flooding around Clear Lake caused over \$5 million in damages and flooded over 60 homes, with some residents evacuated for weeks. Rainfall rates of 4 inches in 6 hours were observed at the onset of the flooding, and at its peak, Clear Lake reached 2.5 feet above flood stage. The flooding continued into March and April. SR-20 was closed for weeks. No deaths or injuries were reported in Lake County.

January 2006

A series of warm winter storms brought heavy rain, mudslides, flooding, and high winds to Northern California, including Lake County. Three deaths occurred due to these storms across the affected region. Lake County was among 16 counties declared in need of federal disaster assistance.

December 2014

An atmospheric river event beginning December 11th brought periods of heavy rainfall, flooding from overly saturated grounds, and high river/stream water levels. Governor Brown declared a state of emergency for heavy rain, flooding, and wind damage in Lake County. Flooding in Clearlake caused significant and widespread damage, leading to neighborhood evacuations and extensive road damage requiring repair and debris removal. No deaths or injuries were reported.

February 2017

Flooding of Clear Lake closed multiple roads, including Lakeshore Boulevard at several locations in North Lakeport, Nice-Lucerne Cutoff, Keys Boulevard, St. Francis Drive, and Lands End Drive. The lake's level remained in flood stage for a month, leading to mandatory evacuations in parts of Lakeport. Early assessments suggested damage to County-maintained roads ranged between \$5 million and \$7 million. No deaths or injuries were reported.

Existing Programs and Regulations

Development Review and Floodplain Management

The Lake County Water Resource Department reviews proposed developments to minimize flooding and drainage hazards according to State and local regulations. The department's review integrates California drainage law, California Environmental Quality Act requirements, and several key chapters of the County Code, including Floodplain Management (Chapter 25), Storm Water Management (Chapter 29), and Clear Lake Shoreline regulations (Chapter 23). Projects in Special Flood Hazard Areas must comply with specific requirements for new development to minimize future flood damage, including the use of flood-resistant materials, floodproofing utilities, and elevating floors above flood levels.

National Flood Insurance Program Participation

Lake County participates in the National Flood Insurance Program, enabling federally backed flood insurance for all buildings in the county. As of 2023, approximately 7,800 flood-prone properties exist in unincorporated Lake County, with about 1,700 flood insurance policies providing over \$341 million in coverage.³⁹ The County enforces substantial damage/improvement requirements, mandating that structures in 100-year flood zones be brought into compliance with current building standards if damage or improvements exceed 50 percent of the structure's market value.

Community Rating System

Lake County's participation in the Community Rating System since 1995 has earned property owners a 15 percent discount on flood insurance premiums in Special Flood Hazard Areas and a 5 percent discount outside these areas. The rating reflects the County's enhanced floodplain management activities, including maintaining elevation certificates, providing map information services, and preserving open space in flood-prone areas.

Middle Creek Flood Control Project

The Lake County Watershed Protection District operates and maintains the Middle Creek Flood Control Project in Upper Lake, which includes 14.4 miles of levees, a pump station, and a diversion channel. The project protects Upper Lake from Middle Creek and Clover Creek flooding, while also safeguarding farmland and residences from inundation from Clear Lake. Through the California Department of Water Resources' Small Communities Flood Risk Reduction Program, the County is conducting studies to identify additional flood risk reduction solutions for the North Lake Communities.

Lake County Code

The Lake County Code contains several chapters that govern flood management and protection:

- Chapter 23, *Clear Lake Shoreline*, establishes standards for development along the Clear Lake shoreline to prevent adverse impacts on water quality, control erosion, and protect lake habitat while allowing reasonable use of shoreline properties.
- Chapter 25, *Floodplain Management*, provides comprehensive regulations for development in flood-prone areas, including requirements for development permits in Special Flood Hazard Areas, standards for construction and utilities in flood zones, and specific provisions for manufactured homes and recreational vehicles.
- Chapter 29, *Storm Water Management Ordinance*, sets requirements for:
 - Stormwater pollution prevention during construction
 - Post-construction stormwater management
 - Maintenance of drainage facilities
 - Enforcement of water quality protection measures

Future Conditions

Likelihood of Future Occurrence

The 1 percent annual chance (100-year) flood zones cover significant portions of the county, particularly in areas around Clear Lake and along major waterways. While these floods have a relatively low probability in any given year, they can occur multiple times in quick succession when conditions align. Areas in the 0.2 percent annual chance (500-year) flood zones face an even lower but still present risk of major flooding.

Localized flooding from stormwater is likely to occur annually when rainfall exceeds drainage system capacity. With older infrastructure and more development channelizing stormwater, this type of flooding is expected to continue occurring regularly during heavy rain events.

Climate Change and Flooding

Climate change is expected to significantly affect flooding patterns and severity in Lake County. The region is expected to see a consistent increase in annual rainfall amounts, but climate scientists project an increase in the frequency and intensity of extreme precipitation events, particularly atmospheric rivers.⁴⁰ By 2100, what is currently considered a 200-year storm could occur every 150 to 160 years, representing a 40- to 50-year increase in frequency. This shift means the current 100- and 500-year floodplains may expand, and existing floodplains could become 40- to 50-year floodplains.

The impacts of climate change on flooding are further compounded by periods of intense drought, which are also expected to increase. Extended dry periods cause soils to harden and become less permeable. When heavy rainfall does occur, these conditions lead to increased surface runoff rather than ground absorption, potentially causing more severe downstream flooding.⁴¹

The combination of these factors suggests that flooding will remain a significant hazard for Lake County, with climate change likely to increase both the frequency and severity of flood events in the coming decades.

Geologic and Seismic Hazards

Lake County faces various geologic and seismic hazards due to its diverse topography and location in a seismically active region of California. These hazards can significantly affect public safety, property, and infrastructure.

Seismic Hazards

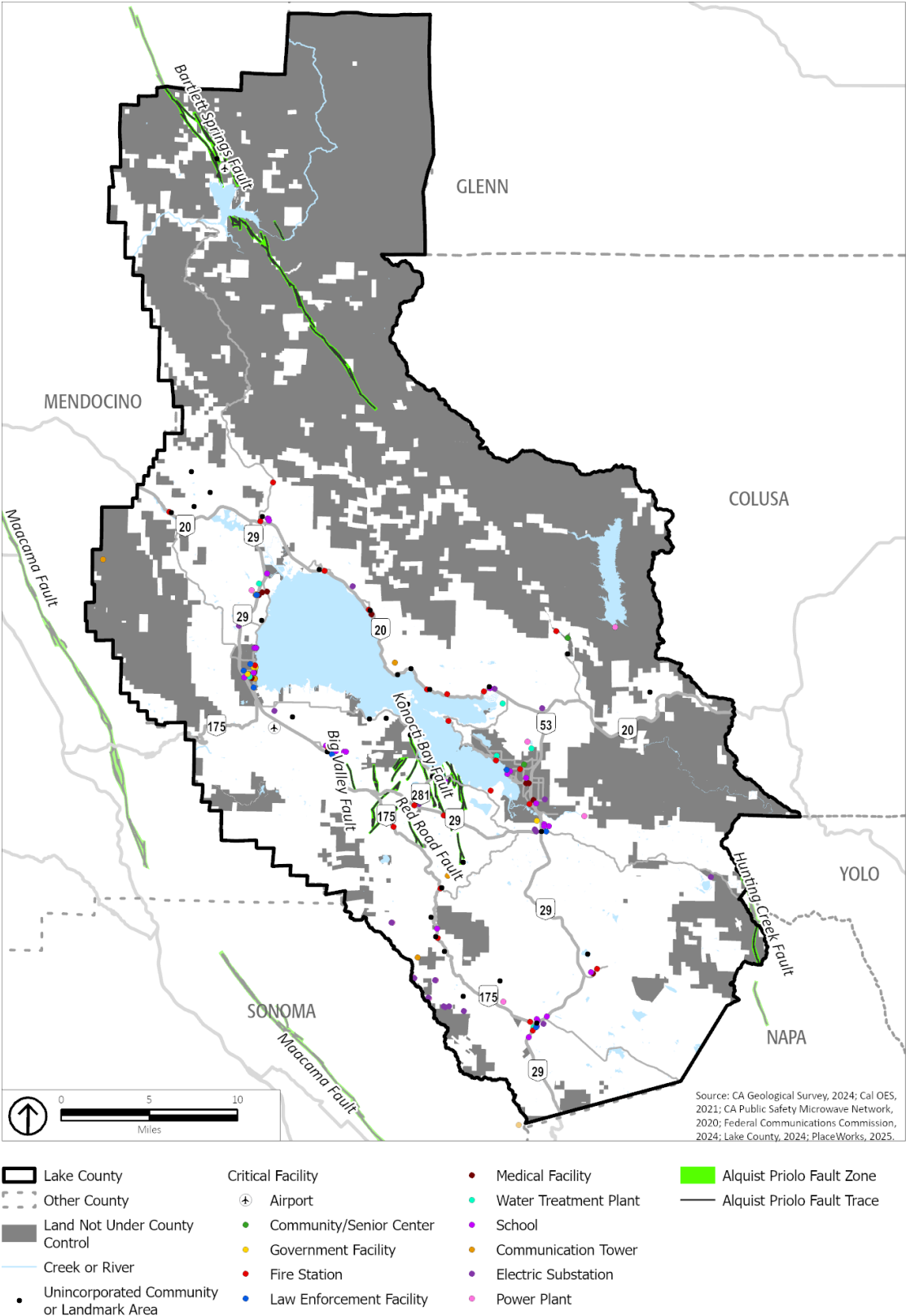
Seismic hazards include ground shaking, surface rupture, and liquefaction. The most common and widespread seismic hazard, ground shaking can vary significantly in intensity depending on factors such as distance from the epicenter, local soil conditions, and building design. According to the California Geologic Survey, much of Lake County would be susceptible to violent ground shaking in the event of a major earthquake on nearby fault systems.

Earthquakes occur when accumulated stress in the earth's crust is suddenly released, causing seismic waves traveling outward from the source. While Lake County has experienced relatively few major earthquakes historically, its location among several significant fault systems creates ongoing seismic risk. As shown on **Figure B-10**, the county contains multiple active fault systems, including the Bartlett Springs Fault System running through the eastern portion of the county, the Konocti Bay Fault Zone extending through the Clear Lake area, and the Callayomi Fault Zone and Hunting Creek-Berryessa Fault Zone in the southern portion. Additionally, the county lies within the broader influence zone of the San Andreas Fault System approximately 30 miles to the west. And finally, the "Mendocino Triple Junction," where the Gorda, North American, and Pacific plates intersect in Humboldt County, poses a significant seismic threat to the northern California region, including Lake County.

The Clear Lake Volcanic Field, one of the most recently active volcanic areas in California, has shaped much of the county's topography. According to the U.S. Geological Survey, this volcanic field remains potentially active, with the most recent eruptions occurring approximately 10,000 years ago. While the probability of an eruption in the near future is low, the presence of active geothermal systems and periodic seismic activity indicates ongoing volcanic processes beneath the surface. The volcanic field contributes to regular seismic activity, particularly in the geothermal areas of southern Lake County near the Geysers, where minor earthquakes occur almost daily, though these events typically register at magnitude 4.0 or less.⁴²

Surface rupture occurs when earthquake energy causes the ground surface to break along a fault line. While Lake County has several small active faults, primarily centered in the Cobb Mountain area, surface rupture risk is generally lower than other seismic hazards due to established setback requirements from known fault zones, according to the Local Hazard Mitigation Plan.

Figure B-10 Regional Fault Lines



Liquefaction occurs when strong ground shaking causes water-saturated soils to lose strength and behave like a liquid. Areas near Clear Lake's shore and along major streams are most susceptible to liquefaction due to their soil composition and high groundwater tables.

Additionally, the numerous water bodies in Lake County, including Clear Lake, Lake Pillsbury, and Indian Valley Reservoir, create potential for seiche hazards during significant seismic events. A seiche is a standing wave in an enclosed or partially enclosed body of water that can be triggered by seismic activity. The wave action from a seiche can damage shoreline structures and potentially cause flooding in low-lying areas around these water bodies.

Geologic Hazards

Lake County's varied topography, ranging from the Clear Lake basin to mountainous regions reaching elevations over 7,000 feet, creates conditions for various geologic hazards, particularly landslides and debris flows. Landslides occur when slopes become unstable and soil, rock, or debris moves downhill. These events can be triggered by heavy rainfall, earthquakes, or human modifications to the landscape, and are especially common in areas previously affected by wildfires where vegetation loss has destabilized slopes.

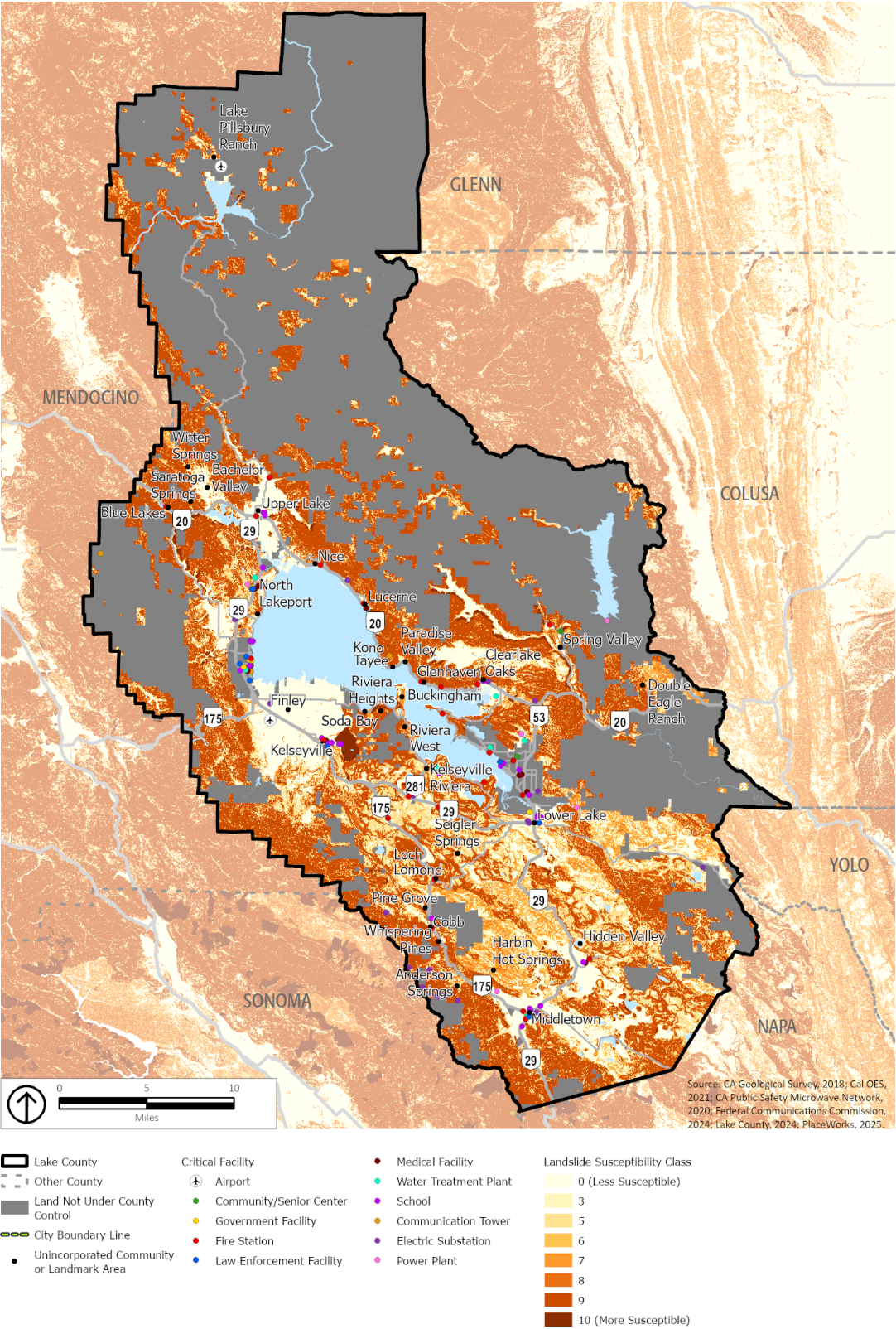
The mountainous terrain of the unincorporated county rises sharply to higher elevations, creating challenging conditions where much of the remote, high-relief landscape is prone to landslides. As shown on **Figure B-11**, landslide susceptibility varies significantly across Lake County, with higher risk areas concentrated in the mountainous regions and areas with steeper slopes. Areas throughout the county that have historically experienced significant landslides include Clearlake Oaks, Lucerne, Clearlake Riviera, Cobb Mountain, and Bartlett Springs.⁴³ These landslides can travel significant distances and accumulate debris, amplifying their destructive impact as they move downslope. They threaten homes and infrastructure, disrupt transportation networks, and contribute to downslope erosion.

Past Occurrences

Seismic Events

Lake County seismic activity within the past two hundred years shows few major or damaging earthquakes on fault lines within county boundaries. The most frequent seismic activity is in the south county geothermal fields near the Geysers-influenced region, where minor earthquakes happen almost daily. These events typically register below magnitude 4.0 and do not result in dangerous ground shaking or damage.⁴⁴ According to the U.S. Geological Survey, it has been 8,500 to 13,500 years since the most recent volcanic activity in Lake County. It occurred as explosive maar eruptions in and along the shores of the southeastern part of Clear Lake. Although there have been no documented eruptions within the last few thousand years, sporadic volcanic-type earthquakes do occur, and the numerous springs and volcanic gas seeps in the field point to its potential for future eruptions.⁴⁵

Figure B-11 Landslide Susceptibility



According to the USGS National Earthquake Information Center database, three earthquakes greater than magnitude 5.0 have been centered within 100 miles of Clear Lake in the past 40 years:

- August 24, 2014: Magnitude 6.0 South Napa earthquake.
- August 10, 2016: Magnitude 5.1 earthquake centered 20 kilometers north-northeast of Upper Lake.
- December 14, 2016: Magnitude 5.0 earthquake centered 10 kilometers west of Cobb.

Landslides and Debris Flows

Landslides occur regularly in Lake County, particularly during periods of heavy rainfall and in areas previously affected by wildfires. The combination of steep terrain, unstable geology, and periodic intense precipitation creates ongoing landslide risk throughout much of the county's western and mountainous regions. As described in the Local Hazard Mitigation Plan, notable landslide events and areas of concern include:

- Spring Valley Landslide: Also known as the Cache Creek Slide, this significant landslide is approximately 1.5 miles downstream of Indian Valley Dam. The slide showed considerable movement between 1993 and 1999. A 2002 geotechnical analysis identified a very high risk of failure during a 100-year, 10-day storm event, with two potential scenarios:
 - a. A midlevel failure (considered most probable) resulting in a 105-foot-high landslide.
 - b. A complete failure resulting in a 191-foot-high landslide.
- Anderson Springs: During the winter storms of 2017, an approximately four-acre landslide developed on private property leased by Calpine at the western end of Anderson Springs. The slide resulted in the closure of Anderson Springs Road and continues to pose risks to the community.
- Ettawa Springs: Discovered during the 2017 winter storms, this approximately two-acre slide demonstrated how intense precipitation can trigger new landslide activity in susceptible areas.

These events represent only the most significant landslides that have impacted development or infrastructure. Many more landslides occur regularly in the county's remote areas, particularly during wet winters or following wildfire events that have destabilized hillsides.

Existing Programs and Regulations

Emergency Debris Management Contingency Plan

The Lake County Emergency Operations Plan, along with the Emergency Debris Management Plan, provides frameworks for responding to geologic hazards that may generate significant debris or require coordinated emergency response. The Emergency Debris Management Plan specifically addresses landslide- and earthquake-generated debris management, including removal, temporary storage, and final disposal procedures.

California Building Code

Lake County adopts and enforces the California Building Code, which contains building and safety codes relevant to geologic and seismic hazards, including the following:

- Chapter 16: *Structural Design*, Section 1613 *Earthquake Loads*: establishes minimum requirements for structural design related to seismic forces.
- Chapter 18: *Soils and Foundations*: provides requirements for soils investigations, excavation, grading, and fill placement for foundation systems.
- Appendix J: *Grading*: establishes requirements for grading, excavation, and earthwork construction.

The California Building Code is incorporated into the Lake County Code of Ordinances, Chapter 5, *Building Regulations*, which establishes minimum requirements to safeguard public safety through structural strength and stability.⁴⁶

Lake County Code of Ordinances

The Lake County Code of Ordinances includes various directives pertaining to geology and soils. Most provisions related to geology and soils are in Chapter 5, *Building Regulations*; Chapter 23, *Clear Lake Shoreline*; and Chapter 30, *Grading Ordinances*.

- Chapter 5: *Building Regulations*, Section 5-4a: This section adopts the ~~2022~~ 2025 California Building Code, with amendments, as the County's Building Code. As such, all new construction within the county is required to adhere to its seismic safety standards. Article V, *Excavating and Filling*, describes the requirements for excavating and filling and addresses where these activities are prohibited, including where land is unstable or in a condition that it may slip, slide, or flow when dry or saturated.
- Chapter 23: *Clear Lake Shoreline*, Section 23-9 *Shorezone Protective Structures*: This section includes provisions to prevent erosion or flooding along Clear Lake's shoreline.
- Chapter 30: *Grading Ordinance*: This chapter includes comprehensive regulations for grading activities to prevent landslides and other geologic hazards by requiring permits for significant grading activities, setting standards for cut and fill slopes, mandating drainage controls, and requiring geologic studies in potentially hazardous areas.
- Chapter 21, Zoning Ordinance, Article 27: *Uses Generally Permitted*, establishes the Geologic Hazard Combining District, which places additional development restrictions on areas with known geologic or seismic risks. This combining district requires geological reports for new development and sets additional construction standards to ensure appropriate development in hazard-prone areas.

Future Conditions

Likelihood of Future Occurrence

Seismic Risk

Lake County seismic activity within the past two hundred years has shown an absence of any major or damaging earthquake on fault lines in Lake County. However, the possibility of an earthquake is ever present in Lake County. The combination of plate tectonics and geology associated with the California coastal mountain range essentially guarantees earthquakes because of the periodic release of tectonic stresses. Lake County's mountainous terrain lies in the center of the North American and Pacific tectonic plate activity. While earthquakes are not a frequent occurrence in Lake County, a major earthquake along any of the nearby faults could result in substantial damage, with the greatest risk coming from the San Andreas Fault (approximately 30 miles to the west) and the Maacama Fault (within 10 miles to the west) due to their proximity and potential to cause severe earthquakes.

Geological Risk

Landslides and debris flows are common in Lake County due to its mountainous terrain, which increases landslide risk in remote, high-relief areas. The county faces a high risk of landslides, particularly on hillsides, with significant rainfall likely triggering additional failures. Minor to moderate landslides are expected to continue impacting the area during heavy precipitation, as they have historically.

Lake County Hazardous Materials Response Plan

The County maintains a comprehensive Hazardous Materials Response Plan that addresses responses to hazardous materials releases. The plan establishes operational concepts, identifies components of local emergency management organizations, and describes responsibilities and actions by various agencies for protecting human health, property, and the environment.

Climate Change and Geological Hazards

While climate change is unlikely to increase earthquake frequency or strength, the threats from seismic and geologic hazards will continue. Climate change may result in precipitation extremes (i.e., wetter rainfall periods and drier dry periods). While total average annual rainfall may not change significantly, rainfall may be concentrated in more intense precipitation events. Saturated soils may also increase the risk of liquefaction near the lakeshore or creeks.

Increased wildfire frequency can destabilize hillsides due to loss of vegetation and change soil composition, contributing to greater runoff and erosion. The combination of a generally drier climate in the future, which will increase the chance of drought and wildfires, and the occasional extreme downpour is likely to cause more mudslides and landslides. These conditions will particularly affect areas previously impacted by wildfires, where vegetation loss has already compromised slope stability.

Hazardous Materials

Hazardous materials are substances that pose a significant risk to public safety, human health, or environmental health. These include toxic chemicals, flammable or corrosive materials, petroleum products, unstable substances, and dangerously reactive materials. Hazardous materials can be released through human error, malfunctioning equipment, or as an indirect consequence of other emergencies such as earthquakes, floods, or severe weather events. The release or spill of hazardous materials can result in fire, explosion, toxic clouds, or direct contamination of water, people, and property. The effects may be localized to a single site or impact many square miles.

In Lake County, hazardous materials risks are primarily associated with transportation routes and fixed facilities. The potential for a major transportation incident exists along the county's main east-west thoroughfare, SR-20, as well as along SR-29, SR-53, SR-175, and Bottle Rock Road. These routes carry materials destined for facilities within the county as well as passing through to points beyond. Transportation surveys indicate that approximately 90 percent of hazardous materials transported through Lake County are bulk petroleum products, including heating fuels, gasoline, diesel, and propane.⁴⁷ The remainder consists of industrial/medical cylinders and general industrial products.

A unique concern identified in Lake County involves freight and delivery transporters carrying quantities of hazardous materials below reporting thresholds, which therefore do not require warning placards. For example, freight deliveries to local hardware stores may contain various hazardous materials like retail-packaged herbicides, pesticides, paint products, and motor oils.

The Environmental Health Department is the Certified Unified Program Agency and manages hazardous materials, waste, and permitting in Lake County. The department consolidates several regulatory programs, including hazardous materials management, accidental release prevention, waste management, and storage tank oversight. A key component of the Certified Unified Program Agency program is the California Accidental Release Prevention initiative, which focuses on preventing releases of high-risk substances through required accident prevention programs and risk management plans from regulated facilities.

The Lake County Fire Chiefs' Association, working in conjunction with the Environmental Health Department, is responsible for overall pre-emergency planning, response, and coordination among various emergency responders for chemical, biological, radiological, nuclear, and explosive incidents. The Sheriff's Office is the primary notification point for incidents, and California Highway Patrol is incident commander for events on State highways and County roads.

Past Occurrences

Lake County has experienced several minor hazardous materials release events over the past five years, primarily related to small-scale sewage overflows, petroleum product spills from vehicles, and household chemical releases. These incidents have been successfully managed through standard response protocols and have not resulted in any major evacuations or significant public health impacts.

The Sulphur Bank Mercury Mine Superfund Site represents a significant hazardous materials concern in Lake County. Located on the eastern shore of the Oaks Arm of Clear Lake, this 150-acre former mine site operated between the late 1800s and 1957, extracting sulfur and mercury. The site was designated as a National Priorities List (Superfund) site in 1990 due to high levels of mercury and arsenic contamination in mine waste, soil, and nearby sediments. The contamination affects the Elem Indian Colony and surrounding residential areas, creating environmental justice concerns for tribal members and local residents who may be exposed to elevated metal concentrations. The Environmental Protection Agency has conducted several removal actions since 1992 and is currently implementing cleanup efforts, with remedial action having started in 2024.

Several cleanup sites in Lake County are identified in the Department of Toxic Substances Control's EnviroStor database and the State Water Control Board's GeoTracker database, including several that are closed or inactive. According to the EnviroStor database, as of 2025, in addition to the Sulphur Bank Mercury Mine Superfund Site, there are ten active hazardous material cleanup sites in Lake County. Several of these sites are mines or quarries scattered throughout the county. The GeoTracker database lists 13 cleanup sites within the county, several of which are mines, quarries, and underground storage tanks. Major concerns at these sites include groundwater impacts on drinking water, mercury in soils and waterways, and gasoline and other fuels in soils and groundwater.

Existing Programs and Regulations

Emergency Operations Plan: Hazardous Materials Annex

The Hazardous Materials Annex to the Lake County Emergency Operations Plan provides detailed operational guidance for addressing hazardous materials emergencies. The annex outlines key response protocols such as notification procedures, on-scene management structures, and post-emergency recovery operations. Under this framework, initial response begins with the Lake County Sheriff's Department dispatch, which coordinates with the appropriate incident commander based on jurisdiction: California Highway Patrol for State highways and County roads, Sheriff's Department for unincorporated areas, and other agencies like the U.S. Forest Service for federal lands. The annex also establishes protocols for activating specialized resources like the Lake County Hazardous Material Response Team or State-level assistance through the State Warning Center when needed.

Business Plan Program

Through the Certified Unified Program Agency, Lake County requires facilities handling hazardous materials to submit annual business plans containing detailed information about their operations, including the types and quantities of hazardous materials inventories, location of inventories, contact information for 24-hour emergency facilities, and site-specific emergency response procedures.

These plans are reviewed by Environmental Health Department staff and shared with appropriate fire agencies and the Lake County Hazardous Materials Response Team. Facilities are inspected every three years to verify compliance.

Pesticide Regulation Program

The Lake County Agricultural Commissioner's Office works in partnership with the California Department of Pesticide Regulation to enforce pesticide laws and regulations. The program includes:

- Site-specific permitting for agricultural chemical use.
- Evaluating application methods and safety precautions.
- Investigating pesticide-related incidents.
- Coordinating with regional water boards on water quality protection.
- Public education and outreach.

Future Conditions

Likelihood of Future Occurrence

Lake County has not experienced major hazardous materials incidents historically, and therefore potential for future occurrences remains low. The transport of hazardous materials, particularly bulk petroleum products, continues along the main transportation corridors, including SR-20, SR-29, SR-53, and SR-175. The challenging geography, with steep creek and stream canyons that can restrict access to potential incident sites, adds complexity to response scenarios. Additionally, the presence of agricultural operations using pesticides and other regulated materials, as well as various commercial and industrial facilities handling hazardous substances, maintains an ongoing risk of potential releases. Based on these factors and patterns of hazardous materials transport through the county, the likelihood of a significant hazardous materials incident is considered possible, though proper implementation of existing safety protocols and regulations helps minimize this risk.

Climate Change and Hazardous Materials

Climate change is unlikely to substantially affect hazardous materials transportation incidents. However, increases in the frequency and intensity of climate hazards, such as floods, landslides, and severe storms, may create a greater risk of hazardous materials releases during these events.

Human Health Hazards

General Overview

Human health hazards encompass a range of bacteria, viruses, parasites, and other organisms that can cause diseases and illnesses affecting Lake County residents. While some of these diseases may cause only mild symptoms, others can be life threatening. Many of these diseases are vector borne, meaning they are transmitted by animals such as mice, rats, ticks, and mosquitos. The risk and severity of these health hazards often correspond with climate patterns that affect vector populations and disease transmission rates.

In Lake County, the Mediterranean climate, characterized by warm summers and mild, wet winters, can support year-round vector activity, particularly in areas near water bodies where mosquitos breed. The county's extensive agricultural areas and wildland-urban interface zones also create opportunities for human-vector contact.

The Lake County Public Health Department monitors and responds to various human health hazards affecting the community. Vector-borne diseases of particular concern include West Nile virus (transmitted by mosquitos), Lyme disease (spread by ticks), and hantavirus pulmonary syndrome (carried by rodents).

Additionally, the department tracks and responds to other health hazards such as foodborne illnesses, waterborne diseases (particularly during harmful algal blooms in Clear Lake), and emerging infectious diseases. The department coordinates with regional and State agencies to monitor disease trends and implement prevention and response measures.

Harmful algal blooms in Clear Lake have created recurring human health concerns for Lake County residents. Community members have reported incidents of skin rashes, respiratory issues, pet deaths, and other health effects related to water contact during bloom events. The Lake County Public Health Department has issued multiple health advisories regarding recreational water contact when blooms are present. The presence of cyanotoxins has also raised concerns about drinking water safety when toxin levels are elevated, particularly for residents using private water systems that may not have adequate treatment capabilities.⁴⁸

The Lake County Environmental Health Department also plays an important role in preventing human health hazards through its various programs, including food facility inspections and food safety education, recreational water quality monitoring, hazardous materials management, drinking water system oversight, and vector control coordination. The division works closely with other County departments and State agencies to protect public health through environmental monitoring and regulation.

Past Occurrences

Lake County has experienced various human health hazard events in the past. The following sections describe significant health hazard events that have affected the area.

Vector-Borne Diseases

Lake County has experienced ongoing challenges with vector-borne diseases since the early 2000s. West Nile virus was first detected in Lake County in 2004, with periodic cases reported since then. The virus, primarily transmitted through mosquito bites, has caused serious illness, particularly in older adults and those with weakened immune systems. Additionally, Lyme Disease cases have been documented in Lake County, transmitted by western blacklegged ticks found in wooded and grassy areas. The county's diverse terrain and wildlife populations provide suitable habitats for tick populations that can transmit the disease.⁴⁹

COVID-19 Pandemic (2020 to Present)

Lake County was significantly affected by the COVID-19 pandemic following the federal disaster declaration in March 2020. As of February 2024, Lake County reported 13,860 total cases and 192 deaths, with disproportionate impacts on older adults and those with underlying health conditions. The county experienced temporary business closures and economic disruption, and healthcare systems faced increased strain. In response, the Lake County General Health Department developed comprehensive vaccination and testing programs and enhanced its public health emergency response capabilities.⁵⁰

Existing Programs and Regulations

Public Health Emergency Response Program

Through its Public Health Emergency Response Program, the Lake County Health Department coordinates with other agencies to plan for and respond to public health emergencies, including disease outbreaks and other health hazards.⁵¹ The department operates surveillance systems to monitor disease trends and potential outbreaks, working closely with healthcare providers, laboratories, and schools to track reportable diseases. This includes maintaining the California Reportable Disease Information Exchange system for Lake County, which helps identify and respond to disease outbreaks quickly.

Vector Control Program

Lake County Vector Control District provides comprehensive vector surveillance and control services throughout Lake County. The district monitors and controls mosquitoes, ticks, and other disease vectors through various methods, including surveillance, source reduction, biological control, and, when necessary, chemical control. The district also provides public education about vector-borne diseases and prevention strategies, particularly focusing on mosquito control around Clear Lake and other water bodies.

Emergency Response and Preparedness Program

The Environmental Health Department maintains an Emergency Response and Preparedness Program that coordinates planning and response for health emergencies. This includes maintaining plans for mass vaccination, medical countermeasure distribution, and pandemic response.

Future Conditions

Likelihood of Future Occurrence

According to the Lake County Local Hazard Mitigation Plan, human health hazards are considered likely in Lake County. This assessment is based on historical occurrences and considers both endemic diseases (those regularly found in the region) and emerging health threats. The county remains vulnerable to various health hazards, from seasonal influenza to vector-borne diseases, and must maintain readiness for new disease outbreaks or pandemics. Vector-borne diseases in particular show seasonal patterns, with increased activity during warmer months when vectors are most active. The likelihood of these diseases

occurring varies based on environmental conditions, vector populations, and human behaviors that affect exposure risk.

Climate Change and Human Health Hazards

Climate change is expected to significantly influence human health hazards in Lake County. Rising temperatures and changing precipitation patterns are likely to affect the geographic range and populations of disease vectors. Warmer, wetter conditions can increase mosquito and tick populations, potentially expanding the spread of diseases like West Nile virus and Lyme disease.⁵²

Extreme weather events, particularly heavy rainfall periods followed by warm temperatures, can create ideal breeding conditions for mosquitoes and other vectors. These conditions are projected to become more frequent with climate change, potentially increasing vector populations and disease transmission rates.⁵³

Changes in precipitation patterns and temperature may also affect the life cycle and transmission of waterborne pathogens, particularly during harmful algal blooms in Clear Lake, which are expected to increase in frequency and intensity with warming temperatures.

These climate-related changes may disproportionately affect vulnerable populations in Lake County, including outdoor workers, older adults, individuals with chronic health conditions, and low-income households.

Severe Weather

Severe weather in Lake County includes destructive weather events that typically manifest as localized storms bringing heavy rains, snow, thunderstorms, and strong winds. These events can occur throughout the year but are most common during winter months from November through April. The varied topography of Lake County, from the Clear Lake basin to the Mendocino National Forest highlands, creates diverse microclimates that can experience markedly different severe weather.⁵⁴

The primary type of severe weather affecting Lake County is the atmospheric river, which is a long, narrow region in the atmosphere that transports water vapor from tropical areas. When these systems make landfall, they can release intense precipitation, leading to flooding, mudslides, and other hazards. While these events play a critical role in the region's water supply, they can also cause significant damage. Though snowfall is relatively infrequent at lower elevations, it regularly affects higher-elevation areas of Lake County, particularly in the Mendocino National Forest and in the Cobb area communities. The county's complex topography can also create localized wind patterns, such as the "Konocti Wind," which travels from Cow Mountain between Lakeport and Ukiah, affecting Kelseyville's Big Valley and Clear Lake before splitting around Mt. Konocti.⁵⁵

Because of the high tree mortality rate in the Cobb communities and the southern areas of Lake County, wind patterns have changed. Straight-line winds downed numerous pine trees 10 years after the Valley Fire, decimating many of the trees. What was once a wind event at tree-top heights is now a ground wind event that uproots pine trees with limited root structure and creates a threat to the community, evacuation routes, and other infrastructure.

Lake County's geographic characteristics make it particularly vulnerable to severe weather impacts. The county's three major ingress/egress routes (SR-20, SR-29, and SR-175) can become impassable during severe weather events, potentially isolating communities. During severe weather conditions, widespread power loss is also a significant concern, whether from temporary outages caused by downed power lines and trees, planned Public Safety Power Shutoffs, or strain on the electrical grid from extreme heat affecting the entire region.⁵⁶

These conditions pose challenges for Lake County's vulnerable populations. According to the American Community Survey 5-Year Estimates, 21 percent of the county's population has a disability, significantly higher than both state and national averages.⁵⁷ These individuals may be more likely to be injured and may rely on medications or medical devices that can be lost, damaged, or rendered unusable during power outages and evacuations. Additionally, approximately 9 percent of residents, representing over 1,700 households, lack access to vehicles.⁵⁸ These individuals may have reduced ability to relocate to safe locations during emergencies. The population of Lake County also fluctuates daily due to tourism, with visitors potentially at higher risk during severe weather events due to unfamiliarity with local alert systems and evacuation routes.

The Lake County Office of Emergency Services is the lead agency for severe weather monitoring, response, and coordination within Lake County. The Office of Emergency Services works closely with the National Weather Service Eureka Office, which provides weather forecasting and issues watches, advisories, and warnings for the Lake County Operational Area.

The Department of Public Works maintains critical infrastructure and provides emergency response during severe weather events. Its responsibilities include road maintenance, snow removal on County roads, storm drain clearance, and emergency repairs to damaged infrastructure. The department implements year-round maintenance programs to reduce severe weather impacts and maintains emergency response capabilities during storm events.

Past Occurrences

Lake County has experienced numerous severe weather events throughout its history, with heavy rains, winter storms, and high winds being the most common. Since 1950, Lake County has received 13 federal disaster declarations related to severe winter storms, flooding, and associated hazards. Additionally, numerous severe weather events did not rise to the level of a disaster declaration but still caused significant local impacts. The following significant events highlight the range and impact of severe weather in Lake County, as described by the Local Hazard Mitigation Plan, Federal Emergency Management Agency, and National Centers for Environmental Information databases.

1986 Storms and Flooding

Severe storms and flooding in February and March led to federal disaster declaration (DR-758). These events caused significant damage to infrastructure and property throughout Lake County.

1998 El Niño Floods

During February 1998, flooding around Clear Lake caused extensive damage. The flooding continued into March and April, with impacts to roads and infrastructure throughout the county. Over \$5 million in damages were reported, affecting over 60 homes.

2005 to 2006 Winter Storms

Severe winter storms between December 2005 and January 2006 resulted in a federal disaster declaration (DR-1628). The storms caused significant flooding, with rainfall rates of up to 4 inches in 6 hours observed. Clear Lake reached 2.5 feet above flood stage, causing over \$5 million in damages and flooding more than 60 homes. Some residents were evacuated for weeks, and SR-20 was closed for an extended period.⁵⁹

2017 Winter Storms

Two separate federal disaster declarations were issued for severe winter storms in 2017 (DR-4301 and DR-4308). These events occurred between January and February, causing extensive flooding, landslides, and mudslides throughout the region.

2019 Atmospheric River

In February 2019, an atmospheric river brought heavy rainfall and widespread flooding to Lake County (DR-4434). The combination of saturated soils and strong winds caused numerous trees and power lines to fall.⁶⁰

2022 to 2023 Winter Storms

A series of atmospheric river events in late 2022 through early 2023 brought significant rainfall to Lake County. Major storms in January 2023 led to a federal disaster declaration (DR-4683) and caused widespread flooding, landslides, and road damage throughout the county.⁶¹

2024 High Wind Event

In February 2024, a high wind event impacted the Cobb Mountain Local Area with hundreds of trees falling into homes, on power lines, and onto roads, blocking emergency access to patients in need of ambulance service, requiring teams of neighbors and first responders to saw through trees to gain access. Although hundreds of trees fell on roads, a house was split in half trapping residents, and power was out countywide, the event did not qualify for a State disaster declaration.

Existing Programs and Regulations

Emergency Operations Plan: Severe Weather: Heavy Rains, Snow and Storms Annex

The Severe Weather: Heavy Rains, Snow and Storms Annex of the Emergency Operations Plan provides comprehensive guidance for the County's severe weather response. The plan outlines three response phases (Seasonal Readiness, Moderate, and Critical) with specific activation triggers and response actions. It details coordination between County departments, stakeholders, and community partners for public information dissemination, resource deployment, and emergency response activities during severe weather events.

Future Conditions

Likelihood of Future Occurrence

According to historical data, severe weather is an annual occurrence in Lake County. Damage and disaster declarations related to severe weather have occurred regularly and will continue to occur in the future. While damage directly associated with severe weather has historically been limited, it is often the secondary hazards like floods, landslides, and wildfires that have had the greatest impact on the county. Based on historical data and climate projections, future severe weather occurrences in Lake County are considered highly likely, with a 90 to 100 percent chance of occurrence in any given year.⁶²

Climate Change and Severe Weather

Climate change is expected to intensify severe weather patterns in Lake County. While Cal-Adapt projections show only modest increases in total annual rainfall, the county is likely to experience greater extremes, with more intense atmospheric river events bringing heavy rainfall over short periods, alternating with prolonged dry periods. These intense storm events can trigger cascading hazards such as flooding, landslides, and debris flows, particularly in areas previously affected by wildfire. The county's critical infrastructure, including roads, bridges, and power distribution systems, faces increased strain from these severe weather events. The remote nature of much of Lake County means there is limited redundancy in communication and energy infrastructure, making it especially vulnerable during extreme weather events. This can be further complicated by Public Safety Power Shutoff events, which may become more frequent as high wind conditions and other severe weather threats increase.

Fire Hazards

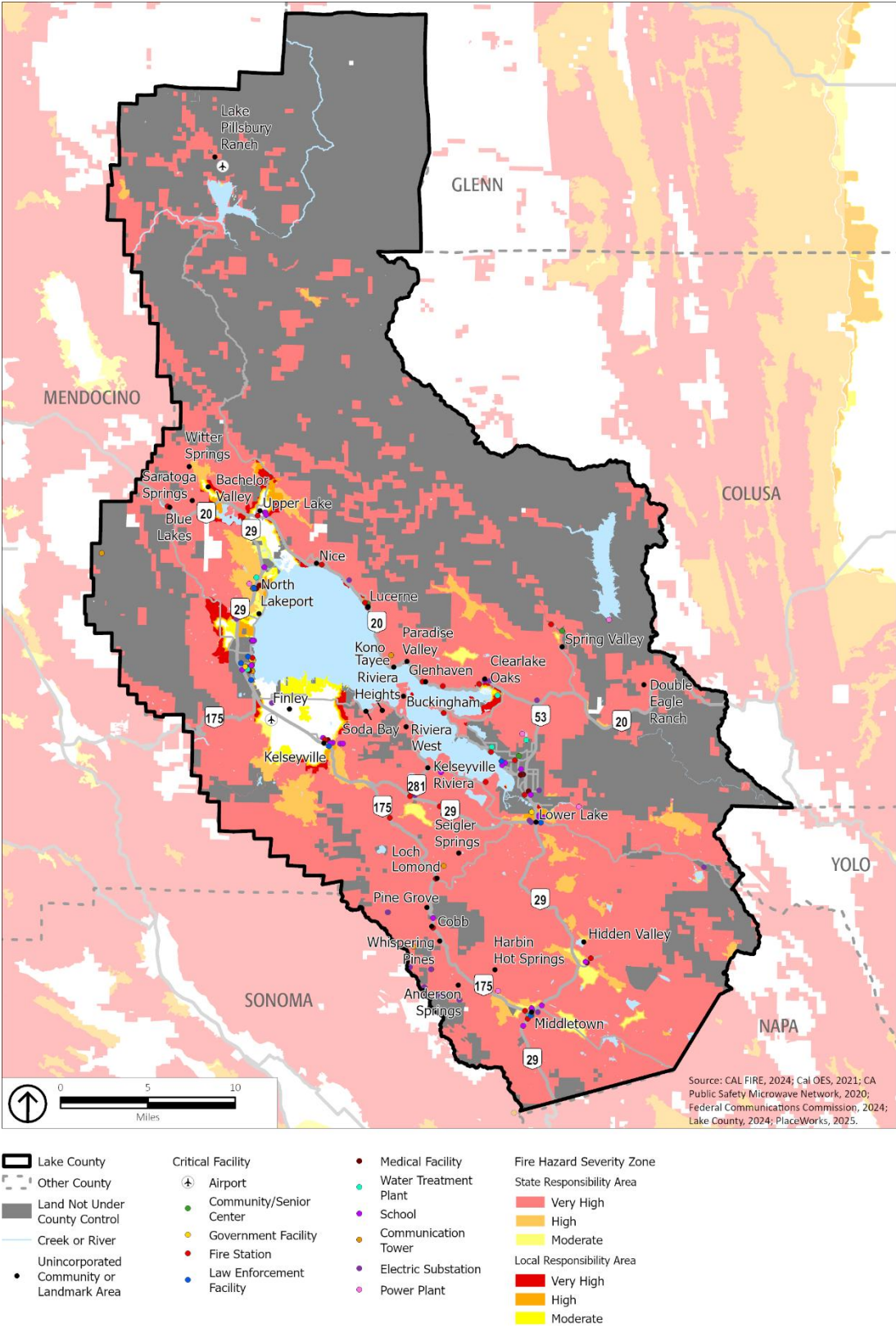
Fire hazards are a significant concern for Lake County, including wildfires and structural fires. The county's terrain, climate, and vegetation, along with natural and human-caused ignition sources, contribute to conditions that promote wildfires. Historically, the fire season occurred from early spring through late fall, but in recent years, wildfire has become a year-round risk.

Four primary factors influence Lake County's fire risk: fuel conditions, topography, weather conditions, and human actions. The county contains various fuel sources, including dead vegetation, standing trees, brush, chaparral, and human-made structures. The county's terrain, with elevation ranging from 600 feet along Putah Creek, to 1,300 feet near lake level to 5,000 to 7,000 feet in the Mendocino National Forest, affects fire behavior. Broad, rounded ridges trending north-south split around Clear Lake, with steep slopes and drainages that can impact firefighting efforts. Weather conditions, such as high temperatures, low relative humidity, and wind conditions, particularly the Konocti Wind, influence fire behavior. The Konocti Wind travels from Cow Mountain between Lakeport and Ukiah, affecting Kelseyville's Big Valley and Clear Lake before splitting around Mt. Konocti and heading to the Sacramento Valley. Human actions, including arson, equipment use, uncontrolled burn piles, improper outdoor cooking, unhoused encampment fires, and vehicle-related incidents, are all significant sources of fire ignition.

Lake County experiences three main types of fire hazards: wildfires, wildland-urban interface fires, and structural fires. Wildfires occur in undeveloped areas, especially in the mountainous and hillside regions that make up much of Lake County. The county's extensive wildland areas are largely mapped within Very High and High Fire Hazard Severity Zones by CAL FIRE, as shown on **Figure B-12**. Very High Fire Hazard Severity Zones are concentrated in several key areas of the county, including the mountainous northern region surrounding Lake Pillsbury Ranch, the western portions near Blue Lakes and Upper Lake areas surrounding Clear Lake (particularly around Nice, Lucerne, Glenhaven, and the Rivas communities), and the southern region encompassing Cobb Mountain and surrounding Middletown. High Fire Hazard Severity Zones are generally found adjacent to Very High Fire Hazard Severity Zones, creating buffer zones around the most severe risk areas, around developed communities like Hidden Valley and Coyote Valley, and in scattered patches throughout the central portion of the county. Moderate Fire Hazard Severity Zones are limited in extent, occurring in small pockets around some developed areas, near agricultural lands in the southeastern portion of the county, and around some community edges where development meets wildlands. Many of the county's critical facilities and infrastructure are located in or adjacent to Very High and High Fire Hazard Severity Zones, including multiple fire stations; community centers and other public facilities serving rural communities; key transportation corridors like SR-20, SR-29, SR-175, and SR-281; and power infrastructure, including electric substations and power plants.

~~The wildland-urban interface (WUI) is an area where buildings (e.g., housing) and infrastructure (e.g., cell towers and water supply facilities) mix with flammable wildland vegetation, allowing wildland fires to easily spread to buildings and structures. CAL FIRE~~ The State defines the wildland-urban interface, in **Chapter 49 of the California Fire the Wildland-Urban Interface Code**, as a geographical area within a Fire Hazard Severity Zone in a State Responsibility Area or Local Responsibility Area. Development in these areas must meet the requirements of California Public Resources Code Section 4291, State Responsibility Area and Very High Fire Hazard Severity Zone Fire Safe Regulations, California Building Code, **Chapter 7A**, and California Fire Code, **and California Wildland-Urban Interface Code Chapter 49**, among other State regulations for fire-resistant construction, defensible space, and vegetation management. In Lake County, CAL FIRE in the State Responsibility Area and fire districts in Local Responsibility Areas review development projects for compliance with these requirements prior to issuance of land use and building permits. CAL FIRE also has the discretion to review residential subdivisions in these areas of 30 units or more for potential fire and evacuation risks.

Figure B-12 Fire Hazard Severity Zones



~~In Lake County, the wildland-urban interface is also defined in the Community Wildfire Protection Plan as areas with dense housing adjacent to vegetation that can burn in a wildfire and the wildland urban intermix is defined as housing development interspersed in areas dominated by wildland vegetation subject to wildfire.~~ The Community Wildfire Protection Plan is prepared and maintained by the Fire Safe Councils in Lake County in accordance with the federal Healthy Forest Restoration Act, and it must be approved by a representative from CAL FIRE. The intent of this plan is to help the community prioritize wildfire risk reduction activities and access funds to carry them out. As shown in **Figure B-13**, the wildland-urban interface and intermix identified in the Community Wildfire Protection Plan overlap substantially with the CAL FIRE designated Fire Hazard Severity Zones. **Figure B-13** was developed using CAL FIRE's wildland urban interface designation, Mendocino National Forest's Proposed Wildland Urban Interface Defense Zones, Community-Identified High Risk and Project Areas, Community-Identified Values and Assets, and issues of topography, landscape characteristics, access, fire threat designation, and fire weather. Therefore, the figure shows both CAL FIRE and U.S. Forest Service zones. **Figure B-13** is for informational purposes only and references to the wildland urban interface in the policies and programs ~~in the General Plan below~~ refer to the ~~CAL FIRE State's~~ definition of these areas.

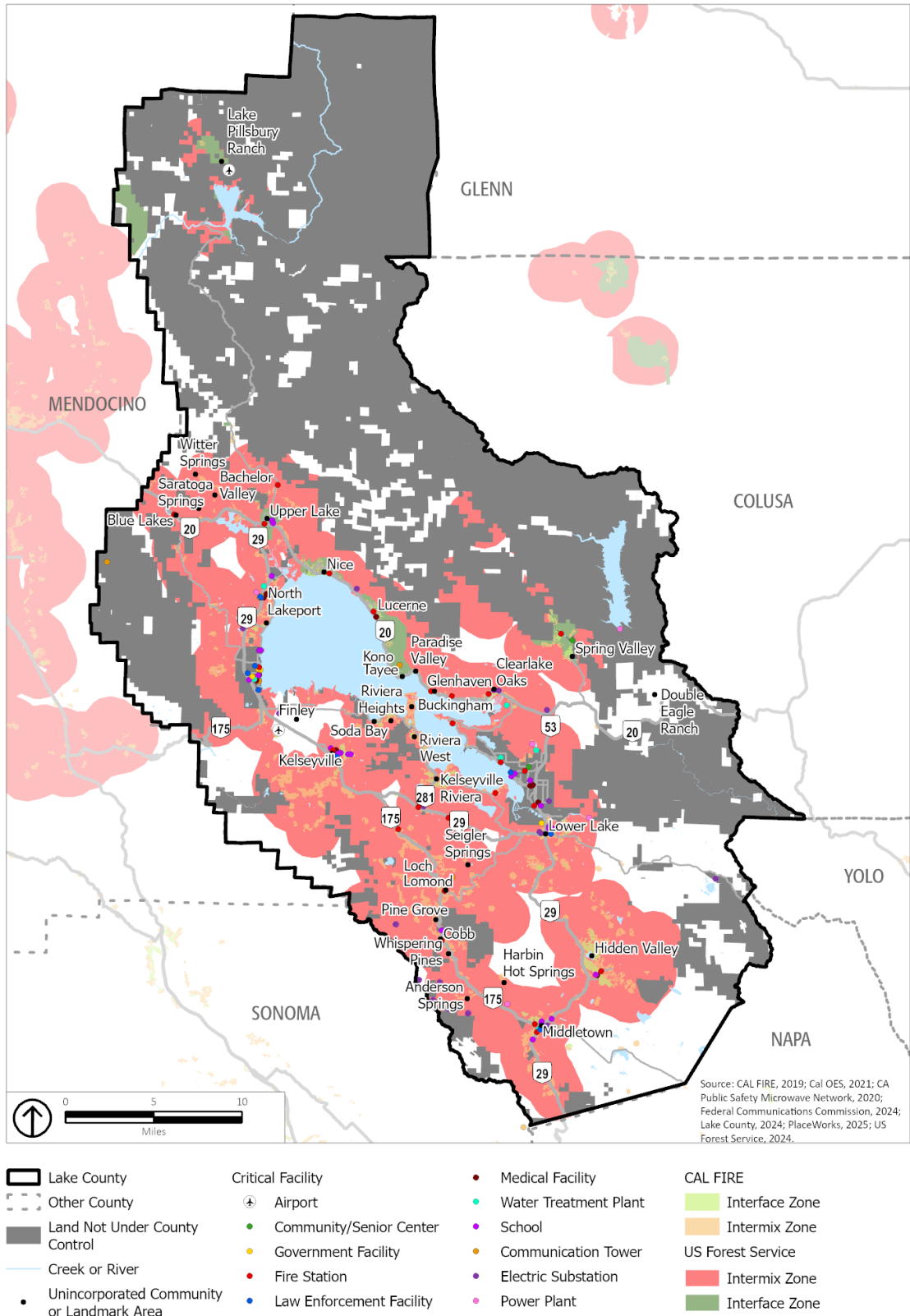
Structural fires occur in built environments and are often caused by faulty wiring, mechanical equipment, or combustible construction materials. The absence of fire alarms and fire sprinkler systems often exacerbates the damage associated with a structural fire. Structural fires are largely caused by human accidents, although deliberate fires (arson) may cause some events. Older buildings lacking modern fire safety features may face greater risk of fire damage. Over 51 percent of homes in Lake County were constructed prior to 1973 and many manufactured throughout the county were not constructed with fire resilient materials.

Wildfire events in Lake County can lead to severe direct impacts, such as loss of human life, destruction of structures and infrastructure, damage to natural and cultural resources, degradation of water supplies, loss of timber and recreational opportunities, and economic losses. Secondary hazards include post-wildfire landslides and debris flows, flooding and erosion, air quality degradation from smoke, and agricultural impacts such as smoke taint or damage and wildlife changes.

Adequate fire protection services are provided to the unincorporated areas of the county. Fire protection services in unincorporated Lake County are provided by multiple fire protection districts: the Lake County Fire Protection District, Lake Pillsbury Fire Protection District, Lakeport Fire Protection District, Northshore Fire Protection District, Kelseyville Fire Protection District, and South Lake County Fire Protection District. These districts provide essential fire prevention, suppression, and emergency medical services across their respective jurisdictions. The districts conduct fire prevention inspections and implement vegetation management activities.

Lake County contains Local Responsibility Areas, where municipalities manage fire protection; State Responsibility Areas, where CAL FIRE or contracted fire districts provides fire management; and Federal Responsibility Areas, where federal agencies manage fire protection. Many unincorporated communities are in State Responsibility Areas, making CAL FIRE a critical partner in wildfire prevention and emergency response. The U.S. Forest Service also conducts wildfire management in Federal Responsibility Areas, such as in the Mendocino National Forest.

Figure B-13 Wildland Urban Interface



The Lake County, South Lake, and Konocti Fire Safe Councils work collaboratively with fire districts, CAL FIRE, and federal and local agencies to design and implement protective measures, such as developing shaded fuel breaks, and other projects to increase wildfire survivability. This includes coordinating with public agencies, nonprofits, businesses, and private landowners to complete fuel reduction projects identified in the Community Wildfire Protection Plan.

Past Occurrences

Lake County has experienced numerous devastating wildfires throughout its history. They have been especially destructive since 2015, burning more than 60 percent of Lake County's landmass. **Figure B-14** illustrates the perimeters of major wildfires that have affected Lake County since 1950, demonstrating the extensive areas impacted by these events, particularly in recent years.

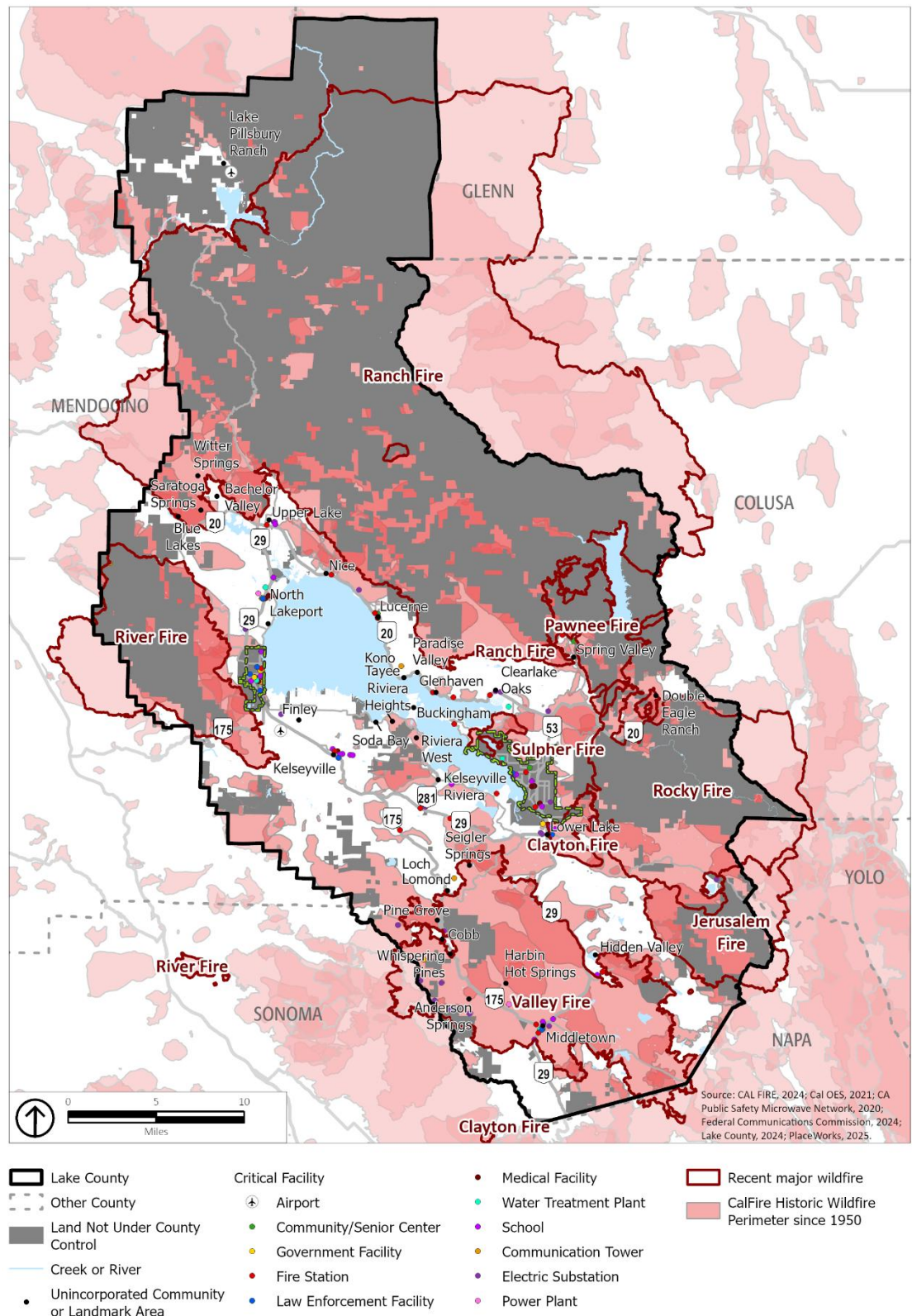
The following describes the most significant wildfire events that have affected the county.

Pre-2015 Wildfires

Prior to 2015, several significant fires affected Lake County:⁶³

- **1961 Cobb Mountain Fire:** Started in Fall, burning over 9,000 acres through the Cobb Mountain area, destroying several structures.
- **1964 Hanley Fire:** Started in Fall near the Lake/Napa County border northwest of Calistoga, burning 52,000 acres.
- **1981 Lang Peak Fire:** Burned over 11,000 acres in eastern Lake County.
- **1981 Cow Mountain Fire:** Traveled eastward from BLM lands near Ukiah to the foothills near Lakeport.
- **1985 Hidden Valley Fire:** Caused significant property damage in the Hidden Valley residential community.
- **1987 Mendenhall Fire:** Burned approximately 70,000 acres across Lake and Mendocino Counties.
- **1996 Fork Fire:** Burned 83,000 acres and 11 structures, threatening communities along Clear Lake's northern shore.
- **2001 Trough Fire:** Started in eastern Colusa County and moved into Lake County, burning 24,970 acres, including portions of the Snow Mountain Wilderness.
- **2008 Walker Fire:** Started on June 22 near Indian Valley Reservoir, burning 14,500 remote acres in eastern Lake County.

Figure B-14 Historic Wildfire Perimeters in Lake County



2015 to 2018 Wildfires

This period saw unprecedented fire activity in Lake County.

- **July 2015 Rocky and Jerusalem Fires:** Caused by a faulty gas-powered water heater, the fire merged with the Jerusalem Fire, which was caused by a resident setting a backfire to protect from Rock Fire, that ultimately burned 69,438 acres and destroyed 43 homes. This affected the Lower Lake Area extending into the Morgan Valley region.
- **September 2015 Valley Fire:** Started by faulty hot tub wiring, this catastrophic fire spread rapidly, burning 76,067 acres, starting in the Cobb Mountain Area and spreading into the Middletown Area and Hidden Valley, killing four people and destroying nearly 2,000 buildings, including 1,280 homes.
- **August 2016 Clayton Fire:** An arson-caused fire that destroyed 189 homes in the Lower Lake area.
- **October 2017 Sulphur Fire:** Burned 2,200 acres and destroyed 138 homes in the East Lake Communities Area.
- **2018 Pawnee Fire:** Burned 15,185 acres and destroyed 12 homes in the East Lake Communities Area.
- **2018 Mendocino Complex:** Both the River and Ranch Fires ignited in Mendocino County; incident command was unified to form the Mendocino Complex fire, which started in July. The River Fire started near Old River Road north of Hopland and the Ranch Fire ignited on a ranch close to State Highway 20. The Mendocino Complex destroyed 157 homes in multiple planning areas, including North Lake Communities Area and East Lake Communities Area in Lake County, with a total of 459,123 acres across four counties. It did not reach full containment until September, but hotspots continued to persist within the perimeter until January 2019.

2020 Wildfires

The 2020 fire season was the largest recorded in California's modern history and the most devastating in recent Lake County history. The August Complex fire, which started in Mendocino County in August 2020 and spread into Lake County, became the largest recorded wildfire in California history. While this fire primarily burned in adjacent counties, it caused severe smoke impacts across Lake County, including the northernmost portions of the North Lake Communities Area.

The LNU Lightning Complex Fire started on August 17, 2020, due to several lightning-sparked fires. While they ignited separately from each other, the Hennessy, Gamble, Green, Markley, Spanish, and Morgan fires merged to burned over 360,000 acres in Lake, Napa, Sonoma, Solano, and Yolo counties. In Lake County, the LNU Lightning Complex reburned areas in the Jerusalem Fire footprint, just five years earlier.

2021 Cache Fire

The Cache Fire in September 2021 caused major damage to more than 100 structures, primarily in the Lower Lake area, including dozens of homes. This fire was included in Federal Disaster Declaration DR-4619.

2024 Boyles Fire

The Boyles Fire in September of 2024 caused extensive damage within the City of Clearlake, destroying 33 structures and damaging six more. This fire given a State Disaster Declaration, FM-5536-CA.

Existing Programs and Regulations

Lake County Community Wildfire Protection Plan

The 2023 Lake County Community Wildfire Protection Plan was developed collaboratively by the County of Lake, Lake County Fire Chiefs' Association, Lake County Fire Safe Council, Lake County Resource Conservation District, and the Clear Lake Environmental Research Center, as an update to the 2009 version.

The plan's development involved gathering input from citizens, local, State, and federal agencies, primarily through virtual meetings and individual consultations during the COVID-19 pandemic. The Clear Lake Environmental Research Center assisted in gathering community and Tribal input and mapping, and local, State, and federal fire personnel provided expertise in developing the plan.

The Community Wildfire Protection Plan serves several key purposes: providing fire safety information and resources to residents, offering guidance on reducing home ignitability, identifying recommended fuel reduction projects, cataloging fire safety resources and organizations, and promoting comprehensive community-based adaptation to living in a fire-adapted ecosystem. The plan is overseen by the County of Lake's Office of Climate Resiliency, the Lake County Community Risk Reduction Authority, and the Lake County Resource Conservation District, which may revise and update information in the appendices throughout the plan's life cycle.

The Community Wildfire Protection Plan establishes several critical programs and regulatory frameworks to reduce wildfire risk across Lake County. These include specific requirements for home hardening and defensible space creation, strategic fuel break locations and maintenance plans, and community-scale vegetation management projects. The plan provides detailed guidelines for ember-resistant construction standards and vegetation management requirements aligned with Public Resources Code 4291. It also establishes educational programs, including fire safety education requirements, community chipper programs, and Firewise Community certification support.

Given Lake County's extensive wildfire history, with nearly 70 percent of its land mass burned in catastrophic wildfires just since 2015, the Community Wildfire Protection Plan serves as a critical planning tool for coordinating wildfire protection efforts across jurisdictions including six county Fire Protection Districts, CAL FIRE, and the US Forest Service's Mendocino National Forest.

Emergency Operations Plan: Wildland Urban Interface Annex

The Lake County Emergency Operations Plan includes a specific Wildland Urban Interface (WUI) Annex that establishes priorities, responsibilities, and coordinated response operations for major WUI fires. The plan, developed through the Lake County Office of Emergency Services and the Lake County Fire Chief's Association, outlines emergency services deployment systems and coordination between multiple agencies. Multiple alert and warning systems are established in the plan, including the Emergency Alert System, NIXLE Information/Alert System, Integrated Public Alert Warning System, and LakeCoAlerts (Everbridge) notification system. The plan details emergency communications protocols between Lake County Sheriff's Dispatch, CAL FIRE's Emergency Command Center, and local fire districts.

The WUI Annex divides Lake County into three emergency operational zones to facilitate resource coordination and mutual aid operations between local fire districts, CAL FIRE, U.S. Forest Service, and Bureau of Land Management. The plan recognizes Lake County's specific wildfire vulnerabilities, including complex terrain, heavy fuel loads, limited water supplies in some areas, narrow rural roads that can complicate evacuations, and utility system vulnerabilities. Through detailed protocols for increased readiness during Red Flag conditions and establishment of Incident Command Post procedures, the Annex provides a comprehensive framework for coordinated emergency response to protect life and property during major wildfire events in Lake County's WUI areas.

Fire Hazard Severity Zone Development Regulations

Nearly all of Lake County's wildland areas and several unincorporated communities—including Nice, Lucerne, Glenhaven, Soda Bay, the Rivas, Cobb, Middletown, and Lake Pillsbury—are designated in Very High Fire Hazard Severity Zones by CAL FIRE. These zones are mapped based on factors such as fire history, vegetation fuel types, terrain, wind patterns, and other climate conditions. Properties in these areas are subject to stringent wildfire safety regulations to mitigate risks to life and property.

Building Code and Construction Standards

In High and Very Fire Hazard Severity Zones, new development must comply with ~~Chapter 7A of the California Building Code, including the Wildland-Urban Interface Code, "Materials and Methods for Exterior Wildfire Exposure."~~ This includes using fire-resistant materials and methods for roofing, exterior walls, windows, doors, and decks. Additionally, defensible space requirements, as outlined in Public Resources Code Section 4291 and the California ~~Wildland-Urban Interface~~ Fire Code, mandate maintaining vegetation clearance within 100 feet of structures.

Lake County enforces these regulations through its building permit and inspection processes, ensuring compliance during construction and renovations. New and existing structures are subject to defensible space inspections, which are coordinated with CAL FIRE and local fire districts.

Lake County Code of Ordinances

The Lake County Code of Ordinances includes specific chapters addressing fire safety:

- Chapter 5, *Building Regulations*, adopts the California Building, ~~and Fire~~, and Urban-Wildland Interface Codes, including ~~additional~~ local amendments for wildfire protection.
- Chapter 17, *Subdivision Regulations*, requires developments to provide adequate ingress and egress for emergency vehicles and residents during evacuations.
- Chapter 22, *Burning Regulations*, coordinates burning restrictions with CAL FIRE and local air quality agencies to prevent fire hazards during peak fire seasons.

PG&E Wildfire Safety Program

PG&E's wildfire safety initiatives in Lake County include undergrounding power lines in some high fire threat areas, implementing enhanced safety settings on electrical equipment, conducting vegetation management around infrastructure, and operating Public Safety Power Shutoff protocols during high fire danger conditions. The utility has completed numerous electric distribution system hardening and undergrounding projects in Lake County's high fire threat districts, resulting in an 80 percent reduction in wildfire ignitions from high wind impacts to facilities.⁶⁴ PG&E also maintains distribution system microgrids in Lucerne, Middletown, Finley, Kelseyville (near Kit's Corner) and North Lakeport that provide backup generation during transmission-level Public Safety Power Shutoff events.

Vegetation Management Programs

The Lake County Board of Supervisors established a Hazardous Vegetation Abatement Ordinance in 2019 (Ordinance No. 3082) requiring homeowners or property owners to remove hazardous vegetation for the safety of residents, wildlife, homes, and other structures. The Northshore Fire Protection District also created a fuels crew in 2022, the Hogback Ridge Crew, which is funded only through major donor sponsorships, grant funding, local partnerships, and payment for services. Additionally, local agencies such as the Lake County Water Resources Department and the Tribal EcoRestoration Alliance collaborate on vegetation management initiatives to reduce fire risk. These efforts include creek and watershed maintenance activities like weed abatement, controlled grazing, prescribed and cultural burning, selective pruning, and herbicide application. Environmental surveys are conducted as needed to ensure these activities minimize ecological impacts while enhancing public safety.

Warning Systems and Alerts

To address these risks, Lake County has implemented warning systems for fire events. These include community warning sirens in various locations and the LakeCoAlerts system through the Sheriff's Office, which can send voice calls, text messages, and email alerts simultaneously. Warning times for evacuation can vary from hours to days, depending on fire conditions and behavior, making these alert systems important for public safety.

Future Conditions

Likelihood of Future Occurrence

Wildfire is a significant hazard of concern for Lake County, with future occurrences considered highly likely in any given year. The risk remains very high due to the combination of climate conditions, complex terrain, vegetation, and extensive wildland-urban interface areas. Large-scale wildfires may not occur every year, but when extreme weather conditions align with other risk factors, fires have proven difficult to contain and caused catastrophic damage.

Climate Change and Wildfire

Climate change is expected to substantially increase wildfire risk in Lake County. Historically (1961 to 1990), an annual average of 7,849 acres burned in Lake County. This is projected to increase by 35 percent to 10,632 acres by midcentury (2035 to 2064) and by 50 percent to 11,912 acres by late century (2070 to 2099).⁶⁵ These figures represent averages—some years may see little to no wildfire activity while other years may experience much larger fires. Climate change is extending the fire season beyond its historical period of early summer through late fall, making wildfire a year-round hazard due to higher temperatures, lower moisture content in air and plant matter, increased vegetation accumulation, and more frequent high wind conditions.

These changes in wildfire patterns are likely to have cascading effects on Lake County communities. More frequent and intense wildfires will likely lead to increased smoke impacts and air quality degradation, causing respiratory health effects for sensitive populations. The economic consequences may become more severe, from direct property damage and fire suppression costs to long-term business disruptions, particularly affecting recreation, tourism, and local biodiversity in burned areas.

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