- California Department of Forestry and Fire Protection
- California State Parks
- California Tahoe Conservancy
- Fallen Leaf Fire Department
- Lake Valley Fire Protection District
- Meeks Bay Fire Protection District
- Nevada Division of Forestry
- Nevada Division of State Lands
- Nevada Division of State Parks
- Nevada Tahoe Resource Team
- North Lake Tahoe Fire Protection District
- North Tahoe Fire Protection District
- South Lake Tahoe Fire Department
- Tahoe Douglas Fire Protection District
- Tahoe Regional Planning Agency
- United States Department of Agriculture Forest Service

Lake Tahoe Basin

Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy

August 2014

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Meeks Bay Fire Protection District	P.O. Box 189 Tahoma, CA 96142	John Pang; Chief (Ret.) Dave Rodriguez; Forest Fuels Coordinator Tim Alameda; Division Chief	 (530) 525-7548 (530) 448-4365
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Cooperating Agencies Letter of Support

August 19, 2014

National, state and local leadership recognize and support the mutual benefits to all jurisdictions, working collaboratively; to reduce fuels in order to sustain resilient forest landscapes and create fire-adapted communities throughout the Lake Tahoe Basin. The development of this Strategy better integrates the National Fire Plan and Cohesive Strategy at all levels in the Lake Tahoe Basin.

The 2014 update of the Strategy emphasizes continued cooperative fuels treatment strategies to achieve both social and ecological benefits. Therefore, we the undersigned resolve to support and implement the Lake Tahoe Basin Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy with Basin Partners.

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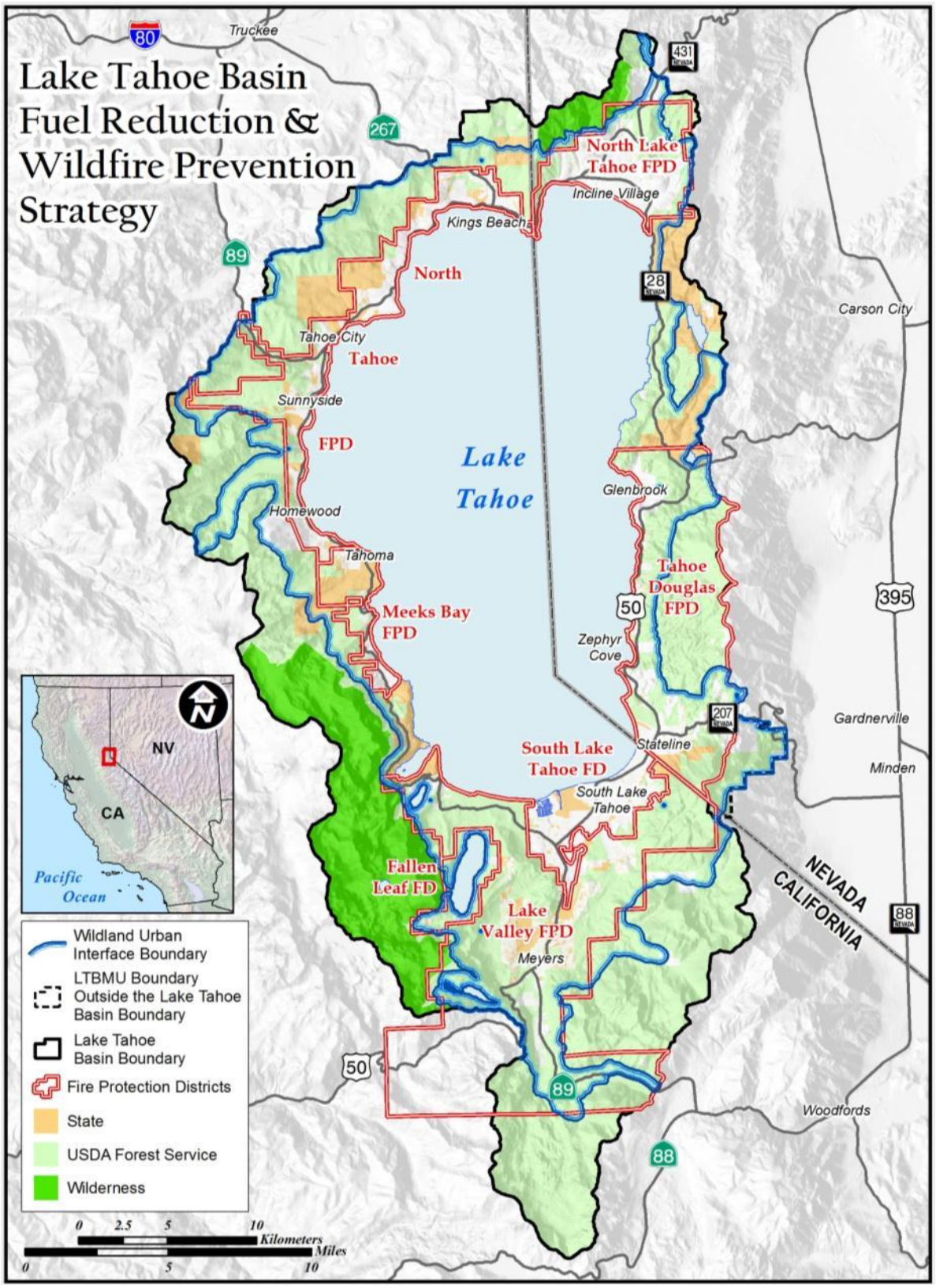

Figure 1. Lake Tahoe Basin jurisdictional areas

Agencies Involved or Consulted

- California Department of Forestry and Fire Protection
- California State Parks
- California Tahoe Conservancy
- Fallen Leaf Fire Department
- Lahontan Regional Water Quality Control Board
- Lake Valley Fire Protection District
- Meeks Bay Fire Protection District
- Nevada Division of Forestry
- Nevada Division of State Lands
- Nevada Division of State Parks
- Nevada Tahoe Resource Team
- North Lake Tahoe Fire Protection District
- North Tahoe Fire Protection District
- South Lake Tahoe Fire Department
- Tahoe-Douglas Fire Protection District
- Tahoe Regional Planning Agency
- USDI Bureau of Land Management
- USDA Forest Service, Lake Tahoe Basin Management Unit

Roles and Responsibilities

Table 1 summarizes the roles and responsibilities of individuals and agencies involved with wildland fire management and prevention in the Basin. All individual landowners and most agencies have land management responsibilities. This includes identifying concerns on parcels under their ownership or administration, and recommending and implementing actions that remedy those concerns. Regulatory responsibilities include promulgating and enforcing laws and regulations related to fire mitigation treatments. Funding sources identify agencies that typically provide funding used to implement projects. Programmatic oversight refers to the agencies that are responsible for program management related to fire mitigation projects.

Table 1. Summary of roles and responsibilities of agencies and individuals to implement the Strategy

Agency	Land Management	Regulatory	Funding	Programmatic Oversight
Individual Landowners	X		X	
Tahoe Regional Planning Agency		X	X	X
USDA Forest Service-LTBMU	X	X	X	X
Fire Protection Districts & Departments	X	X	X	X
California Tahoe Conservancy	X		X	X
CAL FIRE		X	X	X
California State Parks	X		X	X
Lahontan Water Quality Control Board		X		
Nevada Division of Forestry	X	X	X	X
Nevada Division of State Parks	X		X	
Nevada Division of Environmental Protection		X		
Nevada Division of State Lands	X		X	X

Tahoe Fire and Fuels Team

The Tahoe Fire and Fuels Team was formed during the fall of 2007, and organized in the spring of 2008. After the Angora Fire of 2007, the governors of Nevada and California created the California-Nevada Tahoe Basin Fire Commission to examine regulatory and social environments that influence fuels reduction in the Lake Tahoe Basin. In their final report, the Commission recognized the value of multi-jurisdictional collaboration to coordinate fuels reduction projects, obtain and manage funding, and to plan and implement projects identified in the community wildfire protection plans.

The Fire PIT "Get Defensive" campaign

The team utilizes the incident command system (ICS) familiar to fire professionals and emergency management personnel. Staffing is provided by member organizations on an as-needed basis.

Each fire district/department in the Tahoe Basin forms a geographic division within the Tahoe Fire and Fuels Team. The member agencies coordinate the work that is being completed within the divisions, and provide services to homeowners such as defensible space inspections, tree removal permitting, and residential chipping. In addition, the divisions, the Tahoe Regional Planning Agency, University of Nevada Cooperative Extension, University of California Cooperative Extension, and the USDA Forest Service manage public information through the Fire PIT or Fire Public Information Team. The Fire PIT has created several well received public information campaigns such as the popular "Get Defensive" campaign.

Oversight of the Tahoe Fire and Fuels Team is provided by the Multi-Agency Coordinating Group composed of the chief executives of the signatory agencies to the Strategy. The Group provides general direction and political leadership for the Tahoe Fire and Fuels Team, approves yearly operations plans, and assists with identifying funding opportunities.

Executive Summary

The destruction caused by wildfires in the Lake Tahoe Basin has increased substantially in the last decade. In 2007, the Angora Fire burned 3,100 acres and destroyed 254 homes in South Lake Tahoe, California. The impacts of recent fires demonstrate the increased wildland fuel hazards in and around Lake Tahoe communities. Without active management in the wildland-urban interface, the risk of catastrophic wildfire will continue to increase in the years ahead. Values at risk of catastrophic wildfire include:

- Communities and public safety.
- Socioeconomic considerations.
- Recreation and scenic resources.
- Water quality, watersheds, and riparian zones.
- Wildland habitat and forest vegetation.
- Air quality.

A Multi-Jurisdictional Strategy was collaboratively developed in 2007 to reduce the risk of catastrophic fire and protect the social and ecological values in the Basin as well as comply with the White Pine County Conservation, Recreation, and Development Act of 2006. The document combined existing fuel reduction plans and provided a framework to collaboratively treat hazardous fuels in priority areas on Federal, state, local, and private lands. Under the plan, 24,000 acres have been treated, at a cost of approximately $90 million, with an annual average expenditure of about $15 million.

This updated Multi-Jurisdictional Fuels Reduction and Wildfire Prevention Strategy facilitates the strategic decisions that must be made by land management, fire, and regulatory agencies to reduce the probability of a catastrophic wildfire in the Lake Tahoe Basin. It establishes a process for identifying and prioritizing projects that will have the greatest benefit for Lake Tahoe communities.

This Strategy was developed collaboratively by fifteen Lake Tahoe Basin agencies, including the USDA Forest Service, the Tahoe Regional Planning Agency, and the land managers and fire services of California, Nevada, and local jurisdictions. The full commitment by partner agencies to support and implement the Strategy will provide social and ecological benefits to all jurisdictions by protecting Lake Tahoe communities and forest resources.

Since the development of the original Strategy, the National Cohesive Wildland Fire Management Strategy was developed by the Wildland Fire Leadership Council as required by the Federal Land Assistance, Management, and Enhancement Act of 2009 (FLAME Act). The three goals of the National Cohesive Strategy have been embraced by the partner agencies, and are integrated into this strategy. The goals are to:

1. Restore and maintain fire-resilient landscapes.
2. Create fire-adapted communities.
3. Provide effective and efficient wildfire response.

Local knowledge and experience gained through implementation since 2007 have led to important changes and revisions in this strategy. Additions of particular importance include:

- An updated wildland-urban interface map, to recognize the lack of a clear boundary between communities and wildland fuels.
- A formal process for collaboratively planning, tracking, and reporting fuels reduction projects.
- The inclusion of previously treated areas in the prioritization process, to recognize the need for additional treatments to meet fire behavior modification objectives.
- An analysis of the consequences of reduced demand for forest materials, and processes to increase carbon sequestration and decrease greenhouse gas emissions.

The treatment of hazardous fuels in the wildland-urban interface is projected to cost between $144 million and $156 million, with an additional $25 million to $35 million anticipated to implement phased treatments on previously treated areas. The Strategy identifies the need to develop and maintain a stable staff and contractor resource pool to implement the proposed projects. The benefits of implementing this strategy include:

- Reduced wildfire risk.
- Reduced fire behavior.
- Increased defensible space.
- Increased forest resiliency.
- Wildlife habitat protection.
- Reduced risk of scenic quality impacts.
- Reduced potential for significant air quality impacts.
- Carbon sequestration and emission reductions.

Federal, state, and local land managers and fire agencies will continue in partnership with each other and the communities they serve to implement the Strategy and monitor its effectiveness. The continued commitment to coordinate, communicate, and collaborate will result in responsive and cost-effective wildfire prevention and fuels reduction that will protect the people and values of the Lake Tahoe Basin.

Section 1: Introduction

Background

This Strategy's purpose is to increase community protection from wildfire, identify potential fuel reduction treatments, and facilitate communication and cooperation among those responsible for project implementation. This updated Multi-Jurisdictional Fuels Reduction and Wildfire Prevention Strategy (Strategy) for the Lake Tahoe Basin (Basin) continues to facilitate the strategic decisions that must be made by land management, fire, and regulatory agencies over the next 10 years to reduce the probability of a catastrophic fire in the Basin. Originally developed to comply with the White Pine County Conservation, Recreation, and Development Act of 2006 (Public Law 109-432 [H.R. 6111]), the Strategy comprehensively combined all existing fuels reduction plans in the Basin, providing a framework to identify 68,000 acres of priority areas for treatment, and a strategy to work collaboratively on accomplishing those priorities over a 10-year period. Since the implementation of the Strategy, 24,268 project acres have been treated, with over 36,890 acres of treatments (multiple treatments on the same area to achieve the objective). These projects have been in the highest priority areas identified in the community wildfire protection plans.

As the Strategy was being implemented, important changes occurred that led to this revision prior to the end of the 10-year timeframe (6 years of implementation). Changes of particular importance include:

- Revision of the previously defined wildland-urban interface area.
- The loss of key market outlets, including one large sawmill and several biomass facilities, which influence wood product and fuel disposal methods.
- Increased compliance for defensible space regulations.
- Planning future treatments that under a changing climate maintain the efficacy of previous completed forest health and hazardous fuel reduction treatments.
- Creation of a consistent and comprehensive tracking and reporting terminology that can be used for reporting accomplishments under the Environmental Improvement Program, among other reporting databases, and could provide a basis for collaborative and efficient planning of future projects.
- Alignment of the Strategy with the National Cohesive Wildland Fire Management Strategy.

Improvements in mapping technology, fire behavior modeling, and local knowledge and experience have provided a much more comprehensive and inclusive wildland-urban interface boundary that better identifies areas to be considered for priority treatment based upon the updated community wildfire protection plans and recent Lake Tahoe Basin Management Unit Forest Plan Environmental Impact Statement.

Substantial work has been completed to date, with over 43,000 acres treated since 2000 and 23,000 defensible space inspections since 2008. The implementation of defensible space requirements on private property represents a significant investment into fuels reduction by both private landowners and fire agencies. The Basin fire districts/departments provide defensible space inspections and curbside chipping to property owners, and enforce codes and regulations related to defensible space and building construction. CAL FIRE has assumed the "Direct Protection Area" responsibility for the State of California State Responsibility Areas lands and provides greater enforcement capacity for defensible space compliance. Washoe and Douglas counties in Nevada, and the State of California

have adopted codes requiring defensible space and ignition-resistant construction within the Basin which can now be enforced.

Compliance with defensible space requirements is impeded by several factors, including cost and time constraints and property owners' perceptions of risks and benefits as examples (Toman et al. 2013). Retrofitting structures to be less prone to ignition and wildfire can be especially costly. Existing programs have increased compliance, but there is a need for continued outreach and education, expanded implementation assistance programs, and broader enforcement actions.

Since the development of the original Strategy, the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) has been developed by the Wildland Fire Leadership Council as required by the FLAME Act. The tenets of the Cohesive Strategy have been embraced by land management agencies and those charged with fire suppression at the local, state, and national level. The Cohesive Strategy has three broad goals to address the complex challenges of preparing for fire in the wildland-urban interface:

1. **Restore and maintain fire resilient landscapes**.
   Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.

   This goal is at the heart of the Strategy, which recognizes and addresses risks to ecosystems under a changing climate at a landscape scale, as well as risks to life and property. The Strategy allows for the prioritization of projects that will have the greatest benefit to communities and landscapes, without regard of jurisdictional boundaries.

2. **Create fire-adapted communities**.
   Human populations and infrastructure can withstand a wildfire without loss of life or property.

   This goal is closely intertwined with the creation of defensible space and the need for public education, engagement, and enforcement. The Strategy promotes the development of consistent outreach and messaging, facilitates interagency cooperation, and strengthens communication and support between agencies and the public.

3. **Provide effective and efficient wildfire response.**
   All jurisdictions participate in making and implementing safe, effective, and efficient risk-based wildfire management decisions.

   The Strategy improves wildfire response by providing strategic treatments on the landscape designed to facilitate safer and more successful suppression. The improved tracking of completed fuels treatments improves the ability to inform risk-based management decisions as well as tactical suppression actions.

Implementing the Strategy has cost $90,744,735, with an annual average expenditure of $15,124,122 per year. Treating the remaining priority areas is projected to range between $142 million to $156 million, with an additional $25 million to $35 million to begin phased treatments on previously treated areas to maintain fire behavior modification efficacy over the next 10 years. The work is ongoing and Federal, state and local program managers continue to treat the remaining priority areas, and maintain the significant investments of time and money that have been invested to ensure communities are protected into the future.

At the time the Strategy was developed, there were market outlets that served as cost offsets, including one large sawmill and several biomass facilities within the local area. Today, there are

none, although Placer County's Cabin Creek Biomass Facility is planned for construction in 2015. In addition, sawmills further away have either closed or restricted purchase agreements, further reducing available markets for treatment residues. This has contributed to an increased need to utilize more costly prescribed fire to dispose of treatment residue that would have otherwise gone to the biomass facilities. The use of prescribed fire in the Basin is limited by a variety of factors, such as air quality restrictions, favorable weather conditions, and available resources—leading to a backlog of unburned piles. At the same time, restrictions on use of mechanical treatment, access, and lack of markets to dispose of treatment residues increases the need for prescribed fire as an important management tool. As more projects are completed, the need for prescribed burning is anticipated to increase, leading to a much larger backlog of burning needs.

The implementation schedule identified in the 2007 Strategy called for 5,000 acres of treatments annually to meet the desired goal of completing initial fuels entry in all wildland-urban interface acres. Since 2008, the average has been 4,045 acres of treatments completed annually. Over the past 6 years, almost 40 percent of the priority areas have been completed (see section 6, "Fuel Reduction Projects"). The Tahoe Fire and Fuels Team exceeded its production goals each year since 2008 and is well ahead of schedule for the prior Strategy; however, with the new community wildfire protection plans; the total acres planned for the Tahoe Fire and Fuels Team will increase significantly.

Although more than half of the initial entry treatments proposed in the original Strategy remain to be completed, there is a need to consider how and when to return to previously treated areas to maintain the efficacy of these treatments. Treatments completed to date have focused on the highest priority areas, closest to the communities. As initial entry treatments begin to age, it will be necessary for land managers to weigh the hazard risk reduction benefits to be obtained by completing the initial entry on a project that is further from a community versus reentering a treatment unit that is closer to the community. Developing competent data collection and analysis protocols will assist with future project prioritization.

Scheduling and coordination is increasingly important, because much of the future treatments to maintain desired fire behavior characteristics can be implemented at much lower costs/acre, especially when larger acreages are treated. There is also the recognition that these treatments have ancillary benefits related to improving forest structure and resiliency, and reducing the potential for other catastrophic disturbances (such as, drought impacts, insect and disease, and climate change).

Wildland-Urban Interface

The *wildland-urban interface* is defined in the Healthy Forest Restoration Act of 2003 (The Act) as "an area within or adjacent to an at-risk community that is identified in recommendations to the Secretary in a Community Wildfire Protection Plan." The Act specified that it is the local community's responsibility to define the location of the wildland-urban interface and that Federal agencies are required to use the wildland-urban interface defined in the community wildfire protection plan development process. Communities identified as "at-risk" (most of the Basin communities are identified) are identified in *Federal Register* 66(160): 43384–43435.

In the Lake Tahoe Basin there is generally no clear boundary between wildland fuels and developed communities. Wildland fuels exist throughout Tahoe communities with sufficient continuity that a wildland fire would readily burn through the community as though it were burning in wildland areas. Only the presence of roads and impervious surfaces mitigates fire hazard; however, in dry windy conditions, spot fires would cause a fire to travel through the area regardless of the presence of homes or roads.

This Strategy contains an updated wildland-urban interface map, which includes developed areas within the defense zone to recognize the lack of a distinct boundary between communities and wildland fuels. Improvements in mapping technology, fire behavior modeling, and local knowledge and experience have provided a much more comprehensive and inclusive wildland-urban interface that better identifies areas to be considered for priority treatment based upon adopted community wildfire protection plans and recent Lake Tahoe Basin Management Unit Forest Plan (Figure 2). In some instances jurisdictional boundaries extend beyond the watershed boundary of the Basin.

Defense and Threat Zones

The Healthy Forest Restoration Act (the Act) provided guidance to communities as to where the interior boundary of the wildland-urban interface should be located, but did not provide guidance for communities to determine the outer boundary of the wildland-urban interface. The Act left these decisions to the local communities so that local fire managers could take into account fuel loading, topography, and local weather when planning the location of fuels reduction projects. This Strategy identifies two zones within the wildland-urban interface.

►**Defense Zone.** The defense zone is the area that includes the at-risk community extending into the wildland for at least 0.25 mile beyond the community. All areas within the defense zone are a priority for fuels reduction; specifically fuels reduction in wildland areas and defensible space within the built areas. The intent of fuels reduction within the defense zone is to reduce fuels so that fire occurring during extreme fire weather will burn with 4-foot flame lengths or less as it approaches the community and provide an adequate area for firefighters to engage the fire before it can reach the built environment. Buildings and the defensible space around them form a critical component of the defense zone.

- **Built Environment:** All new construction and substantial remodels must comply with either building codes or the International Wildland Urban Interface Code as required by state and local regulations. Owners of existing homes are encouraged to upgrade their homes to meet the intent of the relevant regulations and are required to upgrade their homes when certain conditions are met when remodeling a home or adding a home addition.
- **Defensible Space in the Defense Zone:** Developed properties, including homes and businesses, in communities within the wildland-urban interface are required to implement and maintain rigorous standards for fuels reduction. When structures are present, fuels should be modified following the standards identified in state and local regulations. The "Fire Adapted Communities" booklet published by the Cooperative Extension at the University of Nevada is a useful guide for homeowners to better understand the defensible space options for their homes and community:
    - ***Noncombustible Area:*** This area extends from the structure out to 5 feet. In this area no combustible vegetation or ground covers are permitted. Examples of nonflammable vegetation would be well irrigated flowers or succulent plants. Compost may be used; however, flammable mulches such as pine needles, shredded bark, bark, and woodchips are prohibited.
    - ***Lean, Clean, and Green Area:*** This area extends from the noncombustible area out to 30 feet. In this area single isolated specimens of flammable plants are permitted and plants are to be kept healthy and free of dead material. Combustible mulches may not be used as a widespread ground cover and may not be used in a manner that would carry fire (that is, a fire must self-extinguish in this area).

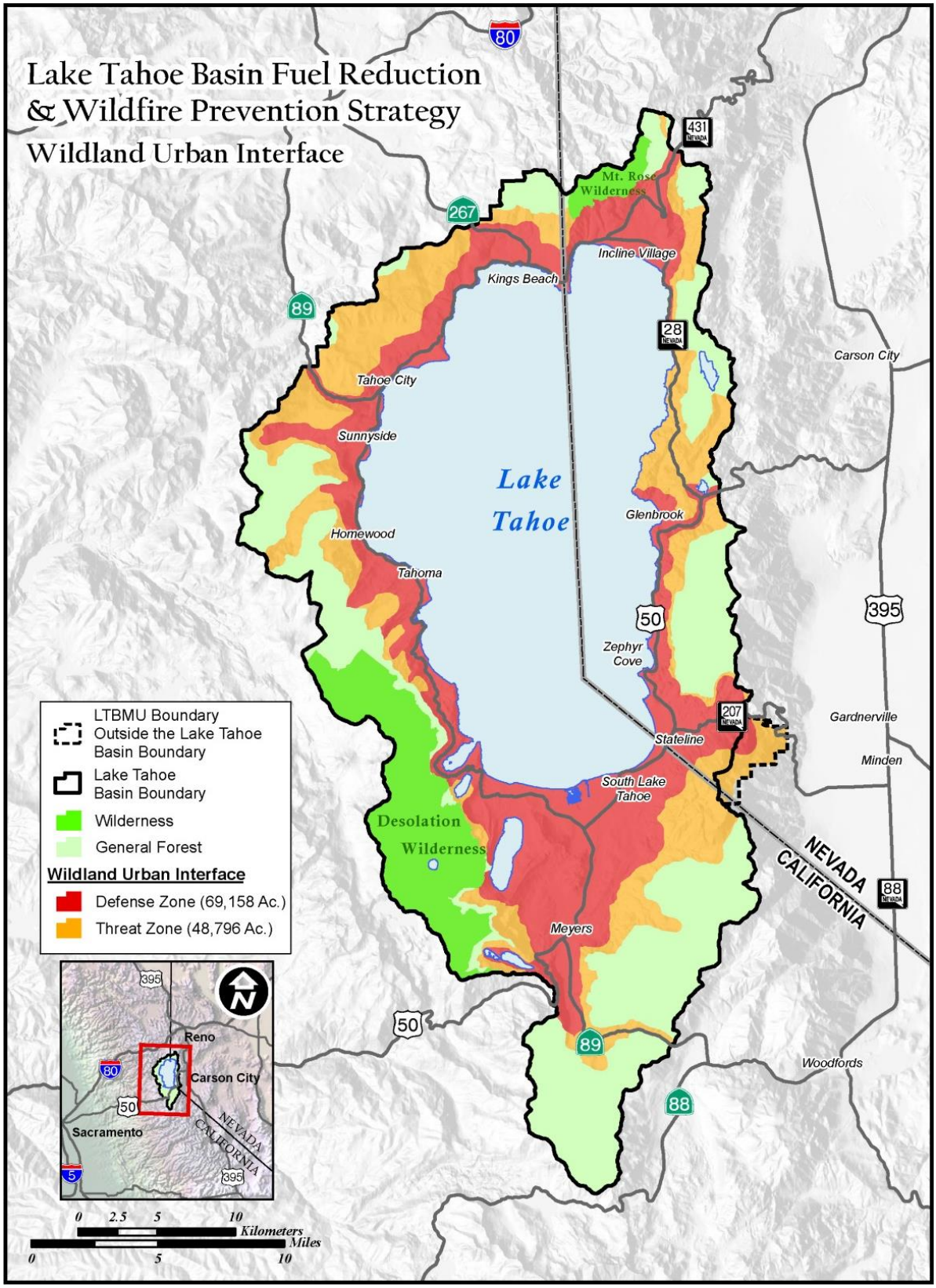

Figure 2. Wildland-urban interface by zone

- ***Wildland Fuel Reduction Area:*** This area extends from the lean, clean, and green area out to the wildland. In general it is recommended that homeowners complete at least 100 feet of defensible space, but that distance may be increased up to 300 feet depending on slope and fuel types. In the wildland fuel reduction area there must not be horizontal and vertical fuel continuity. Isolated patches of native shrubs, trees, and some patches of flammable ground covers are allowed; however, they cannot be continuous or capable of carrying fire to or from the home. Vertical fuel continuity (ladder fuels) is a condition where surface fuels are under small- or medium-sized trees which are then directly under the larger trees that compose the forest canopy. Ladder fuels enable surface fire to travel into the forest canopy and produce flame lengths far greater than what firefighters can safely engage.

►**Threat Zone.** The threat zone is an extension of the defense zone with the important distinction being that not every area within the threat zone may be a priority for treatment. Area treatments within the threat zone are designed to reduce fuels in target areas where fires are known to start, where a fire start is likely to grow and threaten communities.

General Forest

General forest areas are all other lands outside of the identified wildland-urban interface that are not in wilderness. These areas are not specifically addressed in the Healthy Forest Restoration Act; however, treatments can be implemented there for fuels reduction, forest health, and ecosystem resiliency, and to address emergency needs (such as, windthrow, salvage, forest insects and disease, etc.) in addition to other management considerations.

Wildland-Urban Interface Acres by Zone

The total acres of each zone in the wildland-urban interface are shown in Table 2 below.

Table 2. Wildland-Urban Interface Acres within the Basin

Zones	Acres
Wildland-Urban Interface	117,954
Defense Zone	69,158
Threat Zone	48,796
General Forest	63,865

Community Wildfire Protection Plans

Community wildfire protection plans are plans created by local jurisdictions to meet three primary requirements as specified in the Healthy Forest Restoration Act:

> (A) Is developed within the context of the collaborative agreements and the guidance established by the Wildland Fire Leadership Council and agreed to by the applicable local government, local fire department, and state agency responsible for forest management, in consultation with interested parties and the Federal land management agencies managing land in the vicinity of the at-risk community;
>
> (B) identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment on Federal and non-Federal land that will protect [one] or more at-risk communities and essential infrastructure; and
>
> (C) recommends measures to reduce structural ignitability throughout the at-risk community.

All seven local fire protection jurisdictions have developed community wildfire protection plans. In addition, the Tahoe Regional Planning Agency has combined and standardized the individual plans (Holl 2007) that better describes the risk to the Lake Tahoe Basin as a whole. These plans are currently being updated (completion scheduled in August 2014) and are incorporated by reference into the Strategy. Community wildfire protection plans establish the priority of fuels reduction projects. The plans also provide a single point of reference about future needs, enabling land management agencies to schedule and coordinate implementation.

Section 2: Current Conditions and Hazards

Current Condition

The number of acres burned by wildfires in the Lake Tahoe Basin has increased in each decade since 1973, including a ten-fold increase during the last decade (Figure 3). Although the majority of fires were small, three recent fires grew larger than fires of the past 50 years. These were the Gondola and Showers fires (673 and 294 acres, respectively) in 2002 and the Angora Fire in 2007. The Angora Fire, which burned 3,100 acres and destroyed or damaged more than 254 homes, was the largest fire ever recorded in the Basin. Weather conditions recorded at the Lake Tahoe Airport on the initial burning period of each of these fires are listed in Table 3. It should be noted that these recorded weather conditions are below the 90th percentile conditions to which the Basin land managers designs fuel treatments. Even with highly effective suppression resources, the crown fire activity and sizes of these fires provide additional evidence that wildland fuel hazards in the Basin have increased substantially and will continue to increase in the years ahead (Lake Tahoe Basin Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy–December 2007).

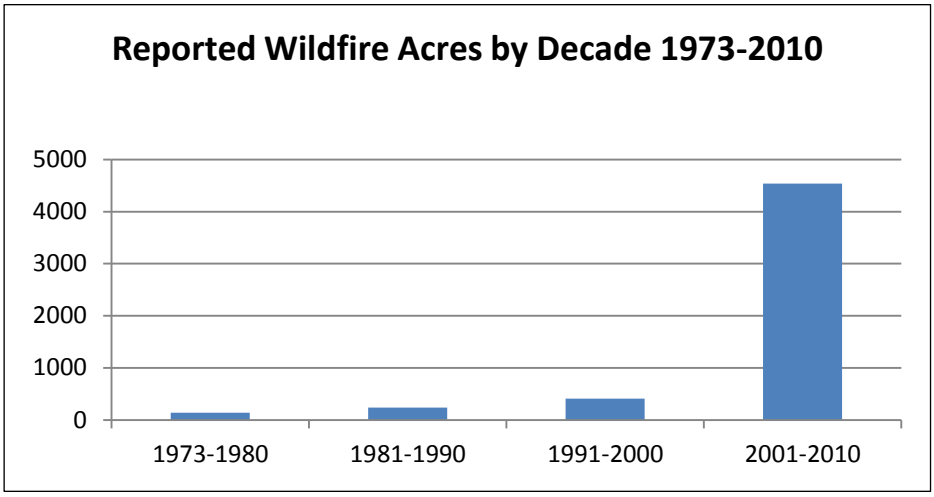

Figure 3. Wildfire acres burned in the Lake Tahoe Basin by decade (1973–2010)

Data from FAMWEB (http://famtest.nwcg.gov/fam-web/) data warehouse: queries and reports—Fire Causes and Acres Burned by Year.

Table 3. Weather recorded on days when a large fire occurred in Lake Tahoe Basin

	Date	Maximum Temperature (°F)	Minimum Relative Humidity (%)	Average Afternoon 20-foot Wind (mph)
Gondola	3 July, 2002	77	18	9–13 with gust to 22
Showers	19 August, 2002	76	11	10–16 with gusts to 26
Angora	24 June, 2007	68	11	9–13 with gusts to 28
90th percentile		85	5	25 (10 minute average)

Note: Data from National Weather Service; Lake Tahoe Airport. 90th percentile calculated from Meyers RAWS historical dataset May through October.

The long history of fire suppression combined with incidences of drought and forest insect and pathogen-induced mortality has resulted in forest stands with a high concentration of hazardous fuels. This condition has increased the threat of large catastrophic fire and is indicative of a forest where many natural processes have been excluded.

Current Vegetative Conditions and Fire Regimes

Recent estimates indicate that lower elevation forests in the Lake Tahoe Basin have four times the density of trees (Figure 4), and higher elevation forests have twice the density of trees, when compared to forest conditions prior to 1870 (USDA Forest Service 2000a). High densities of trees increase competition for nutrients resulting in poor forest health. High rates of tree mortality (Figure 5) (particularly white fir [*Abies concolor*] but also some pine species), have increased the number of standing dead trees and downed logs. In addition to the accumulation of dead material on the forest floor, there are also smaller mid-story trees that create fuel ladders that allow fires to readily move into dense crowns. The lack of frequent, low-intensity fires has resulted in accumulations of dead fuels, increased understory shrubs, and dense young trees. As a result, flame lengths and rates of fire spread lead to higher intensity fires (Holl 2007).

Figure 4. Dense forests in Lake Tahoe Basin

Residential, commercial, and infrastructure construction have also influenced today's vegetation patterns. Not only have large areas of vegetative cover been removed, but the composition of the remaining vegetation has changed through landscaping. In addition to the increased density of trees, the species composition has changed from species that are fire resistant (especially Jeffrey pine which has few branches close to the ground and thicker bark to insulate the bole), growing in open canopies with high sun exposure to species that tolerate shaded, closed-canopy environments. These species (especially white fir) are not fire resistant, having thin bark and branches close to the ground, growing in much higher densities underneath the overstory canopy.

Figure 5. Forest mortality in Lake Tahoe Basin

Historic Fire Regime

Prior to European settlement, fires in the Basin were ignited by lightning or members of the Washoe Tribe, who inhabited the Tahoe Basin during the summer months. The fire-return interval varied from 5 to 128 years, depending on elevation (Taylor 2004), with fire-return intervals being the shortest (5 to 18 years) at the lowest elevations around the lake. Based on historic fire-return intervals, it is estimated 2,100 to 8,000 acres burned annually in the Lake Tahoe Basin, with approximately 50 percent of that at the lower elevations (USDA 2000a). Because frequent fires reduced surface and ladder fuels, fire intensities were low and there was little mortality of mature trees. These frequent fire intervals favored fire-resistant tree species, maintaining open canopies, and low tree densities, and minimized vertical and horizontal fuel continuity.

As Europeans settled in the Basin, several factors contributed to changes in the fire regime and fuel hazards. Between 1875 and 1895, large-scale clearcutting removed most of the old-growth forests in the Basin (Lindstrom et al. 2000). By 1900, 60 percent of the Basin's forests were dominated by seedlings (less than 1 inch diameter), saplings (between 1 and 6 inches diameter), and pole-sized trees (between 6 and 12 inches diameter), with a few areas of remnant old-growth forests. In conclusion, disturbance by fire which was a frequent and normal part of the historic vegetative condition has been severely altered.

Current Fire Regime

Since 1910 management direction focused on protection of natural resources by suppressing wildfires, which removed a natural source of vegetation disturbance. Modeled fire behavior in the Basin and observed fire behavior in the Angora, Gondola, Showers, and Pioneer fires demonstrates current fire behavior is characterized by high-intensity fires, regardless of slope or riparian vegetation. Thus, the fire regime has changed from frequent, low-intensity fires to infrequent, high-intensity fires. High-intensity wildfires will result in high tree mortality in forest stands, could result in extensive property loss, and could cause large amounts of erosion and sedimentation that would adversely affect water quality.

Fire Return Interval Departure

The *fire return interval departure* is a measure of how much the existing condition has departed from the historic conditions related to fire-return intervals (Safford et al. 2011). Figure 6 indicates that approximately 71 percent of the Basin is in a condition of severe departure, meaning that "Fire regimes have been substantially altered from their natural (historical) range. The risk of losing key ecosystem components is high. Fire frequencies have departed from natural frequencies by multiple return intervals. Dramatic changes occur to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been substantially altered from their natural (historical) range."

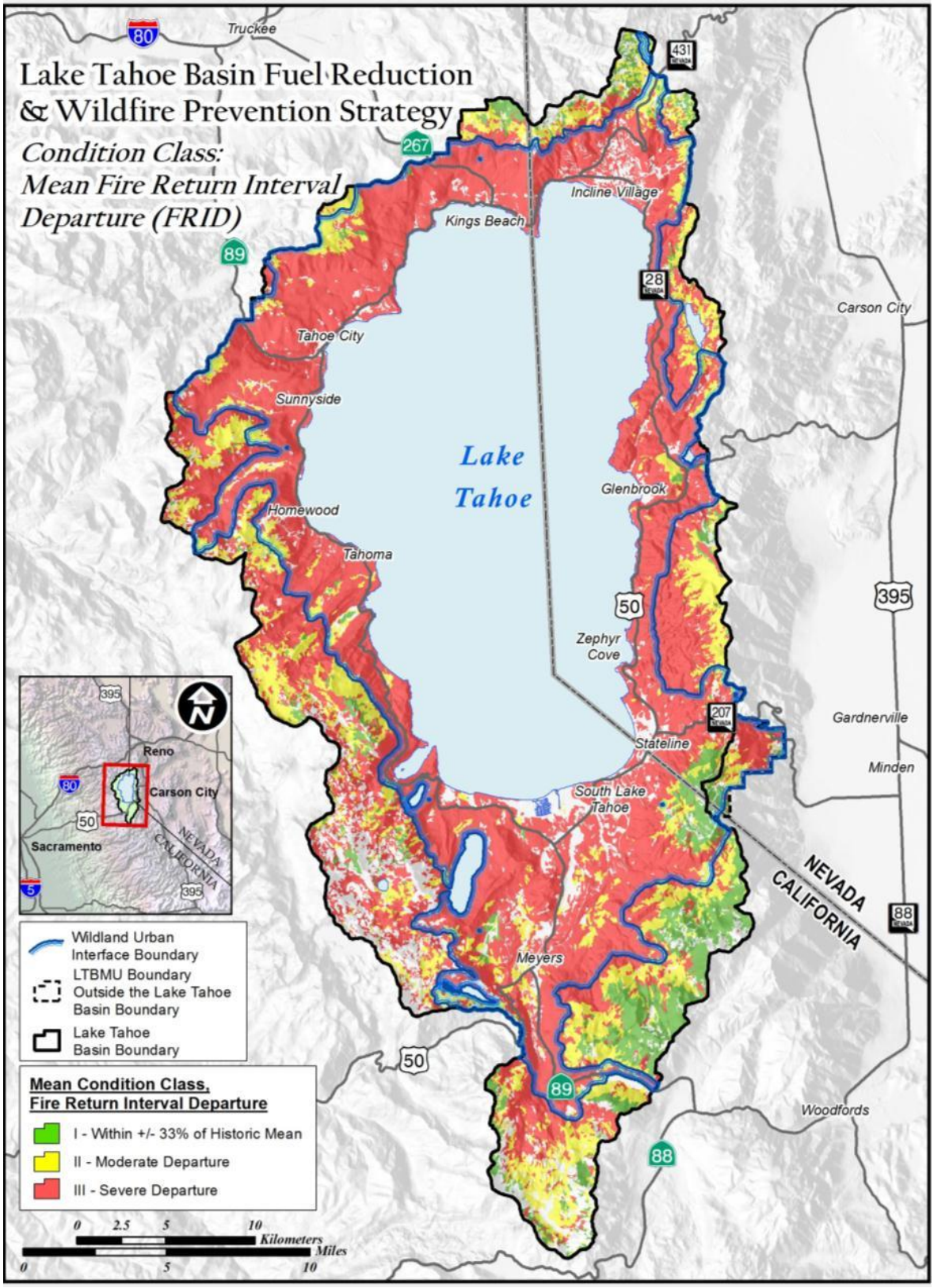

Figure 6. Mean fire return interval departure

Source: www.fs.fed.us/r5/rsl/clearinghouse/r5gis/frid)

Current Wildfire Potential

The Lake Tahoe Basin Final Revised Land and Resource Management Plan Final Environmental Impact Statement (USDA Forest Service Lake Tahoe Basin Management Unit 2013) quantified and assessed the wildfire threats in the Tahoe Basin. Ignition history and fire behavior modeling were used to predict fire susceptibility in the Basin. FLAMMAP (version 3) was used to predict fire behavior characteristics such as flame length and fire type (that is, crown fire, surface fire). FLAMMAP uses Geographic Information System (GIS)-based raster inputs for terrain and fuel characteristics and computes fire behavior outputs for a given landscape using standard fire behavior prediction algorithms.

Ignition Risk

Ignition risk is the probability of a fire start and is determined by utilizing the frequency of historical fire starts. The Lake Tahoe Basin Management Unit used historic ignition point data (1976 to 2010) to generate an ignition density surface to represent relative likelihood of an ignition occurring based on historical occurrences (Figure 7). Nearly 80 percent of all ignitions occur in the wildland-urban interface, of which the vast majority of ignitions are human caused.

Fire Type and Flame Length

Fire type can be classified into three general types: *surface fire*, *passive crown fire*, and *active crown fire* (Anderson 1982). A *surface fire* is a fire that is carried by surface fuels. A *passive crown fire* is a type of crown fire in which the crowns of individual trees or small groups of trees burn, but solid flaming in the canopy cannot be maintained except for short periods (Scott and Reinhardt 2001). An *active crown fire* presents a solid wall of flame from the surface through the canopy fuel layers. Active crown fires can exhibit extreme fire behavior where rapid rates of spread, extreme flame lengths, spotting, convection columns, and fire whirls can make direct attack efforts by firefighters impossible. Fire type can be used as an indicator for determining the risk of large tree loss in the event of fire (Figure 8).

- Approximately 36,000 acres received an extreme fire behavior rating (active crown fire). Under these conditions, resources such as aircraft will be needed to engage these fires, with prompt suppression unlikely (Figure 8).
- Approximately 63,000 acres produced passive crown fire, which would hamper suppression efforts.
- Approximately 86,000 acres would be considered to have low-moderate fire behavior (surface fire). These fires can be directly engaged with fire personnel, engines and other direct attack methods.

Flame length is the distance between the flame tip and the midpoint of the flame depth at the base of the flame (Rothermel 1983). Higher flame lengths are more likely to facilitate movement of a surface fire to a passive crown fire or an active crown fire. Fuel composition and weather significantly influence flame length. Flame length relates to the types of resources needed for effective suppression. Flame lengths are analyzed and described in four categories (see Table 4).

This analysis found that under 90th percentile weather conditions[1] the predictive models indicate that fire in two-thirds of the forest would exceed the 4-foot flame length and result in large-scale tree mortality.

[1] 90th percentile weather conditions is defined as the threshold for the severest 10 percent of fire weather indices, based on historical weather data for that location.

- Approximately 100,000 acres in the Basin would produce flame lengths less than 4 feet; 105,000 acres would produce flame lengths greater than 4 feet. Under fire behavior conditions with greater than 4-feet flame lengths and passive crown fire, fire crews cannot use direct attack strategies and must rely on mechanized equipment and aerial support to suppress these fires (Table 4 and Figure 9).

Table 4. Explanation of analysis categories for flame lengths

Flame Length (feet)	Description
0–4	Fires can generally be attacked at the head of flanks by persons using hand tools.
4–8	Fires are too intense for direct attack on the head of the fire by persons using hand tools. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8–11	Fires may present serious control problems torching, crowning, and spotting. Control at the fire head will probably be ineffective.
>11	Crowning, spotting, and major fire runs are probable. Control efforts at the head of the fire are usually ineffective.

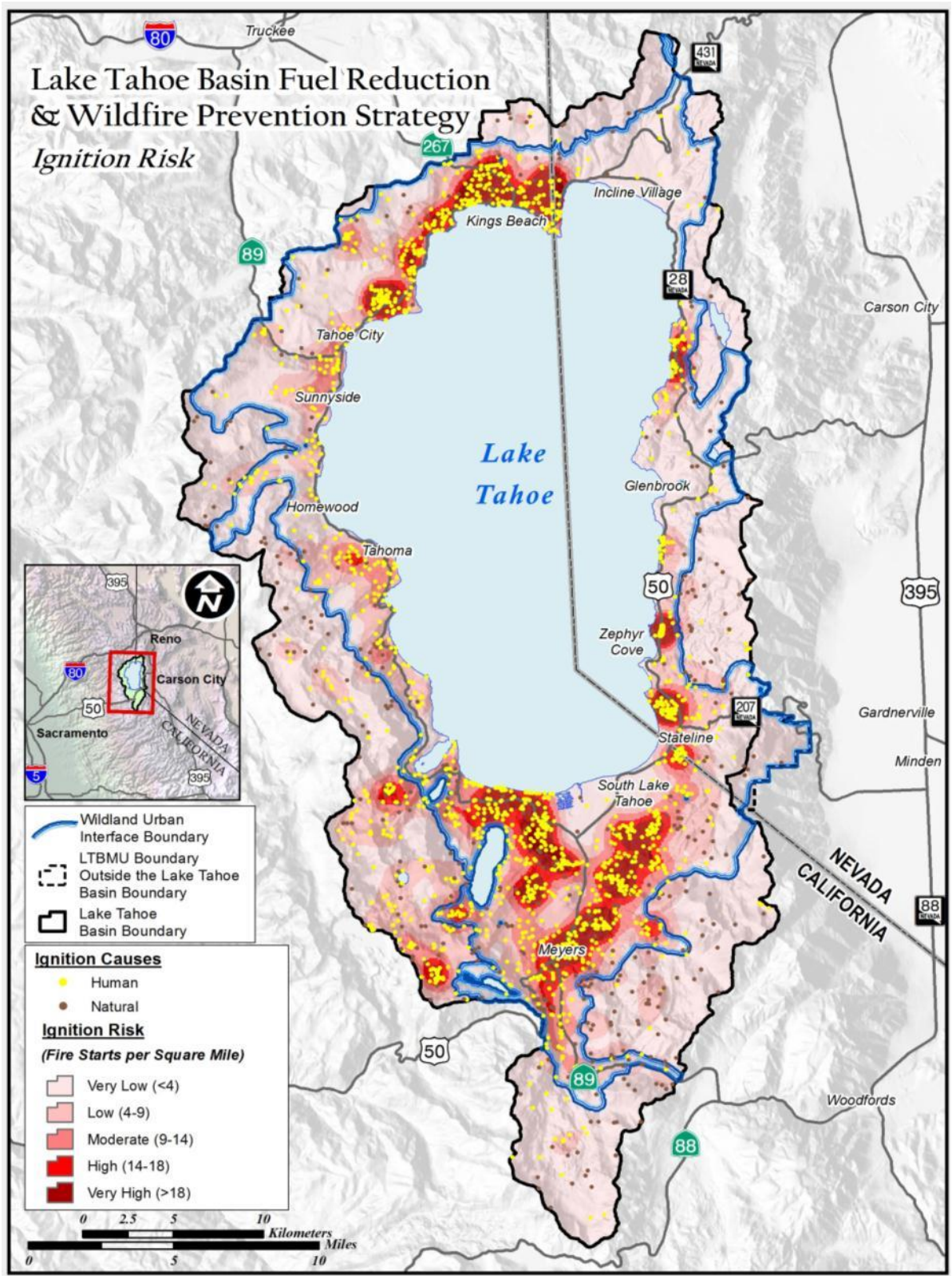

Figure 7. Ignition risk based on LTBMU historic ignition point data 1976–2010

Source: LTBMU Forest Plan and FEIS, 2013.

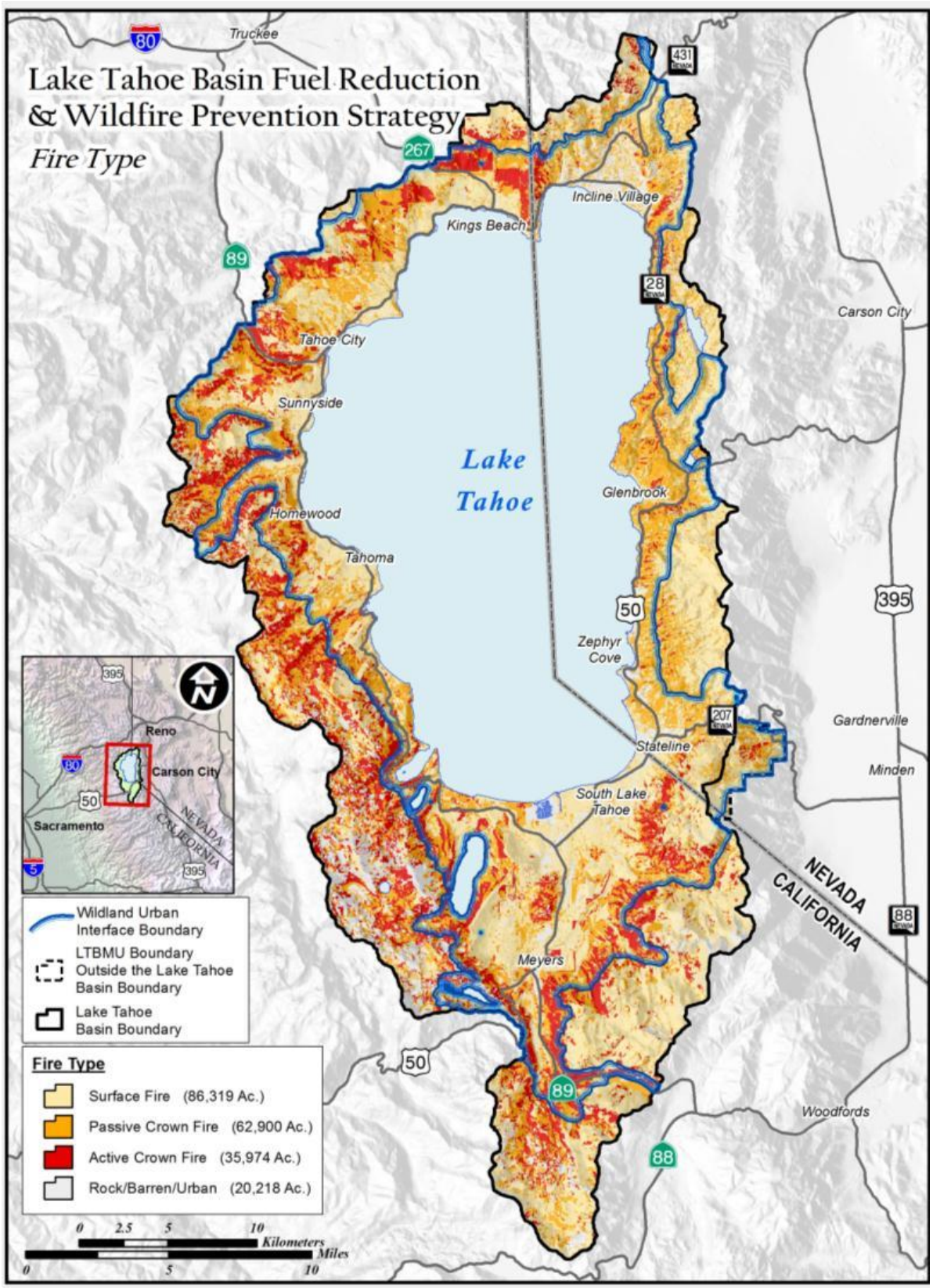

Figure 8. Predicted fire type

Source: LTBMU Forest Plan and FEIS, 2013.

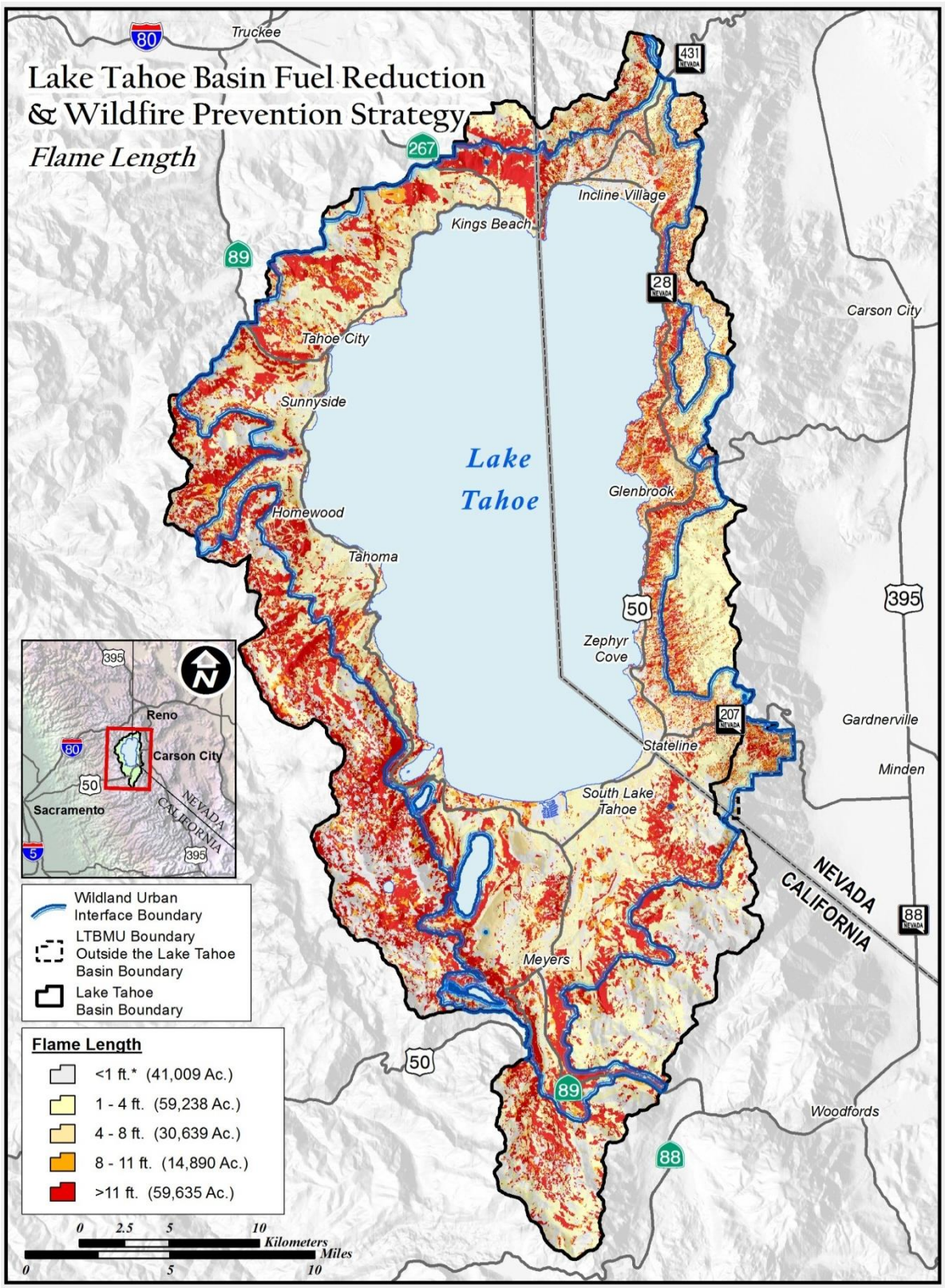

Figure 9. Predicted flame length

Source: LTBMU Forest Plan and FEIS, 2013.

Defensible Space

Many homes throughout the Basin have *defensible space*. Homes without defensible space influence the probability of ignition from wildland fire, and can greatly hamper fire suppression efforts. Fire behavior becomes more extreme and uncontrollable in communities or neighborhoods that:

- Do not create defensible space;
- Have unenclosed structures, such as decks; and
- Are built with flammable materials, such as wood shake roofs.

While many homes in the Tahoe Basin do not adhere to the best practices for ignition-resistant construction, adequate defensible space can greatly reduce the probability of ignition even in these vulnerable structures (Figure 10). Thus, there is great benefit to continuing the current efforts to encourage and assist homeowners in meeting defensible space requirements.

In neighborhoods where homeowners have created defensible space around individual homes, the treated areas overlap and create larger areas where firefighters would be able to directly attack fire or engage in structure protection operations. State and local fire agencies are actively educating, inspecting, and enforcing defensible space standards. All local fire agencies in the Tahoe Basin have memorandums of understanding with the Tahoe Regional Planning Agency whereby the local fire department can inspect properties and issue tree removal permits if tree removal is deemed necessary to create adequate defensible space. Along with issuing permits, local fire agencies consult with homeowners about defensible space and provide an inspection report based on state laws requiring defensible space. As the number of homes owned by out-of-area owners increases, the challenges of implementing defensible space standards and public education regarding wildland fire hazard becomes increasingly complex.

Local fire agencies provide implementation assistance to homeowners, such as chipping programs where residents can have yard waste chipped and hauled from the property. In addition, the LTBMU provides homeowner and stewardship agreements to allow homeowners to extend their defensible space onto national forest lands.

Figure 10. Hand thinning to create defensible space in an urban area (before and after)

Climate Change – Past and Projected Trends

The Lake Tahoe Basin Management Unit Forest Plan Final Environmental Impact Statement provides a summary of past and projected climate trends (USDA Forest Service Lake Tahoe Basin Management Unit 2013). Trends observed in the Basin in recent years include a 2 °F increase in mean temperatures over the last century, and fewer nights with night-time temperatures below freezing. For the first time on record, mean annual temperature is above freezing, and since 1910, the average number of days below freezing has decreased by 27 days. Annual precipitation has been highly variable. The amount of precipitation that falls as rain is increasing, and peak snowmelt is occurring earlier. The winters of 2011 to 2014 have been some of the driest on record.

All climate change models project significant warming (4 to 9 °F) by 2100. Most models project precipitation amounts similar to current, but drier summers and continued increases in rain to snow ratios. Stream flows in winter and early spring are expected to increase while decreased stream flow is expected for late spring and summer. Projections also indicate shifts in vegetation elevation ranges and decreasing conifer range, coupled with expansion of grass and shrub types.

Potential impacts include more frequent and larger fires, increased tree mortality during longer growing-season droughts, increased bark beetle risk due to drought-induced susceptibility and multiple beetle broods per season. In addition to mortality agents, increased tree recruitment and growth may occur in meadows due to increased CO_2 fertilization and drought, as well as increased growth rate of fast-growing native tree species which contributes to fuel build up and increasing need for maintenance treatments.

While most of the projected trends and potential impacts are considered likely by most experts, there is always uncertainty related to future projections, especially when applied to systems as dynamic and complex as climate-ecological interactions. Therefore, the importance of a flexible strategy cannot be overemphasized.

This Strategy addresses these issues by building adaptive capacity through ecological restoration, improving forest carbon sequestration, and increasing resilience to environmental stressors. Ecological restoration will increase ecosystem capacity to adapt to future climate conditions by increasing landscape diversity and restoring resilience to climate warming and associated stressors such as drought. The fuels reduction and restoration projects may also be designed to maintain biological diversity and develop habitat connectivity. While untreated forest may store large amounts of carbon, much of the carbon will be released compared to when a treated forest burns, or carbon released during prescribed fires. Further, untreated forests have a higher risk of burning and a lower probability of successful wildfire suppression than a treated forest.

Desired Conditions

Desired conditions are a collection of quantifiable metrics that when present indicate that the ecosystem is healthy and functioning. With respect to fire, desired conditions will indicate that the current fire regime condition class is similar to their historic norms and expected low intensity fire behavior allows safe and effective fire suppression. Generally, this means reducing vegetation in proposed project areas toward historic levels (low [I] condition class) resulting in fire behavior characteristics associated with surface fires (Table 5).

Table 5. Desired wildland fuel conditions

	Current Trend	Desired Trend
Fire Regime Condition Class	Moderate (II) to high (III)	Moderate (II) to low (I)
Fire Behavior	Passive to active crown fires with flame lengths that exceed 4 feet	Surface fires with flame lengths less than 4 feet

Desired conditions for this Strategy are derived from the Lake Tahoe Basin Management Unit (LTBMU) Forest Plan and the community wildfire protection plans adopted by the local fire agencies. Fuel treatments on all Federal lands will be consistent with the standards and guidelines identified in the LTBMU Forest Plan. On all other land ownerships, fuel treatments will be consistent with the regulations, standards, and guidelines of the appropriate fire districts or departments and the Tahoe Regional Planning Agency. In the wildland-urban interface, defensible space on developed lots will be established and maintained consistent with applicable state or local ordinances.

Section 3: Values at Risk

Values at risk are not only monetary, but include intrinsic, non-monetary values as well. These might include the beauty of the surrounding environment, diversity of vegetation and associated habitat, clean water and air, as well as recreational opportunities and cultural resources.

Communities and Safety

Within the Lake Tahoe Basin, 117,954 acres (56 percent) are within the wildland-urban interface. Communities at risk identified in the *Federal Register* (August 2001) include: Incline Village, Crystal Bay, Sand Harbor, Glenbrook, Kingsbury, Highway 50 Corridor, South Lake Tahoe, City of South Lake Tahoe, Homewood, Tahoe Pines, Sunnyside, Tahoe City, Dollar Point, Carnelian Bay, Tahoe Vista, and Kings Beach. However, all communities within the Basin are exposed to substantial wildland fire risks, even if not identified in the *Federal Register*.

Human health is also at risk. Exposure to air pollutants from wildfire smoke is associated with numerous effects on human health, including increased respiratory symptoms or decreased lung function, hospitalization for heart or lung diseases, or premature death. In addition, public safety and firefighter safety is at risk when wildfires continue to burn with high intensity and uncharacteristic fire behavior.

Socioeconomic Considerations

The Lake Tahoe Basin economy is driven largely by recreation and tourism. Although the Basin's population has declined over the past decade (2010 U.S. Census), a growing numbers of residents in the adjoining counties visit the Basin and influence Tahoe's environment and economy (LTBMU Forest Plan). Daily car visitors, skiers, business meetings, seminars, organized summer camp activities, camping, hiking, mountain biking, fishing, and summer water sports bring thousands of tourists from all over the world to the area each year. Like other resort areas such as Park City, Utah, or Sun Valley, Idaho, winter sports are a significant driver of the regional economy. For example, in the North Lake Tahoe area, total visitor spending contributed nearly $361 million to the local economy (Runyan 2009). The Lake Tahoe Basin also includes some very high property value homes and businesses. The greatest concern with large fires in the Basin is life, property, and natural resource values that are threatened. Even a small wildfire in the Basin is potentially significant because of the alignment of high ignition potential, high density and value of human developments, and high fuel hazard. High-intensity wildfires could result in extensive property damage or loss.

Recreation and Scenic Resources

Lake Tahoe is a nationally and internationally renowned landscape. The dramatic beauty and ecological uniqueness of the region's landscape defines it more than any fact or figure. Wildfire has the potential to affect the large-scale landscape character and scenic integrity.

Recreation opportunities in the Basin are some of the best in the country including California and Nevada state parks, national forests, and the activities centered on Lake Tahoe. Recreation and related tourism shapes the social, economic, and ecological conditions, and influences policies in the region. Winter- and water-sports related recreation and resorts are a primary attraction for recreationists and drive local tourism and jobs. In North Lake Tahoe, nearly 5,500 jobs are directly related to these activities (Runyan 2009).

Water Quality, Watersheds, and Riparian Zones

The clarity of Lake Tahoe is world renowned and the loss of that clarity is of concern to many. After steadily declining for 30 years, the lake's clarity hit an all-time low in 1997. In 2013, researchers at the University of California-Davis reported that monitoring data indicates the clarity level trend had stabilized for the preceding decade (Schladow 2013). High-intensity wildfires could cause large amounts of erosion and sedimentation that would adversely affect water quality (Holl 2007). Allowing hazardous fuels capable of supporting a crown fire to build up in stream environment zones could have significant effects on water quality in the Lake Tahoe Basin. The loss of vegetation from wildfire would result in erosion and sedimentation, decreasing water quality (Holl 2007).

Fires can have extraordinary effects on watershed processes and can significantly influence aquatic organisms and the quality of aquatic habitats in many ways (Benda et al. 2003; Rieman et al. 2003; Wondzell and King 2003). Substantial reductions in riparian shading and altered stream flows can increase stream temperatures to extreme levels (Rieman et al. 2003; McMahon and DeCalista 1990). Flooding, surface erosion, and mass wasting (landslides) may increase due to vegetation loss and the creation of hydrophobic (water-repellant) soils.

Wildlife Habitat and Forest Vegetation

Wildfire has the potential to damage or destroy suitable habitat for wildlife. Of particular concern are critical threatened, endangered, proposed and other special status species, such as the mountain yellow-legged frog, California spotted owl, northern goshawk, bald eagle, and osprey.

High-intensity wildfires will directly result in high tree mortality in forest stands, especially within moderate- and high-density forests having increased horizontal and vertical fuel continuity. Tree mortality (representing severity of fire effects on vegetation) would probably be high in areas that have not been treated to reduce fuels (areas where the vegetation is overly dense and multi-storied).

Native flora is also at risk as noxious weeds and invasive species tend to spread rapidly following wildfires. Wildfire areas are especially vulnerable to weed infestation because: (1) equipment used in wildfire suppression and burned area emergency rehabilitation may bring weed seeds into an area; and (2) burned areas provide ideal conditions for weed germination. Weed populations can easily gain a foothold before native vegetation has a chance to recover from the fire.

Air Quality

Many factors contribute to Lake Tahoe Basin's air pollution, including pollution from urban areas, dust from roads, automobile emissions, and smoke from wood burning stoves. Wildfires also emit large amounts of particulate matter (PM_{10} and $PM_{2.5}$) and carbon monoxide, as well as nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which are precursors to ozone. Historically, almost all wildfires have exceeded the national and state standards for particulate matter, primarily due to the high outputs of these pollutants over a short period of time. Other constituents of smoke (gases and chemicals) may also enter the lungs. Some components, such as benzo-apyrene and aldehydes, can be carcinogenic.

Wildfires typically result in twice the emissions per acre when compared to prescribed fire (Huff et al. 1995), and pollution commonly exceeds ambient air quality standards during large fires. Large fires also often occur under conditions of high temperature and low humidity, when high concentrations of ozone are most likely. Although there is currently no quantitative way to fully display the emissions from wildfire as compared to a prescribed burn, the intent of fuels reduction activities is to reduce the size of, and hence the emissions, from wildfire.

Section 4: Benefits

Benefits of fuels reduction include the reduction in the potential for a wildfire to occur; increased protection of communities, property, infrastructure and natural resource values; and an increased ability for direct suppression, thereby increasing firefighter and public safety. Additional benefits include the increased resilience of treated areas to withstand disturbance and adapt to climate change, increased carbon sequestration, and decreased potential for adverse air quality events.

Wildfire Risk

The most significant direct benefit of fuels treatment activities is the reduction in wildfire risk. The majority of treatments to date and those currently planned occur within the wildland-urban interface, primarily within the defense zone. As indicated in Figure 6, wildland-urban interface areas have the most significant departure from the historic conditions of frequent, low-severity fires that resulted in more open forests with scattered larger trees, and little understory vegetation. Treatments have moved these areas towards more "fire-adapted" conditions, reducing the potential for a surface fire to move into the crowns (Figure 11).

Figure 11. Hazardous fuels reduction to reduce the risk of extreme fire behavior (before and after)

Reduced Fire Behavior

Flame lengths in treated areas are expected to be reduced to 4 feet or less and torching and crowning will be reduced and/or eliminated. Reducing flame lengths and reducing the risk of extreme fire behavior allows for direct attack by firefighters. Direct attack suppression efforts can be rapid and effective in minimizing fire spread and fire impacts.

Increased Defensible Space

The reduction of fuels immediately adjacent to neighborhoods and communities extends the defensible space around individual homes and structures into the wildland, contributing to the protection of these communities. It also increases firefighter safety and allows firefighters to directly attack wildfire in these areas where the fire is less severe.

Increased Forest Resiliency

The reduction of fuel loading and understory (brush and small trees), and decreases in stand density, increases the resiliency of the forest stand by reducing competition for site resources (light, nutrients, and especially water) while improving the vigor of the remaining trees (Figure 12). These treatments also help to change forest species composition by removing many of the shade-tolerant species that are more fire-prone, transitioning the overall stand species composition back towards more fire-resistant species (white fir to Jeffrey pine as an example). Reducing the tree density also allows for increased structural integrity as the residual stand increases wind firmness and ability to resist insect and disease. Opening the canopy through density reduction also increases the opportunity for the shade-intolerant, fire-adapted species to regenerate and further improve species composition. As more areas are treated, and given changes in climate, the overall landscape increases in resiliency to withstand natural or human disturbances.

Figure 12. Mechanical thinning to reduce understory and fuel loading (before and after)

Wildlife Habitat Protection

Fuel reduction treatments represent a change in habitats and provide benefits to a wide variety of species. Changes that result from fuel treatments affect species differently within a range of habitats from early-seral to mature forests. Wildfire also changes habitat and recent wildfires have created large patches of high-severity burn areas. Utilizing prescribed fire can contribute to specific habitat needs that more closely emulates historic patch size and variation. In general, this Strategy aims to reduce the risk of stand-replacing fire in critical habitat areas and satisfy wildlife habitat needs to the extent possible while meeting fuel reduction objectives as identified in project-specific planning.

Reduced Risk of Scenic Quality Impacts

The forests surrounding Lake Tahoe blanket mountain slopes visible from both the lake and from the ground, whether from a road or trail. Though the forests have been altered and their conditions are not entirely healthy, they generally appear green and visually pleasing. Increasing the integrity of the forest to withstand drought, insect outbreak, forest pathogens and wildfire will help to achieve a high level of scenic stability.

Reduced Risk of Significant Air Quality Impacts

Reducing the potential for catastrophic wildfire also reduces the potential for air quality impacts from smoke and particulates generated by wildfire. Although the treatments completed and proposed

do not completely eliminate smoke, the judicious use of prescribed fire when atmospheric conditions are appropriate (following state smoke management requirements) substantially reduces the amount of smoke and particulates created. Research indicates that prescribed fire typically generates half the amount of smoke and particulates as a wildfire in the same location, due to the ability to control ignition, time of burn, and burn duration with a prescribed fire as opposed to a wildfire (Huff et al. 2005).

Carbon Sequestration and Emission Reductions

Forests cycle carbon throughout the lifespan of the forest, creating carbon emissions or becoming carbon sinks. When forest mortality increases, emissions from decomposition reduce the carbon sink effect. To the extent the fuels reduction treatments reduce future wildfire intensity, potential carbon emissions from these disturbance events would be equally reduced. Although some management actions may weaken a forest's carbon sink effect temporarily (through significant density reduction), active management may best serve stakeholders by providing the multiple uses associated with resilient forests, including carbon sequestration benefits provided by increased growth rates in post-treatment residual stands and rapid regeneration (Reinhardt and Holsinger 2010).

Without a substantial reduction in fossil fuel emissions, the impacts of projected climate change on disturbance regimes and species composition will likely overwhelm the short-term effects of land management actions. From this perspective, the primary forest management action to mitigate increasing atmospheric carbon dioxide concentrations is the sustainable use of woody biomass to generate energy and biofuels and displace the use of more fossil-fuel intensive construction materials (Nabuurs et al. 2007). As the Intergovernmental Panel on Climate Change concluded; "In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber, or energy from the forest will generate the largest sustained mitigation benefit" (Nabuurs et al. 2007).

As in other areas of the West, Tahoe's forests act as both a source of greenhouse gas (GHG) emissions and a carbon sink that removes CO_2 from the atmosphere. The Strategy is intended, in part, to significantly reduce the GHG emissions from wildfire, pests and disease, and to significantly increase the carbon stored in the Basin's forests.

Carbon Storage Benefits from Healthy Tahoe Forests. Carbon storage benefits from continued implementation of the Strategy are likely to be small in the early years, but increase over time and generate significant long-term benefits based on the increased growth of forest stands and their improved resistance to fire, insect infestations, and climate change. The increased long-term carbon storage capacity of the Basin's forests, together with expected reductions in wildfire risk, can generate significant GHG benefits.

The projected long-term carbon storage benefits of the Strategy could be compared with the baseline values of the carbon stocks associated with Tahoe's forest lands generated as part of the GHG emissions inventory prepared for the Tahoe Conservancy in 2012 (California Tahoe Conservancy 2012). The Tahoe GHG Inventory estimates were produced for the base years of 2005 and 2010, and for 2020 and 2035 to ensure consistency with California's AB 32 and SB 375 mandates to reduce greenhouse gas emissions (see Table 6). These baseline estimates are based upon the Carbon Online Estimator v2 database, which is maintained by the USDA Forest Service's Forest Inventory and Analysis program as a record of the health of forests in the United States.

Table 6. Ten-year average tree carbon and CO_2 for the Tahoe basin (in metric tons)

Region	Tree Carbon	CO2
Carson	32,777	123,242
Douglas	117,240	440,822
Washoe	2,422	9,107
El Dorado (unincorporated)	392,749	1,476,736
Placer	138,246	519,805
Basin Total	683,434	2,569,712

The projected carbon storage benefits of the Strategy can also be calculated using the U.S. Forest Service's Forest Vegetation Simulator, which compares the growth of treated and untreated forest stands until 2050, and simulates a moderate fire event during this period. Using a conservative estimate of up to 2,500 acres treated annually, these results are shown in Table 7.

GHG Emission Reductions from Biomass Removal. The projected GHG emission reduction benefits from removing and transporting forest material can be generated based on the results from an on-the-ground demonstration project sponsored by the Sierra Nevada Conservancy, Placer County, and the Placer County Air Pollution Control District. The project compared GHG emissions associated with the collection, processing, and transport of woody biomass to a biomass/energy facility and with the air emissions from the biomass/energy facility to the common alternative of open pile burning.

The woody biomass material generated as a by-product from forest health projects, typically measured in green tons (GT) per acre, varies depending upon the treatment method and location. Assuming the proposed projects would generate an average of 26 GT per acre with about 30 percent water content, about 13 bone-dry-tons would be generated per acre. The research showed that 0.38 metric tons of carbon dioxide equivalent (MT CO_{2e}) per bone-dry-ton of woody biomass wastes would be diverted from pile burning and used for energy, providing a GHG emission reduction of nearly 5 tons per acre treated.

In addition to reducing CO_2 emissions, biomass removal also reduces methane and black carbon emissions from pile burning, which are both potent sources of greenhouse gases. And finally, the forest biomass can displace fossil fuels in providing energy to help meet the state's renewable energy mandates. When compared to less efficient, single-cycle natural gas facilities or coal generation, the GHG emission reductions are reported to be as high as 0.90 metric tons CO_{2e} per BDT, yielding an additional 11 tons of GHG emission reductions per acre.

As shown in Table 7, GHG emissions under the Strategy will be reduced by at least 40,000 metric tons of CO_{2e} annually and grow over time. This annual total is based on the combination of the annual GHG reduction benefits from treating at least 2,500 acres of high priority fuel treatments and the annual expected benefit from removing the biomass waste from these projects to a biomass energy facility near the basin. By the year 2020, the projection exceeds 239,000 metric tons of GHG emission reduced, and by 2024 up to 398,500 metric tons of GHG emission reduced. Overall the program will result in reducing fuels on over 25,000 acres within high priority fuel treatment areas identified in the Strategy, and by 2050, will reduce more than 1.4 million metric tons of greenhouse gases. These estimates do not include the additional GHG reductions expected from reductions in wildfires, which have been increasing in number and severity over the last decade, that are likely to occur with a significant increase in forest thinning projects.

Table 7. Estimated GHG carbon storage and emission reduction benefits in metric tons of carbon dioxide equivalent (MT CO_{2e})

Projected Annual Acres Treated	Annual GHG Benefits from Treatments	Annual GHG Benefits from Biomass Removal to Bioenergy	2020 Cumulative GHG Benefits	2050 Cumulative GHG Benefits
2,500	12,350 MT CO_{2e}	27,500 MT CO_{2e}	239,000 MT CO_{2e}	1,434,600 MT CO_{2e}

These estimates can also be compared with the baseline estimates developed as part of the Tahoe GHG Inventory. As shown below, the increased level of wildfires from 2005 to 2010 increased GHG emissions from the forestry sector (inside and outside of the Basin) from insignificant levels in 2005 to 6 percent of total basin-wide GHG emissions in 2010. As the update to the Strategy is implemented, the participating agencies could use these baseline estimates to evaluate the benefits of the projects as they are completed.

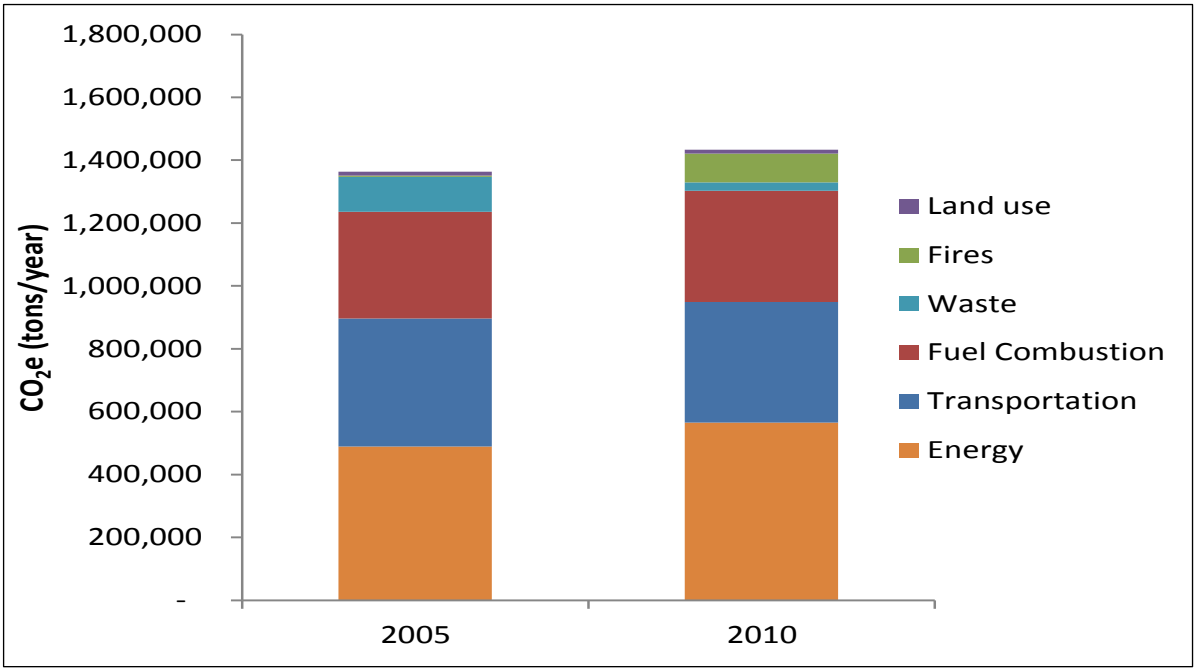

Figure 13. Baseline Basinwide CO_{2e} emissions by source sector

Section 5: Fuel Reduction Projects

All existing planning efforts were reviewed and additional proposed wildland fuel reduction treatments were synthesized into this Strategy. A primary emphasis of this Strategy is to consolidate all accomplished and proposed treatments into one database to support future scheduling and prioritization efforts. Coordination between agencies to prioritize and implement projects in the community wildfire protection plans is critical to the overall success of this comprehensive Strategy. The local fire protection districts and fire departments may periodically update their community wildfire protection plans for their respective jurisdictions, with changes in project locations or priorities as a result of these updates incorporated into the Strategy by reference.

All projects are designed to change vegetation conditions to modify fire behavior and reduce the potential for wildfire by altering three primary fuel conditions as necessary: surface fuels, ladder fuels, and overstory crown densities. This is accomplished through the implementation of a variety of treatments, commonly using more than one treatment type on the same piece of ground to achieve the desired condition. Appendix B describes the different treatments commonly used to implement these fuel reduction projects.

It is important to note that the vegetation conditions that pose a fuels hazard are dynamic, with continued growth, needle-cast, litter-fall, and new growth of understory vegetation continually occurring. As such, future treatments will need to occur over time on the same area to sustain the benefits of the previous treatments.

Accomplishments

Between 2000 and 2013, 50,112 acres were treated in the Lake Tahoe Basin (Table 8). Since 2008, the acres treated have increased to almost twice the acres previously treated. The total acres treated do not completely portray the amount of work that has been accomplished because a substantial number of treatments occurred on small urban lots (Table 9). Significant work has been accomplished within the interior of communities treating small urban lots and undeveloped areas adjacent to private lands. These urban lots, many less than 1 acre in size, are challenging and expensive to treat, but are some of the highest priority for treatment due to their location and proximity to residences. The acres displayed in Table 8 and Table 9 are the land area treated to meet desired fire behavior conditions and fuels characteristics. Table 10 displays the total acres of treatment types that were used to achieve the desired condition. For many areas, more than one treatment type was required to achieve the final desired result.

Table 8. Fuel reduction acres (footprint acres) completed (2000–2013)

Years	USDA Forest Service LTBMU	Private and Local	California State Parks	California Tahoe Conservancy	State of Nevada[1]	Total	Average per Year
2000–2007	13,447	2,331	424	942	1,753	18,897	2,362
2008–2013	17,678	2,979	919	1,274	1,418	24,268	4,045
Total	**31,125**	**5,310**	**1,343**	**2,216**	**3,171**	**43,165**	

[1] Includes Nevada State Lands and Nevada State Parks.

Table 9. Number of project units treated by size (2008–2013)

Project Size	USDA Forest Service LTBMU	Private and Local	State of California[1]	State of Nevada[2]	Total
1 acre or less	807	82	730	195	1,814
Greater than 1 acre	267	242	200	79	788
Total	**1,074**	**324**	**930**	**274**	**2,602**

[1] Includes California State Parks and California Tahoe Conservancy.
[2] Includes Nevada State Parks and Nevada State Lands.

Table 10. Treatment acres accomplished (2008–2013)

Treatment Types	USDA Forest Service LTBMU	Private and Local	California State Parks	California Tahoe Conservancy	State of Nevada[1]	Total
Mechanical thinning	4,164	999	416	631	171	6,381
Hand thinning	12,910	1,826	492	630	1,392	17,250
Chipping	412	548	18	6	0	984
Mastication	1,429	270	319	512	1	2,531
Pile burning	6,060	1,261	211	188	1,202	8,922
Understory burning	604	162	13	0	44	823
Total	**25,579**	**5,066**	**1,469**	**1,967**	**2,810**	**36,891**

[1] Includes Nevada State Lands and Nevada State Parks.

Current and Future Projects

There are numerous projects currently in planning or in the implementation phase that have not yet been reported as accomplished. The following maps (Figure 14-17) show the projects that have been completed (Completed), projects areas in the planning phase (Planned), and projects being considered as a result of the change in the wildland-urban interface boundary designation. The definitions below further explain these categories**.** *It is important to note that these maps identify large areas to be considered for treatment. Not every acre needs treatment to meet desired fuel conditions; therefore, actual acres treated will be less.*

"Completed" projects on the following maps are those that were planned and fully implemented by the end of 2013. These projects will be considered for treatment again as vegetation/fuels conditions warrant. Fire behavior in treated areas is expected to be surface fire types, with flame lengths less than 4 feet. These characteristics allow for direct suppression actions, increasing firefighter and public safety.

"Planned" projects are those identified in the original Strategy, but have not yet been implemented. This includes projects that have not been initiated yet, are currently in the planning process, planned and waiting for funding, or currently being implemented, but not yet completed. The specific treatment areas will be prioritized through the annual planning process that is conducted by the Tahoe Fire and Fuels Team. The annual target is approximately 4,000 acres to allow completion of the remaining planned work; however, this is dependent on funding and timing restrictions.

"To Be Considered" includes many areas that were not previously considered because they did not warrant treatment at the time of the original Strategy or were outside of the original community wildfire protection plan or wildland-urban interface boundaries. These areas will be considered for treatment as vegetation conditions warrant.

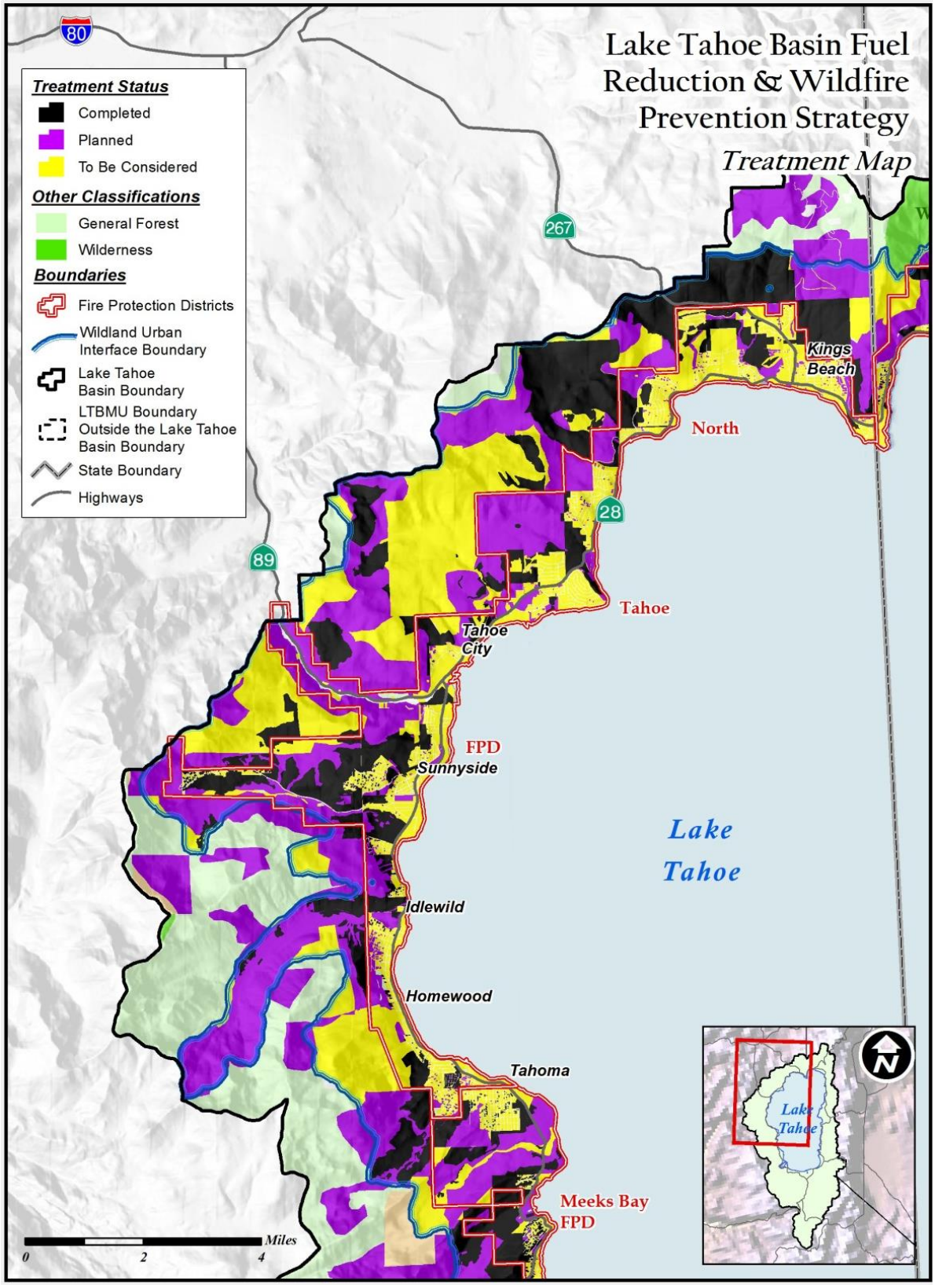

Figure 14. Treatment map 1

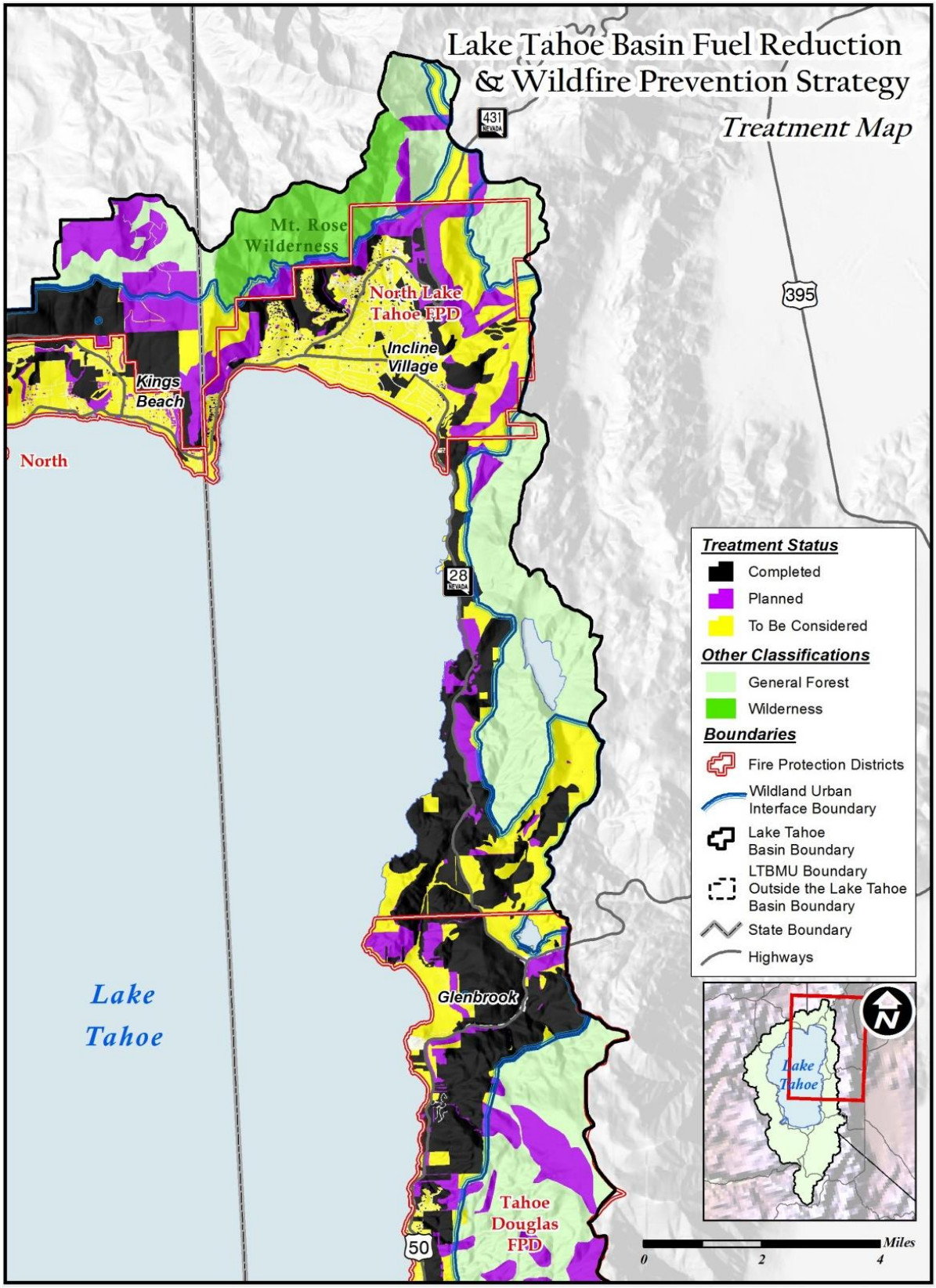

Figure 15. Treatment map 2

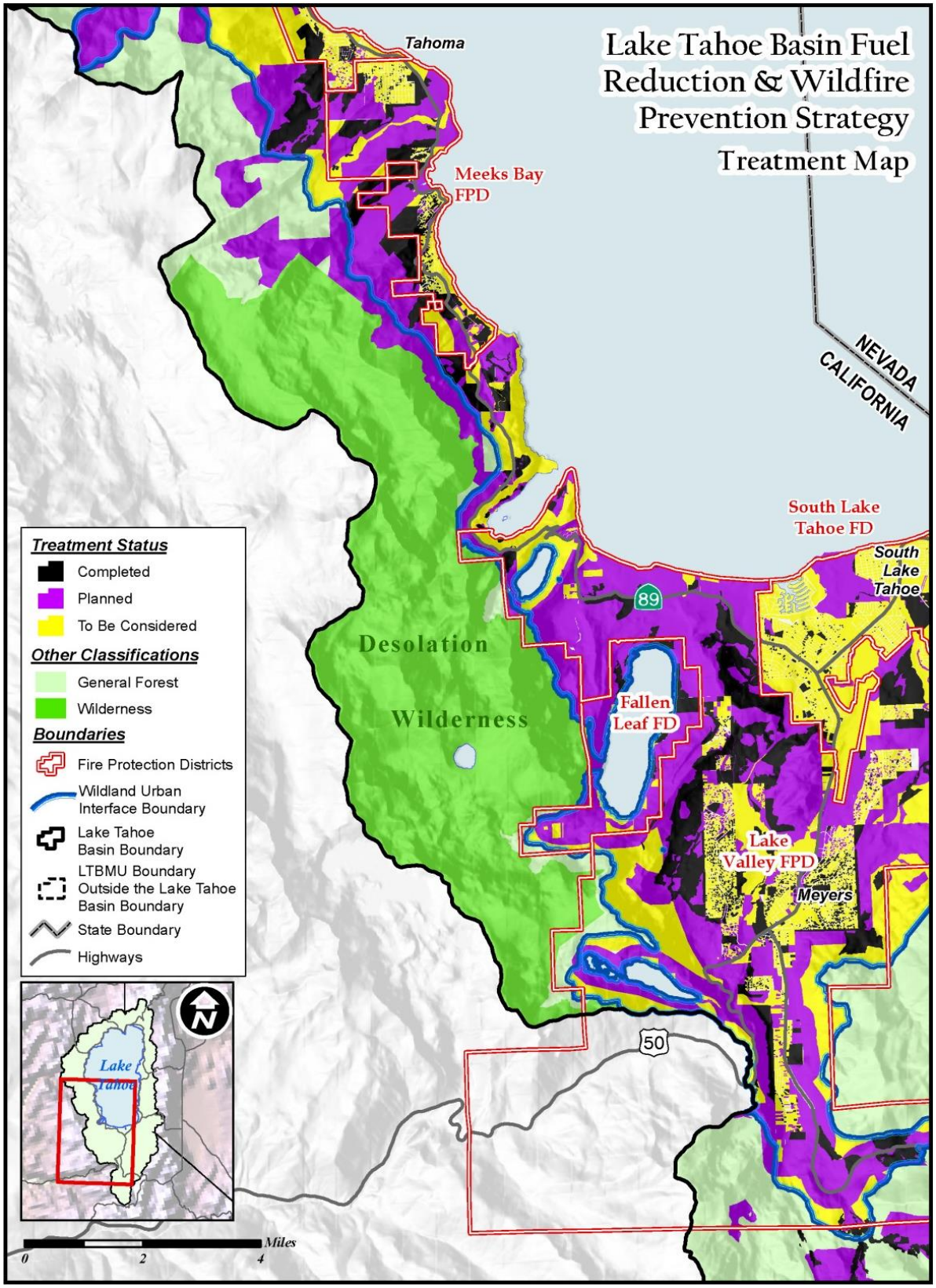

Figure 16. Treatment map 4

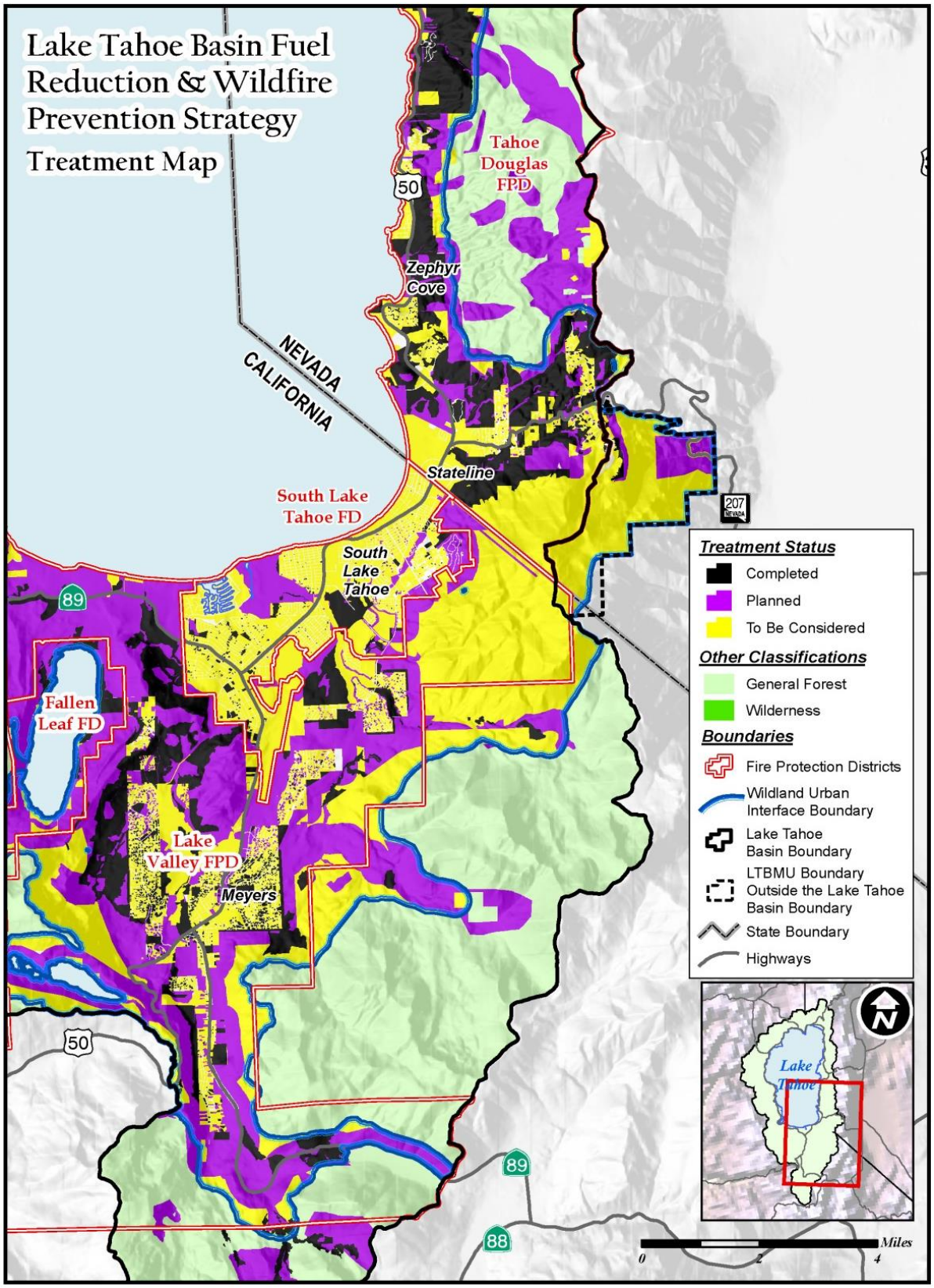

Figure 17. Treatment map 3

Section 6: Project Scheduling

Projects are first prioritized by the responsible jurisdictions, giving first priority to defense zone treatments within the wildland-urban interface that are identified in the most current community wildfire protection plans. However, the need for emergency actions to respond to natural disturbances (windstorms, beetle-kill, fire, and others) may take precedence over previously scheduled projects.

Another consideration is the timeframe required to move an individual project through the process of design, environmental compliance, contracting, and final implementation (see flow chart at right). This process, which may take several months to several years, makes it difficult to schedule activities across jurisdictional boundaries. For the non-Federal jurisdictions, projects are typically smaller and may require less time to plan. For the Lake Tahoe Basin Management Unit, projects are much larger. The Lake Tahoe Basin Management Unit has recently completed several planning projects, which will allow for the non-Federal jurisdictions to coordinate implementation with the Lake Tahoe Basin Management Unit.

The Tahoe Fire and Fuels Team, comprised of members of the local fire districts and fire protection/land management agencies, and the Multi-Agency Coordinating Group meet annually to develop incident action plans to coordinate project implementation and permitting needs. These incident action plans are developed by the Tahoe Fire and Fuels Team based on treatment priority recommendations in the community wildfire protection plans, and reviewed and approved by the Multi-Agency Coordinating Group.

Section 7: Projects Costs

Actual costs for projects incurred by different agencies in the Lake Tahoe Basin have been difficult to determine for several reasons. The biggest variables to overall project costs are typically treatment unit size and accessibility. Where treatment areas are large, and access is directly available for machinery, overall costs per acre tend to be lower. Within the Basin, many jurisdictions are responsible for numerous small parcels, which substantially increase their costs per acre for treatments.

Planning Costs

The costs associated with project planning include surveys (cultural, biological and physical) and project design, environmental compliance, project layout, contracting, and monitoring. In addition, recent cost estimates have included best management practices, road maintenance, and rehabilitation of treatment area, because this aspect of land management is critical to providing safe, efficient, and minimal resource impact access for both fuels treatments and fire suppression activities.

Accurate costs for these items are difficult to establish because agencies track these costs differently. Cost estimates for planning, environmental compliance, and final layout range from $200 to $1,800 per acre, with an average of $1,250 per acre. The planning costs have been towards the higher end of the range as many of the projects accomplished were on the small parcels.

Implementation Costs

Implementation costs vary widely, primarily due to the size of the treatment parcel, with small urban lots having some of the highest treatment costs. Mitigation measures associated with environmental compliance, lack of road access, steep topography, proximity to residential areas and areas with high recreational use, limited operating seasons, and coordination between multiple agencies can add significant cost to treatments. Table 11 displays the range and average costs that have been incurred by treatment parcel size.

Table 11. Implementation costs in the Lake Tahoe Basin

Treatment	Original Strategy Estimated Costs	Actual Costs <1 Acre Range (average)	Actual Costs >1 Acre Range (average)
Mechanical thinning	$1,000–$3,500	$2,000–$4,000 ($2,500)	$2,000–$3,000 ($2,500)
Hand thinning	$650–$3,500	$2,800–$6,500 ($3,500)	$1,200–$3,500 ($2,350)
Chipping	$200–$700	$2,000–$3,000 ($2,500)	$1,000–$2,000 ($1,500)
Mastication	$700–$1,500	$2,000–$3,000 ($2,500)	$1,000–$2,000 ($1,500)
Pile burning	$300–$700	$1,000–$2,000 ($1,500)	$120–$685 ($400)
Understory burning	$400–$1500	N/A	$100–$500 ($300)

Total Expenditures

The total costs (including planning and implementation costs) to achieve the 24,268 acres accomplished under the Strategy are $90,744,735, with an annual average expenditure of $15,124,122 per year. Funding has come from a variety of sources, with significant funding through grants to the local fire jurisdictions.

Projected Costs

Costs associated with planned treatments over the next 10 years are expected to range between $142 million to $156 million, with annual predicted expenditures of $10 million to $15 million to treat the remaining priority areas. An additional $25 million to $35 million over the next 10 years is projected to begin phased treatments on previously treated areas to maintain fire behavior modification efficacy over the next 10 years. These treatments are expected to be substantially less expensive than the initial treatments as the amount of fuels to be treated will be less complex. It is anticipated that funding availability may be more limiting in the future; therefore, the amount of work that can be accomplished may decline.

One-third of the 69,158 acres identified in the wildland-urban interface defense zone is private or local-government owned. Contained in the private and local land areas are over 39,000 parcels less than 1 acre in size. Responsibility to create and maintain defensible space on these small lots falls to the individual property owner, creating a substantial private and local investment in fuels reduction.

Section 8: Utilization Potential

The primary objectives of the proposed hazardous fuel reduction projects are to reduce the potential of a catastrophic fire, protect life and property, and restore forest health. As a result, forest materials that are removed will generally be small- to medium-sized trees, and brush. Materials that are removed may significantly reduce particulate and greenhouse gas emissions from pile burning, and may provide some revenue to reduce the cost of the proposed projects, allowing public funds to be used elsewhere for hazardous fuels reduction. Potential forest products from the proposed projects include biomass, small logs, and large logs.

Biomass

Biomass is used to generate heat, steam, and electricity, and create products such as ethanol, soil amendments, or landscaping material. Developing a biomass facility or utilizing existing facilities in or near the Lake Tahoe Basin would be consistent with recent Federal and state policies.

There are two primary impediments to utilizing forest biomass: (1) access to remove the biomass from the site and (2) transportation costs. Removal from a site is limited by slope (mechanical operations are prohibited on slopes greater than 30 percent), availability of on-site processing sites (landings, access from suitable haul roads to the landing), and the distance to the collection point. Sufficient access for larger trucks to transport the material can be challenging in the urban environment within the Basin due to the existing infrastructure. Transportation costs are also a limiting factor, with fuel prices high and biomass demand down due to the increase in inexpensive natural gas.

Tahoe's Biomass Utilization Strategy

In 2010 the California Tahoe Conservancy (2010) convened the Lake Tahoe Biomass Working Group to develop a Lake Tahoe Biomass Utilization Strategy for the Basin. The Biomass Strategy included the following key findings:

- Current and proposed forest fuels treatments would create large amounts of forest biomass waste, a byproduct of forest treatment activities, which are piled and burned in the forest.
- Compared to pile burning, the air quality benefits of removing biomass are significant, including a 95 to 99 percent reduction in particulate matter, carbon monoxide, and volatile organics, and a 60 to 80 percent reduction in nitrogen oxides when compared to open burning (Springsteen et al. 2011) (Figure 18).
- Approximately 60,120 acres of high-priority fuels management areas contain forest materials that could be sent to a biomass facility rather than pile-burned (Figure 19).
- A new biomass facility should be constructed near the Tahoe Basin to reduce transportation costs, the most significant barrier to biomass removal.

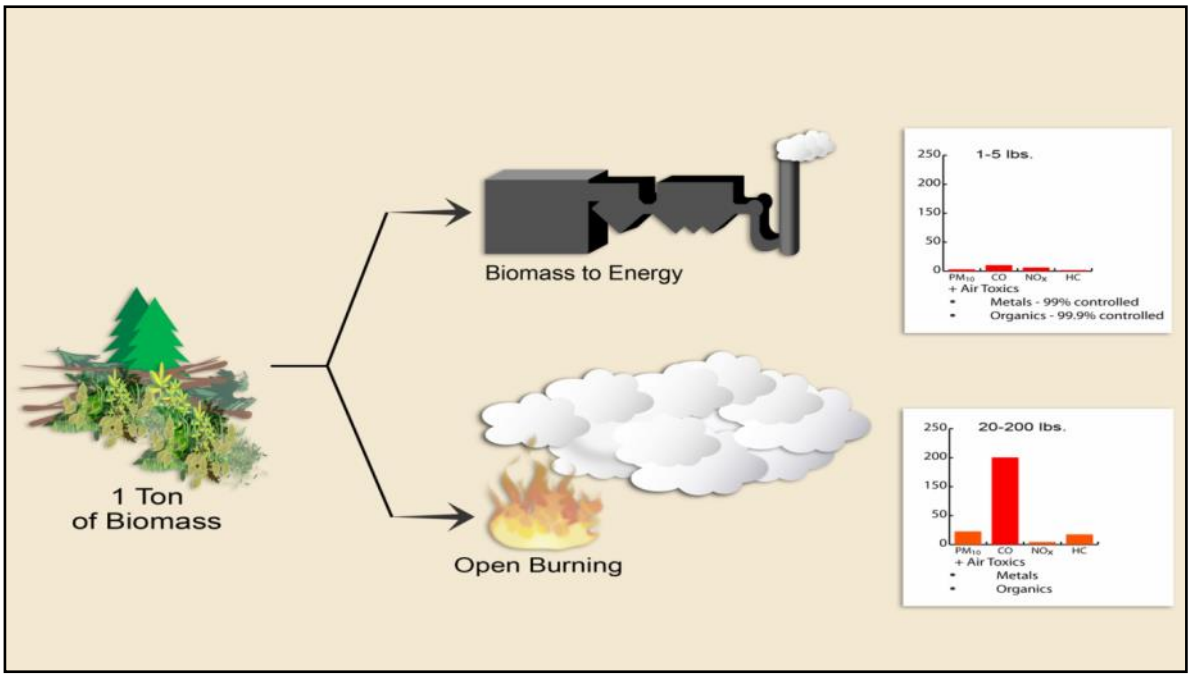

Figure 18. Biomass combustion air emissions; biomass to energy utilization compared to open burning

Source: Graphic courtesy of Placer County (CA) Air Pollution Control District).

Since the Tahoe Biomass Strategy was adopted in 2011, the participating agencies have moved forward with several of its key recommendations:

- The Lake Tahoe Basin Management Unit and Placer County have signed a long-term master stewardship contract, the second such agreement in the Nation, to facilitate removal of biomass from Forest Service treatments in the Tahoe and Truckee regions for energy or other purposes.
- The California Tahoe Conservancy entered into an agreement with Placer County to facilitate the removal and transport of biomass waste from forest health projects, and collected 1,944 green tons of material that was converted to 1,160 megawatts of electrical energy (enough to power 115 homes for 1 year).
- Placer County has developed final plans for construction of a new small-scale heat and power facility near Truckee, California. The facility will be powered entirely by woody biomass generated from forest health projects in the Lake Tahoe and Truckee regions, and would utilize approximately 17,000 bone-dry-tons per year (approximately 34,000 green tons). Construction on the facility is expected to begin in 2015, and potential markets include thermal and electrical power, soil amendments, and carbon filtration products.
- The California Tahoe Conservancy funded a GHG emissions inventory in 2012, which generated baseline values of the carbon stocks associated with Tahoe's forested lands (California Tahoe Conservancy 2013).
- In 2014 the Tahoe Conservancy, in partnership with the Basin's fire districts and land management agencies, prepared the Lake Tahoe Cap-and-Trade Investment Plan for Forest Health and Bioenergy to provide the California share of funding for the Strategy.

A lack of biomass facilities has limited the options for utilizing biomass, thereby necessitating the use of prescribed fire. However, the use of prescribed fire in the basin is limited by a variety of factors, such as air quality restrictions, favorable weather conditions, and available resources leading to a backlog of unburned piles. As more projects are completed, the need for prescribed burning is anticipated to increase to maintain the efficacy of treated areas.

Firewood

Agencies may also make available material that could be classified as biomass or small logs (see below) as firewood. For example, Nevada Division of State Lands provides, when possible, firewood generated from treatments to residents. This benefits Nevada Division of State Lands by removing the material from the treated parcel and benefits the public by providing a resource at no cost. In addition, Nevada State Parks offers approximately 100 cords of firewood each year at a cost of $45 per cord. Local fire agencies, state agencies, and the Forest Service make firewood available. Firewood gathering is limited by how far individuals are willing to carry the firewood, making many of the treatment sites unsuitable for firewood gathering.

Small Logs

Small logs have been used to produce pulp, veneer for laminated lumber, oriented-strand board, posts and poles, and sawn lumber. Sawn lumber provides the lower economic return because the juvenile wood that is sawn is subject to extensive warping and cupping. Posts and poles are less susceptible to warping than sawn lumber; however, there is a lack of information on structural use and how to fasten and secure round pieces of wood in traditional structures (USDA Forest Service 2000b).

Sawlogs

Fuel reduction treatments in the Lake Tahoe Basin generally emphasize removal of small, suppressed, and intermediate trees through prescriptions that thin from below. These treatments will include removal of trees greater than 10 inches in diameter (at breast height) that can be sold as timber. Currently there are two mills (located at Quincy, California and Lincoln, California) that can purchase timber. Both of these mills are over 2 hours from North Tahoe and over 2.5 hours from South Shore. In general, small logs and short logs from cut-to-length logging receive the lowest price from log buyers, and as of May 2014 receive $325 per 1,000 board feet. A standard, short-log trailer holds approximately 3,000 board feet of timber, and thus can haul approximately $1,000 worth of timber. Trucking costs are approximately $100 per hour, and thus each load of timber nets about $500 per load. Typically the contractor will reduce the price charged per acre by the net value of the timber. However, with treatment costs of up to $3000 per acre, the value of saw logs only offsets a small portion of total costs.

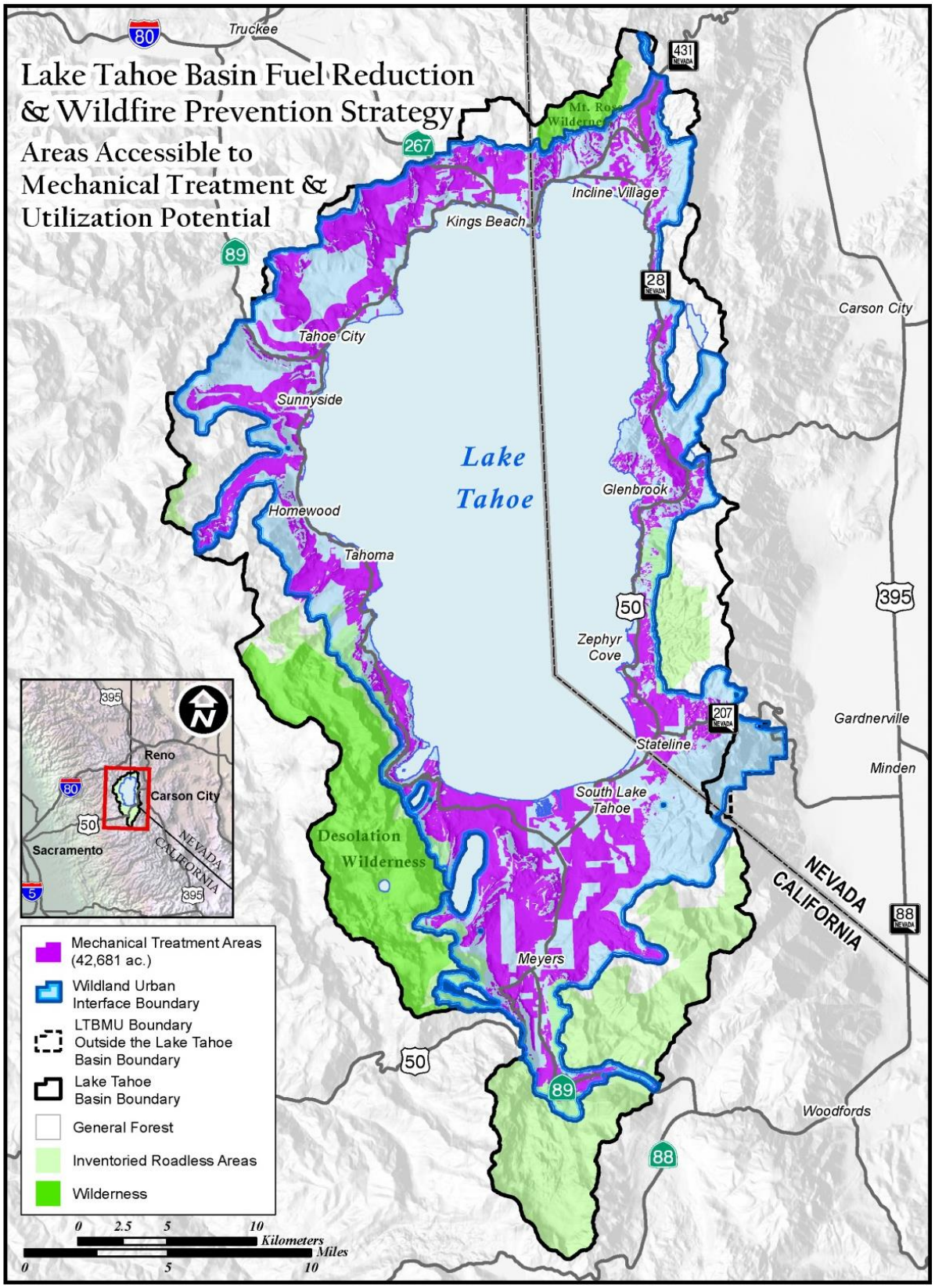

Figure 19. Areas accessible to mechanical treatment and utilization potential

Section 9: Public Education and Wildfire Prevention Plans

Key to the success of the proposed community defense and general forest-based treatments in this Strategy is continued public outreach and education directed at private landowners regarding their responsibility to create defensible space around individual homes and buildings. Surveys conducted in 2003 and 2004 determined 70 percent of the residences did not have adequate defensible space to protect them from a wildfire (Resource Concepts, Inc. 2004a, 2004b; C.G. Celio & Sons et al. 2004). Since the implementation of the Strategy, the percentage has improved greatly, but there are still a larger number of residences that do not have adequate defensible space. While defensible-space clearing around rural residences has been the law for some time in California, it has only been enforced since 2009 in the Tahoe Basin. Nevada adopted the defensible space provisions of the International Wildland Urban Interface Code in 2010. Curbside inspections of all single family residences recently completed in the Tahoe-Douglas Fire Protection District indicate that approximately 60 percent of the homes in the district have substantially complied with defensible space regulations.

Intertwined with these physical facts are social issues. Most of the Basin's residents elect to live in Lake Tahoe because of the rural setting or the diverse recreation opportunities. Previous experiences undoubtedly forged many of their concepts of what forests provided and how they should be managed. Federal and state policies strongly advocated fire suppression. Media attention of extensive clearcut logging on public lands in the 1970s and 1980s initiated a common belief that all logging sacrificed irreplaceable natural resources. Many of the public associate fuels hazards only with large, standing dead trees, and do not associate live green brush, down woody material, and pine needles/litter as the primary fuel loading. This perception makes it difficult to understand the need for defensible space treatments, and the need to remove these fuel components from around their structures.

Faced with these challenges, Federal, state, and local agencies and organizations have made substantial progress to reduce fuel hazards and educate the public. Currently, Federal and state land management agencies, as well as state and local fire agencies in the Basin, develop and provide information in various formats to educate the public regarding fire prevention.

The National Cohesive Wildland Fire Management Strategy identified the need to create fire-adapted communities as one of three goals to address wildfire problems at the landscape scale. The Lake Tahoe Basin fire agencies have been selected and funded to serve as a "Learning Network Hub" for the implementation of this program. In addition, the University of Nevada Cooperative Extension, "Living with Fire" program has received funding to establish the Nevada Network of Fire Adapted Communities. One tool that will be part of these programs is the "Ready, Set, Go" program developed by the International Association of Fire Chiefs. The "Fire Adapted Communities" guide incorporate the concepts of fire adapted communities, "Living With Fire" and the "Ready, Set, Go" program.

Following the 2007 Angora Fire, it became apparent that one of the challenges of public education was delivering a consistent message that is easy for the public to understand. Using the standard messaging of "Living with Fire," "Fire Adapted Communities," and "Ready, Set, Go" will ensure that the public receives consistent messages regarding defensible space and emergency preparedness. The effort to deliver a consistent message will be bolstered by the participation of all of the Strategy's partner agencies in the public information function of the Tahoe Fire and Fuels Team,

which is termed the "Fire PIT" (Fire Public Information Team). The Fire PIT serves as a joint information center for all agencies involved in fuels reduction in the Basin.

The Forest Service (LTBMU) is responsible for, and provides wildfire suppression, for Federal responsibility areas in both California and Nevada. CAL FIRE is responsible for and provides wildfire suppression for "state responsibility area" lands in California within the Basin. CAL FIRE has two permanently funded fire engines in the Tahoe Basin, one located on the South Shore and the other located on the North Shore. In addition, CAL FIRE supports a full-time division chief/registered professional forester in the Basin who enforces Pubic Resources Code §4291 and oversees two seasonal defensible space inspectors and a fire captain specialist for planning and building code enforcement. Nevada Division of Forestry has responsibility for protection of state lands on the Nevada side of the lake, which the local fire protection districts provide through cooperative agreements.

Seven fire protection districts provide municipal fire protection in Lake Tahoe: South Lake Tahoe Fire Department, Lake Valley Fire Protection District (Meyers), Fallen Leaf Lake Fire Department, Meeks Bay Fire Protection District, North Tahoe Fire Protection District (Tahoe City), North Lake Tahoe Fire Protection District (Incline Village), and Tahoe-Douglas Fire District (Spooner Summit to Stateline, Nevada). The Lake Tahoe Basin Management Unit and CAL FIRE work cooperatively with all local government fire agencies on mutual aid, public education, and Basinwide community fire planning, including hazardous fuel reduction.

Current Efforts

Fire Prevention Plans

Each cooperating fire protection agency has, to varying extents, developed a wildfire prevention plan. For example, the USDA Forest Service has developed a comprehensive prevention plan that focuses on education, detection, engineering, and enforcement. This plan details patrolling, media outreach, public education, and annual public events that the Lake Tahoe Basin Management Unit (LTBMU) actively supports. The plan is implemented by a dedicated prevention staff that includes three fire prevention technicians and a fire prevention officer. In another example, CAL FIRE's Fire Prevention Program includes fire engineering, vegetation management, fire planning, education, and law enforcement. CAL FIRE's fire planning incorporates concepts of the National Fire Plan, the 2010 California Strategic Fire Plan, and individual CAL FIRE unit fire prevention plans, as well as community wildfire protection plans. The Amador-El Dorado Unit Fire Plan and the Nevada-Yuba-Placer unit fire plans outline fire situations at the local level, including the North Shore and the South Shore of Lake Tahoe in California. Each identifies prevention measures to reduce risks, educates and involves the local community or communities, and provides a framework to diminish the potential loss due to wildfire.

All of the local fire agencies have adopted the community wildfire protection plans as their primary wildland fire prevention and mitigation documents. They also all have prevention departments that are responsible for enforcing the building codes in their respective jurisdictions. All of the local fire jurisdictions require ignition-resistant construction as per California Building Code Chapter 7A or the International Wildland Urban Interface Code. All new construction and significant remodels are required to follow the applicable building standards for their area. Additionally, anyone who is planning a project that requires a Tahoe Regional Planning Agency permit must first provide their local fire department a site plan that includes plans for creating defensible space.

One-on-One Contacts

CAL FIRE and local government fire districts have personnel that meet with individual homeowners during defensible space inspections. While these contacts are time consuming, they are the most effective means for providing information to homeowners because they are tailored to the individual property. Additionally, these organizations also provide free literature to residents, including "Fire Adapted Communities – the Next Step in Wildfire Preparedness". The Nevada Division of State Lands also publishes and makes available a programmatic brochure that explains fuels management as part of its community outreach.

Community Events

The local fire protection agencies, the Tahoe Regional Planning Agency, and USDA Forest Service and state agencies participate in annual wildfire awareness and education events throughout the Tahoe Basin. These events can be as simple as small community barbecues with a defensible space demonstration yard, to very elaborate Wildfire Awareness Week events with hundreds of visitors and entertainment such as hot air balloon rides. A variety of events are planned each year to educate the community about the need for defensible space and ignition-resistant construction and how to actually do the work required to create defensible space.

Websites and Public Service Announcements

CAL FIRE, USDA Forest Service, Tahoe Regional Planning Agency, and the local government fire agencies host websites that offer extensive information on defensible-space inspections, defensible-space requirements, grant-funded-chipping services to dispose of defensible space hazardous fuels, and links to other sources of information. The most common link is to http://www.livingwithfire.info/tahoe/, a University of Nevada sponsored website that provides extensive information on what residents should do before, during, and after a wildland fire. All of the agencies also support and participate in public service announcements that focus on defensible space requirements and public safety.

Future Efforts

The current efforts have resulted in substantially more residents complying with the defensible space requirements. Additional efforts will be required in the future to obtain defensible space compliance from the large number of absentee residents whose periodic visits focus on recreation. Efforts should also be focused on educating residents about changing the current forest conditions to restore the health of those forest stands and encouraging residents to develop defensible space around their homes. Therefore, an effective education program will be continued that addresses the following two paradigms:

- It is the responsibility of landowners to create and maintain defensible space around their structures (required in California per Public Resources Code 4291, and in Nevada by the International Wildland Urban Interface Code); and
- Lake Tahoe's forest ecosystems and watersheds will thrive under a managed disturbance regime.

These messages are consistent with the Cohesive Strategy and specifically address the core concepts of "Fire Adapted Communities" and resilient landscapes.

Section 10: Environmental Regulations and Compliance

All individual projects designed to reduce fuel hazards that are proposed by public agencies; funded by public agencies; or that require Federal, state, local, or local discretionary approval; will be subject to Federal, state, or regional environmental regulations. These regulations shape the scope, location, methodologies, timing, and cost of proposed fuel reduction treatments in the Basin.

Environmental regulations (such as the Clean Water Act, Clean Air Act, California Forest Practices Act, Nevada Forest Practices Act, and Endangered Species Act; and Tahoe Regional Planning Agency Code of Ordinances) are designed to analyze and disclose impacts on the environment and allow the public to participate in agency decision-making processes that may affect the environment (for example, National Environmental Policy Act and California Environmental Quality Act). Because of the unique values at risk in the Lake Tahoe Basin and complex land ownership, there are numerous regulations governing fire mitigating activities in the Basin. Unlike other areas in the United States, in addition to Federal and state laws, the bi-state governing Tahoe Regional Planning Agency has a comprehensive code of ordinances that prescribes rules for forest thinning and vegetation management on residential and commercial properties. The extent of environmental compliance is determined by the landownership where the project is occurring, the funding agency, and the complexity of the project (Figure 20).

National Policies and Regulations

Several national policies and regulations guide wildland fire management; they include:

- The National Fire Plan, 10-Year Comprehensive Strategy (USDI and USDA 2001);
- National Fire Plan 10-Year Comprehensive Strategy Implementation Plan (USDI and USDA 2002);
- Federal Wildland Fire Policy (USDI et al. 1995 [updated 2001]);
- Healthy Forests Initiative (2002);
- Healthy Forests Restoration Act (2003);
- Protecting People and Natural Resources: A Cohesive Fuels Treatment Strategy (USDI and USDA 2006).

This Strategy is consistent with all of these policies and regulations, which are described below.

The National Fire Plan and 10-Year Comprehensive Strategy

The National Fire Plan was developed by the U.S. Department of the Interior and U.S. Department of Agriculture in 2000 (USDI and USDA 2000) to actively respond to severe wildland fires and their impacts to communities, while ensuring sufficient firefighting capacity for the future. It provided direction for the identification of "communities at risk", which are located in the vicinity of Federal lands where wildland fires have the potential to threaten adjacent private lands. Identifying communities at risk has assisted planning for fuel reduction projects on Federal lands and increased awareness of wildfire threats in those communities. Communities at risk in the Lake Tahoe Basin are Incline Village, Crystal Bay, Sand Harbor, Glenbrook, Kingsbury, South Lake Tahoe, City of South Lake Tahoe, Homewood, Tahoe Pines, Sunnyside, Tahoe City, Dollar Point, Carnelian Bay, Tahoe Vista, and Kings Beach (*Federal Register* 66(160): 43384–43435).

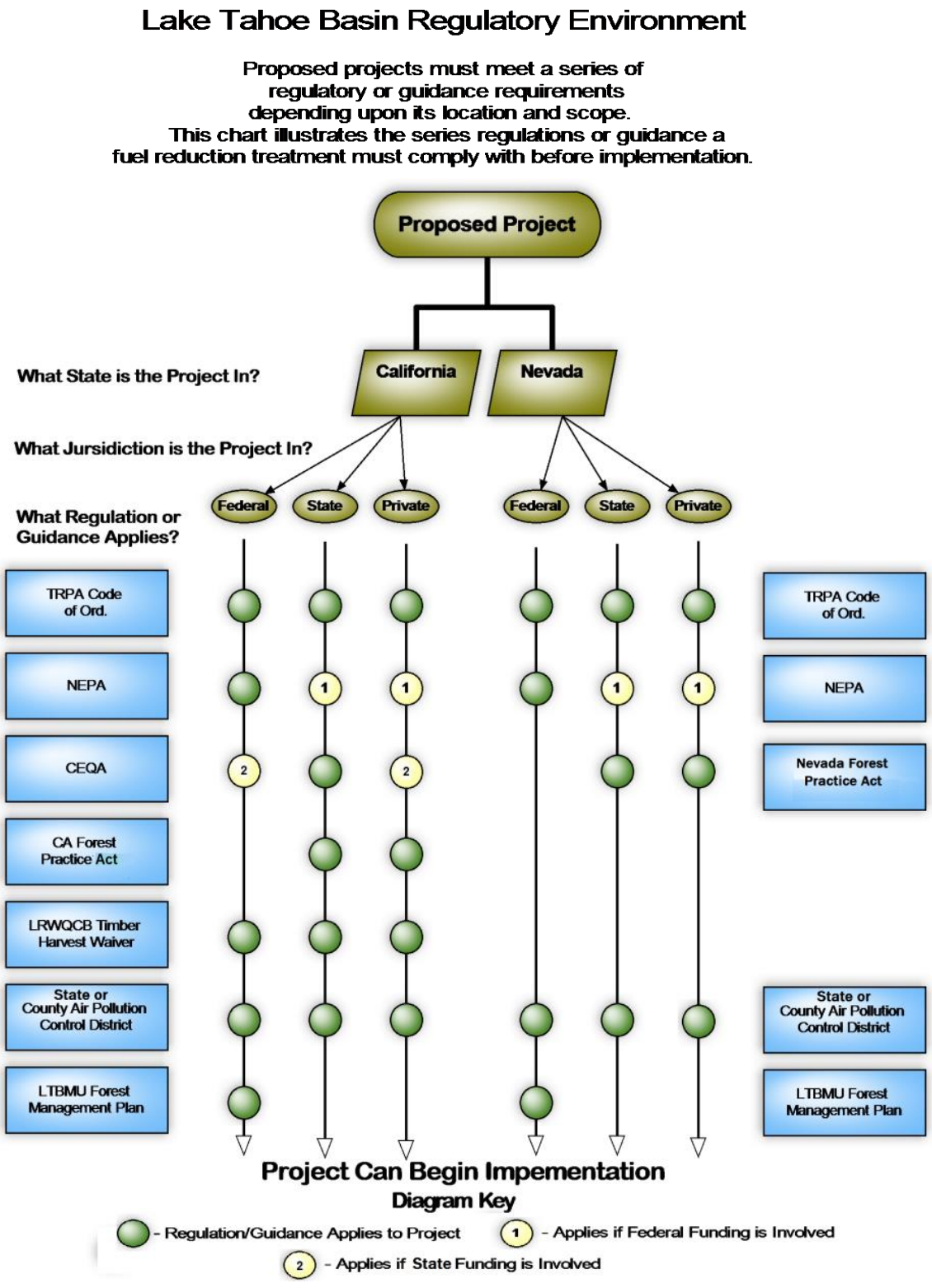

Figure 20. Diagram of the regulatory influences on fire and fuels management in the Lake Tahoe Basin

National Environmental Policy Act

All fuel reduction projects funded by the Federal government that occur on Federal land (such as Lake Tahoe Basin Management Unit), or require a Federal agency to issue a permit, must comply with the National Environmental Policy Act (NEPA). NEPA requires agencies to prepare environmental impact statements, environmental assessments, or categorical exclusions, to evaluate potential impacts of proposed projects on the quality of the human environment. These analyses may be used to satisfy other requirements as required by the Tahoe Regional Planning Agency or the California Environmental Quality Act.

The Healthy Forest Restoration Act (H.R. 1904, December 2003)

The Healthy Forest Restoration Act (The Act) simplifies the NEPA process by limiting the range of alternatives required to be considered in an environmental document for fuel reduction or forest health projects designed to protect communities, watersheds, or endangered or threatened species from wildfire. The Act also changed the Forest Service administrative appeal process for NEPA decisions to a simpler objection process.

The Act allows communities to designate their wildland-urban interface, authorizes fuel reduction projects on Federal lands in the wildland-urban interface, requires Federal agencies to consider recommendations made by communities at risk that have developed community wildfire protection plans, and gives funding priority to communities that have adopted community wildfire protection plans. At the Lake Tahoe Basin Wildfire Prevention Summit on March 13, 2004, fire officials from Lake Tahoe accepted the challenge to develop community wildfire protection plans for their communities. Community wildfire protection plans were prepared for and approved by the state fire and forestry agencies, the fire protection districts, and fire departments in the Basin (Resource Concepts, Inc. 2004a, 2004b; C.G. Celio & Sons et al. 2004). These community wildfire protection plans were updated concurrently with the Strategy update to ensure the most recent information was considered. Environmental assessments and environmental impact statements documenting the Act-authorized projects may consider only one action alternative if that alternative meets certain wildland-urban interface criteria and implements the general actions of an applicable community wildfire protection plan.

Lake Tahoe Restoration Act (H.R. 3388, 24 January 2000)

The purposes of this Act are to (1) enable the Forest Service to plan and implement significant new environmental restoration activities and forest management activities to address water quality and the forest fuels that have significantly increased the risk of catastrophic forest fires; and (2) to ensure that Federal, state, local, regional, tribal and private entities continue to work together to improve water quality and manage Federal land in the LTBMU.

Regional Policies and Regulations

Tahoe Regional Planning Agency Regional Plan Thresholds and Carrying Capacities

The Tahoe Regional Planning Agency's (TRPA) "threshold carrying capacities" are standards of environmental quality targets to be achieved in the Tahoe Region. The standards identify the level of human impact the Lake Tahoe environment can take before irreparable damage occurs. The thresholds and carrying capacities identify common vegetation, uncommon plant communities, sensitive plants, and late-seral, old-growth ecosystems.

Tahoe Regional Planning Agency Code of Ordinances

The Tahoe Regional Planning Agency (TRPA) primarily regulates tree removal through chapter 61 of its code of ordinances. Removal of all live trees greater than 14 inches in diameter requires a tree removal permit; however, TRPA has delegated authority to issue tree removal permits to the local fire agencies for defensible space treatments. A tree removal permit must be approved by TRPA for all projects that require substantial removal of trees, which is defined as removing more than 100 trees greater than 14 inches in diameter.

Lake Tahoe Basin Management Unit Land Management Plan

All management activities conducted by the Forest Service are governed by the 1988 Lake Tahoe Basin Management Unit Land and Resource Management Plan (Plan). The current direction comes from the 1988 plan as amended by the 2004 Sierra Nevada Forest Plan Amendment. The Plan recognizes the excessive buildup of fuel hazards in the Sierra Nevada Mountains surrounding the lake and established that the highest priority for fuels treatments would be in the wildland-urban interface areas. This Plan is currently under revision and is expected to be signed later this year (2014). Forest Service activities will then adhere to the new plan direction. The new plan direction is consistent with this Strategy.

California Environmental Quality Act (CEQA)

Fuel reduction projects on privately owned and non-Federal publicly owned lands in California that require environmental approvals from a local or state agency must comply with CEQA or a functionally equivalent program (such as the California Forest Practice Act as in the case of commercial timber harvesting). In some cases, a California Forest Practice Act harvesting document, such as a timber harvest plan, is required to be prepared in lieu of a traditional CEQA document when harvested material has a commercial purpose. The harvesting document must be prepared and signed by a California registered professional forester before submittal to CAL FIRE for review and approval or denial. Furthermore, in such circumstances, timber operations must be conducted by a California licensed timber operator. Some projects not resulting in ground disturbance, such as defensible space clearance and non-commercial hand thinning fuel reduction work, are generally exempt from CEQA or a functionally equivalent program. In addition, there are opportunities to complete CEQA and NEPA documents using a joint analysis.

California Forest Practice Act

The California Forest Practice Act and its rules and regulations are the California statute regulating timber harvesting in California on non-Federal timberlands. The practice of cutting or/and removing native conifer trees for commercial purposes, as well as the conversion of timberland to a non-growing use on non-Federal timberlands in California, requires the preparation and approval of a harvesting document as per California Public Resource Code §4527. Nearly all harvesting documents submitted to CAL FIRE for approval must be prepared and signed by a California registered professional forester. All harvesting documents must be signed by a licensed timber operator who must also conduct harvesting operations.

California Public Resource Code §4291 applies to all landowners who own or maintain structures on state responsibility area lands. California Public Resource Code §4291 requires these landowners to maintain a defensible space around all structures each year to reduce the risk of damage or destruction caused by wildfire. Inspection and enforcement of California Public Resource Code §4291 is conducted annually by Tahoe Basin-assigned CAL FIRE personnel and California Tahoe Basin local government fire agencies.

Lahontan Regional Water Quality Control Board Basin Plan

The California Water Quality Control Board sets California policy for the implementation of state and Federal clean water laws and regulations. The Lahontan Regional Water Quality Control Board is responsible for protecting water quality and enforcing the California Water Code and the Clean Water Act. It enforces its water quality control plan in California that includes implementation plans and policies, including timber waivers.

Nevada Division of Forestry NRS 528

Nevada Revised Statute (NRS) section 528 creates the Nevada Forest Practice Act that regulates forest practices and reforestation on private and state lands in Nevada. Commercial forest thinning projects, or projects that propose removing trees from within 200 feet of a designated stream, must comply with the provisions of the Nevada Forest Practice Act (Act). The purpose of the Act is to ensure that (1) the timber resources in the State of Nevada are adequately protected; (2) water resources are protected during harvesting activities; and (3) project best management practices are followed. Any forest thinning project that takes place in Nevada that has a commercial component must apply for a logging permit and will likely have to issue a performance bond to cover the cost of any potential remediation that could be prescribed by the Nevada Division of Forestry.

Nevada NRS 477.030

In 2009 the State of Nevada adopted rules requiring the state fire warden to cooperate with the local fire districts on the Nevada side of the Tahoe Basin to create and enforce defensible space regulations. The State of Nevada then adopted the provisions of the International Wildland Urban Interface Code that prescribe defensible space standards at Nevada Administrative Code 477.281.

Agency Responsibilities

Several land management and regulatory agencies are responsible for complying with and enforcing regulations in the Lake Tahoe Basin. The land management agencies include the USDA Forest Service, Nevada Division of Forestry, California Tahoe Conservancy, and California State Parks. The regulatory agencies include the Tahoe Regional Planning Agency, Lahontan Regional Water Quality Control Board, local fire agencies and CAL FIRE.

Land Management Agencies

USDA Forest Service Lake Tahoe Basin Management Unit

The USDA Forest Service Lake Tahoe Basin Management Unit (LTBMU) is responsible for managing approximately 75 percent of the land base and its resources in the Lake Tahoe Basin. All management activities conducted by the LTBMU are governed by the Lake Tahoe Basin Management Unit Land and Resource Management Plan.

California State Parks

There are nine park units under the ownership of California State Parks within the Lake Tahoe Basin (listed from north to south): Kings Beach State Recreation Area, Burton Creek State Park, Tahoe State Recreation Area, Ward Creek (unclassified unit), Ed Z'berg Sugar Pine Point State Park, D.L. Bliss State Park, Emerald Bay State Park, Washoe Meadows State Park, and Lake Valley State Recreation Area. The mission of California State Parks is to provide for the health, inspiration, and education of the people of California by helping to preserve the State's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for

high-quality outdoor recreation. California State Parks seeks to maintain natural ecosystem processes that form and maintain natural resources, including reintroduction of fire when feasible and safe to help manage and maintain healthy forests.

California Tahoe Conservancy

The California Tahoe Conservancy (Conservancy) is an agency within the Natural Resources Agency of the State of California. Its jurisdiction extends only to the California side of the Lake Tahoe Basin. It was established to develop and implement programs through acquisitions and site improvements to improve water quality in Lake Tahoe, preserve the scenic beauty and recreational opportunities of the region, provide public access, preserve wildlife habitat areas, and manage and restore lands to protect the natural environment.

The properties managed by the Conservancy within the Basin consist of about 4,800 parcels; of which the average size is one-third acre or less. Most of these parcels are within the wildland-urban interface. The Conservancy is also responsible for planning and implementing projects on their respective lands that restore ecosystem health by reducing fuel hazards. They are responsible for ensuring their plans are consistent with Federal, state, and local laws, regulations, and policies.

Nevada Division of Forestry

The Nevada Division of Forestry manages all forestry, nursery, endangered plant species, and watershed resource activities on certain public and private lands within the Basin. The Division also provides fire protection of natural resources through fire suppression and prevention programs. The Nevada Division of Forestry is responsible for enforcing Nevada Revised Statutes (NRS) 528.

The Nevada Tahoe Resource Team, an interagency team within the Department of Conservation and Natural Resources, is responsible for implementing forest health and fuel reduction projects on State of Nevada property in the Lake Tahoe Basin.

Nevada State Parks

The Nevada Division of State Parks administers and manages the Lake Tahoe State Park, which includes beaches, fishing, and camping, and over 13,000 acres of backcountry recreation. The Carson Range State Parks, in conjunction with the Nevada Tahoe Resource Team, has prepared a plan to reduce fuel hazards and restore forest health in the park.

Nevada Division of State Lands

Nevada Division of State Lands manages 490 urban parcels in the Lake Tahoe Basin from Crystal Bay to Stateline, Nevada. These are managed by the Nevada Tahoe Resource Team (see above). Urban parcels are managed by the State Lands forester. There are 141 urban parcels (115 acres) in Douglas County and 349 urban parcels (110 acres) in Washoe County. These conservation areas are managed in accordance with a Tahoe Regional Planning Agency Memorandum of Understanding, Nevada Laws on Forestry and Fire, and Nevada Revised Statues 472, 527 and 528 which pertain to forest restoration and watershed protection of trees and flora through accepted forest practices.

Local Fire Protection Agencies

The local fire protection agencies of the Tahoe Basin have agreed to represent local government and private landowners who seek to create defensible space or who wish to thin forests adjacent to communities. While there is no statutory requirement for the fire agencies to actively manage private and local lands, all of the agencies have agreed to do so. Thus, the local fire agencies manage the largest land mass in the defense zone when considering defensible space and fuels reduction in

the wildland-urban interface. In Nevada, the International Wildland Urban Interface Code adopted by the state, does not include the building construction provisions found in chapter 5. The populated counties in the Basin have adopted the Wildland Urban Interface Code including chapter 5 (with amendments).

Regulatory Agencies

Tahoe Regional Planning Agency

The Tahoe Regional Planning Agency (TRPA) is a bi-state agency created by the states of Nevada and California to lead a cooperative effort to preserve, restore, and enhance the unique natural and human environment of the Lake Tahoe Basin. TRPA enforces the TRPA Regional Plan.

Lahontan Regional Water Quality Control Board

The Lahontan Regional Water Quality Control Board is responsible for water quality and enforcing California State Water Code. It regulates forest management practices and activities on stream environment zones.

California and Nevada Air Quality Regulatory Agencies

Air quality in the Tahoe Basin is managed by state and county agencies. In California, the California Air Resources Board determines if burning is allowed on a daily basis. County Air Pollution Control Districts are responsible for issuing burn permits and enforcing state regulations.

The Nevada Division of Environmental Protection regulates burning in Douglas County. The Washoe County District Board of Health regulates burning in Washoe County.

California Department of Forestry and Fire Protection (CAL FIRE)

CAL FIRE is responsible for enforcing the Z'Berg-Nejedly California Forest Practice Act of 1973 on non-Federal timberlands in California. CAL FIRE is also responsible for providing input and/or enforcing pre-development fire protection stands (PRC §4290), performing and enforcing defensible space law (PRC §4291), and the California Wildland Urban Interface Building Code.

In addition, CAL FIRE works with other internal programs, such as the California Office of the State Fire Marshal, California State Board of Forestry and Fire Protection, and CAL FIRE's Fire and Resource Assessment Program. The California Office of the State Fire Marshal is also part of CAL FIRE. The mission of the State Fire Marshal is to protect life and property through the development and application of fire prevention engineering (such as the Wildland Urban Interface Building Standards), education, and enforcement. The California State Board of Forestry and Fire Protection's mission is to provide policy leadership and to generate public interest and support in those matters key to the future of the State's forest and rangelands, including but not limited to PRC §4291, the California Forest Practice Act, and PRC §4290. The California Department of Forestry and Fire Protection's Fire and Resource Assessment Program assesses the amount and extent of California's forests and rangelands, analyzes their conditions, and identifies alternative management and policy guidelines.

Nevada Department of Environmental Protection (NDEP)

The NDEP administers statutes and implements rules and regulations intended to maintain the quality of the water resources of Nevada. Regarding forest management and fuels reduction activities, the protection of the quality of waters of the state is accomplished in coordination with the Nevada Division of Forestry and other state and local agencies as specified in the Nevada Forest

Practice Act, NRS 528.010 to .090, and in the Diffuse Sources section of NAC 445A.305 to 445A.340. These regulations generally specify and limit activities nearby water bodies and require use of best practices and erosion control methods to prevent significant degradation of water quality. NDEP also issues air quality permits for prescribed fire activities in the Nevada portion of the Basin.

Section 11: Conclusions

Implementing the Strategy has cost $90,744,735 with an annual average expenditure of $15,124,122 per year. Treating the remaining project areas is projected to cost between $144 million and $156 million, with an additional $25 million to $35 million anticipated to begin phased treatments on previously treated areas to maintain fire behavior modification efficacy over the next 10 years. The work is ongoing. The Federal, state and local program managers continue to treat the remaining project areas, and maintain the significant investments of time and money that have been completed to ensure community protection is realized into the future.

One of the key concerns to continued progress is the removal of the fuels that are treated. With limited opportunities for biomass due to access to remove the material, and facilities to utilize the material, increased use of prescribed fire will continue to present challenges. There are limited options to dispose of forest debris generated from forest projects. Both due to difficulty in accessing project forest debris and facilities that utilize biomass as fuel are limited. Prescribed burning will continue to be a necessary tool for fuel reduction and maintenance treatments.

While this Strategy proposes continuing fuel reduction treatments in and around communities throughout the Basin, one key to its success is the simultaneous development of defensible space around private residences, buildings, and the general infrastructure of the area. Participating agencies and organizations have facilitated this through an active education and enforcement campaign, and recognize that additional emphasis needs to be placed on these activities to ensure success.

The partners to this Strategy recognize that collaboration on several key focus areas should continue to ensure this Strategy's success. These focus areas include:

- Identifying pathways for regulatory collaboration in areas such as air quality, stream environment zones, limited operating periods, and watershed protection;
- Developing strategies to reduce planning and implementation costs associated with access issues and the use of innovative treatment techniques;
- Facilitating partnerships with potential biomass end-users;
- Developing and maintaining an adequate staff and contractor resource pool to implement the proposed projects; and
- Identifying efficient mechanisms to implement projects over multiple jurisdictions.

Finally, this Strategy will only be as successful as the continued commitment of each participating agency. This continuing commitment—to coordinate, communicate, and collaborate with each other and the people they serve—will result in responsive and cost-effective wildfire prevention that ultimately will protect the people and values at risk treasured in the Lake Tahoe Basin.

Federal, state, and local land managers, and Lake Tahoe fire agencies, continue to meet annually to review the results of the prior year fuels reduction efforts and identify fuels reduction projects and priorities, within the scope of this Strategy, for the upcoming year. Future projects identified by this group will meet the intent of this Strategy and meet the intent of all the underlying implementation plans including the community wildfire protection plans for the Lake Tahoe Basin. Projects will be prioritized for funding consistent with this Strategy and current direction and intent. Where projects cross jurisdictional boundaries, the group will collaborate on implementing the project with the goal of reducing environmental compliance, permitting, and contracting costs.

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Appendix A: Reporting Process-Project Tracking

Purpose

Provide a coordinated, comprehensive, and consistent process to manage project planning, accomplishment, and funding sources for scheduling and reporting needs across all jurisdictions.

Responsibilities

Tahoe Fire and Fuels Team manage the spatial data (building data dictionary, metadata), TRPA is responsible for EIP Reporting tool and data calls for annual reporting needs.

Baseline requirements

- Consistent reporting timeframe for updating; annually, in February (data call).
- Reporting should be easy to complete by local units (automated drop down selections), electronic form or standardized paper form for data input).
- Based on standardized definitions.
- Be compatible/integrated with geospatial data.
- Satisfy majority of reporting needs (congressional reports, annual accomplishments, funding use, etc.).

Definitions

Refer to EIP Performance Measures (PM) Information Sheets.

EIP Performance Measure Subcategories

Treatment Zone

- **General Forest** ~ Areas outside of delineated wildland-urban interface that are available for treatment under the Strategy (does not include wilderness or congressionally designated areas).
- **Defense Zone** ~ Includes EIP identified urban core, because this area was not delineated spatially and EIP identified community defense zone.
- **Threat Zone** ~ Area between the defense zone and general forest.

Treatment Type

- Hand thinning
- Mechanical thinning
- Mastication
- Chipping
- Prescribed burning (includes both pile burning and understory burning)
- Biomass removal
- Pruning

Initial Treatment

These are first entry treatments in high priority areas that exhibit fuels characteristics that would contribute to extreme fire behavior. These treatments may require multiple treatment types to achieve the desired condition.

Post Treatments (Phased)

These treatments occur 5 to 10 or more years after the initial treatments are completed to sustain the efficacy of the initial treatments, and typically require lower cost treatments to remove surface fuel accumulations resulting from vegetation growth and fuel accumulations (pine needles, branches, down woody debris, etc.).

Property Ownership

Follow EIP PM Definitions: This provides the best approach to spatially assigning acres treated.

Implementing Agency

The Name of the Unit Managing the Treatment Unit: Using standardized nomenclature. Differentiate when multiple jurisdictions/agencies are involved (i.e., CTC).

EIP Project Name

The unit name (must be unique) associated with the piece of ground being treated.

Additional Reporting Requirements

Planning/Scheduling

Provide a method of quickly visualizing and reporting where proposed treatments are located and what stage of planning to support coordination of implementation efforts.

- **Future ~** Available for consideration, not currently in priority list. Can be identified for out-year consideration.
- **Planning ~** Projects that are in the planning stages, but have not completed all requirements to allow implementation.
- **Planned ~** All environmental compliance and other requirements completed, ready for implementation scheduling.
- **In Progress ~** Layout; contract preparation in progress or scheduled for current year; ground work started or in progress.
- **Completed ~** Treatment type completed (may not mean all treatments are completed).

Costs

- Define cost components (overhead, planning, and implementation).
- Defensible space costs; in kind costs.
- Costs identified (shares by agency), funding sources.

Greenhouse Gas Emissions

- Annual benefits from treatments.
- Annual benefits from biomass conversion to bioenergy.

Appendix B: Treatment Types

Treatments are methods used to achieve the desired fuel loading conditions described below. Which treatment strategy to use depends upon cost effectiveness, availability of implementation resources, the size and type of vegetation to be removed, and site-specific resource protection needs. The primary treatments used in the Lake Tahoe Basin include (may not apply to every agency):

- Thinning (hand and ground-based mechanical)
- Prescribed burning (pile and understory burning)
- Mastication and chipping

Thinning

Mechanical and hand thinning are used to reduce the number of trees, which affects crown fire potential. Mechanical thinning is generally more cost effective than hand thinning for removal of large trees (trees greater than 16 inches diameter), and allows removal of larger trees to achieve spacing objectives. Ground-based mechanical thinning is generally prohibited on slopes more than 30 percent and on sensitive areas, such as stream environment zones. Aerial-based mechanical thinning uses helicopter or cable-based systems to remove trees on slopes greater than 30 percent. Hand thinning is generally limited to the removal of trees less than 16 inches diameter on steeper slopes, and in sensitive areas. Hand thinning may also involve pruning, which removes lower branches on trees, increasing the crown-base height (the distance from surface fuels to tree crowns). Because it is labor-intensive, pruning is generally limited to project areas in the defense zone.

Prescribed Burning

Prescribed burning reduces surface fuels using pile burning or understory burning. Pile burning is used on steep slopes where machines are prohibited and adjacent to developed areas where machines cannot process or otherwise remove material. Understory burning may be used to remove slash created by machine thinning and as an additional treatment in previously treated areas, or to restore forest health and to mimic the historic process of low-intensity fire.

Mastication and Chipping

Mastication and chipping are used to reduce ladder and surface fuels. Masticators consist of a mastication head on the end of an articulated arm that moves through the forest on a tracked or rubber-tired machine or mounted on a small loader-type machine with rubber tracks. Fuels are ground up into irregular-shaped chunks and left on the ground. The irregular-shapes allow air and water to seep between them, hastening decomposition. Chips are created when material is fed into a chipper and either removed from the site as biomass or spread on site. Chipping creates uniform-sized chips that can form an interlocking mat that decomposes very slowly and inhibits regeneration of shrubs and grasses.

Strategy Preparers

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