Monrovia Community Wildfire Protection Plan Introduction

Monrovia Community Wildfire Protection Plan

This Community Wildfire Protection Plan (CWPP) is being sponsored by the City of Monrovia. Principal funding for development of this plan is being provided by the City of Monrovia, with initial funding provided by a competitive grant (10USFS-0544) from the California Fire Safe Council.

1.1 Monrovia Fire Plan Purpose

The purposes of this plan are:

- To identify priority projects to reduce risks and hazards from wildfire while protecting environmental stewardship values in Monrovia's wildland-urban interface (WUI), including the voter-designated Hillside Wilderness Area, adjacent developed areas, critical infrastructure, recreational resources, and included private in-holdings. Goals are to be achieved principally through prioritization and implementation of fuel hazard reduction, building sustainability, community education, and fire-suppression projects and activities.
- To provide an adaptable guidance document for future actions of the City of Monrovia and the Monrovia Fire Department working with local, county, state and federal resources.
- To examine current practices and recommend improvements in wildfire mitigation, preparedness, response and recovery
- To develop best management practices (BMPs) for vegetation management and building sustainability
- To provide community priorities and direction for stewardship-based fuel reduction on city-managed open space lands.
- To provide fire safety educational information to residents of Monrovia.
- To provide a positive balance among fire prevention, stewardship, and wildlife protection.
- To coordinate fire protection strategies across property boundaries.
- To integrate private land management goals with community needs and expectations for fire safety.
- Finally, this document is being written as a Community Wildfire Protection Plan, in order to meet the requirements of future National Fire Plan(s) and other government funding sources, and to provide community direction for local land management within the planning area.

1.2 Organization of This Document

This document is adapted from the design of the *Sierra Nevada Community Stewardship and Wildfire Protection Plan (CCWPP) Guidebook*. It contains the following sections:

Executive Summary and Action Plan –

A summary of all the following chapters and the CWPP Action Plan.

CHAPTER 1, Plan Introduction –

An introduction to the document and the principles behind it

CHAPTER 2, City of Monrovia Fire Safe Planning Process –

Summarizes the public process used to develop this Fire Plan.

CHAPTER 3, Wildfire: Current Environment and Behavior –

Introduces wildfire concepts and issues in Monrovia's Wildland Urban Interace (WUI).

CHAPTER 4, Fire Ecology and Management of Vegetation Types –

Summarizes the common vegetation types found in the Monrovia WUI , their fire ecology, and stewardship and fuel management considerations.

CHAPTER 5, The Home Ignition Zone –

Explains how home ignition can be avoided using best management practices in building construction, retrofitting and landscaping; also summarizes existing building codes and discusses the Ready, Set, Go evacuation program.

CHAPTER 6, City of Monrovia Community Features –

Describes the social, political, and community-planning setting; includes a discussion of land ownership and management.

CHAPTER 7, Fire Protection Organizations—

Summarizes current fire protection resources and issues in the Very High Fire Severity Zone.

CHAPTER 8, Risk Assessment: Identifying and Evaluating Assets at Risk—

Summarizes assets at risk and the community risk assessment process and results.

CHAPTER 9, Monrovia Fire Safe Action Plan

Identifies prioritized actions to reduce risks from wildfire in Monrovia's at-risk neighborhoods.

CHAPTER 10, Facilitating Monrovia Fire Safety in the Long Term

Outlines a monitoring strategy and long-term steps to maintain and update this plan.

The Appendices to this plan are:

A-1 - Laws, Regulations and Guidance

- A-1a Monrovia Defensible Space Ordinance
- A-1b Oak Tree Ordinance
- A-1c Building and Fire Codes (applicable sections)
- A-1d Monrovia Fire Department 5-Year Strategic Plan
- A-1e Braunton's Milk vetch documents and summary
- A-1f Cooper Report on Recommended Vegetation Management in Monrovia Foothills

A-2 - Planning Process Records

- A-2a Fire Chief's CWPP Advisory Group
  - Invitation Letter
  - Meeting Presentation Slides
- A-2b Outreach
  - Fliers, Announcements and Mailings
  - Email notification list
- A-2c Public Workshops
  - Agendas
  - Minutes
  - Attendee Lists
  - Workshop Presentation Slides
- A-2d Stakeholders
  - Letter to Stakeholders
  - Meeting Presentation Slide
- A-2d Written Community Input

A-3 – Monrovia Ready Set Go! Program Brochure

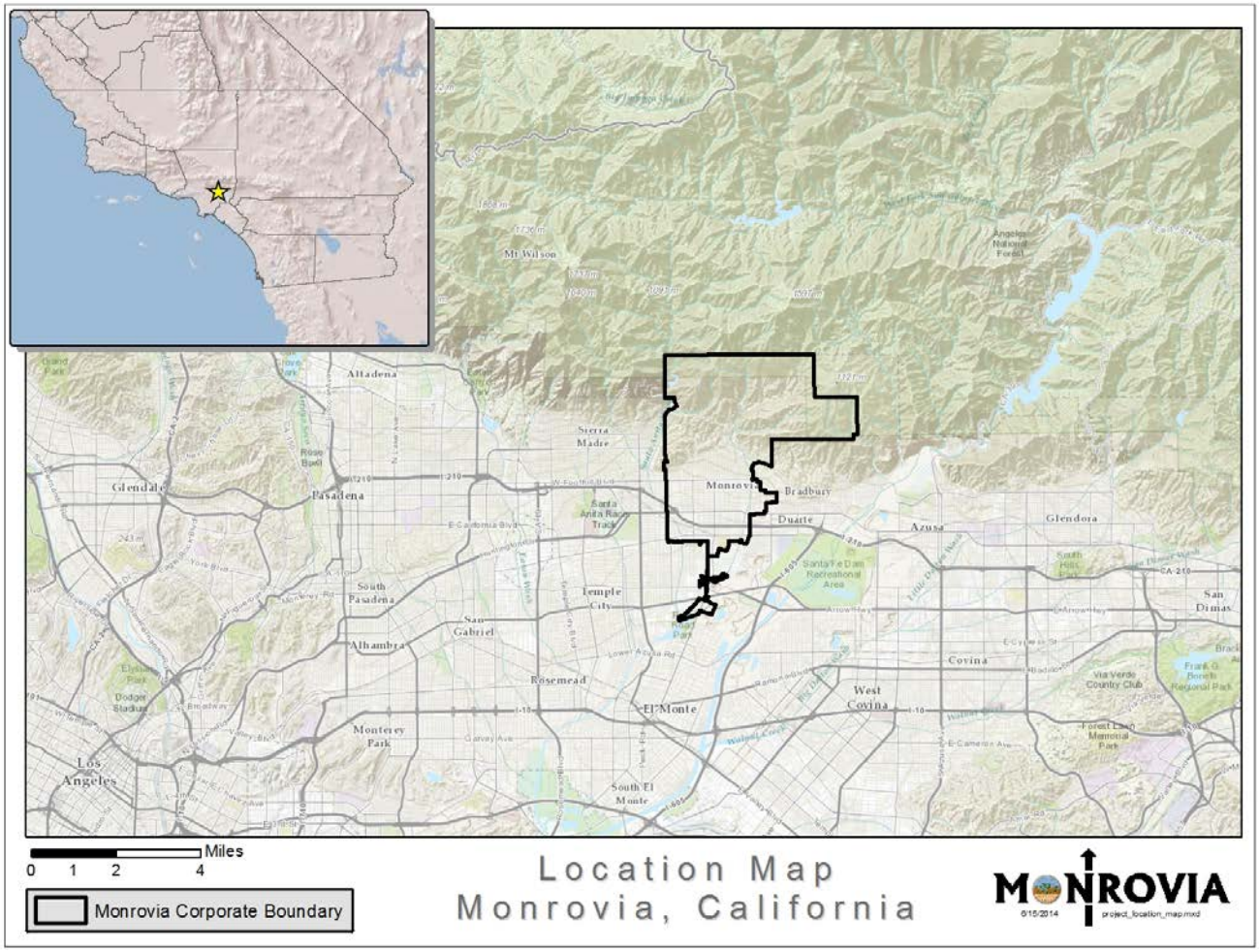

Figure 1-1 Location of Monrovia, California

1.3 Principles for Community Wildfire Protection in Monrovia California

Monrovia is located in Southern California, in the foothills of the San Gabriel Mountains and at the border of the Los Angeles coastal plain. (See location map, Figure 1-1.) Most Monrovia residents choose to live here because of the community and hometown charm, combined with the natural beauty and recreational opportunities of our location. Many homeowners also embrace the idea that living adjacent to *wildlands*[1] carries a responsibility to be good stewards of the land, learning to live sustainably in the natural world, of which fire is a significant part. This document summarizes what residents can do to coexist safely with fire within the Monrovia Wildland Interface. It will examine how we can provide a positive balance among *fire prevention,*[2] stewardship, and wildlife protection in our homes. We've chosen to live here, and with that choice we have accepted a stewardship responsibility.

[1] Wildlands: An area of land that is uncultivated and relatively free of human interference. Plants and animals exist in a natural state, thus wildlands help to maintain biodiversity and to preserve other natural values.

[2] Fire Prevention: Actions taken by homeowners and community members to lessen wildfires and damage caused by wildfires. Includes education, enforcement, and land management practices.

1.3.1 Monrovia Fire Hazard Conditions

Southern California's Mediterranean climate conditions create a high level of risk for wildland fires. The wet, mild winters and dry, hot summers provide a long growing season that produces an abundance of plant fuel. Heavy rains, and seasonal or prolonged drought all result in excessive plant fuel accumulation and the potential for catastrophic wildfires.

Monrovia is located along the southern foothills of the San Gabriel Mountains. Throughout history, the San Gabriel Mountains have been subjected to repeat burning. A major fire threat exists in the steeper slopes of the San Gabriel Mountains to the north with potential to sweep into the hillsides and residential foothill developments. The northern portion of Monrovia, comprising over 1,400 homes, several recreational facilities, and critical infrastructure, is located in an area designated by the State of California as a Very High Fire Severity Zone (in accordance with AB337) based on topography, vegetation and climate conditions (Figure 1-2).

The main weather patterns associated with severe wildfire in this area are 1) lightning, which is common with summer thunderstorms and 2) the Santa Ana Wind, a warm, dry wind that blows from the north and northeast over the mountains from the desert, typically occurring in the autumn, further drying the vegetation.

Previous fires have attested to the extensive damage that can take place from brush fires. Although periodic fires are a natural and essential component of the ecology of certain of our habitats such as coastal sage scrub and chaparral, increased fire frequency and associated changes in vegetation may increase the severity of a wildfire and threaten native habitat and neighboring development. Areas most susceptible to fire have three common characteristics: 1) steep slopes; 2) medium to heavy fuel loading; and 3) frequent critical fire hazard weather conditions. Fire hazards are generally highest during late summer and fall when moisture levels in vegetation have fallen, however, fire season is increasingly viewed as a year-round phenomenon in southern California. Fire has the potential to denude hillsides and render them susceptible to landslides.

1.3.2 Monrovia's Unique Natural Resources

Monrovia has a unique municipal resource – that is, its 1400-acre Hillside Wilderness and Hillside Recreation Areas (hereafter, referred to generally as the "wilderness area"). The location of the wilderness area is shown in Figure 1-3.

In the planning process for this CWPP Monrovians have identified the wilderness area as one of the valued natural assets that are to be protected by this CWPP from hazards associated with wildfire, as well as from activities related to fire prevention and suppression, to the extent possible while maintaining public safety. As part of the planning process for the wilderness area, Monrovians foresaw the need for fire safety planning and recommended the following fire management and safety strategies be implemented: 1) identifying the specific fire risk for both the Hillside Wilderness Preserve and Hillside Recreation planning areas, 2) developing a Community Wildfire Protection Plan (CWPP) and implementation program, 3) evaluation of vegetation and re-vegetation management practices to best preserve pristine resources while enhancing community safety, and 4) expanding community outreach

The wilderness natural assets include views, wildlife and vegetative communities, as well as environmental services such as watershed protection. Those assets, and the city's overall vision for management of them, are detailed in the Hillside Wilderness public documents:

Hillside Wilderness Preserve and Hillside Recreation Area Resource Management Plan ("RMP")[3]

Final Environmental Impact Report, City of Monrovia Hillside Wilderness Preserve and Hillside Recreation Area Resource Management Plan, dated November 2011, and adopted February 7, 2012 ("EIR")[4].

[3] City of Monrovia Hillside Wilderness Preserve and Hillside Recreation Area Resource Management Plan (RMP) available at http://www.cityofmonrovia.org/recreation/page/wilderness-preserve

[4] Final Environmental Impact Report, City of Monrovia Hillside Wilderness Preserve and Hillside Recreation Area Resource Management Plan, dated November 2011, and adopted February 7, 2012 http://www.cityofmonrovia.org/recreation/page/wilderness-preserve

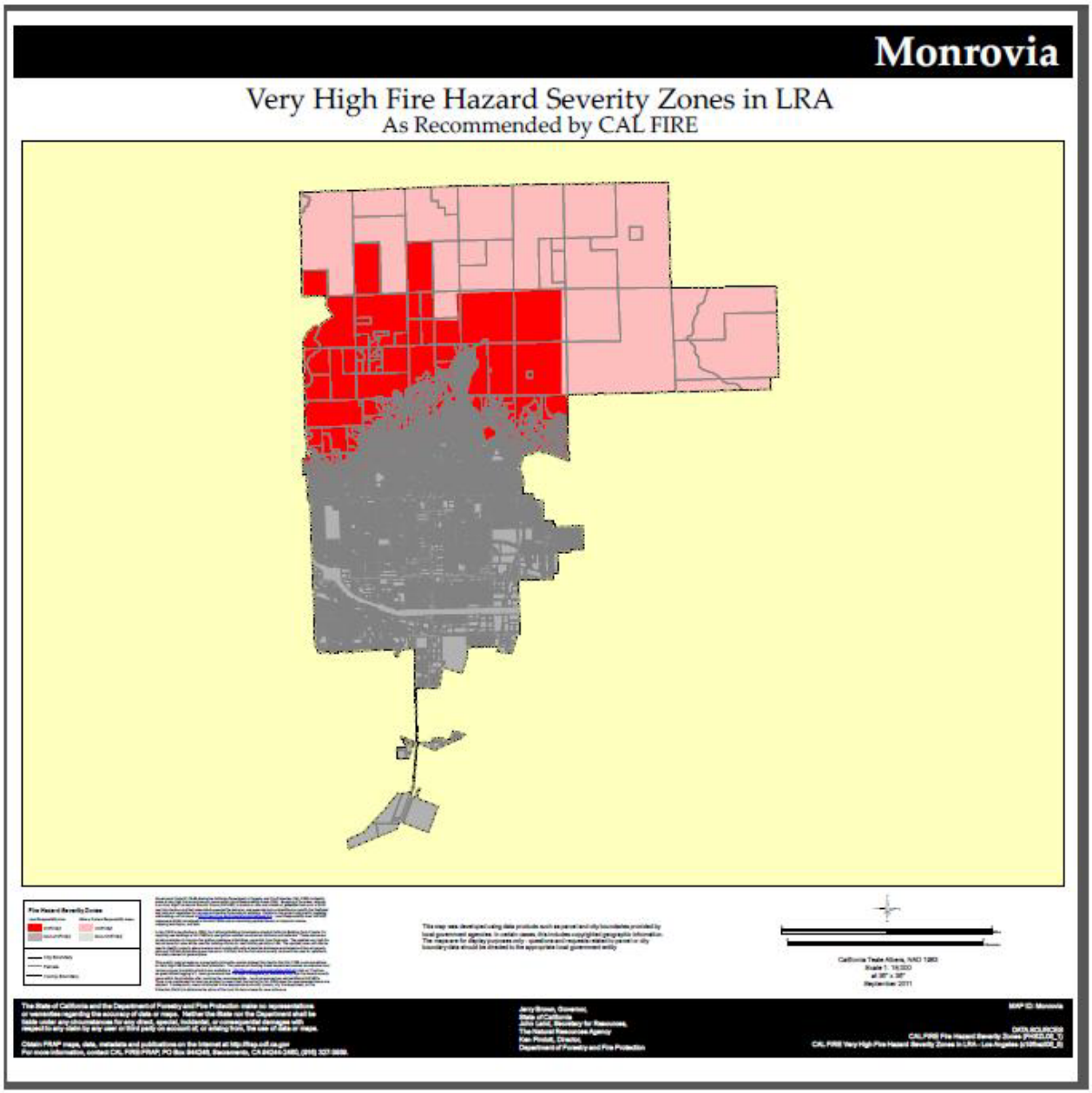

Figure 1-2 CalFire Recommended Fire Hazard Zones for Local Responsibility Areas

Monrovia Hillsides

Non Fire Hazard Area

Very High Fire Hazard Severity Zone

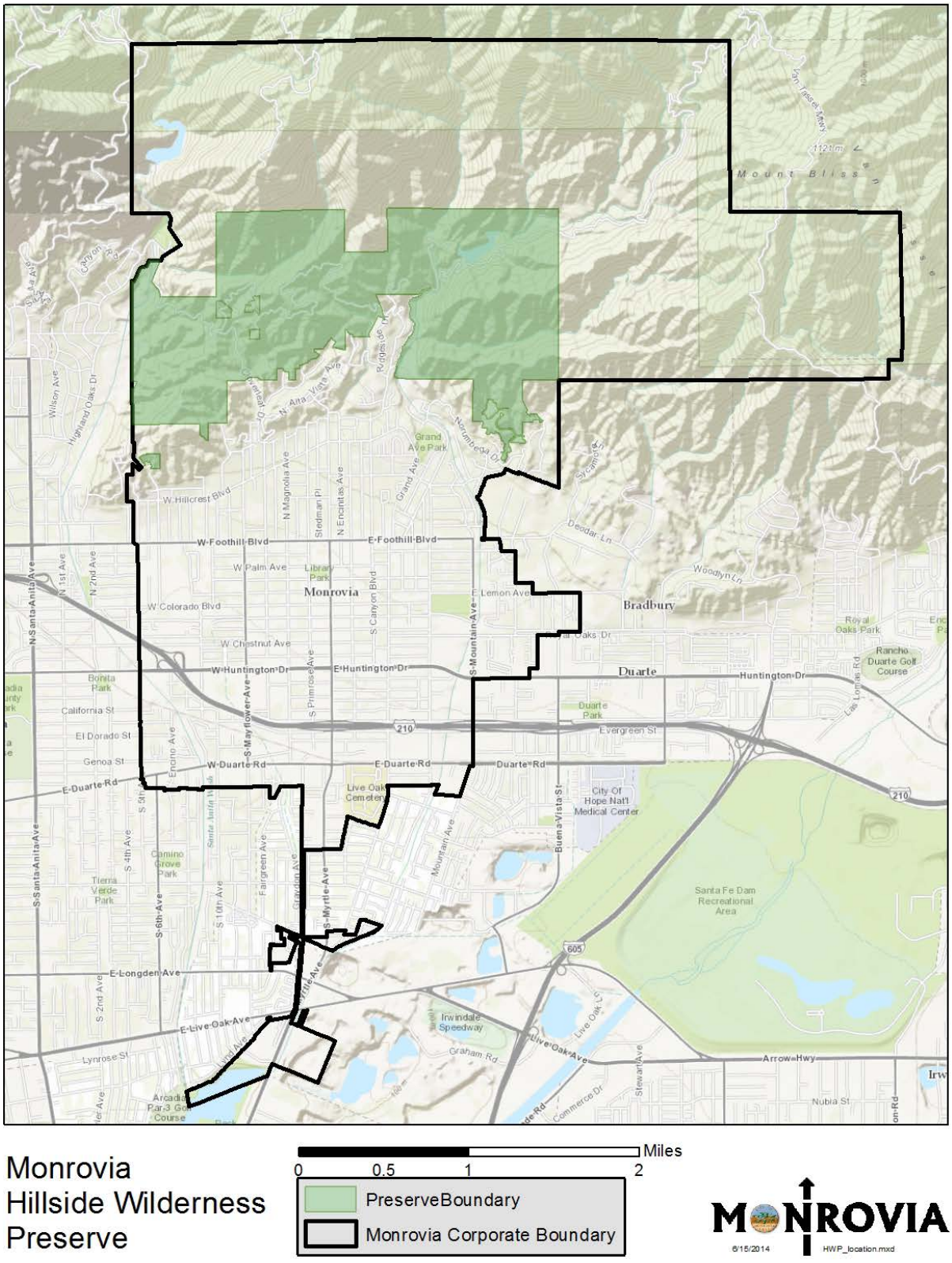

Figure 1-3. Monrovia Hillside Wilderness Area

1.3.3 Some Basic Concepts to Remember for Living with Fire in the City of Monrovia

- **Fire is a dynamic element within Southern California.**

  Our foothill lands have burned at various times in the past and can be expected to burn again some time in the future. While it is rarely practical to completely "fire proof" your property, there are many steps you can take to make sure that you and your house survive the likely event of wildfire. And you will benefit if your surrounding landscape can quickly recover afterwards, to continue providing you with the many benefits of plants, including slope stability – this is what we mean by a more *fire-resilient landscape.*[5]

- **One size does not fit all in terms of homeowner fire safety.**

  Work with the Monrovia Fire Department, our local Cooperative *Extension Agent,*[6] the Los Angeles County Fire Department, and/or contractors to design the appropriate *fire-safe practices*[7] and *defensible space*[8] for your property.

- **Your home exists within a larger *watershed.*[9]**

  It is located in the midst of a much larger landscape. Think about where your property is on the *slope.*[10] Are you on top of a ridge, where fire will more easily burn toward your home? Is your slope steep or gentle? Much of Monrovia's hillside development is in steep terrain. Fire moves quickly up steeper slopes, which means that you may need to *treat*[11] a larger area to create your defensible space. What is below and above you? What direction, or "*aspect,"*[12] does your property face? Overall, Monrovia has a south-facing aspect, although properties in some of the canyons may face east, west or even north. Generally, south-facing properties are hotter and drier; they can therefore be more susceptible to fire. Are there any natural *firebreaks*[13] around you such as streams, streets, or rocky outcrops where a fire might naturally slow its progress? Do wildlife use or move through your property to get to food, shelter, or water? Do the roads in and out of your property follow ridges or canyons? Look beyond your property lines to understand the ecological perspective of your place.

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[5] Fire-Resilient Landscape: A natural landscape featuring plants that have adapted to local wildfire conditions, or a domestic outdoor space where appropriate actions have been taken to make it less vulnerable to wildfire and certainly less prone to causing one.

[6] Extension Agent: An employee from the government or a university who provides information to rural communities about agriculture, land management, and/or resource management. In California, the University of California Cooperative Extension (UCCE) provides this service. For more information on UCCE, see: ucanr.org/.

[7] Fire Safe Practices: Activities such as creating defensible space, firebreaks, access to your home, fire-resistant landscapes, changes to your home in terms of material and design, etc., that make your home/property safer in wildfire situations.

[8] Defensible Space: An area around a home/structure that has been cleared of flammable materials to act as a barrier between wildfires and property, thereby decreasing the risk of damage or loss. This space is now defined as 100 feet around a structure in California.

[9] Watershed: All of the land that drains water runoff into a specific body of water. Watersheds may be referred to as drainage areas or drainage basins. Ridges of higher elevation usually form the boundaries between watersheds by directing the water to one side of the ridge or the other. The water then flows to the low point of the watershed.

[10] Slope: A percentage or degree change in elevation over a defined distance that measures the steepness of a landscape.

[11] Treat: insert definition of treat

[12] Aspect: The direction that a slope faces—north, south, east, west, etc.

[13] Firebreak: A strip of land that has been cleared of vegetation to help slow or stop the spread of wildfire. It may be a road, trail, or path cleared of vegetation or other burnable materials. A firebreak could also be a stream.

- **Fire can behave both predictably and unpredictably.**

  We can generally predict fire direction and behavior; it will typically go the way the wind is blowing and only burn if *fuel*[14] is available. Predicting the exact time and place where fire will burn is less obvious. As fire moves across the landscape it can climb up into your trees, given the right conditions. A key fire safety objective is to prevent that spread. Excessive dead leaves and branches on the ground *(surface fuels*[15]*)* act as a *wick*[16] to move fire horizontally across the land. Shrubs, small trees, branches and foliage *(ladder fuels*[17]*)* can carry fire vertically into the larger trees. Too much of these surface and ladder fuels can cause the *overstory*[18] trees to burn up in what is called a "crown fire"—when fire spreads from tree to tree in the forest canopy (or tree tops). One of the main principles in creating defensible space and reducing hazardous fuel conditions is to create physical space between vegetation layers (both vertically and horizontally) so a fire cannot climb easily from the ground into the trees or to your home.

- **Timing is everything.**

  There are appropriate times for different actions on your property, much as there are different seasons of work in your garden. Do your defensible space and fuel reduction work well before fire season, to avoid having sparks from equipment start fires in dry vegetation. This is the rationale behind the Monrovia Fire Department's schedule for doing hazardous vegetation inspections in late spring-early summer. However, many residents wait to do their defensible space and fuel reduction work until this time. It is better – for safety, for the environment and for cost- and labor-savings to make defensible space a year-round project. Other considerations are to avoid *ground-disturbing*[19] activities in your wildland when the ground is too wet or when birds and animals are nesting. In general, don't try to do everything at once—think about your fire safety seasonally: plan your activities in the winter and spring; start clearing when the ground begins to dry; finish treatments by early summer before the vegetation is dry; continue with grooming as needed throughout the dry season; do your defensible space maintenance around and inside your home in the fall and do major tree or shrub removal, or trimming of dormant trees in winter, if possible, before bird nesting season begins..

- **Your house is likely a fuel source.**

  Many homes are located in places where a fire can start and spread into surrounding vegetation. Fire prevention experts and the Monrovia Fire Department promote the "house-out" approach : the more you prepare your house and other structures, the less you will have to treat the surrounding vegetation. The biggest improvement you can make to reduce your fire risk is to build or remodel your house to resist the millions of tiny *embers*[20] created by *ember-attack*[21] from wildfires. When wildfires burn in extreme conditions they send burning firebrands (embers)

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[14] Fuel: All burnable materials including but not limited to living or dead vegetation, structures, and chemicals that feed a fire.

[15] Surface Fuels: Material on the ground, like needles or low-growing shrubs, that provides the fuel for fires to spread on the ground. Surface fuels are generally considered all fuels within six feet of the ground.

[16] Wick: A combustible material that allows fire to travel along a confined path to larger fuel sources. An example would be a wooden fence connected to your home.

[17] Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

[18] Overstory: The topmost trees in a forest which compose the upper canopy layer; compared to the understory, which is the lower woody or herbaceous layer underneath treetops.

[19] Ground-Disturbing Activities: Actions that interrupt the natural condition of the ground, such as digging and compaction from heavy equipment.

[20] Embers: Small glowing or smoldering pieces of wood or other organic debris often dispersed ahead of a fire, also known as firebrands.

[21] Ember Attack: Embers blown by the wind during a firestorm that accumulates at intersections between horizontal and vertical members on the outside of your house, igniting debris and combustible materials. Embers can also enter into openings (e.g., attic vents and other wall openings), igniting debris on the inside of your home.

ahead of them; these firebrands ignite new fires. Using *fire-resistant building materials*[22] and appropriately designed structures will give you the best chance to survive wildfire. Replace wood shake roofs with fire-resistant materials. Don't let your home be part of the problem. An interactive source of information to reduce homeowner risk in the wildland-urban interface is provided by the University of California Center for Fire Research and Outreach; it's called the Fire Information Engine Toolkit. *See http://firecenter.berkeley.edu/toolkit/homeowners.html for details on how this web-based program can help you make better decisions to reduce your fire risk, and the related UC Extension's Homeowner's Wildfire Mitigation Guide groups.ucanr.org/HWMG/index.cfm. Refer to the Monrovia Fire Department website at www.ci.monrovia.ca.us, or call the Fire Marshal at 626-256-8181.*

If you are building a new home, consider slope, aspect, surrounding fuels, and your potential environmental impacts before deciding where to site your home. This may be more important than the view in the long term. Be sure to check with the Community Development Department to learn about Monrovia's fire-safe building regulations.

➥ **Know your legal obligations.**

Learn your legal requirements regarding defensible space and fire-safe building and construction under Monrovia's Municipal Code Section 8.14 "Fire Hazards Relating to Vegetation and Other Conditions or Activities" included in Appendix A-1a and available on the Monrovia city website at www.ci.monrovia.ca.us. This CWPP attempts to provide you the information you need to discover how to balance these with the ecological needs of your place.

➥ **Firefighters need your help to protect your home**.

Make it safe for them and their equipment to get to and from your house. Be sure they can find you with visible road and address signs. Remember that fire-safe landscaping and construction greatly improves firefighters' ability to protect your home. *For more information see principle 4C below, Monrovia Municipal Code Section 8.14 an/or www.livingwithfire.info/beforethefire/accesszone/index.php.*

1.3.4 Stewardship Principles for Living With Wildfire in Monrovia

Consider the Stewardship Principles below in how you approach your fire safety and defensible space. It's all about balance. It is possible to have an aesthetically pleasing landscape that is fire-safe, supports local plant and animal species, and still provides you with privacy and plantings.

These Stewardship Principles were adapted from the Draft Santa Monica Mountains Community Wildfire Protection Plan (Katelman, Tracy, et al. 2010 ForEverGreenForestry) accessed at: http://www.forevergreenforestry.com/smmcwpp_pub.html.

Remembering the Vegetation (Native Trees and Other Plants)

a. Discovering and monitoring your vegetation's dynamic changes.

Thinking both in the short term (what will happen this year) and the long term (what will happen over time) can help you make small changes that will add up over time to give you a lower-maintenance and more fire-safe landscape.

[22] Fire-Resistant Building Materials: Materials used in the construction of a house that are resistant to ignition when exposed to radiant heat or flames. Examples include clay tile roofs, metal roofs, and stucco siding.

b. Acting conservatively.

We wish to create a landscape that is both more resistant to fire and more resilient if it does burn. In doing this, we need to apply the general concepts of the *precautionary principle*[23] while implementing *fuel treatments*[24]*:* you can always remove more trees and vegetation at a later time, but you cannot immediately replace what you have cut. The vegetation you leave is ultimately most important. Be sure that what you remove is done with careful planning and consideration to ensure that what you leave standing is healthy and *resilient.*[25] .

c. Protecting native species that share your home.

Look at the native vegetation around your property—or ask a local plant or forestry specialist for help—to see what different plants share your neighborhood. There may even be plants that are increasingly rare. For example, Monrovia hillside neighborhoods contain a rare and declining type of oak tree known as the Engelmann Oak, as well as several rare shrubs, grasses and wildflowers. If so, if you are able, you will be doing future generations of Californians a service by protecting those plants. The California Native Plant Society is an excellent source of information about both common and rare native plants. Watch for *invasive weeds.*[26] The Monrovia Fire Department can provide you with illustrated pamphlets and other information sources to help you identify the invasive weeds typical to Southern California. Some of these are of particular concern for their ability to ignite or spread fire or damage watersheds; and many of the invasive weeds are serious threats to wildlife habitat as well. Follow up your work by monitoring and removing weeds that grow back.

Avoid unnecessarily introducing water into your landscape, as water will generally help non-native plants out-compete native plants..

d. Managing your urban forest.

Avoid harming your oldest and biggest native trees, and, recognizing that no tree lives forever, also foster the establishment of the next generation of trees. The key principal is "the right tree in the right place" – based on the tree's size at maturity, its requirements for soil, water, sun and space, and your needs and desires. The City of Monrovia and Los Angeles County both protect certain native oak trees by law, and, moreover, oaks and other native trees provide numerous benefits, such as slope stabilization, shade, wildlife habitat and resilience to fire, as well as shielding your home from flying embers during a wildfire. The Monrovia Community Development Department is the source for information on our Oak Tree Ordinance (see also Appendix A-1b).

Remembering the Soil

e. Maintaining the life in your soil.

There is as much or more activity below the ground on your property as there is above the ground. Keep this in mind in terms of what you do above ground. Minimize activities that could *compact,*[27] flood, or poison

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[23] Precautionary Principle: A concept that promotes a cautious approach to development and managing the environment when information is uncertain or unreliable. Erring on the side of caution and stewardship is encouraged, along with a "Better safe than sorry" attitude.

[24] Fuel Treatment: The act of removing burnable materials to lower the risk of fires igniting and to lessen the likelihood of damage to property and communities. Treatments may include creating a defensible space, developing fuelbreaks, initiating prescribed burns, and thinning vegetation.

[25] Resilient, Resiliency: The ability of an ecosystem to return to its balanced state after a disturbance.

[26] Invasive Weeds: Undesirable plants that are not native and have been introduced to an area by humans. These plants generally have no natural enemies and are able to spread rapidly throughout the new location. Some examples include Himalayan Blackberries, English Ivy, and Scotch Broom.

[27] Compact: To pack closely or tightly together, as in the fragments of soil being compacted from heavy equipment, thereby limiting the ability of oxygen or water to pass freely.

your soil. The health of your land is directly dependent on the health of your soil. As such, the soil is one of the most valuable assets of your property.

f. Ensuring that your soil cover is fire safe.

Replace cover that burns easily (such as pine needles) with cover that is less *flammable*[28] (e.g. gravel, fleshy green plants, etc.). The objective is to ensure that if and when a fire comes through, it is not so hot that it kills the life in your soil. Rather, it should move through without a lot of fuel to consume in its path. For example, a very light layer of fallen leaves can help with soil erosion *(see below)*, but too much can be a fuel problem.

g. Minimizing erosion.

Protect your soil by keeping it covered. Cover helps to prevent *erosion,*[29] especially on ground that is not flat; it keeps the soil in place. Don't let soil move across your property, most importantly not into streams or other natural water sources. Keep ground-disturbing activities away from *unstable*[30] areas and *riparian*[31] areas. Pay special attention on steep slopes. The steeper the slope, the faster the soil can move downhill if it's disturbed, and the faster a fire can climb uphill under the right (or wrong!) conditions..

h. Protecting your soil after a fire.

Soil can be most fragile after a wildfire. This is often exacerbated when winter rains come soon after a fire. The potential for erosion and loss of soil is huge with this combination of conditions. If you have experienced fire on your property, first employ the precautionary principle: do not disturb the soil if you can avoid it. Note that many of the deep-rooted native plants may actually be alive under the soil surface, and may soon re-sprout. Do not seed or hydro seed, but if conditions are extreme, contact the Monrovia Engineering Department for advice regarding netting, wattles, or other protection measures.

Remembering the Wildlife

i. Protecting wildlife habitat.

Monrovians value our local wildlife – whether it be the birds overhead and singing in the bushes, the lizards on our fences, or the deer sheltering in the shade of an oak. Of course, our wildlife comes with certain problems as well – we may be concerned with rattlesnakes in our woodpiles, bears in our garbage, or deer eating our prize roses. However, overall, wildlife enhances our lives, and Monrovians choose to live with wildlife. Find ways to balance your land management activities with their needs, and leave some areas *untreated*[32] for the birds and wildlife using them, while maintaining your defensible space. Protect them as you would your home by creating defensible space while still considering their needs for *cover.*[33] If you watch quietly you may see animals using those areas. *For information on avoiding wildlife problems in Monrovia see http://www.cityofmonrovia.org/police/page/living-wildlife*.

j. Protecting future generations of wildlife.

Avoid harming nesting or breeding animals when working in and around your wildlands. The Migratory Bird Treaty Act (MBTA) applies to everyone and protects most of our local bird species during their breeding season. The Los Angeles Audubon Society, and the resources below, are excellent sources of information on

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[28] Flammable: A quality of a substance that makes it likely to catch fire, be easily ignited, burn quickly and/or have a fast rate of spreading flames.

[29] Erosion: The removal of soil over time by weather, wind and/or water such as rain or water runoff from roads.

[30] Unstable: Land that is lacking stability, or liable to change with activity, such as in the case of step slopes or crumbly soils.

[31] Riparian: A strip of land along the bank of a natural freshwater stream, river, creek, or lake that provides vast diversity and productivity of plants and animals.

[32] Untreated: Not altered from a natural or original state; unprocessed, e.g. no fuel reduction or defensible space activities.

[33] Cover: Any plants or organic matter that holds soil in place or grows over and creates shade that provides wildlife with an area to reproduce and find protection from predators and weather.

compliance with the MBTA, and wildlife protection in general. *See www.audubon.org/bird/at_home/SafeMisc.html for more information.*

k. Conserving rare and endangered species.

One of the bonuses—and responsibilities—of living in the Wildland Interface is living with the many rare and endangered species with which you share habitat. Consider rare and endangered species and plan your fuel reduction actions around the needs of these species. Often by a fairly minor refinement of your activities, such as timing, technique, or extent, you can protect species while realizing your fuel reduction goals. *For more information on rare and endangered species in the Monrovia foothills, see the RMP and EIR documents for the Wilderness Preserve.*

Remembering the People

l. Planning your actions with your neighbors.

Coordinated work amongst neighbors will have a greater impact on your individual fire safety. Finding ways to cooperate in your land management actions could make it more cost-effective for both of you. Your defensible space will likely impact your neighbor's chances of surviving a wildfire and vice-versa. Talk about what to do in an emergency and how to most safely evacuate. Help make your community a Firewise community. Organizations and neighborhood groups coordinating wildfire safety in Monrovia include:

Community Emergency Response Team (CERT) – contact Monrovia Fire Department (626) 256-8102

Fire Safe Monrovia – contact www.cafiresafecouncil.org/firewise

Neighborhood Watch – contact Monrovia Police Department (626) 256-8000

Finding qualified workers and treating them well.

If your objective is to reduce fuels while still maintaining ecological integrity and diversity on a site, your workers must have the knowledge and experience to help you achieve this. Inexperienced or unqualified workers can do more damage than good in the long-term. This is particularly true when it comes to trimming trees – improper pruning methods can harm and eventually kill your valued trees causing you to incur considerable expense in the future. Use properly licensed workers and pay them appropriately. Involve the workforce in the design, planning, and monitoring of projects. Talk to your neighbors and check references to find reputable contractors. Your workers also require a City of Monrovia Business License. *See the California State Licensing Board (http://www.cslb.ca.gov/).*

m. Working with the Fire Department.

Register with the city's public safety alert system, called Nixle, by texting 888-777 or online at www.nixle.com. Talk to your local firefighters when they come to make their annual inspection, visit us at the Fire Station (141 E. Lemon), call to speak with the Fire Marshall (626) 256-8181, or go to the Monrovia Fire Department website. Find out what the firefighters need to safely get to your house and back out. Make sure that your *access roads*[34] are safe; maintain your fuel treatments along all roads, both for firefighter safety in protecting your home and your safety in case of evacuation. Have street and address signs visible so out-of-town firefighters can find you if there is a big fire. These preparations and more are explained in Monrovia's Ready, Set, Go! program brochure, available at the Fire Station.

[34] Access Roads: Roads that allow entrance into and out of a property.

1.4 *Introduction to Monrovia, California*

1.4.1 Physical Description

The city covers 13.75 square miles with an assessed population of 36,590 per the 2010 census. Monrovia is located at the base of the San Gabriel Mountains within Los Angeles County, which contains approximately 10,000 acres of Wildland Urban Interface property. The City of Monrovia owns and maintains 1,400 acres of hillsides that make up the Monrovia Hillside Area. This is contiguous to a larger regional ecosystem that includes Monrovia Canyon Park (80 acres), Angeles National Forest (ANF) (650,000 acres) and Arcadia Wilderness Park (120 acres). Due to the Wilderness Area location between the ANF and the developed San Gabriel Valley, the area functions as an edge of urban/wildland interface.

In 1958, the total housing stock for the City of Monrovia was 7,881 homes. At present, the number of homes has almost doubled to 13,929 homes which is an 88% increase, resulting in a significant exposure to the Wildland interface. Currently, the City of Monrovia has 2,766 homes that lie within a half mile of the urban wildland interface. The majority of these Type V35 constructed homes were built prior to 1958 before fire resistive construction codes were established. These residential neighborhoods were designed before access standards were required in the interface. This resulted in narrow roadways and a lack of secondary access routes.

1.4.2 Communities-At-Risk in and Around Monrovia

Monrovia is listed as a Community-At-Risk of damage from wildfire according to the California State Forester, and other nearby communities are included on this list as well, as shown in Table 1-1 and Figure 1-4. This is an official list, deriving from the National Fire Plan, which was developed following damaging wildfires in 2000. The National Fire Plan directs funding to be provided for projects designed to reduce the fire risks to communities, and necessitates the identification of communities that are at high risk of damage from wildfire, which, in California, is done under the auspices of the California Department of Forestry and Fire Protection (Cal Fire). With California's extensive urban Wildland-Urban Interface situation, there are 1,289 communities currently on the Communities at Risk List. These high risk communities were identified within the wildland-urban interface, the area where homes and wildlands intermix. Three main factors were used to determine wildland fire threat to Wildland-Urban Interface areas of California36.

1) *Ranking Fuel Hazards*: Ranking vegetation types by their potential fire behavior during a wildfire.
2) *Assessing the Probability of Fire*: The annual likelihood that a large damaging wildfire would occur in a particular vegetation type.
3) *Defining Areas of Suitable Housing Density that Would Create Wildland-Urban Interface Fire Protection Strategy Situations*: Areas of intermingled wildland fuels and urban environments that are in the vicinity of fire threats.

The California State Forester (CAL FIRE Director) has assigned the role of managing the list to the California Fire Alliance (Alliance). Communities may be added to or removed from the list.

[35] Type V: wood-frame construction; combustible exterior

[36] California Fire Alliance

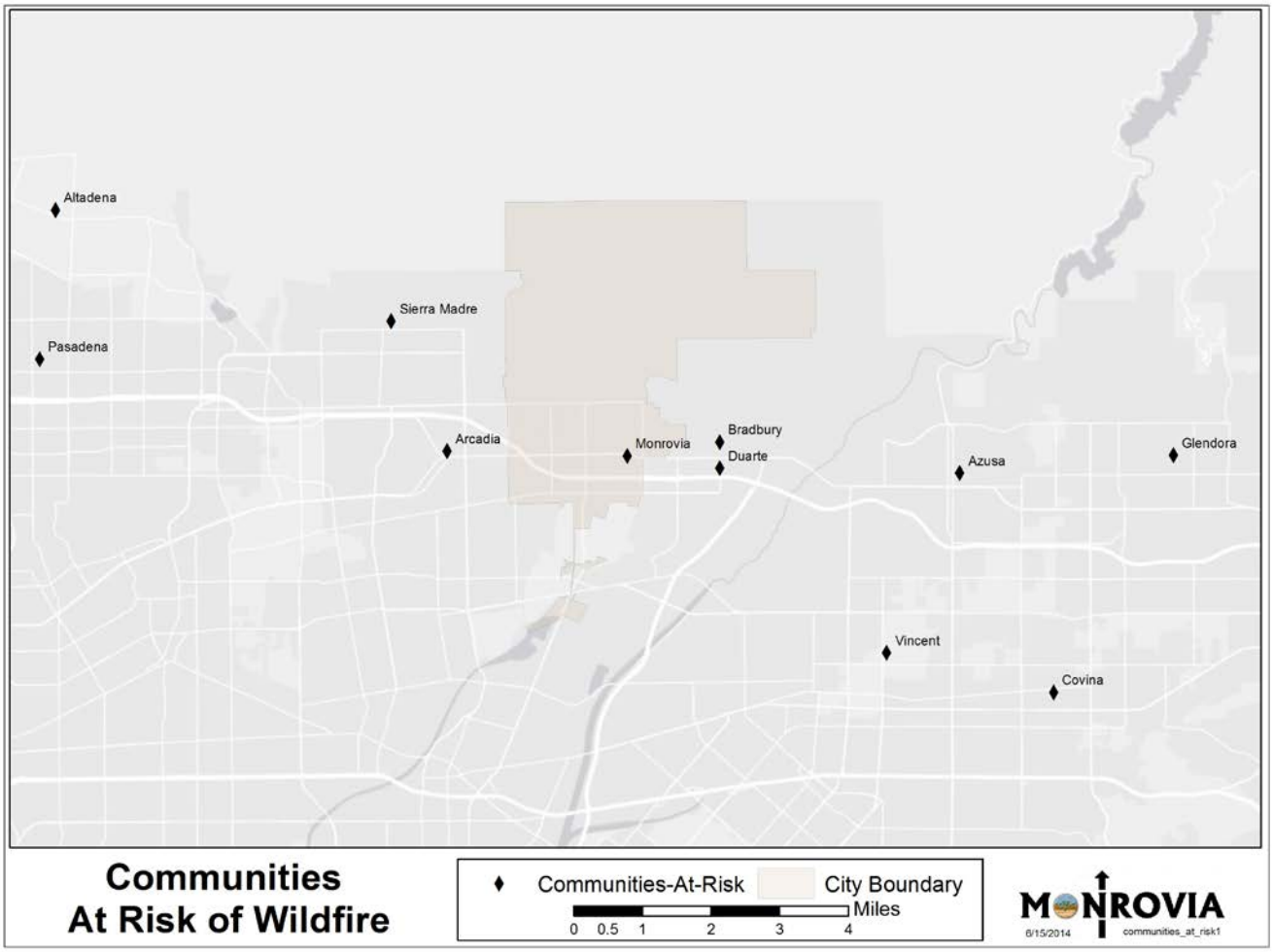

Table 1-1 Communities at Risk from Wildfire Near Monrovia

Name of Community at Risk	Year Added		Name of Community at Risk	Year Added
Arcadia	2001		Monrovia	2001
Altadena	2001		Pasadena	2001
Bradbury	2001		Sierra Madre	2001
Duarte	2001			

Figure 1-4. Communities at Risk

1.4.3 Monrovia's Wildland-Urban Interface (WUI)

The term Wildland-Urban Interface (WUI) refers to the area, as discussed above, where homes and wildlands intermix. The WUI fire hazard concept was promoted in The Healthy Forests Restoration Act of 2003 (HFRA), the impetus legislation for the creation of Community Wildfire Protection Plans, such as this one. HFRA provides incentives for wildfire mitigation projects carried out within a WUI.

The HFRA spelled out four different types of WUI conditions. (Federal Register 66(3), January 4, 2001):

Interface Condition – a situation where structures abut wildland fuels. There is a clear line of demarcation between the structures and the wildland fuels along roads or back fences. The development density for an interface condition is usually 3+ structures per acre. This condition describes some of Monrovia's hillside neighborhoods.

Intermix Condition – a situation where structures are scattered throughout a wildland area. There is no clear line of demarcation, the wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres. This condition also describes some of Monrovia's hillside neighborhoods, particularly where heavily-vegetated parcels are found.

Occluded Condition – a situation, normally within a city, where structures abut an island of wildland fuels (park or open space). There is a clear line of demarcation between the structures and the wildland fuels along roads and fences. The development density for an occluded condition is usually similar to that found in the interface condition and the occluded area is usually less than 1,000 acres in size.

Rural Condition – a situation where the scattered small clusters of structures (ranches, farms, resorts, or summer cabins) are exposed to wildland fuels. There may be miles between these clusters. This condition describes the isolated developments within Monrovia's open space areas, such as Monrovia Canyon Park, Trask Camp, and several isolated inholdings within the Hillside Wilderness Preserve.

The HFRA provides a default definition of the WUI, but allows a community to define its WUI boundaries itself in its CWPP. The default WUI definition places the boundary at a distance of ½ mile from the community or within 1.5 miles when mitigating circumstances exist, such as sustained steep slopes or geographic features aiding in creating a fire break. At least 50 percent of all funds appropriated for projects under the HFRA must be used within the WUI as defined by either a CWPP or by the definition provided in the HFRA when it has not been defined in a CWPP. Fuels treatments can occur along evacuation routes regardless of their distance from the community.

1.4.4 CalFire Fire Hazard Zoning

California law requires the California Department of Forestry and Fire Protection (CDF also "Cal Fire") to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZ), then define the application of various mitigation strategies to reduce risk associated with wildland fires, including the application of WUI building standards to new construction and other regulations. Classification of a zone as moderate, high or very high fire hazard is based on a combination of how a fire will behave and the probability of flames and embers threatening buildings. Each area of the map gets a score for flame length, embers, and the likelihood of the area burning. Scores are then averaged over the zone areas. Final zone class (moderate, high and very high) is based on the averaged scores for the zone[37].

The zones are:

- Moderate Fire Hazard Severity Zone (MFHSZ)
- High Fire Hazard Severity Zone (HFHSZ)
- Very High Fire Hazard Severity Zone (VHFHSZ)

[37] Office of the State Fire Marshall (OFSM) , FREQUENTLY ASKED QUESTIONS ABOUT: Fire Hazard Severity Zoning and New Building Codes for California's Wildland-Urban Interface
http://osfm.fire.ca.gov/codedevelopment/pdf/Wildfire%20Protection/FHSZ%20and%20Calif%20New%20WUI%20Building%20Code%202007%20FAQ.pdf

Fire Hazard Severity Zone maps evaluate "hazard," not "risk". They are like flood zone maps. Wildfire hazard vs wildfire risk are subtly different: "Hazard" is based on the physical conditions that create a likelihood that an area will burn over a 30 to 50-year period without considering modifications such as fuel reduction efforts. "Risk" is defined as the potential damage a fire can do to the area under existing conditions, including any modifications such as defensible space, irrigation and sprinklers, and ignition resistant building construction.[38]

Within areas of local jurisdiction, Cal Fire recommended zones in 2007 which could be adopted or amended by the local jurisdiction. Monrovia adopted Cal Fire's recommended zones in 2008. Monrovia's Very High Fire Severity Zone (VHFHSZ) is shown in Figure 1-2.

A key outcome of the fire hazard zoning relates to the application of California building codes and defensible space codes. The exterior wildfire exposure protection codes apply to the design and construction of new buildings located in VHFHSZ in local responsibility areas. Local ordinances may be stricter than the state ones, and may require ignition resistant construction for remodel projects. Monrovia's building codes for construction in the VHFHSZ are presented in Appendix A-1c.

In addition, California law requires defensible space and other wildland fire safety practices for buildings in the VHFHSZ. Owners are also required to make a natural hazard disclosure as part of a real estate transfer.

1.4.5 City of Monrovia Fire Department

The Monrovia Fire Department (MFD) provides fire protection services within the City of Monrovia. The MFD operates two fire stations within the City at 141 East Lemon Avenue (Fire Station 101) and 2055 South Myrtle Avenue (Fire Station 102) and is staffed by approximately 41 full-time personnel. Monrovia's fire fighting capabilities are supplemented through cooperative mutual aid agreements with several other fire fighting agencies. Such agencies would provide aid to the City of Monrovia in the event of a wildfire, as necessary.

Monrovia borders federal land, as well as several other cities. This impacts the principal jurisdiction responsible for fire protection within them – referred to as Direct Protection Areas – which may be federal, state or local. In the Monrovia area, the lands that are part of the Angeles National Forest are federal DPAs, while the other lands are local DPAs, falling under the City of Monrovia's responsibility. Adjoining cities such as Arcadia, Bradbury and Duarte, are responsible for their local areas adjacent to Monrovia's boundary.

Details on fire protection agencies and their services are provided in Chapter 7.

City of Monrovia Municipal Fire and Defensible Space Code

The Monrovia Municipal Code (MMC) includes regulations to minimize the potential for fire hazards in the City. Chapter 15.20, Fire Code, of the MMC establishes minimum requirements consistent with nationally recognized good practice. In very high fire hazard areas, defensible space is required around structures. Chapter 8.14 of the MMC provides specific maintenance and landscaping requirements in defensible spaces.

1.4.6 Background on CWPP Development

The impetus to develop this CWPP originally evolved from Monrovia's decision to purchase up to 1,400 acres of open space land along the wildland urban interface (WUI). Those lands are referred to as the Monrovia Hillside Wilderness Preserve (HWP). A Resource Management Plan (RMP) was initially drafted in 2008 and an Environmental Impact Report (EIR) followed; both were adopted in February 2012 to provide management direction

[38] OFSM

for the HWA. These documents set out wildfire safety goals for the HWA and adjacent neighborhoods that tasked the City with preparation of a CWPP.

1.4.7 Wildland Urban Interface Projects

The City of Monrovia directed by the Fire Department is responsible for emergency mitigation and prevention of fire within the Foothills of Monrovia. The department has sponsored and led a number of successful programs in the Wildland Urban Interface:

- ✓ Municipal Code: Established WUI Defensible Space requirements, with inspection and enforcement program
- ✓ Obtained funding through competitive grants from the California Firesafe Council for significant fuel reduction, fire planning and public outreach programs (07USF9677, 07UFS9811, 08UFS0057, 09UFS0144, 10USFS0544 2007−2012, 13USFS0066 2013-2013):
    - Chipper Program
    - Goat-assisted Fuel Reduction
    - Hazardous Tree Removals
    - Fuel modification program
- ✓ Obtained FEMA funding for hazard mitigation planning
- ✓ Obtained additional CFSC funding (10USFS0544 and 13 USFS0066) for public outreach/education in applying Home Ignition Zone risk assessment principals, implementing the Ready, Set, Go wildfire readiness program and initiating this CWPP.
- ✓ Collaboration between Fire Department and Monrovia Wilderness Preserve with Rio Hondo Fire Academy and the Los Angeles County Weed Management Area for invasive weed management projects
- ✓ Prepared a Local Hazard Mitigation Plan (2004; updated 2014).

Please see Chapter 9 for details regarding these activities.

1.4.8 Monrovia Fire Department Strategic and/or Future Plans

See Appendix A-1d for the Fire Department's five year strategic plan.

1.5 Fire Safety Objectives

The objectives for fire safety will drive the development of the assessment and eventual solutions. These objectives reflect the particular characteristics facing Monrovia.

a. Minimize Ignitions

Unplanned ignitions should be minimized. Numerous ignitions place a strain on firefighting resources, which can lead to high levels of damage because of greater fire area burned.

This plan will emphasize the importance of public education to minimize human behaviors that ignite fires. Patrolling and enforcement programs will be considered as well.

b. Decrease Intensity

One factor that disposes structures to fire damage is fire intensity, or the amount of heat transferred to the structure. High-intensity fires also are most likely to produce *crown fires*[39] and *torching.*[40] Embers created from these crown fires are lofted well ahead of the fire front, creating numerous *spot fires,*[41] and they are often the cause of structures burning. The level of fire intensity greatly influences the damage to natural resources. Every ecosystem is adapted to a range of fire intensities; however, higher-intensity fire causes a greater level of damage, such as erosion, degraded water quality, tree mortality, visual blights, and a decline in certain wildlife habitats.

Homeowners and other property owners have the greatest influence on reduction of fire intensity through fuel reduction activities around their home. This plan will develop vegetation management policies, best management practices, and public education and compliance programs.

c. Decrease Damage

Fire is part of the natural ecology of the hillsides. In contrast, wildfire damage to structures, human improvements and other valued assets needs to be minimized.

This plan will identify those valued assets that are at risk from wildfire. By promoting defensible space, early evacuation, and other strategies, this plan will provide ways to decrease damage to lives, properties and the environments.

Cal Fire has established a strategic goal for local protection area (LRA) fires to no more than 20 acres. The Monrovia Fire Department has embraced this goal and taken it further: our operational goal is to hold all fires started within Monrovia's LRA land to 10 acres or less.

d. Increase Permeability

One idea is to allow fire to play its natural role without loss. This describes the concept of permeability, whereby fire can spread through a community with minimal negative impact. The perfect situation will be one in which vulnerable resources are protected while fire burns under its normal regime.

e. Increase Resiliency

An important objective is to rebound quickly after a wildfire burns through a community. Fires of small size or limited damage support a more rapid recovery.

f. Evacuation Planning/Emergency Preparedness

Develop and educate the community on the importance of informed and organized evacuation protocols to ensure the community is well prepared for an impending fire event. Communities with greater preparation for wildfires (rehearsed evacuations, established communication protocols, etc.) also have greater resiliency.

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[39] Crown Fire: Is a fire that spreads from treetop to treetop and is characteristic of hot fires and dry conditions. Crown fires are generally more complex to control than fires on the surface.

[40] Torching: A rapid and intense burning of a single or small group of trees/shrubs, causing the upward movement of fire; a.k.a. flare-up.

[41] Spot Fire: A smaller fire outside the boundary of the main fire, started by airborne sparks or embers.

Monrovia Fire Safe Planning Process

2. Monrovia Fire Safe Planning Process

2.1. Planning Area Boundaries

This Fire Plan covers portions of Monrovia, California as shown in Figure 2-1. The entire area covered by this plan is referred to as the Project Area. The Project Area includes the *Very High Fire Hazard Severity Zone*[1] (VHFHSZ) as defined by *CAL FIRE*[2], which is further subdivided into four (4) neighborhood zones. Also included in the Project Area are an Ember Protection Zone and a Safety Zone. The Safety Zone, the Ember Protection Zone, and the four neighborhood zones are each considered a Planning Unit for the purposes of this plan, so that specific projects can be developed within each of these units. There are thus a total of six (6) Planning Units (Table 2-1).

Table 2-1 Monrovia CWPP Planning Units

1. VHFHSZ West (5th to Mayflower)
2. VHFHSZ West-Central (Mayflower to Myrtle)
3. VHFHSZ East-Central (Myrtle to Crestview)
4. VHFHSZ East (Crestview to eastern Monrovia boundary)
5. Ember Protection Zone
6. Safety Zone

These planning units are shown on a map (Figure 2-2) and described briefly below:

Planning Units 1-4: Very High Fire Hazard Severity Zone

Planning Units 1-4 include all developed and semi-developed areas in the VHFHSZ, including residential neighborhoods, Monrovia Canyon Park, Trask Boy Scouts Camp, portions of the Monrovia Hillside Wilderness Preserve, Grand Avenue Park, the Maryknoll Home and a number of reservoirs and debris basins.

The Sawpit Dam, Sawpit Debris Basin, Sawpit Sediment Placement Site, and associated flood control channels are owned and operated by the Los Angeles County Department of Public Works (LACDPW). Trask Boy Scouts Camp is operated under the jurisdiction of the United States Forest Service (USFS) by the San Gabriel Boy Scout Council. Monrovia Canyon Park, Grand Avenue Park, the Monrovia Hillside Wilderness Preserve (HWP) and the reservoirs are Monrovia municipal facilities.

The residential neighborhoods comprise over 1,400 homes and a small number of undeveloped parcels.

Planning Unit 5: Ember Protection Zone

The Ember Protection Zone borders the VHFHSZ along its southern border within residential neighborhoods. Because embers (firebrands) in a large wildland fire can fly more than the ½ mile typically considered in mapping WUI boundaries, the Ember Protection Zone provides for additional resident awareness and education for properties within ¼ mile of the VHFHSZ. The Ember Protection Zone consists of approximately 3,000 homes plus several schools, parks and reservoirs.

Planning Unit 6: Safety Zone

The Safety Zone is that area of the city that will provide emergency staging, evacuation centers, and other support in the event of a major wildfire emergency.

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[1] Very High Fire Hazard Severity Zone: Lands designated by the California Department of Forestry and Fire Protection to be areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. For statewide maps and more information on the program see http://frap.fire.ca.gov/projects/hazard/fhz.html.

[2] CAL FIRE: the California Department of Forestry and Fire Protection, also abbreviated as CDF, which is part of the State Natural Resources Agency.

2.2. Process and Plan Development

The Monrovia Fire Department initiated the development of the CWPP and assembled a volunteer Fire Chief's CWPP Advisory Group to help shape the process. Fire Department staff is principally authoring the plan, with the assistance of the Advisory Group and input from Monrovia residents and stakeholders. The process involved the following components:

- The Fire Chief's CWPP Advisory Group;
- Community outreach to alert residents that a plan was in preparation, solicit input, and notify them of upcoming meetings, information sources and contact channels;
- Outreach to organizational stakeholders;
- A CWPP website where interested parties could go for alerts of upcoming meetings, summaries and information from past meetings and links to relevant documents;
- Public meetings (14 in total, detailed below)
- Incorporation of public and stakeholder comments received.

This process is further detailed in the sections below.

2.2.1. Fire Chief's CWPP Advisory Group

A Fire Chief's CWPP Advisory Group (Advisory Group) was established to oversee development of this CWPP. The committee consists of volunteer community members. The purposes of the Advisory Group are:

- ✓ To provide oversight to the Monrovia CWPP process,
- ✓ To meet the requirements of Community Wildfire Protection Plans (CWPP) of the National Fire Plan, and
- ✓ To ensure that the CWPP meets the needs of all sectors of the Monrovia community.

Advisory Group members were nominated by the Monrovia City Council from community members who could broadly represent the community, including residents within the VHFHSZ, residents of other portions of Monrovia, members of the Community Emergency Response Team (CERT), commissioners, and other deeply-involved community members. The nominees were contacted and invited to join the committee (the invitation letter is included in Appendix A-2a.) The final make-up of the Advisory Group is listed in Table 2-3.

The Advisory Group met once or twice per quarter in working meetings that were announced and open to the public for observation. Each meeting included an educational component in addition to open discussion and group exercises to develop the plan goals and format, planning area and planning unit maps, risk assessment and mitigation strategies. The meetings were held at 6:00 p.m. Monrovia Fire Department Headquarters, 141 East Lemon Avenue, Monrovia.

Table 2-2: Fire Chief's CWPP Advisory Group Members:

Name	Organization		Name	Organization
Cheryl Baines	Monrovia Area Partnership (MAP)		Barbara Radford	Monrovia Area Partnership (MAP)
William Beebe	Planning Commission		Helmut Scherer	Resident in Very High Fire Hazard Severity Zone (VHFHSZ)
Gloria Crudgington	Community Services Commission; Measure A/B advocate		Brenda Trainor	Community Emergency Response Team (CERT)
Tom Dittmar	Community Services Commission		Anthony Villalobos	Trask Boy Scouts Camp caretaker
Suzanne Dobson	Community Emergency Response Team (CERT) Coordinator; Resident in Very High Fire Hazard Severity Zone (VHFHSZ)		Joannie Yuille	Monrovia Area Partnership (MAP)

Presentation slides from each Advisory Group meeting were posted on the CWPP website and are included in Appendix A-2a

Advisory Group members were also invited to attend a home tour with guest expert Pat Durland to assess structural ignitability. This tour was videotaped and is currently in preparation as a show to be aired on Monrovia's community access television station, KGEM. The tour involved three homes in the VHFHSZ, whose owners generously agreed to allow us to survey their wildfire hazard mitigation efforts and record the assessment on videotape.

2.2.2. Community Outreach and Input

2.2.2.1. Overall Program

A community outreach campaign was conducted to solicit input from people who live or work in the project area. A CWPP Q&A flier and comment sheet was developed, updated periodically, and provided at public counters, events and online, and included in mailings. All versions of that flier are included in Appendix A-2b. Fourteen (14) public meetings were held to provide a forum for discussion of wildfire planning issues, solicit input on the CWPP and disseminate fire safety information to the public. All were announced and open to the public. These were held from Sept. 12, 2012 – June 26, 2013 and comprised:

- ✓ 3 Public Workshops
- ✓ 1 Stakeholders' Meeting
- ✓ 4 Neighborhood Meetings
- ✓ 8 Advisory Group Meetings

The overall meeting schedule was as follows (Table 2-2):

Table 2-2 CWPP Meeting Schedule

9/12/2012	Advisory Group
10/22/2012	Public Workshop (Guest Speaker, J Lopez, LA County Fire)
11/7/2012	Advisory Group
12/5/2012	Advisory Group
2/21/2013	Stakeholders Meeting
2/25/2013	Public Workshop (Guest Speaker, Sabrina Drill, LA and Ventura County Resource Advisor)
3/6/2013	Advisory Group
4/3/13	Advisory Group
4/29/2013	Public Workshop (Guest Speaker, Pat Durland, Stone Creek Fire)
5/22/13	Advisory Group
6/20/13	Neighborhood Meeting – Planning Unit 2 (West-Central VHFHSZ)
6/23/13	Neighborhood Meeting – Planning Unit 4 (East VHFHSZ)
6/24/13	Neighborhood Meeting – Planning Unit 3 (East-Central VHFHSZ)
6/26/13	Neighborhood Meeting - Planning Unit 1 (West VHFHSZ)
10/9/13	Advisory Group
11/6/13	Advisory Group
1/13/14	Advisory Group
2/19/13	Advisory Group

A variety of means were employed to publicize the meetings and the CWPP process:

- First-class mailings to residents of the Very High Fire Hazard Severity Zone (VHFHSZ)
- First-class mailing to identified stakeholder groups and agencies
- Articles in quarterly City magazine, Monrovia Today
- Notification email/phone list
- Tabling at public events
- Announcements on front page of City Website
- Notices in bi-weekly City online newsletter, "Monrovia Reports"
- Official posting of notices and agendas for CWPP Public Workshops
- Fliers and handouts at public counters of City Hall and the Fire Department

Three (3) separate first-class mailings were sent out to each of the over 1450 residences in the Very High Fire Hazard Severity Zone. The dates and descriptions of these mailings are listed below, and the full mailings are included in Appendix A-2b:

September 28, 2012	Save the Date flier announcing October 22 Public Workshop[3]
April 17, 2013	CWPP Q&A flier[4]
May 29, 2013	Invitation to attend Neighborhood Meetings[5]

[3] Flier was included with mailing Ready, Set, Go Program brochure, with mailing costs supported by CFSC Grant 10USFS-0544.

[4] Flier was included with annual "brush letter", instructing residents on the brush inspection process and requirements, with mailing costs supported by CFSC Grant 13USFS-0066.

[5] Mailing costs of invitation were supported by CFSC Grant 13USFS-0066.

Letters or emails were sent to each of over 50 agency stakeholder representatives, or stakeholder groups, inviting them to comment on Monrovia's CWPP process and to attend the Stakeholders' Meeting. Details are in Section 2.2.2.4 below.

The Spring 2013 and Summer 2013 issues of Monrovia Today both contained detailed announcements of upcoming CWPP meetings. Monrovia Today is the City's official quarterly magazine, with a circulation of approximately 18,000. It is mailed to each Monrovia residence (16,200 addresses) and also provided at Monrovia businesses and the City Hall public counter. The pages containing the CWPP meeting announcements are reproduced in Appendix A-2b.

Email notifications of upcoming meetings were provided to those who requested this service. The email notification list consisted of fifteen (15) residents who requested notifications, based on previous mailings and publicity. This list is provided in Appendix A-2b

The CWPP process and upcoming meetings were publicized at public events. Approximately 100 fliers were distributed at the "Wednesday Old Town Event" prior to the April 29, 2013 Public Meeting. CWPP information sheets and comment forms were distributed at the CERT Table at Fire Service Day/Pancake Breakfast on May 11, 2013 which was attended by over 1,000 residents. These fliers are included in Appendix A-2b

The CWPP webpage has been online since September, 2012, accessed by a featured link from the front page of the Monrovia City website. The CWPP webpage includes announcements of each upcoming meeting and links to recordings of previous meetings, as well as background information about wildfire safety. "Monrovia Reports", the biweekly City e-newsletter, featured the CWPP process at least once per month between September, 2012 and June, 2013, announcing upcoming meetings, providing contact information, offering links to the CWPP webpage and soliciting comments.

Each of the three Public Workshops, held in City Council Chambers, was officially announced and the agenda posted by the City Clerk, as is done for Council meetings. These announcements are included in Appendix A-2b.

2.2.2.2. CWPP Public Workshops

Three CWPP Public Workshops were held to introduce interested community members to the Monrovia Community Wildfire Protection Plan project. The meetings were held at the Monrovia City Council Chambers, 415 South Ivy Avenue, Monrovia. The general format for each meeting was:

I. Monrovia wildfire planning introduction
II. Guest speaker/public education
III. Participant input exercise

The meetings were held starting at 6:00 p.m. on the following dates:

October 22, 2012
February 25, 2013
April 29, 2013

Following the meetings, the Power point presentations and any additional handouts were posted on the CWPP website. In addition, each meeting was videotaped and the video was also linked on the website.

The public education component was a key element of each Public Workshop. Monrovia was fortunate to be able to provide expert guest speakers on different topics:

Table 2-3 Public Education Guest Speakers

Guest Speaker	Title	Topic	Date
J. Lopez	Acting Assistant Chief, Forestry Division, County of Los Angeles Fire Department	CWPP Process	10/22/12
Dan Cooper	Biologist; Principal, Cooper Environmental Monitoring	Protecting Biological Resources	12/5/12*
Sabrina Drill	Natural Resources Advisor for University Cooperative Extension, Los Angeles and Ventura Counties	Vegetation Management	2/25/13
Pat Durland	Principal, Stone Creek Fire, LLC	Structure Hardening	4/29/13[6]

**The 12/5/12 meeting at which Dan Cooper spoke was a meeting of the CWPP Advisory Group, which was open to the public for observation. The presentation slides from that meeting were made available on the CWPP website, and are included in Appendix A-2a.*

The agendas, minutes, PowerPoint presentations and attendee lists for each of the CWPP Public Workshops are provided in Appendix A-2c.

2.2.2.3. Neighborhood Meetings

A series of four community neighborhood meetings was held in various locations throughout the Monrovia Very High Fire Hazard Severity Zone for the dual purposes of soliciting input on the CWPP and informing residents about Monrovia's Ready, Set, Go program. The neighborhood meetings were held in the following locations within Monrovia during June, 2013. The meetings in Units 1, 2 and 3 were held beginning at 6:30 p.m. on different weekday evenings, while the meeting in Unit 4 was held at 3:00 p.m. on a Sunday. By distributing the meetings times in this way, it was possible to accommodate a variety of work schedules. The meetings were open to all (not restricted to residents within the given zone). Meetings lasted approximately two hours.

- 6/20/13, 6:30 p.m. – Planning Unit 2 (West-Central VHFHSZ), Private Home, 15 Hidden Valley Dr.
- 6/23/13, 3:00 p.m. – Planning Unit 4 (East VHFHSZ), Maryknoll Sisters' Home/Annex, 340 Norumbega Dr.
- 6/25/13, 6:30 p.m. – Planning Unit 3 (East-Central VHFHSZ), Monrovia Canyon Park Cabin, 1200 N. Canyon Blvd.
- 6/26/13, 6:30 p.m. – Planning Unit 1 (West VHFHSZ), Monrovia Fire Department Training Room, 141 E. Lemon Ave.

The following agenda was used at the four neighborhood meetings:

Neighborhood Meeting Agenda

- Introduction
- Identify Neighborhood Values and Assets at Risk
- Ready, Set, Go! Program
- Identify Neighborhood High-Risk and High-Hazard Areas
- Develop Proposed Projects to Reduce Identified Risks
- Prioritize Projects/Wrap Up

The attendee lists from the Neighborhood Meetings are included in Appendix A-2c.

[6] Pat Durland's contribution was supported by California Fire Safe Council grant 13USFS-0066.

2.2.2.4. Stakeholder Outreach

A list of organizations and others holding a stake in this wildfire plan was carefully developed. At the first Advisory Group meeting in September 2012, participants were asked to brainstorm this list and the list was expanded, refined and prioritized by participants at the first Public Workshop in October 2012. A date was set for a meeting during working hours to accommodate the organizational stakeholders, and an invitation letter was sent. The letter is included in Appendix A-2d. The meeting was scheduled and held on Thursday, February 21, 2013. The stakeholders invited to participate are listed in Table 2-4 below:

Table 2-4. Stakeholder Representatives and Date Invited to Participate

Agency/Stakeholder Group	Representative	Title	Date Invited to Participate
Southern California Edison	Ahmed Solomon		1/28/13
Monrovia Chamber of Commerce	Karin Crehan	Executive Director	1/28/13
Community Emergency Response Team (CERT)	Captain Brannigan Scott		1/28/13
United States Forest Service	Scott Lowden	Battalion Chief, L.A. River Ranger District	1/28/13
United States Forest Service	Daniel S. O'Connor	Fuels Officer, San Gabriel River Ranger District	1/28/13
United States Forest Service	Kevin Hunt	Forestry Technician	1/28/13
United States Forest Service	Esmeralda Bracamonte	Natural Resources Officer	1/28/13
U.S. Army Corps of Engineers		Public Affairs Officer	1/28/13
California Department of Fish & Game	Edmund Pert	Regional Manager, South Coast Region	1/28/13
U.S. Fish and Wildlife Service; Ecological Services	Jonathan Snyder	Division Chief, Carlsbad Fish and Wildlife Office	1/28/13
Los Angeles County Fire Department	J Lopez	Acting Assistant Chief, Forestry Division	1/28/13
Los Angeles County Flood Control District	Bob Holderness	Flood Control Construction Supervisor, Flood Maintenance Division	1/28/13
Los Angeles County Flood Control District	Lonnie Munson	Pest Control Advisor, Flood Maintenance Division	1/28/13
Los Angeles County Department of Public Works	Keith Lilley	Principal Engineer, Water Resources Division	1/28/13
Los Angeles County Sheriff's Department	Sergeant Tony Haynes		1/28/13
Los Angeles County DMAC	Brenda Hunemiller	Disaster Management Area D Coordinator	1/28/13
Los Angeles County Vector Control	Kelly Middleton	Public Information Officer	1/28/13
Los Angeles County Dep't of Parks and Recreation	Kim Bosell	Natural Areas Administrator	1/28/13
Monrovia Unified School District (MUSD)	Linda Wagner	Superintendent	1/28/13
City of Monrovia Police Department/Animal Control	Alan Sanvictores	Captain	1/28/13
Monrovia Police Department - Chaplain	Pastor TK Brown	Greater Ambassador Church of God	1/28/13
City of Monrovia Department of Public Works	Ron Bow	Director	1/28/13
Ministerial Association of Monrovia	Pastor John Mastrogiovanni	President	1/28/13

Abundant Life Fellowship C.C. Monrovia	Tim Wolfe	Pastor	1/28/13
Rotary Club	Julie Roybal	President	1/28/13
Foothill Unity Center	Betty McWilliams	Executive Director	1/28/13
Kiwanis	Jeff Ford	President	1/28/13
South Coast Air Quality Management District	Rainbow Yeung	Sr. Public Information Specialist	1/28/13
AT&T California	Mark Rivera	Area Manager	1/28/13
Sprint Telephony			
Verizon California			
T-Mobile			1/28/13
Bechtel Communications	Gregory Kinne		1/28/13
Modus Inc.	Courtney Lai	Planner	1/28/13
Core Communications Group	Kim Nguyen		1/28/13
San Gabriel Boy Scout Council (Trask)	Anthony Villalobos		1/28/13
California Highway Patrol CHP	Dennis Woodbury	Lieutenant CHP, Baldwin Park Office	1/28/13
Arcadia Methodist Hospital	Dan F. Ausman	President/CEO	1/28/13
Monrovia Community Hospital	Ron Kupferstein	CEO	1/28/13
Red Cross	Jennifer Bailey	Disaster Preparedness Team	1/28/13
Arcadia Fire Department	Barry Spriggs	Battalion Chief	1/28/13
City of Bradbury	Michelle Keith	City Manager	1/28/13
City of Duarte	Brian Villalobos	Director of Safety Coordination	1/28/13
City of El Monte	Sgt. Richard Luna	EOC Coordinator El Monte Police Department	1/28/13
City of Irwindale	John Davidson	City Manager	1/28/13
Southern California Gas Co.	Helen Romero Shaw	Public Affairs Manager	1/28/13
Athens	Mary McKenrick	Municipal Sales Manager	1/28/13
Monrovia Historic Museum	Mark Still	Curator of Exhibits	1/28/13
Monrovia Historic Preservation Group		President	1/28/13
Santa Anita Family YMCA	Damon Colaluca	Director	1/28/13
Upper San Gabriel Valley Municipal Water District	Elena Layugan	Water Conservation Coordinator	1/28/13
California American Water Company			1/28/13
Los Angeles County Department of Public Works; Water Resources Division; Debris Basins	Sterling Kippel		3/26/2013

The Stakeholder Meeting was held on Thursday February 21, 2013 from 10:00-11:30 a.m. in City Council Chambers. The meeting agenda was as follows:

I. Introduction to CWPP Process and Updates

II. Participant questions and comments
   a. Review of Project Maps
   b. Hazard Mitigation Strategies – participant input

III. Adjournment
   a. Upcoming Meetings
   b. Submitting Additional Comments

The meeting attendees are listed in Table 2-5, below:

Table 2-5 Stakeholder Meeting Attendee List

Name	Organization		Name	Organization
Ahmed Solomon	Southern California Edison		Daniel Sanchez	Abundant Life Fellowship C.C. Monrovia
Battalion Chief Scott Lowden	United States Forest Service		Lieutenant Dennis Woodbury	California Highway Patrol
Kelly Middleton	LA County Vector Control		Battalion Chief Barry Spriggs	Arcadia Fire Department
Kim Bosell	LA County Dept. of Parks & Recreation		Kevin R. Kearney	City of Bradbury
Karen Herrera	City of Duarte			

Presentation slides from the Stakeholder Meeting are included in Appendix A-2d.

2.2.2.5. Written Community Input During Planning Phase

A Comment Form/CWPP Info Flier was included in the April, 2013 mailing to all 1450 VHFHSZ residents and also distributed via counter hand-outs, and the CWPP webpage. In addition, written comments were solicited from the organizational stakeholders listed in Table 2-4 who were unable to attend the February meeting. Those comments received from the community during the document planning phases are listed in Table 2-6. Appendix A-2e contains the full text of the comments received.

Table 2-6. Written Community Input During Planning of Monrovia CWPP

Comments submitted from (Name and Affiliation):	Date Rec'd:	Format	Topic
Edmund Pert, CA Dept of Fish & Wildlife	2/12/13	Letter	Species conservation; vegetation; prescribed burning; permitting
Kelly Middleton, San Gabriel Valley Mosquito & Vector Control	3/4/13	Letter	Worker safety; wildlife guzzlers; standing water/mosquitoes; during-fire/post-fire concerns
Elizabeth Goldstein, Monrovia resident	5/1/2013	Comment form	Opening of wildlands at Highland and Franklin; careless visitors
Steve Hackworth, Monrovia resident	6/6/13	Comment form	Vegetation; Lower Clamshell Motorway
Michael Allen, Monrovia resident	6/11/13	Comment form	Vegetation; abandoned properties
Alexandra Swanson, Monrovia resident	6/25/13	Comment form	Smoking bans; wildfire ignition
Nancy Zack, Monrovia resident	2/7/14	email	Preservation of wildlife and wildlife habitat; use of Phos-chek fire retardant
Betty J. Courtney, CA Dept of Fish & Wildlife	11/5/14	Letter	Vegetation removal, species protection and jurisdictional delineation

2.3. Draft Review Process

Based on input received during the above meetings and community input process, draft CWPP chapters were prepared and circulated internally for review.

With the endorsement of the Advisory Group, we have adopted a template based on the *Sierra Nevada Community Conservation and Wildfire Protection Plan Guidebook*[7], with modifications as needed. This model was chosen because it incorporates means for users to self-educate or delve deeper into selected topics. This model also incorporates natural resource conservation values, which are important to the Monrovia community. To improve the relevance of the document to the local Southern California landscape, a substantial amount of material was also adapted, with permission, from the *Santa Monica Mountains CWPP*[8].

Internal drafts of individual chapters were reviewed by the CWPP Advisory Group as they are prepared.

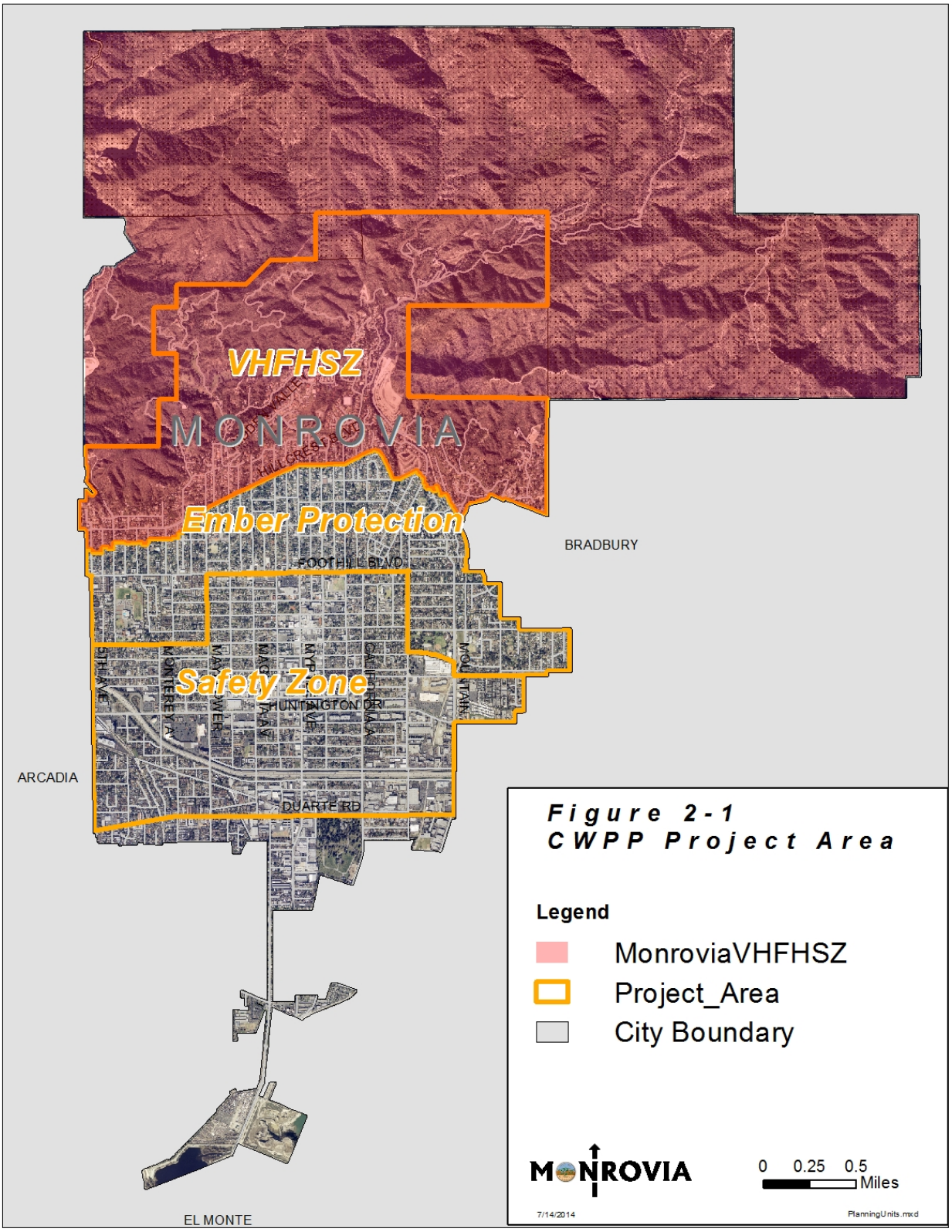
An executive summary of the CWPP was prepared for City Council review and presented to Council in a closed study session on May 6, 2014.

A complete Internal Draft CWPP was prepared on August 8, 2014 and circulated to the Advisory Group. A Final Draft will be made available to the public October 1, 2013 and presented in an open session to the community and the City Council on or after November 4, 2014. The meeting agenda will be published by the City Clerk at least 72 hours in advance of the meeting.

[7] *Sierra Nevada Community Conservation and Wildfire Protection Plan Guidebook*, written by Tracy Katelman, Marko Bey, Susan Britting, and Carol Rice. Some text in this document is taken directly from the Guidebook. For more information on the Guidebook, see forevergreenforestry.com/SierraConservationCWPP.html

[8] *Santa Monica Mountains Community Wildfire Protection Plan*, May 2012, http://www.nps.gov/samo/parkmgmt/upload/SMM_CWPP_02MAY2012_FINAL_v3.pdf

Maps and figures for Chapter 2



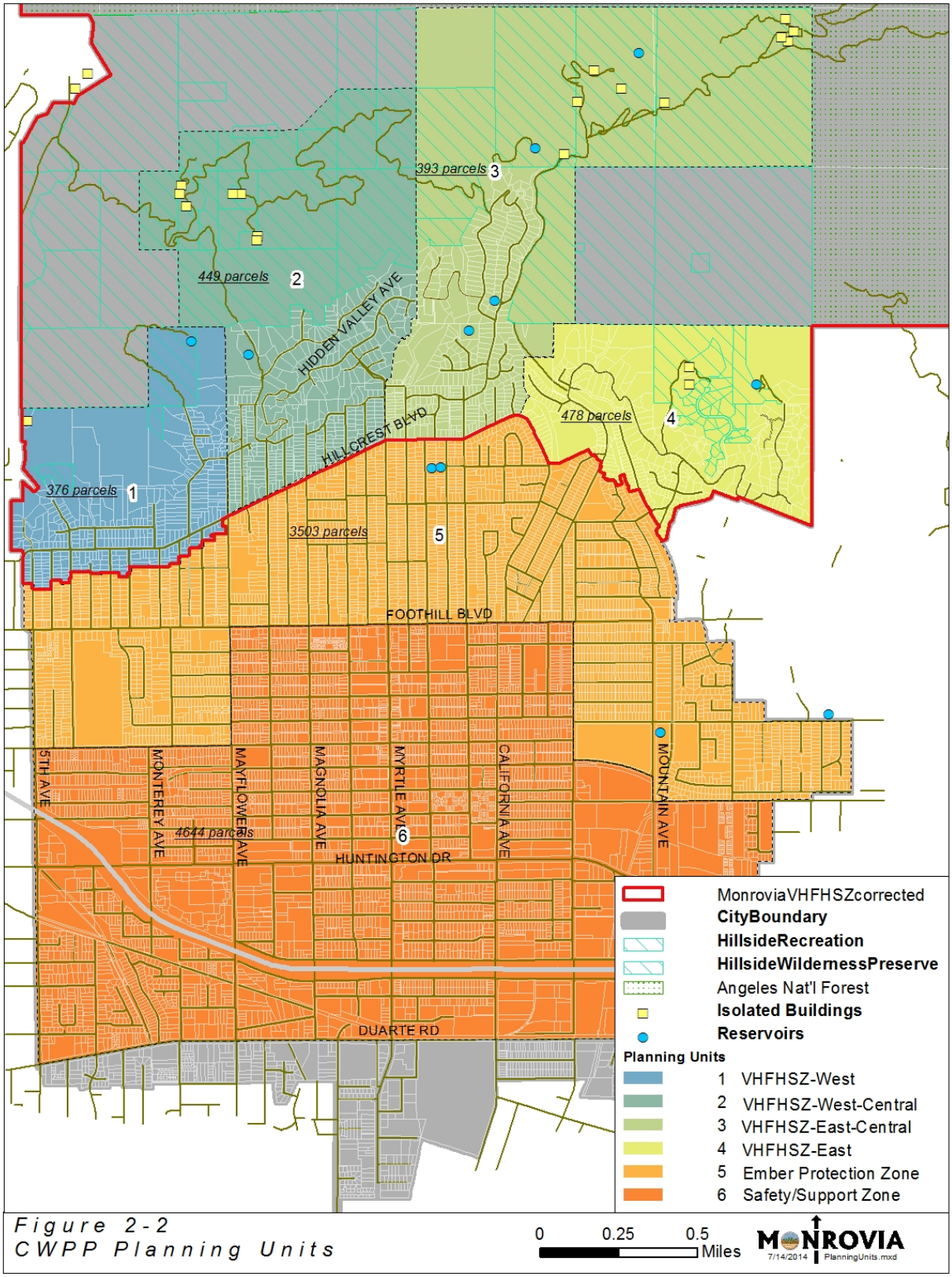


Figure 2-2
CWPP Planning Units

Neighborhood_meeting

April 29, 2013 Public workshop

Advisory Group Meeting with Biologist Dan Cooper

Neighborhood_meeting

Wildfire: Current Environment and Behavior

3. Wildfire: Current Environment and Behavior[1]

In this section we will discuss *fire behavior*[2] and those elements of the Monrovia foothills environment that influence it.

3.1. Introduction: Defining the Wildfire Problem

How wildfire will impact the planning area depends on several factors including the site topography, weather, and condition and type of vegetation and other fuels. Developing an understanding of the environmental conditions in the planning area is the first step in formulating practices or actions that can best modify the environment to improve its fire resiliency.[3]

Top 20 Largest California Wildfires

	FIRE NAME/CAUSE	DATE	COUNTY	*ACRES*	STRUCTURES	DEATHS
1	CEDAR *(HUMAN RELATED)*	October 2003	SAN DIEGO	273,246	2,820	14
2	RUSH (*LIGHTNING*)	August 2012	LASSEN	271,911 CA / 43,666 NV	0	0
3	RIM (HUMAN RELATED)*	August 2013	TUOLUMNE	257,135	112	0
4	ZACA (HUMAN RELATED)	July 2007	SANTA BARBARA	240,207	1	0
5	MATILIJA (UNDETERMINED)	September 1932	VENTURA	220,000	0	0
6	WITCH (POWERLINES)	October 2007	SAN DIEGO	197,990	1,650	2
7	KLAMATH THEATER COMPLEX (LIGHTNING)	June 2008	SISKIYOU	192,038	0	2
8	MARBLE CONE (LIGHTNING)	July 1977	MONTEREY	177,866	0	0
9	LAGUNA (POWERLINES)	September 1970	SAN DIEGO	175,425	382	5
10	BASIN COMPLEX (LIGHTNING)	June 2008	MONTEREY	162,818	58	0
11	DAY FIRE (HUMAN RELATED)	September 2006	VENTURA	162,702	11	0
12	STATION FIRE (HUMAN RELATED)	August 2009	LOS ANGELES	160,557	209	2
13	McNALLY (HUMAN RELATED)	July 2002	TULARE	150,696	17	0
14	STANISLAUS COMPLEX (LIGHTNING)	August 1987	TUOLUMNE	145,980	28	1
15	BIG BAR COMPLEX (LIGHTNING)	August 1999	TRINITY	140,948	0	0
16	CAMPBELL COMPLEX (POWERLINES)	August 1990	TEHAMA	125,892	27	0
17	WHEELER (ARSON)	July 1985	VENTURA	118,000	26	0
18	SIMI (UNDER INVESTIGATION)	October 2003	VENTURA	108,204	300	0
19	HWY. 58 (VEHICLE)	August 1996	SAN LUIS OBISPO	106,668	13	0
20	IRON ALPS COMPLEX (LIGHTNING)	June 2008	TRINITY	105,805	2	10

*Rim Fire information may change until the fire is contained.

There is no doubt that there were fires with significant acreage loss in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large acreage-loss fires in more recent times. (Also note that this list does not include fire jurisdiction. These are the top 20 within the state, regardless of whether they were state, federal, or local responsibility.)

CAL FIRE

10/4/2013

Figure 3-1 Largest California Wildfires (Cal Fire data)

[1] This section was adapted from the template written primarily by Carol Rice, Wildland Resource Management.

[2] Fire Behavior: The combination of fire spread, heat output, flame length intensity, etc. as the fire responds to weather, topography, types of fuels, etc.

[3] Fire Resiliency: The ability of an ecosystem to maintain its native biodiversity, ecological integrity, and natural recovery processes following a wildland fire disturbance.

Monrovians have experienced several wildfires near or within our borders in the last 10 years. In April, 2013, the Madison Fire burned 125 acres in steep terrain. Fortunately, there were no structures destroyed, lives lost or serious injuries. The Station Fire of 2009 approached within three miles of Monrovia neighborhoods. Burning over 160,000 acres, it was the largest fire in the recorded history of Angeles National Forest and the 12th largest fire in California since 1933[4] and destroyed 209 structures, and took two human lives (Figure 3-1)[5] However, in spite of its large size, it did not rank among the top 20 most destructive wildfires (Figure 3-2)[6]. In fact, California's most destructive wildfire – the Tunnel Fire in the Berkeley Hills in 1991, burned only 1/1000th the Station Fire's area (1,600 acres) but killed 25 people and destroyed 2,900 structures. So, our concerns about wildfire are principally focused on its potential to harm people and those things we value most, which may be independent of the number of acres burned in undeveloped land. Of course, wildfire within undeveloped land has consequences as well, and these will be addressed further in Chapter 4.

20 Largest California Wildland Fires (By Structures Destroyed)

	FIRE NAME/*CAUSE*	DATE	COUNTY	ACRES	*STRUCTURES*	DEATHS
1	TUNNEL *(REKINDLE)*	October 1991	ALAMEDA	1,600	2,900	25
2	CEDAR *(HUMAN)*	October 2003	SAN DIEGO	273,246	2,820	15
3	WITCH *(UNDER INVESTIGATION)*	October 2007	SAN DIEGO	197,990	1,650	2
4	OLD *(HUMAN)*	October 2003	SAN BERNARDINO	91,281	1,003	6
5	JONES *(UNDETERMINED)*	October 1999	SHASTA	26,200	954	1
6	PAINT *(ARSON)*	June 1990	SANTA BARBARA	4,900	641	1
7	FOUNTAIN *(ARSON)*	August 1992	SHASTA	63,960	636	0
8	SAYRE *(MISC)*	Novermber 2008	LOS ANGELES	11,262	604	0
9	CITY OF BERKELEY *(POWERLINES)*	September 1923	ALAMEDA	130	584	0
10	HARRIS *(UNDER INVESTIGATION)*	October 2007	SAN DIEGO	90,440	548	8
11	BEL AIR *(UNDETERMINED)*	November 1961	LOS ANGELES	6,090	484	0
12	LAGUNA FIRE *(ARSON)*	October 1993	ORANGE	14,437	441	0
13	LAGUNA *(POWERLINES)*	September 1970	SAN DIEGO	175,425	382	5
14	HUMBOLDT *(ARSON)*	June 2008	BUTTE	23,344	351	0
15	PANORAMA *(ARSON)*	November 1980	SAN BERNARDINO	23,600	325	4
16	TOPANGA *(ARSON)*	November 1993	LOS ANGELES	18,000	323	3
17	49ER *(BURNING DEBRIS)*	September 1988	NEVADA	33,700	312	0
18	ANGORA (HUMAN)	June 2007	EL DORADO	3,100	309	0
19	SIMI *(UNDER INVESTIGATION)*	October 2003	VENTURA	108,204	300	0
20	SLIDE *(UNDER INVESTIGATION)*	October 2007	SAN BERNARDINO	12,759	272	0

Note that this list does not include fire jurisdiction. These are the Top 20 within California, regardless of whether they were state, federal, or local responsibility. Also note that "structures" is meant to include all loss - homes and outbuildings, etc.

CAL FIRE

11/4/2009

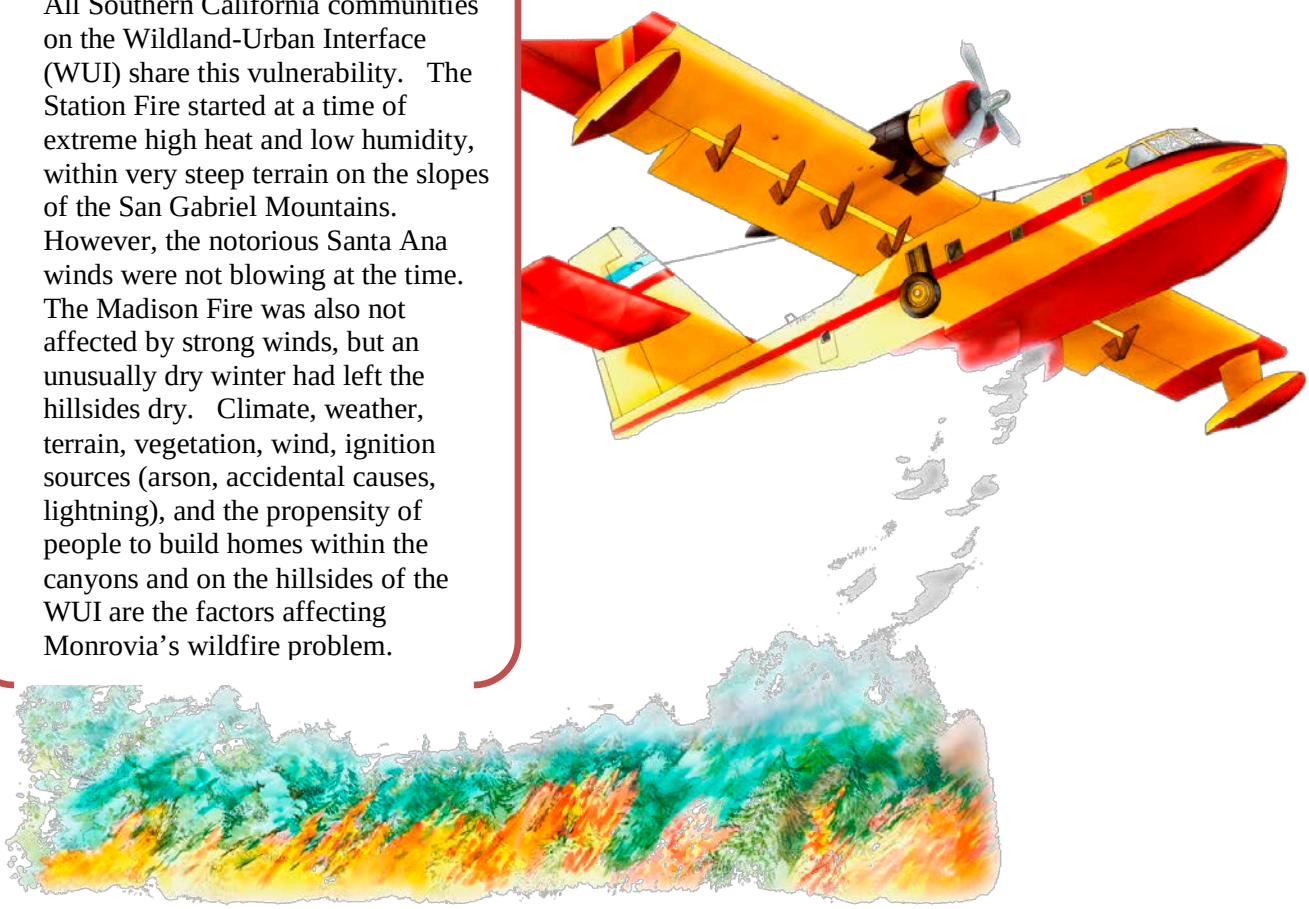
Figure 3-2 Most Destructive California Wildfires (Cal Fire Data)

[4] Cal Fire http://cdfdata.fire.ca.gov/incidents/incidents_statsevents as accessed on 17 September 2013

[5] Cal Fire http://www.fire.ca.gov/communications/downloads/fact_sheets/20LACRES.pdf as accessed on 17 September 2013

[6] Cal Fire http://www.fire.ca.gov/communications/downloads/fact_sheets/20LSTRUCTURES.pdf as accessed on 17 September 2013

The Madison Fire and Station Fire helped focus our attention on our community's vulnerability to fire. All Southern California communities on the Wildland-Urban Interface (WUI) share this vulnerability. The Station Fire started at a time of extreme high heat and low humidity, within very steep terrain on the slopes of the San Gabriel Mountains. However, the notorious Santa Ana winds were not blowing at the time. The Madison Fire was also not affected by strong winds, but an unusually dry winter had left the hillsides dry. Climate, weather, terrain, vegetation, wind, ignition sources (arson, accidental causes, lightning), and the propensity of people to build homes within the canyons and on the hillsides of the WUI are the factors affecting Monrovia's wildfire problem.



3.2. Fire Behavior Characteristics and Terminology

Knowing the attributes of fire behavior is important in order to communicate the various threats from any fire and the benefits of mitigation. Flame lengths, *fire intensity,*[7] *heat output,*[8] rate of spread, residence time, and whether the fire burns on the surface or crown are all ways to describe fire behavior and to relate its resistance to *control*[9] and potential damage or positive impacts from fire. The following paragraphs describe these terms.

Surface Fires

On flat or moderate (<30% slopes = 17 degrees – see Table 3-1 below) terrain in light fuels, fires usually burn as a surface fire. Surface fires may advance quickly with short or long *residence time*[10] and low to high heat output, and as such, they respond well to suppression. A manageable fire is one of the desired results of *fuel modifications.*[11]

[7] Fire Intensity: A measurement of the heat released in an area during a specific amount of time (btu/ft/sec). Intensity has a large influence on an ecosystems' recovery from fire.

[8] Heat Output: The total amount of heat a fire released in a specific area during the passing of the flaming front.

[9] Control: The act of managing a fire, which generally entails a completed control line around the fire.

[10] Residence Time: How long the flaming front burns in any one location.

[11] Fuel Modification: The management of fuels for fire safety. Examples include thinning of vegetation and creation of barriers to fire spread.

Table 3-1 Percent Slope to Slope Angle Conversion

Percent Slope	Slope Angle (degrees)
10	6
20	11
30	17
40	22
50	27
60	31
70	35
80	39
90	42
100	45

Crown Fire Potential

Crowning activity indicates locations where fire is expected to travel into and possibly consume the crowns (or tops) of trees, or the uppermost vegetation layer. In areas of continuous shrub coverage, such as chaparral, the uppermost vegetation layer consists of shrubs. Crown fires typify a fire of high intensity and exhibit high heat output and rates of spread. These attributes challenge suppression efforts. When a fire burns through tree or shrub crowns, countless *embers*[12] are produced and distributed, sometimes over long distances. These embers can start new fires *(spot fires*[13]*)*, which can each grow and confound the finest fire-suppression forces.

Crown fire initiation (or torching) occurs when *ladder fuels*[14] are present, providing a connection between the surface fuels and the crown fuels. The higher the base of the tree canopy from surface fuels, the more difficult it is for crown fires to ignite. Once in the tree canopy, crown fire spread is more likely in dense canopies and with high wind speeds.

Fire Intensity

Fire intensity describes the amount of heat that is released by flaming combustion in a specific unit of time (BTU/ft/sec[15]). This measurement captures the energy of a fire in any location; it is often confused with fire severity, which is a term describing fire effects.

Fire Severity

Fire severity describes the resulting effects of a fire, based on the amount of soil damage and tree mortality. It is determined by observing vegetation and soil conditions after a fire. The relationship between predicted fire behavior characteristics (flame length, heat per unit area, fireline intensity, etc.) and fire severity are being explored but are not yet well established. Long flame lengths, large amounts of torching, crown fire presence, high fireline intensity, and high heat per unit area are all indicators of potentially severe fires.

[12] Embers: Small glowing or smoldering pieces of wood or other organic debris, often dispersed ahead of a fire, also known as firebrands

[13] Spot Fire: A smaller fire outside the boundary of the main fire (usually ahead of the direction the fire is traveling), started by airborne sparks or embers.

[14] Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

[15] BTU: British Thermal Units (heat)/feet/second.

Flame Length

Flame length is the span of the flame from the tip to the base, irrespective of its tilt. This factor most influences the difficulty or ease of fire suppression. Flame length is highly correlated with fire intensity, which can help predict fire severity. Flame lengths that are less than four feet are associated with fires that are more easily controlled—generally with hand crews. In contrast, flame lengths longer than twelve feet often thwart suppression efforts and are associated with crown fires seen on the front pages of newspapers. Typically fuel management goals aim for production of flame lengths less than four feet in areas where managers anticipate suppression efforts.

Rate of Spread

The rate of spread (ROS) measures how fast the *leading edge*[16] of a fire advances. A ROS faster than fire-line-building capacity will challenge fire suppression efforts. High spread rates also indicate the potential for quick changes in fire spread direction, which could endanger firefighters and increase the potential damages. Grass fires can result in very high ROS, possibly exceeding three hundred feet per minute (300 ft/min, or over 3 miles per hour). Slow-burning fires in forested fuel types spread at a rate of two to eight feet per minute. In rare crown fires, rates of spread can exceed one hundred feet per minute (100 ft/min). In extreme conditions such as those found at times during the Station Fire, rates of spread up to 600 ft/min may occur. During the Station Fire, firefighters Hall and Quinones lost their lives at Camp 16 in the Angeles Forest when the advancing fire front overtook them. In analyzing that tragedy, investigators estimated that the fire was advancing at 260—300 ft per minute[17].

Residence Time

The residence time of a fire defines how long the leading edge of the fire burns in any one location. Usually grass fires are consumed quickly and have a short residence time (e.g. 30 seconds), in contrast to the residence time of fires in a deep *duff*[18] layer, which can burn for hours. Foliage and *suspended dead material*[19] are usually consumed in less than 90 seconds. Residence time is useful in predicting tree mortality and potential for fire-induced *hydrophobic*[20] soils.

Heat Per Unit Area

Heat per unit area is defined as the total heat produced by flaming combustion in any one location. This does not include long *burn-out times*[21] and smoldering. Heat per unit area is especially important in determining soil heating and is a fairly good predictor of potential root damage and *cambium*[22] heating, all indicators of fire severity.

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16 Leading Edge: The foremost part of a fire that is guiding the fire in the direction of travel.

17 Los Angeles County Fire Department, Factual Report; Camp 16 Incident August 30, 2009, CA-LAC-09196997. http://www.iaff.org/hs/LODD_Manual/LODD%20Reports/Los%20Angeles%20County,%20CA%20-%20Hall%20and%20Quinones.pdf as accessed on 9/17/2013.

18 Duff: A layer on the forest floor that is made up of decomposing organic matter such as leaves, needles, and small branches.

19 Suspended Dead Material: Typically composed of pine needles that are draped on living brush. Made up of dead fuels not in direct contact with the ground, consisting mainly of dead needles, foliage, twigs, branches, stems, bark, vines, moss, and high brush. In general these fuels easily dry out and can carry surface fires into the canopy.

20 Hydrophobic: Literally meaning "water-fearing" as in a substance such as oil, which does not mix well with water. Also refers to a soil that will no longer absorb water.

21 Burn-Out Time: The length of time in which flaming and smoldering phases occur in a given area or for the whole fire.

22 Cambium: The growing layer of a tree, located between the bark and wood of the stem.

3.3. Monrovia's Wildfire Environment

3.3.1. Topography

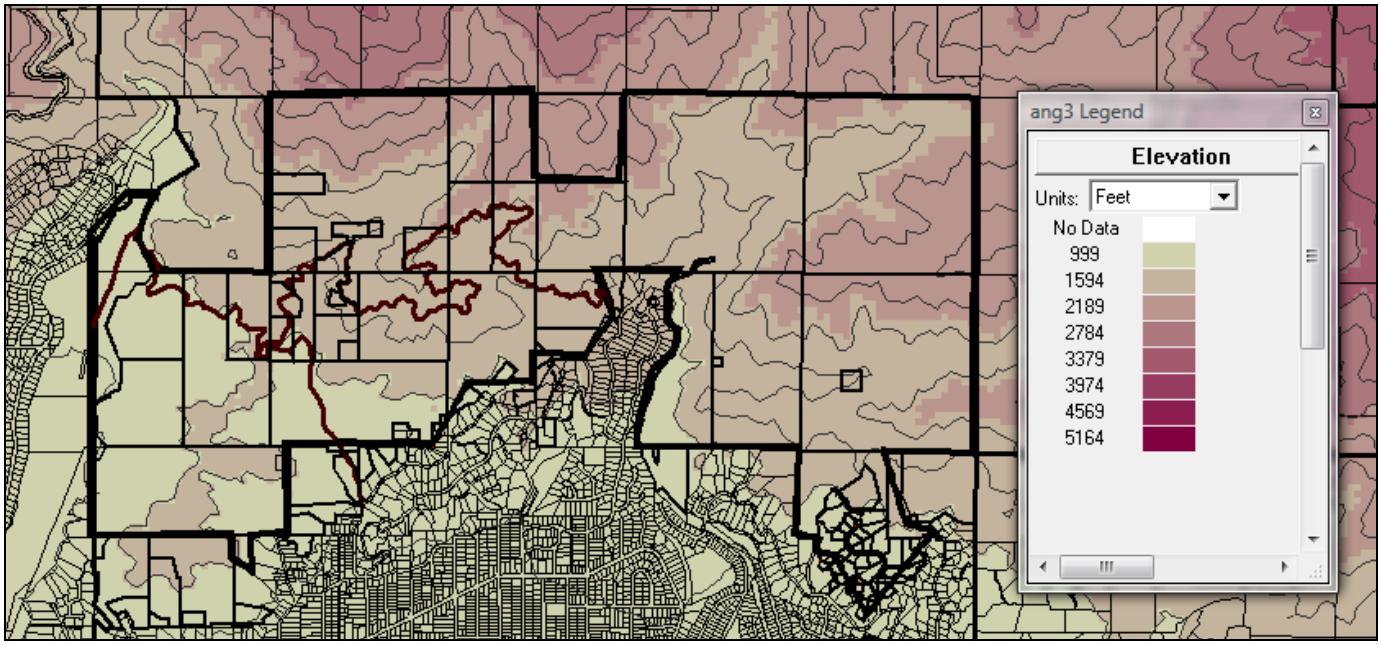


Figure 3-3 Elevations: Monrovia Hillside Wilderness and Vicinity[23]

The topography of the Monrovia foothills is characterized by steep hillsides, deeply incised ravines and canyons, and gently to moderately angled aprons along the mountain front. Topographic features such as slope, *aspect*,[24] and the overall form of the land have a profound effect on fire behavior. Streams, rivers, and canyons tend to channel local *diurnal*[25] and general winds, which can accelerate the fire's speed and affect its direction, especially during *foehn*[26] winds (e.g. Santa Ana winds).

Local winds are greatly affected by topography, which "bends the wind" as it flows around or over land forms. Topography also causes daily upslope and downslope winds. The topographic features of aspect and elevation affect vegetation; solar exposure affects fuel moisture.

[23] Black outline indicates Hillside Wilderness Preserve; Modelling by Shelly Crook.

[24] Aspect: The direction that a slope faces (as in north, south, east, or west).

[25] Diurnal: Belonging to or active during the day.

[26] Foehn Events: A wind that blows warm, dry, and generally strong, creating extremely dry fuel and dangerous fire potential. Southern California's Santa Ana winds are an example of foehn winds.

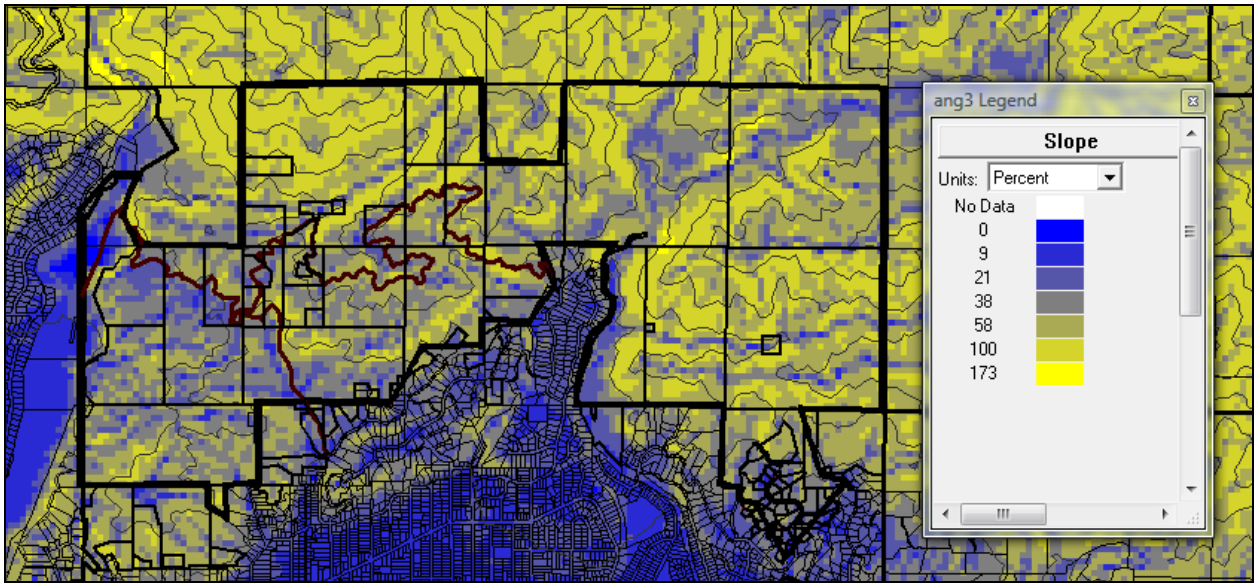


Figure 3-4 Slope Steepness; Monrovia Hillside Wilderness and Vicinity[27]

The major drainage systems in the project area generally run from north to south with tributaries running at an angle. For example, Cloverleaf Canyon runs generally north-to-south and Hidden Valley, a tributary to Cloverleaf Canyon, runs from northeast to southwest. Understanding the drainage relationships is significant because ravines, canyons and valleys create topographic features called chimneys, which can result in a rapid spread of fire up or down-canyon. Fires typically spread 14 times faster in the uphill direction than in the downhill direction, making the top of a chimney one of the most dangerous locations to site a structure. But local down-canyon winds are typical in the late afternoon and early evening of warm days, and these can move fire rapidly in the downhill direction as well. And Santa Ana wind directions can spread fire very rapidly downhill as well.

The shape of Monrovia's WUI is very complex, resulting in situations in which wilderness areas exist downhill and/or downwind of residential neighborhoods. A fire that starts in a wilderness area that is topographically downhill of a residence, or downwind of a residence, may present an increased hazard to that residence.

Figure 3-3 illustrates the topographic contours of the Monrovia hillsides, illustrating elevations from below 1,000 feet (depicted as gray color on the figure) to approximately 2,200 feet (depicted as a medium-light lavender color).

Topography directly and indirectly affects the intensity direction, and spread rate of wildfire. Fires burning in flat or gently sloping areas tend to burn more slowly and to spread in a wider ellipse than fires on steep slopes. Figure 3-4 illustrates the steepness of the slopes found in the Monrovia foothills, which range from nearly flat-lying areas (0-8 degrees – depicted as bright blue on the figure) to nearly vertical cliffs (173-180 degrees – depicted as lemon yellow).

The slope aspect – that is, the direction the slope looks out toward -- is generally south. Aspect is important, as southern aspects are generally hotter and drier, due to being exposed to greater levels of sun exposure. Slopes with a northerly aspect tend to be cooler and moister, and thus typically exhibit more moderate fire behavior than slopes with a southerly aspect. Northerly slopes comprise a relatively small proportion of the project area – we find them along the southern banks of east-west-trending ravines, such as Hidden Valley, where the homes on the southeast side of the street have a typically northerly exposure, and Spanish Canyon (undeveloped).

[27] Black outline indicates Hillside Wilderness Preserve. Modelling by Shelly Crook.

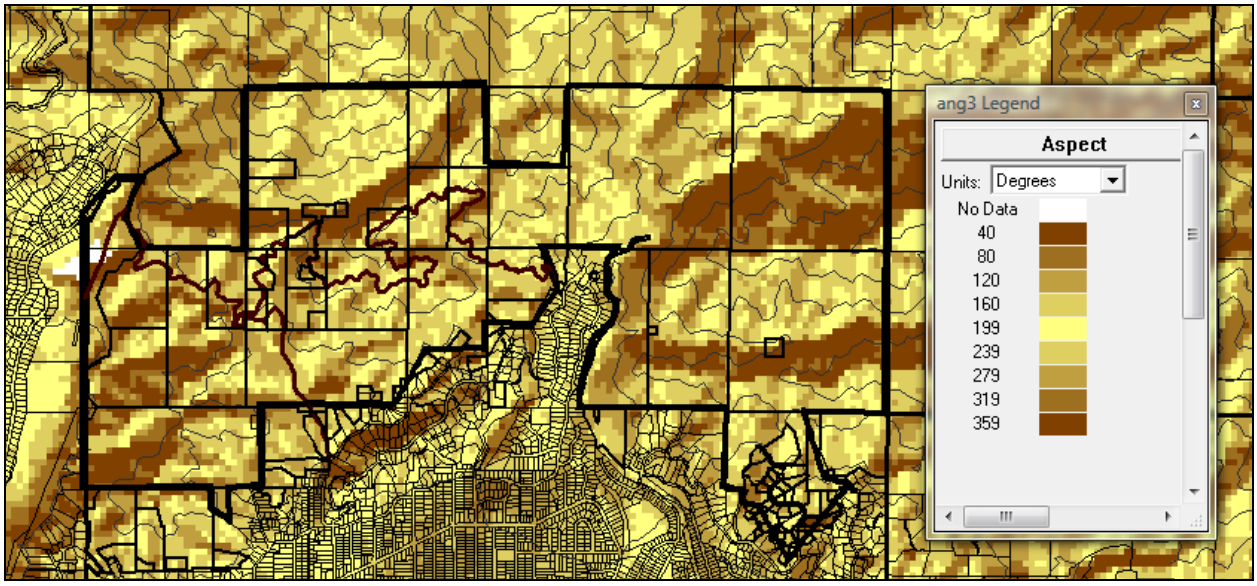


Figure 3-5 Slope Aspect: Monrovia Hillside Wilderness Preserve and Vicinity[28]

3.3.2. Weather

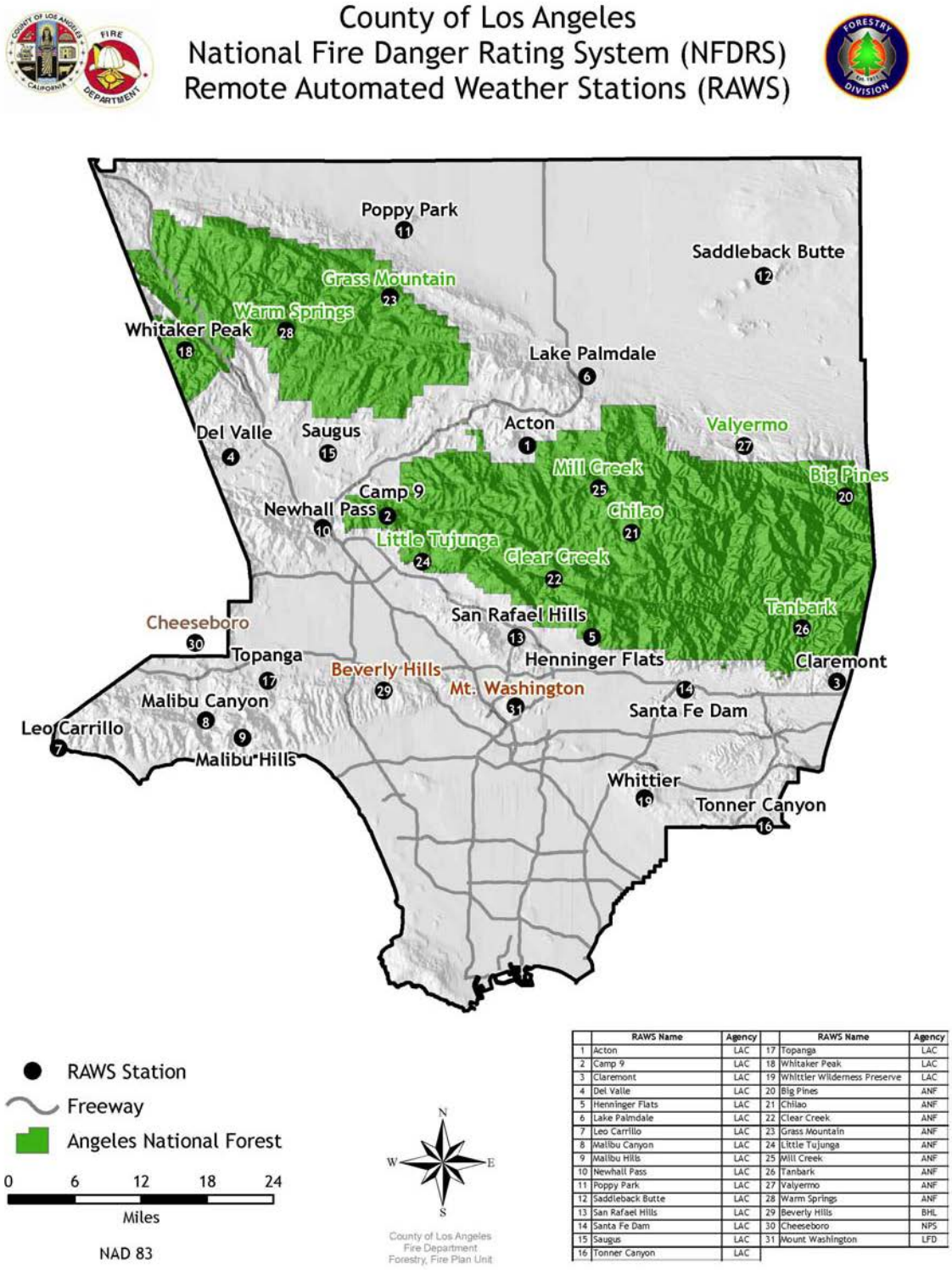
This section describes common weather conditions and weather patterns that exist at the time the most damaging fires could occur, along with routine conditions during which serious fires also may burn.

Because of the importance of up-to-the-minute weather information in understanding wildfire, there are nearly 2,200 interagency Remote Automatic Weather Stations (RAWS) strategically located throughout the United States. These stations monitor the weather and provide weather data that assists land management agencies with a variety of projects such as monitoring air quality, rating fire danger, and providing information for research applications. Most of the stations owned by the wildland fire agencies are placed in locations where they can monitor fire danger. RAWS units collect, store, and forward data to a computer system at the National Interagency Fire Center (NIFC) in Boise, Idaho, via the Geostationary Operational Environmental Satellite (GOES). The GOES is operated by the National Oceanic and Atmospheric Administration (NOAA). The data is automatically forwarded to several other computer systems including the Weather Information Management System (WIMS) and the Western Regional Climate Center (WRCC) in Reno, Nevada. The Los Angeles County Fire Department is the local coordinator for RAWS data and provides a daily assessment of overall wildfire hazard for large sub-areas of the county, which can be accessed on their website at: http://fire.lacounty.gov/Forestry/FireWeatherDanger.asp

Fire managers use this data to predict fire behavior and monitor fuels; resource managers use the data to monitor environmental conditions. Locations of RAWS stations can be searched online courtesy of the Western Regional Climate Center.[29] The locations of RAWS stations in L.A. County is shown in the following map.

[28] Black outline indicates Hillside Wilderness Preserve. Modelling by Shelly Crook.

[29] http://raws.fam.nwcg.gov/, as access on 9/28/13.



	RAWS Name	Agency		RAWS Name	Agency
1	Acton	LAC	17	Topanga	LAC
2	Camp 9	LAC	18	Whitaker Peak	LAC
3	Claremont	LAC	19	Whittier Wilderness Preserve	LAC
4	Del Valle	LAC	20	Big Pines	ANF
5	Henninger Flats	LAC	21	Chilao	ANF
6	Lake Palmdale	LAC	22	Clear Creek	ANF
7	Leo Carrillo	LAC	23	Grass Mountain	ANF
8	Malibu Canyon	LAC	24	Little Tujunga	ANF
9	Malibu Hills	LAC	25	Mill Creek	ANF
10	Newhall Pass	LAC	26	Tanbark	ANF
11	Poppy Park	LAC	27	Valyermo	ANF
12	Saddleback Butte	LAC	28	Warm Springs	ANF
13	San Rafael Hills	LAC	29	Beverly Hills	BHL
14	Santa Fe Dam	LAC	30	Cheeseboro	NPS
15	Saugus	LAC	31	Mount Washington	LFD
16	Tonner Canyon	LAC			

Figure 3-6 Locations of Remote Area Weather Stations in Los Angeles County
http://fire.lacounty.gov/Forestry/PDF/internet_RAWSmap_061411.pdf

The average weather conditions in Monrovia are shown in the following data tables.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average temp. (°F)	50.6	51.7	53.0	57.2	62.2	69.1	74.2	74.5	71.3	64.5	56.0	51.0
High temperature (°F)	61.3	62.6	63.8	68.9	73.4	80.7	85.8	86.2	82.9	76.0	67.5	62.1
Low temperature (°F)	39.7	40.8	42.0	45.5	50.9	57.4	62.4	62.8	59.7	52.8	44.4	39.9
Precipitation (in)	6.0	7.0	6.0	1.6	0.7	0.2	0.1	0.2	0.7	1.1	2.2	3.4

Table 3-3 Normal Climate Around Monrovia, CA[30]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Days with precip.	6	5	5	3	1	0	0	0	1	2	3	5
Wind speed (mph)	5.2	6.0	6.7	7.4	7.1	7.0	6.8	6.6	6.2	5.6	5.2	5.0
Morning humidity (%)	76	78	80	80	81	82	82	82	83	81	79	77
Afternoon humidity (%)	53	54	55	51	55	56	54	53	54	54	53	52

Table 3-2 Average weather in Monrovia, California

Monrovia is located within the South Coast Air Basin, bounded by the Pacific Ocean on the west and the San Gabriel, San Bernardino, and San Jacinto Mountains on the north and east. The regional climate in the South Coast Air Basin is classified as Mediterranean, characterized by warm dry summers and mild, moist winters. The warmest month of the year is July and the coldest is January. Although the climate is considered semiarid, the marine layer keeps the air near the land surface moist on most days. Annual average relative humidity is 71 percent along the coast and 59 percent inland (LSA 2008).

More than 90 percent of rainfall in the South Coast Air Basin occurs from November through April. The majority of precipitation is in the form of rain. Monthly and yearly precipitation is extremely variable. Average annual rainfall along the San Gabriel River corridor varies from approximately 28 inches in the San Gabriel Mountains, to 18 inches in the San Gabriel Valley, to approximately 14 inches on the coastal plain. Average annual precipitation in the City of Monrovia is approximately 20 inches. (LSA 2008).

Weather conditions significantly impact the potential for fire ignition, as well as rates of spread, intensity, and direction in which fires burn. Wind, temperature, and humidity are the more important weather variables used to predict fire behavior.[31] The term "fire weather"[32] refers to weather elements that influence fire ignition, behavior, and suppression. These elements include temperature, relative humidity, wind speed and direction, precipitation, atmospheric stability, and aloft winds.[33] "General winds" is also an accepted term for local winds produced by broad-scale pressure gradients and modified by friction or topographic effects. General winds are combined with slope winds to get actual forecasted wind.

[30] Monrovia LHMP 2013 Update Draft page 17.

[31] Husari, S., T. Nichols, N.G. Sugihara, and S.L. Stephens (2006). "Fuel Management." In: N.G. Sugihara, J. van Wagtendonk, K.E. Shaffer, J. Fites-Kaufman, and A.E. Thode, editors. *Fire in California's Ecosystems.* Berkeley: University of California Press. Pp. 444–465.

[32] Fire Weather: The various types of weather that affect how a fire ignites, behaves, and is controlled.

[33] Aloft Winds: Upper winds that occur in the atmosphere above the surface level, generally 2,000 feet and higher.

Wind is considered the most variable and difficult weather element to predict, while wind direction and velocity profoundly affect fire behavior. Wind increases the flammability of fuels by removing moisture through evaporation, by pre-heating fuels in a fire's path, and increasing spotting distances (the distance at which a spot fire might be set by a flying ember). Wind velocities and directions may vary in vertical elevation, with somewhat different impacts on fire behavior. The direction and velocity of surface winds can directly control the direction and rate at which the fire spreads. Winds that blow at least 20 feet above the ground can carry embers and firebrands downwind, causing spot fires to precede the primary front.

Winds in Monrovia vary by season and time of day. Furthermore, winds are typically stronger in the canyons within the WUI than they are within the lower, flatter portions of the project area.

The most significant winds are the infamous Santa Ana winds, which often accompany the fire season. They are also called foehn or Chinook winds. Santa Ana winds are blustery, warm – (often hot) – dry winds that blow from the east or northeast. These occur below the passes and canyons of the coastal ranges of Southern California and in the Los Angeles basin. Typically they occur from October to March when cooler air in the desert increases air pressure and creates strong westerly winds. Generally speaking, wind speed must reach 25 knots to be classified as a Santa Ana wind.[34]

The map at right shows the direction of the Santa Ana winds as they travel from the stable, high pressure weather system called the Great Basin High through the canyons and towards the low pressure system off the Pacific. Areas of Los Angeles County are in the direct path of the ocean-bound Santa Ana winds.

Fires during foehn events usually result in extreme fire behavior because the winds are particularly strong and dry, thus preheating fuels and predisposing them to burning with intensity. These conditions are usually worse at night, as these foehn winds combine with downslope/down-canyon diurnal winds.

When the temperature is high, relative humidity low, wind speed is high and/or originating from the east in a foehn wind, conditions are very favorable for extensive and severe wildfires. In order to assess immediate wildfire hazard, various agencies (including Los Angeles County) take measurements of the moisture level in different size ranges of fuels from fine fuels *(1-hour[35])* to medium fuels (*10-hour fuel[36])* to heavy fuels (*100-hour fuel[37]*).

[34] Monrovia Disaster Mitigation Plan (MDMA) 2004 p. 305

[35] 1-Hour Fuel: Fuels that are less than ¼ inch in diameter. These fuels will only take about an hour to lose or gain two-thirds of the equilibrium moisture content of their environment.

[36] 10-Hour Fuel: Fuels that range in diameter from ¼ inch to 1 inch, and take about ten hours to lose or gain two-thirds of the equilibrium moisture content of their environment.

[37] 100-Hour Fuel: Fuels that range from 1 inch to 3 inches and take about 100 hours to lose or gain two-thirds of the equilibrium moisture content of their environment.

3.3.3. Vegetation and Fuels and Classification of Vegetation

The vegetation of Monrovia's hillsides can be classified in a variety of ways. The classification typically used by ecologists may be familiar to many Monrovians, and will be presented in another chapter of this CWPP (Ch. 4)[38]. That system is useful for characterizing subtle contrasts in the assemblage of plants, while understanding ecology and resource conservation.

Fire fighters and planners use a broader classification system to facilitate the prediction of fire behavior, known as "fuel models", which we present in the current chapter. Fuel models offer a system that planners can use to assess relative levels of wildfire hazard and that fire fighters can use during a wildfire incident to facilitate "real-time" predictions of where the fire will go next, how fast, and what equipment is needed to fight it. We will use this system below in characterizing the wildfire environment for Monrovia's foothills, while subsequent chapters will combine this information with ecological values.

We will speak of vegetative and man-made fuels – basically anything that can burn, including plants, fences, decks, furniture, cars, and houses. Fuels vary by size, height, and density. The volume and distribution of fuels, the *moisture content,*[39] and the arrangement of fuels greatly influence resulting fire behavior.

Vegetative fuel includes any plant material that can burn: grass, shrubs, and trees, live or dead, planted or wild. We may categorize it generally in terms of sizes and volumes: light fuels (consisting of grass, dry leaves, and kindling-size twigs), medium fuels (shrubs), or heavy fuels (logs and trees). To add more precision and predictive ability, we also characterize the distribution of the volume and sizes of fuels in any one space, along with the moisture content and arrangement of fuels, which greatly influence resulting fire behavior. These observations are utilized in developing the fuel models, as described in Section 3.4 below.

3.4. Fuel: Description of Fuel Through Fuel Models

A fuel model is a standardized description of fuels available to a fire based on the amount, distribution, and continuity of vegetation and wood[40]. Fuel models distinguish between vegetation such as tall and short chaparral, tall and short grass, timber with and without an understory, and oak woodland with and without understory vegetation. They describe the structure (or arrangement) of the vegetation primarily, as well as the kinds of plants that grow in the vegetation. The original fuel model classification system identified 13 different fuel models for the United States, and this system is still in wide use[41]. For planning purposes, fire managers distinguish 255 fuel models within the current United States Fire Behavior Prediction System (US FBPS). Fire behavior prediction models are useful because they forecast how fast a fire will spread, or how damaging the fire might become (in terms of fire intensity), or whether it is likely to torch in the area. Information regarding fuel volumes and fire behavior descriptions is available from the publication *How to Predict the Spread and Intensity of Forest and Range Fires.*[42]

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[38] Holland, 1986 and Sawyer, Keeler-Wolf and Evens, 2009.

[39] Moisture Content: The dry weight of a material, such as wood or soil, compared to the wet weight of the same material. It is not unusual for live material to have a moisture content greater than 100% because it could contain more water than solid material by weight.

[40] Scott, Joe H.; Burgan, Robert E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

[41] NWCG 2006, National Wildfire Coordinating Group, NWCG Fireline Handbook Appenix B Fire Behavior, April, 2006.

[42] Rothermel, Richard C. (1983). General Technical Report INT-143, published by the USDA Forest Service Intermountain Forest and Range Experiment Station.

Fuel models describe vegetation structure, in addition to typical species composition; structure largely determines the fuel that will actually support the fire. In a vegetation type with more than one layer, or story, such as a forest, the understory is more important than the overstory. The most significant factor is the amount and distribution of smaller-diameter fuels, because these materials generally spread wildland fires. A grassy field with oak trees that cover less than one-third of the slope would be classified as a grass fuel model because the contribution of oak leaves and branches to fire behavior may be negligible. Another important factor in fuel models is the amount and size of dead biomass; dead biomass contributes fine fuel litter as well as carries flames more readily.

Overall, the 255 fuel models fit into the following general classes:

(NB) Nonburnable*	(GS) Grass-Shrub	(TU) Timber-Understory	(SB) Slash-Blowdown
(GR) Grass	(SH) Shrub	(TL) Timber Litter	

** Nonburnable does not necessarily mean non-combustible, only that ignitions will typically occur either via wind-blown embers or house-to-house ignition. However, if suburban vegetation is sufficiently dense to carry the fire, then the area will be classified according to one of the other fuel models.*

Fuel model classifications were determined for the Monrovia foothills based on available land cover data as confirmed by on the ground surveys during early 2010, as illustrated in Figure 3-7 below.[43]

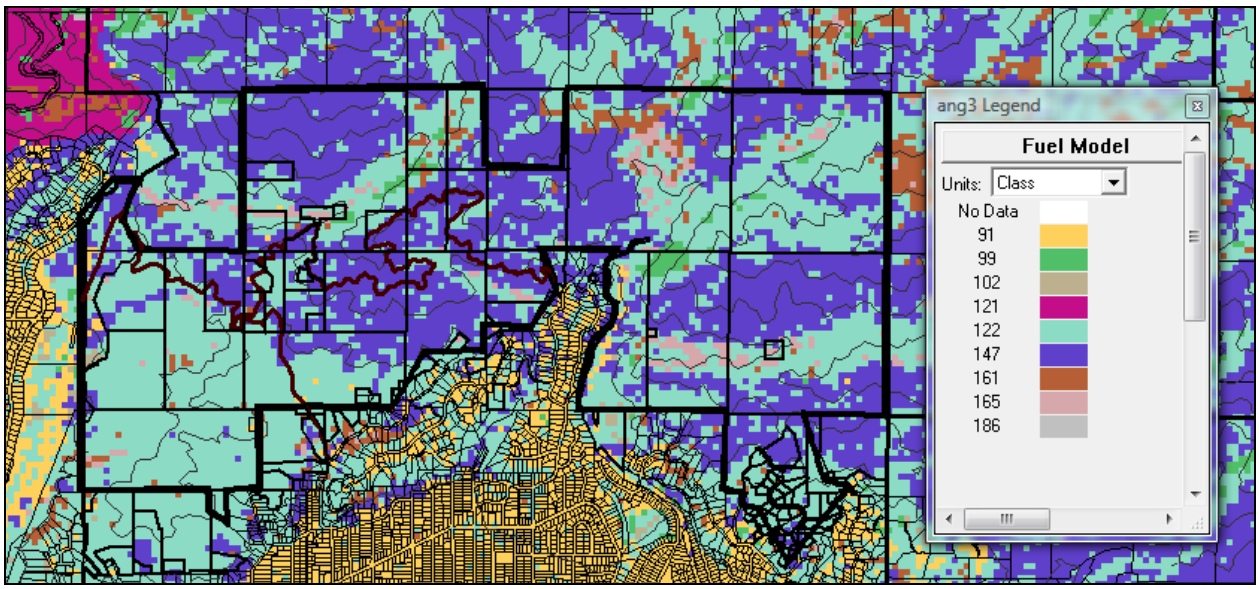

Figure 3-7 Vegetation (Fuel Model) - Hillside Wilderness Preserve and Vicinity

The key to the fuel models in the above fuel map is as follows:

Code #	Color on Map	Fuel Type Code	Fuel Type Description
91	Yellow	NB1	Non-burnable* – urban/developed
99	Green	NB9	Non-burnable – bare ground
102	Tan	GR2	Short grass; low load, coarse, dry climate
121	Fuchsia	GS1	Grass-shrub mix; very low load, dry climate
122	Light blue	GS2	Grass-shrub mix; low load, dry climate
147	Dark blue	SH7	Shrub; very high load, dry climate
161	Orange-brown	TU1	Timber-grass-shrub; low load, dry climate
165	Pink	TU5	Timber-shrub; very high load, dry climate
186	Gray	TL6	Not Applicable in Project Area

[43] Shelly Crook, Fire Behavior Analyst, 2010.

Non-burnable Fuel Models (NB)

This fuel model should be approached with caution, as it only refers to the status of the wildland vegetation, where it is absent or too sparse to carry the fire. However, it is important to remember that there may be manmade fuels, such as buildings, vehicles, furniture, stored items, etc., that could carry fire. If suburban landscaping is sufficiently dense to carry the fire, then the area should be classified according to one of the other fuel models. If the plants are maintained truly "clean, lean and green", well-separated from each other and from other combustible items, then we say that the home has adequate defensible space, and the "NB9: non-burnable/urban-developed" fuel model should apply. However, the maintenance of that defensible space landscaping may change over time, so an area mapped as "non-burnable/urban-developed" could change in a short time due to neglected or overgrown landscaping.

Grass Fuel Models (GR)

Grassland fuels (both annual and perennial) are fairly uniform and homogeneous compared to other fuel types. Grasslands generally have a light total fuel load, made entirely of fine herbaceous material that cures in the summer. This material responds to changes in humidity and is easily ignited in dry periods. It is characterized by the USDA Forest Service Fire Behavior Prediction System as:

> *"Grasslands and savanna are represented along with stubble, and grass-shrub combinations where shrubs cover less than one-third of the area. Annual and perennial grasses are included in this fuel model."*

Grasslands fuel type normally has under 3 tons/acre of fine fuel, and a *fuel bed height*[44] of approximately 18 inches. Fires will go out if moisture content is greater than about 12-15% (known as the "moisture of extinction".)

Grass fuels do not produce much heat, but they produce a fire that travels quickly. Thus containment is the greatest challenge in these fuel types. Grass also serves as a wick to more hazardous fuels that are apt to cause more damage. It provides an avenue for fire to travel to densely vegetated areas and build up enough of a "head of steam" to burn into those areas, or other types of fuels under conditions that would not sustain a fire by themselves.

Grass-Shrub Fuel Models (GS)

The primary carrier of fire in the GS fuel models is grass and shrubs combined; both components are important in determining fire behavior.

All GS fuel models are dynamic, meaning that their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model.

In fuel model GS2, shrubs are 1 to 3 feet high, grass load is moderate. Spread rate is high; flame length moderate. Moisture of extinction is low (15%).

[44] Fuel Bed Height: A measurement of the height of fuel composition from the ground surface.

Shrub Fuel Models (SH)

The primary carrier of fire in the SH fuel models is live and dead shrub twigs and foliage in combination with dead and down shrub litter. Fuel Model SH7 is woody shrubs and shrub litter with a very heavy shrub load, depth 4 to 6 feet. Spread rate is high; flame length very high. The moisture of extinction is roughly 30%.

Fires in SH7 are not easily ignited, but when fire does travel through the stand, it almost always creates long flame lengths and rapid spread, resulting in an intense fire.

This vegetation is described in the Fire Behavior Prediction System:

> *"Fire intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrub, six or more feet tall, such as California mixed chaparral...are typical candidates. Besides flammable foliage, there is dead woody material in the stand that significantly contributes to the fire intensity. Height of stands qualifying for this model depends on local conditions. There may be also a deep litter layer that confounds suppression efforts."*

This fuel model has a large portion of fuel as foliage in the canopy. The fuel loading by size class follows: Fine dead fuels (<¼" diameter) represent 5.01 tons per acre. Fuels which are ¼ to 1 inch diameter total 4.01 tons/acre, and fuels between 1 and 3 inches diameter total 2.0 tons per acre. Live herbaceous fuels are not a significant component in this fuel model; however, live woody fuels constitute 5.01 tons per acre of fuel.

Timber-Understory Fuel Models (TU)

The primary carrier of fire in the TU fuel models is forest litter in combination with herbaceous or shrub fuels. TU1 contains live herbaceous load which varies with year and season (for example, annual grasses, which die out in summer), causing the live herbaceous moisture content to vary. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model. In TU1 the spread rate flame length are typically low and the moisture of extinction is typically 20%. TU5 contains heavy forest litter with a shrub or small tree understory. The spread rate and flame length are moderate and the moisture of extinction is 25%.

The surface fuels in Monrovia TU areas may consist principally of compact oak leaf litter within oak woodlands. Fire intensity, flame lengths, and scorch heights are usually low in oak woodlands. Oak woodlands are characterized as follows in the Fire Behavior Prediction System:

> *"Slow-burning ground fires (carried in the compact litter layer) with low flame heights are the rule, although the fire may encounter an occasional 'jackpot' or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed-canopy stands … that have leafed out support fire in the compact litter layer ... since little undergrowth is present in the stand."*

The resulting fire behavior is rather benign. Rates of fire spread are slow, approximately 2 feet/minute. Flame lengths are predicted to be 1 foot. Leisurely spread rates, combined with the relatively short flame lengths of the predicted fire behavior, demonstrate a manageable, moderate fire hazard in this fuel type.

Fuel conditions in oak woodlands vary with the slope, age, height, and canopy closure of the over story, depth of the litter, and density of understory shrub cover. Under severe weather conditions involving high temperatures, low humidity's, and high winds the fuels pose fire hazards. Ground-layer and understory fuel loads beneath dense oaks may be minimal (well under 1 ton/acre), but horizontal fuels may be continuous and ladder fuels present where the vertical distribution of foliage is continuous.

Even though TU/woodland vegetations can be seen on the map to cover less area in Monrovia than shrub types, much attention will be paid in the subsequent chapter to the management of fuels within woodlands. This is because many Monrovia neighborhoods were developed within oak and riparian woodlands, and, furthermore, because these areas are particularly important ecologically.

The above fuel models were combined with weather information to model predicted fire behavior using the FARSITE program, and yielded results illustrated in the following graph. It shows the size of predicted fires, in acres, after one and two days.

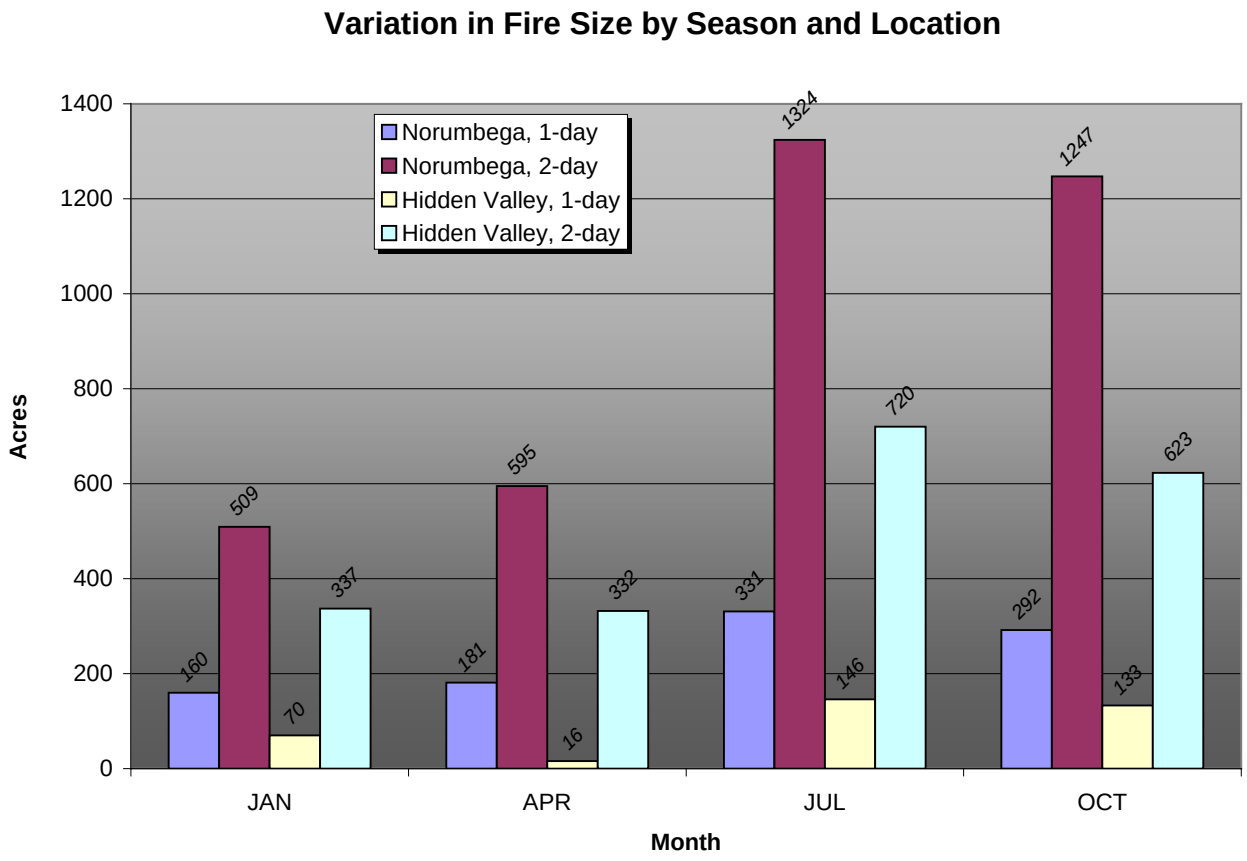

Figure 3-8 FARSITE Fire Modeling Predicted Fire Size

3.5. Fire History

The fire history of an area is a description of the time, space, and cause of fires in the planning area. The fire history of an area is important because it illustrates the potential for future fires. Large fires often repeat themselves; thus it is useful to understand burning patterns over time. An area's fire history also portrays ignition patterns that can target effective prevention programs.

Fire records maintained by the Los Angeles County Fire Department between the years 1919 and 1999 indicate that large portions of the Foothill area have been subject to wild land fires of 100 to 500 acres. The major fire threat exists in the steeper slopes of the San Gabriel Mountains to the north and their potential to sweep into the hillsides and residential foothill developments. The Bradbury fire in the summer of 1981, and the three 1999 fires known as the Azusa Canyon fire, the La Canada-Flintridge-Glendale-Rafael fire, and the Arcadia-Santa Anita fire, all attest to the extensive damage that can take place from brush fires.[45]

The history of California wildfires indicates that the following trends will continue:

- ✓ Risk from wildfire to life, property, natural resources, and firefighter safety is increasing.
- ✓ Population will grow and more people will live and use wildland areas.
- ✓ Topography and climate support ecosystems where large wildfires can be expected.
- ✓ Drought and fuel moisture conditions will be unpredictable but almost always dangerous in fire season.
- ✓ More structures will be constructed in areas that are very susceptible to wildfire.
- ✓ Historical legacy of narrow roads, difficult entrance, insufficient water supplies, flammable building construction and location that make many communities and homes wildfire-prone still exits.
- ✓ Public demand for wild land fire protection and other services will increase.
- ✓ Assets at risk will increase, especially watershed assets, because of the rapid rise in the demand for water to supply more people. Based on population projections, the potential for accelerating loss of protected assets, especially life and property, will be greater from disastrous wildfires.

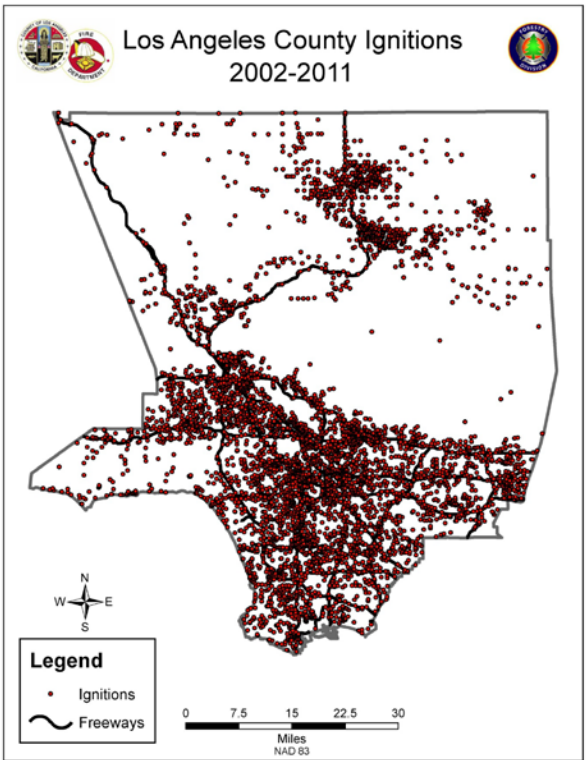

Figure 3-9 Wildfire Ignition Locations, Preliminary Data, Los Angeles County, 2002-2011[47]

The pattern of fire ignitions is indicated in the adjacent map, showing wildfire ignitions Los Angeles county-wide.[46]

[45] MDMA 2004 p.265

[46] County of Los Angeles Fire Department 2013 Strategic Fire Plan, 6/15/2013. http://cdfdata.fire.ca.gov/pub/fireplan/fpupload/fpppdf1488.pdf , as accessed on 8/7/14

3.6. Fire Hazard

The term "hazard" is usually used in the fire community in relation to topography and *fuel complex*[48] (the volume type, condition, arrangement, and location of fuels).[49] Fire hazard is influenced by past disturbances. The history of fire or management activities greatly alters the hazard for better or worse by changing the overall moisture of the site, as well as the volume and spatial arrangement of the fuels. This history is characterized by three fire management eras: the time before human occupation when lightning was the only ignition source, the era of Native American occupation when fire was used extensively, and the era after European Settlement as discussed in the Fire History section above."[50]

3.7. Fire Regime

The fire regime is an objective measurement of fire's natural occurrence in the landscape, which is not necessarily the current condition or appearance. The fire regime includes the season, frequency, intensity, and spatial distribution of fires. There is quite a wide variability of "natural" intervals, intensities, and seasons, but some generalities can be made. Each vegetation type will have its own fire regime. A standardized set of five fire regimes has been generally accepted nationwide.[51],[52]

The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of over story replacement) of the fire on the dominant over story vegetation. These five regimes include:

I: 0 to 35-year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant over story vegetation replaced);

II: 0 to 35-year frequency and high (stand replacement) severity (greater than 75% of the dominant over story vegetation replaced);

III: 35- to 100+-year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);

IV: 35- to 100+-year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);

V: 200+-year frequency and high (stand replacement) severity.

As scale of application becomes finer, these five classes may be defined with more detail, or any one class may be split into finer categories.

Monrovia's natural hillside vegetation applies principally to Fire Regime III: 35-100+ year historic fire return interval and mixed severity, as illustrated in the following map.

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[47] http://fire.lacounty.gov/Forestry/PDF/internet_RAWSmap_061411.pdf

[48] Fuel Complex: The volume type, condition, arrangement, and location of fuels.

[49] Husari et al. 2006.

[50] Stephens, S.L., and N.G. Sugihara (2006). "Fire management and policy since European settlement." In: Sugihara, N.G., J. van Wagtendonk, K.E. Shaffer, J. Fites-Kaufman, and A.E. Thode, editors. *Fire in California's Ecosystems.* Berkeley: University of California Press. Pp. 431–443.

[51] Hardy, K.M., C.C. Schmidt, J.M. Menakis, and N.R. Samson (2001). "Spatial data for national fire planning and fuel management." *International Journal of Wildland Fire* 10: 353–372.

[52] Hann, W.J., and D.L. Bunnell (2001). "Fire and land management planning and implementation across multiple scales." *Int. J. Wildland Fire* 10: 389–403.

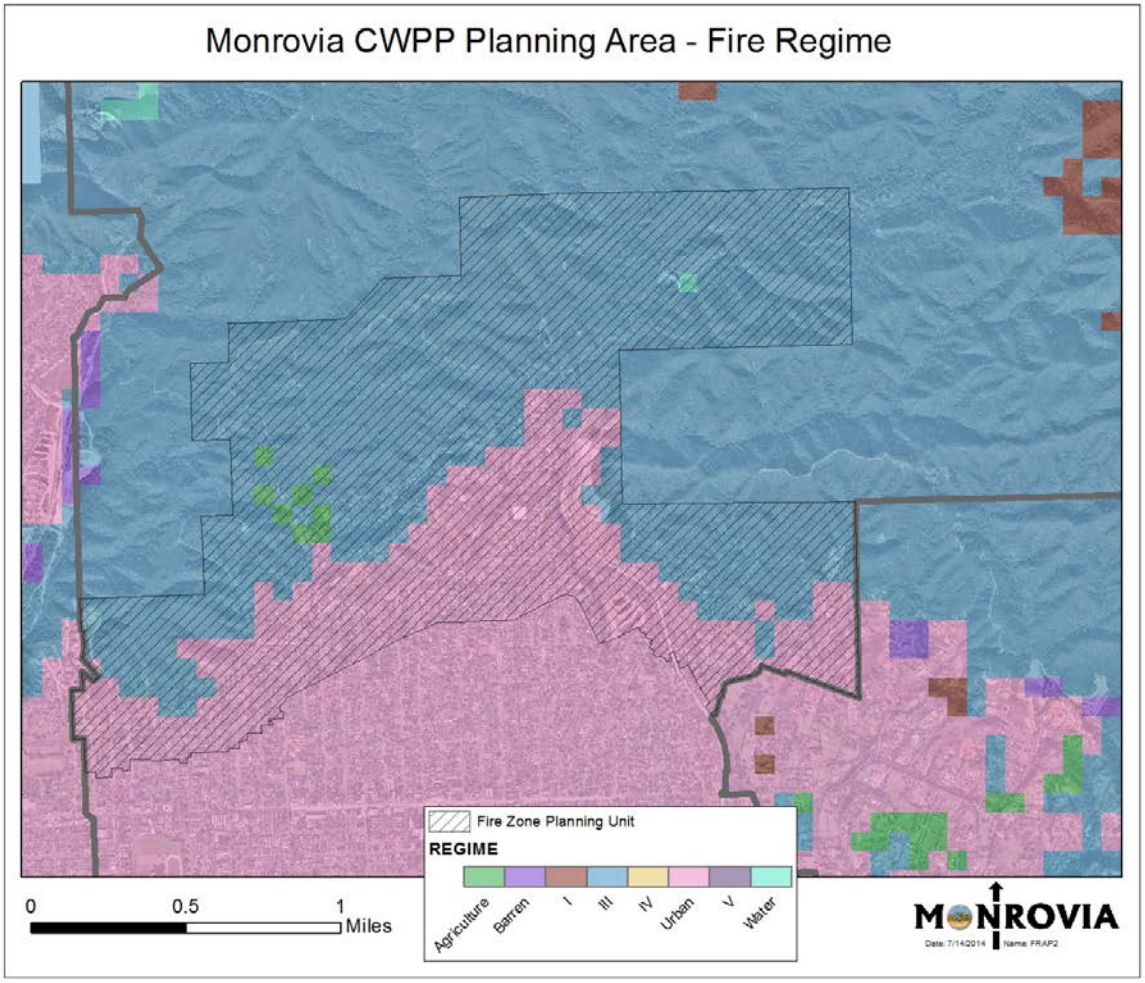

Figure 3-11 Fire Regime of Monrovia Foothills

3.7.1. Fire Condition Class

The difference in fire regime between pre- and post-European settlement is described by the condition class. This is a subjective measurement, but mapping of the fire regime condition class has been done nationwide and is widely applied in areas where fire suppression has radically altered the fire hazard. Condition class is a measure of the departure from the norm, or natural state. This departure may go in one direction or the other – fires may be less frequent or more frequent now than in the historical/natural regime. Where the condition class indicates that fire has been absent for an unnaturally long time, the hazard and potential damages are high to both the environment and human improvements in the area – we might expect the next fire to be particularly severe. Where the condition class indicates that fires are occurring more frequently than in pre-settlement times, while it would be difficult to predict the severity of the next fire, we expect that there are likely to be ecological effects, such as the conversion of a shrub vegetation to one of annual grasses. The Monrovia foothills exhibit the full range of condition class, as can be seen in the accompanying Figure 3-12.

Condition class is mapped by overlaying a map of natural fire regime over historical fire perimeters, and may result in a very complex pattern, or mosaic, as is the case in Figure 3-12.

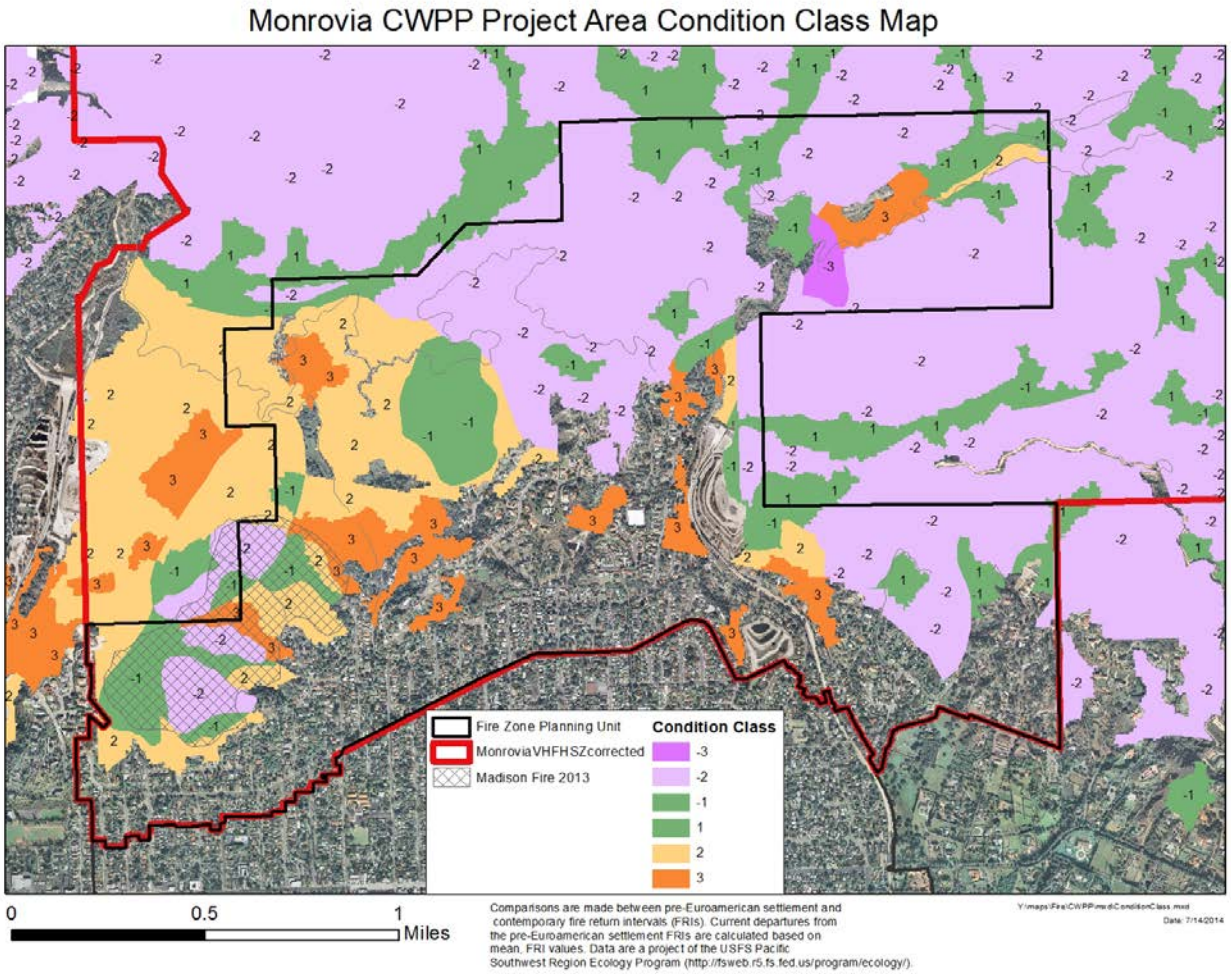

Figure 3-12 Condition Class of Monrovia Hillsides

EXPLANATION:

Condition Class	Degree of Departure from Historical Natural Fire Regime	Direction of Departure From Historical Natural Fire Regime
FRCC 3	High	Fire is less frequent at present than norms
FRCC 2	Moderate	Fire is less frequent at present than norms
FRCC 1	Low	Fire is less frequent at present than norms
FRCC -1	Low	Fire is more frequent at present than norms
FRCC -2	Moderate	Fire is more frequent at present than norms
FRCC -3	High	Fire is more frequent at present than norms

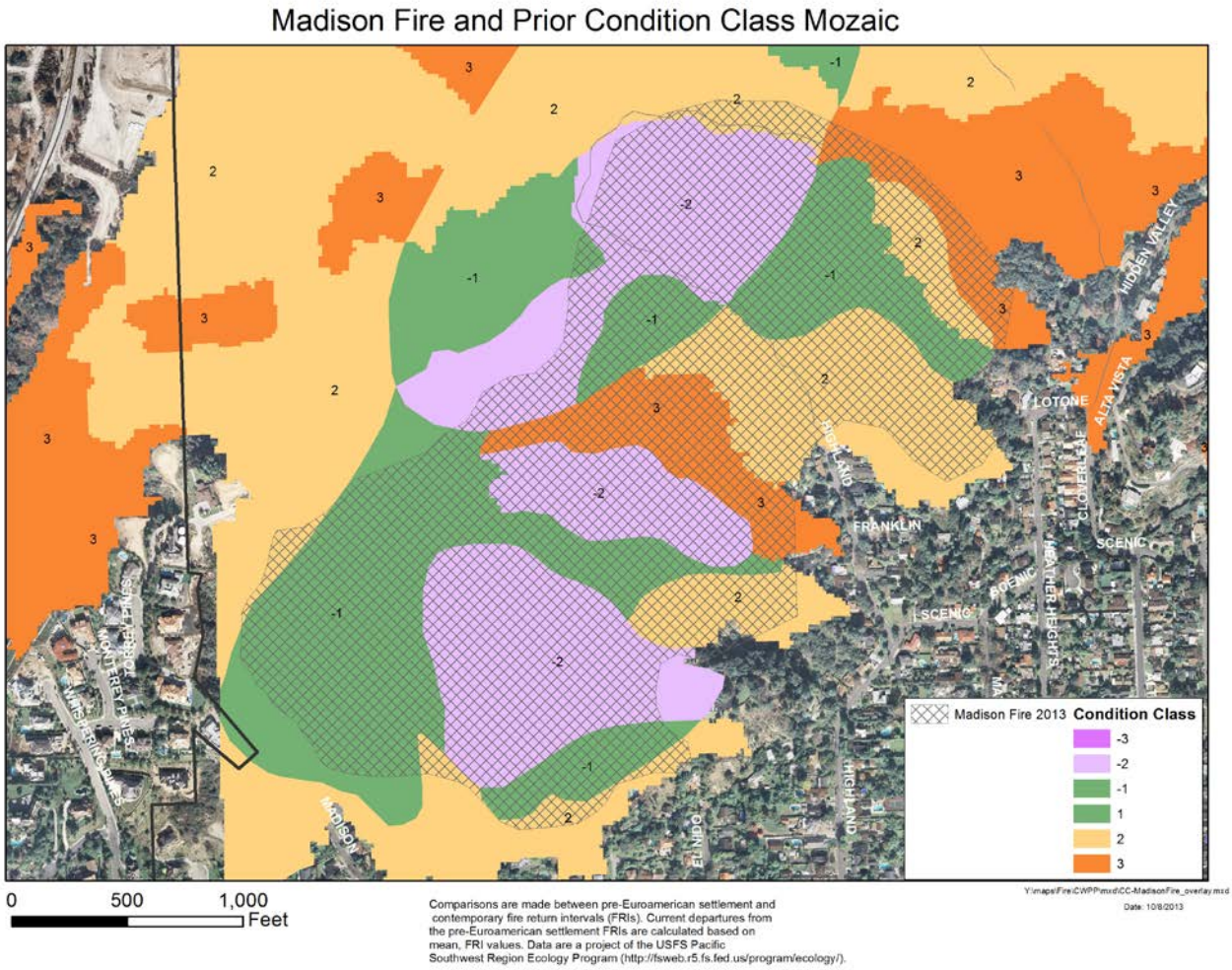

Figure 4-13 Madison Fire Perimeter and Condition Class Prior to Fire

The six classes are based on low (FRCC[53] 1 or -1), moderate (FRCC 2 or -2), and high (FRCC 3 or -3) departure from the central tendency of the natural (historical) regime. "Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside."[54] Areas considered at a high or moderate departure from the natural regime may be experiencing dramatic increases in fire behavior, intensity, severity, and fire size, or suffering ecological changes.[55]

The greater the departure from the natural fire regime, the greater the variations to ecological components and the higher the risk of losing *key ecosystem components.*[56] For example, FRCC 3 classification means that fire regimes have been greatly altered from their natural range and likewise, vegetation characteristics have been dramatically altered from their natural range. As another example, FRCC 2 classification means that fire regimes have been

[53] Fire Regime Condition Class website (October 2006), Definition, www.frcc.gov.

[54] National Wildfire Coordinating Group. "Fire Regime Condition Class Definition. " (June 2003) www.nwcg.gov/teams/wfewt/message/FrccDefinitions.pdf

[55] Fire Regime Condition Class website, Definition, (October 2006), www.frcc.gov

[56] Key Ecosystem Component: An important piece of an ecosystem such as soil, native species, or mature/rare habitats, which are essential to the stability of an ecosystem.

moderately altered from their natural range, resulting in vegetation characteristics that have been moderately altered. The risk is also moderate.

Fuel management projects may attempt to restore the vegetation type and structure. Thus fuel management can move a condition class to one more closely resembling pre-European settlement, regardless of recent fire history.

The condition class in the planning area ranges from FRCC -3 to FRCC 3, based on national data developed by Cal Fire's Fire Resource and Assessment Program (FRAP). The data on which the map was based has not been updated to include the Madison Fire in 2013, so the Madison Fire perimeter has been exhibited on the map, indicated by the hatchured pattern. A detailed view of the Madison Fire Perimeter is presented in Figure 4-13, overlaid over the condition class data. Figure 4-13 exhibits that the extent of the Madison Fire does not appear to have been affected by the condition class of the existing vegetation, as it burned through patches of condition classes representing nearly the full spectrum.

3.8. Changing Fuels in the Wildland Urban Interface

The above information and assessments provide a context and history of the changing fire environment. Many recognize that the changing fire environment, climate change and the increasing encroachment of neighborhoods into the foothill canyons and ridges, have created conditions where human life and property, as well as key ecosystem components, are at increasing risk from the effects of wildfires.

Unlike the coniferous forests of northern California, where experts agree that the history of fire suppression has increased the severity of fires and disrupted the natural forest ecology, fire ecologists increasingly recognize that the story is not so simple in the Southern California shrub lands, such as those that characterize the Monrovia foothills. In fact there is current debate and even controversy among fire experts regarding this issue. It is no longer accepted by all that prehistoric chaparral fires were more frequent and smaller than those of the current day. Recent wildfires such as the Silver Fire (summer 2013 – San Jacinto area) that have re-burned areas of "young" chaparral are pointing to a different viewpoint, in which it is argued that prehistoric chaparral fires were generally infrequent, and were often as large in extent as our current-day mega-fires, so that the relative youth or age of the chaparral has little bearing on the overall size of the fire. A further point is not disputed – that is, when a patch of chaparral is not allowed to fully mature, but instead burns at a relatively high frequency, it tends to become invaded and taken over by easily-ignitable weeds of a type that are called "light, flashy fuels" which create their own set of fire and environmental problems. Subsequent chapters will address in detail the question of how to best manage shrub and chaparral vegetation in view of these conflicting trends.

3.9 Maps of Monrovia Wildfire History

The wildfire history of the Monrovia area is illustrated in a series of maps (Figures 3-10a – f) included below. The maps show fire perimeters from 1900 to 2013 and indicate that the majority of Monrovia's hillside areas have burned at least once in this 100-year-plus time period.

Figure 3-10a displays the wildfire history of Monrovia from 1900 to 2002, showing areas with overlapping fire perimeters in progressively darker shades of orange as the same area burned repeatedly. The remainder of the maps (Figures 3-10b – f) show the historical fire activity within various time periods.

Note: The maps include only the large wildfire incidents from CalFire's database. It does not include small starts of 1-2 acres that were suppressed quickly – historical data on these small incidents is not available.

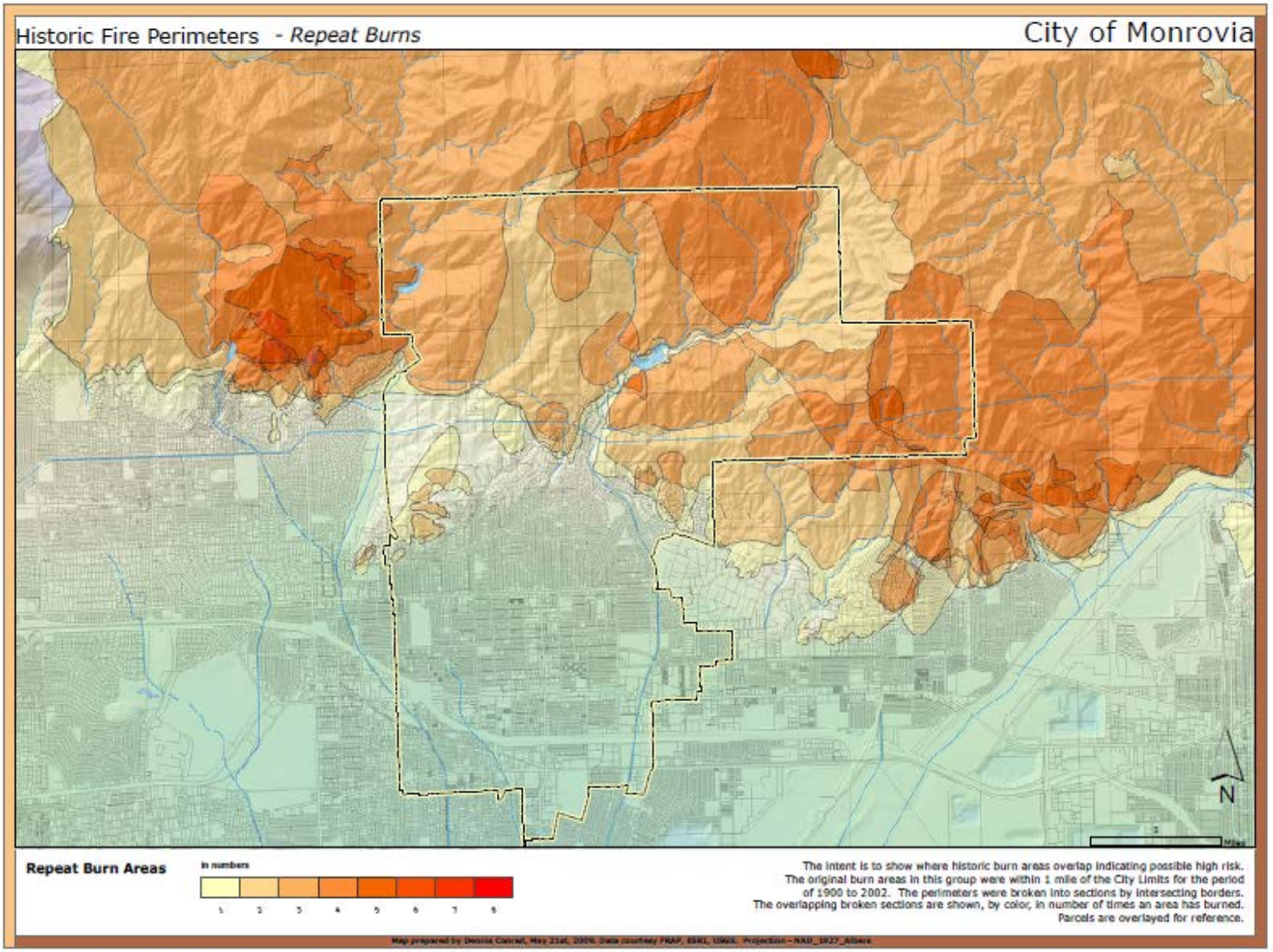

Figure 3-10a - Monrovia Fire History - Repeat Burns 1900-2002

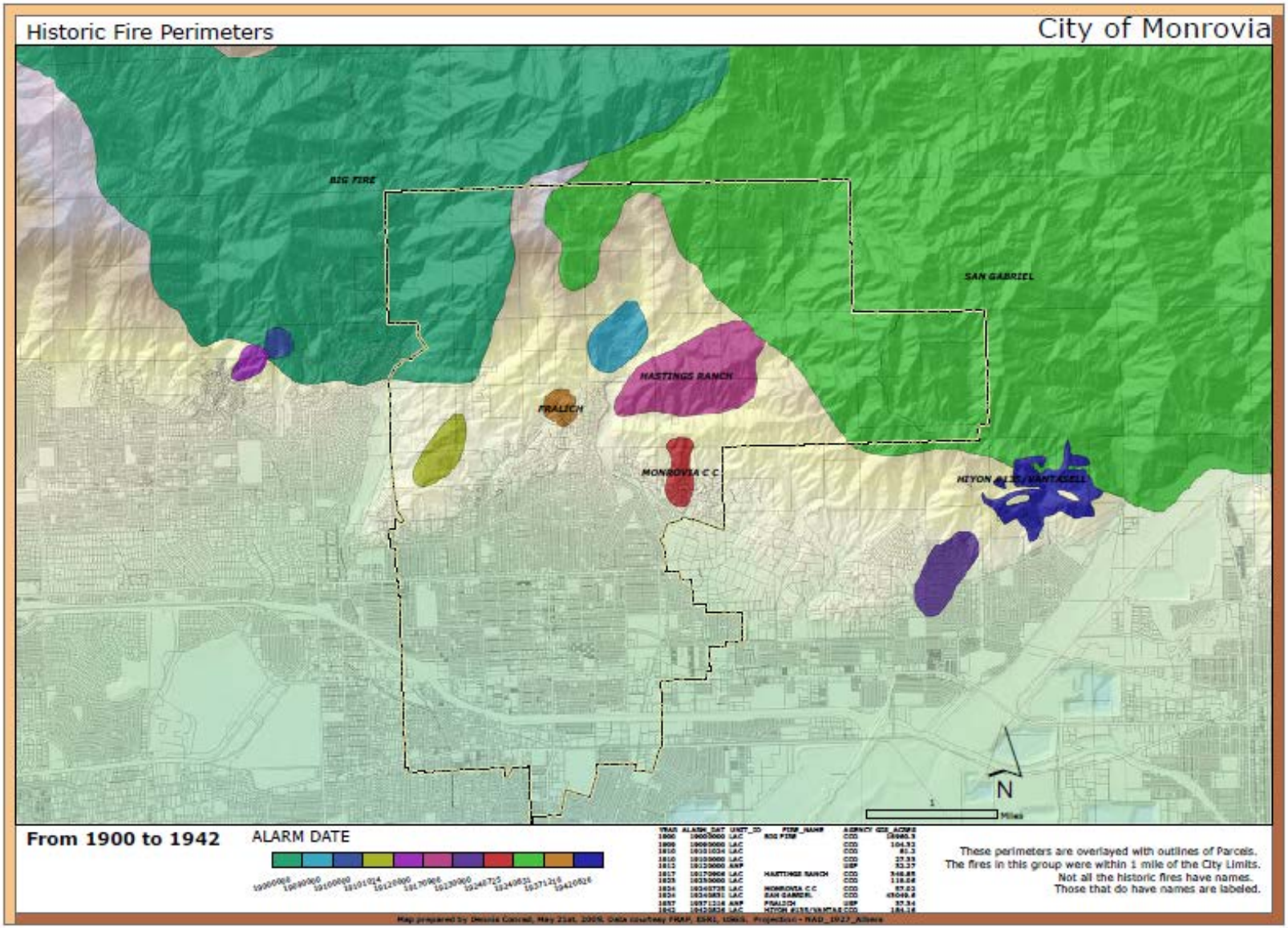

Figure 3-10b - Monrovia Fire History - Repeat Burns 1900 – 1942

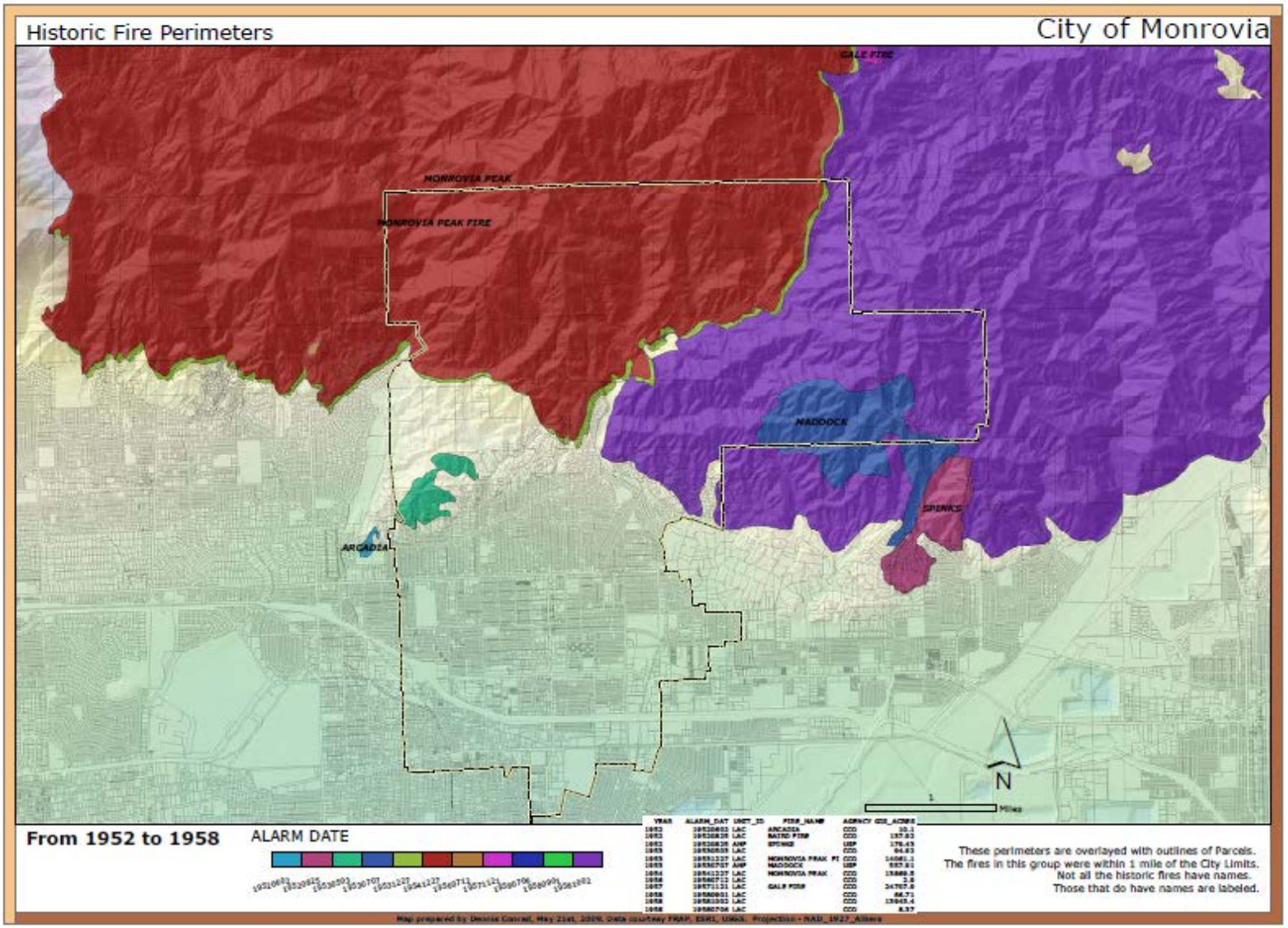

Figure 3-10c - Monrovia Fire History - Repeat Burns 1952 – 1958

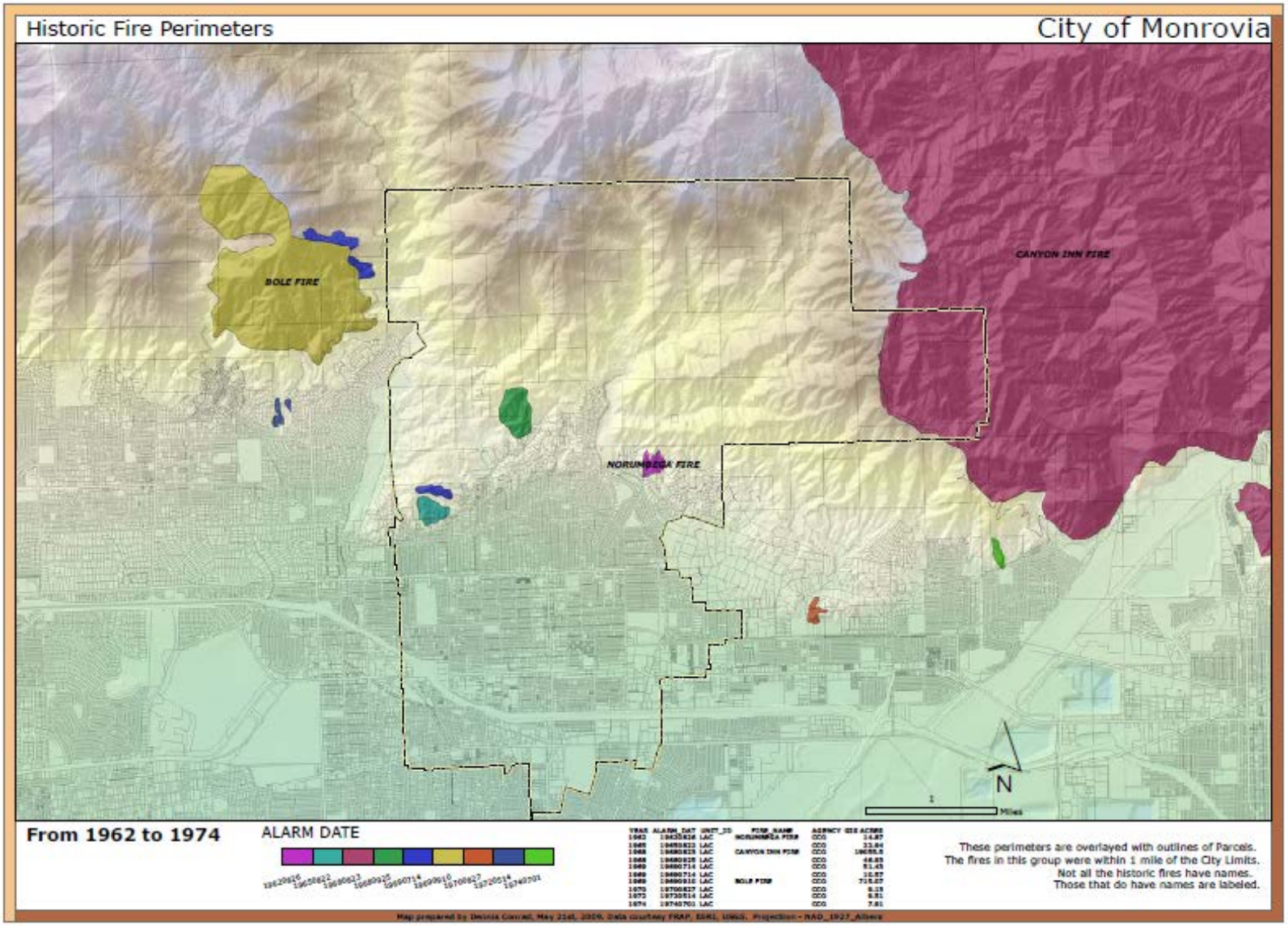

Figure 3-10d - Monrovia Fire History - Repeat Burns 1962 – 1974

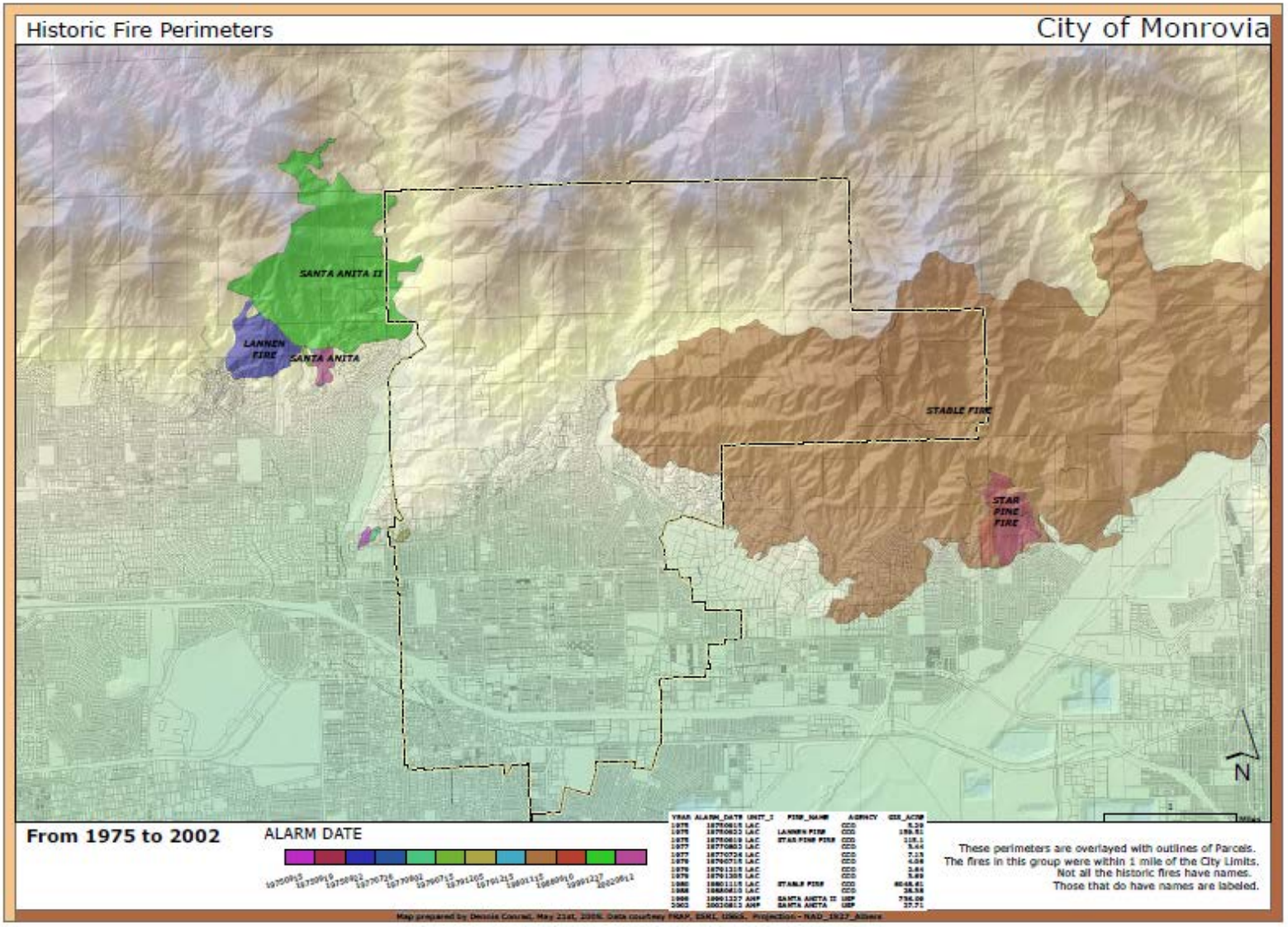

Figure -3-10e - Monrovia Fire History - Repeat Burns 1975 – 2002

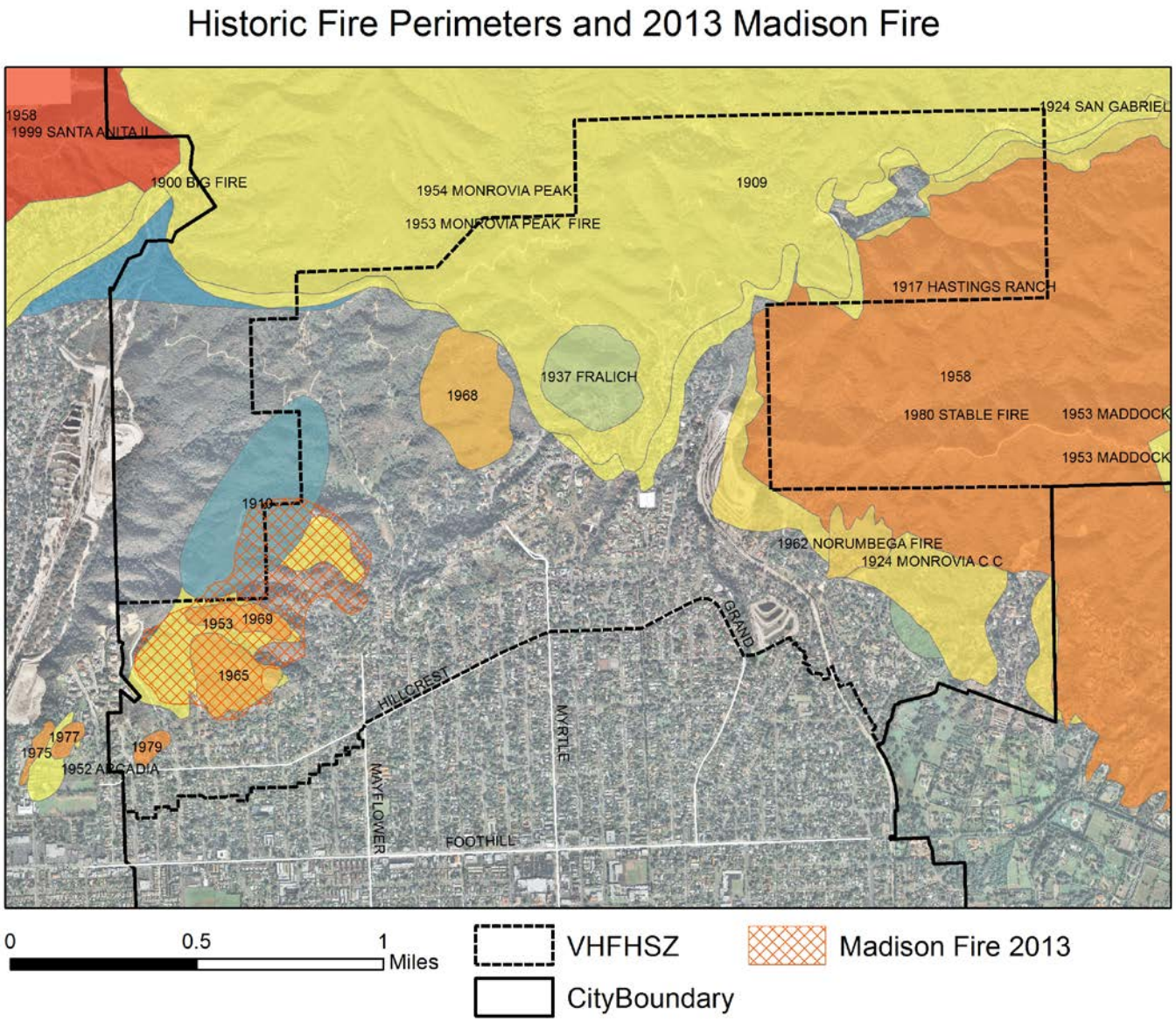

Figure 3-10f - Historic Fire Perimeters Including 2013 Madison Fire

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