Appendix J-5

RANCHO MISSION VIEJO
WILDLAND FIRE MANAGEMENT PLAN

INTRODUCTION

APPENDIX J-5
WILDLAND FIRE MANAGEMENT PLAN

0.0 INTRODUCTION

This Wildland Fire Management Plan (WFMP) has been prepared to guide the management of fire on lands belonging to Rancho Mission Viejo (RMV), located in Southern Orange County, California. Portions of these RMV lands may be dedicated as open space (RMV Open Space) as part of the approval of the RMV GPA/ZC application by the Orange County Board of Supervisors. As discussed later, this WFMP is an integral part of the Adaptive Management Program for the proposed RMV Open Space and further implements certain key NCCP/HCP and SAMP/MSAA policies.

As noted above, the WFMP is a key component of the Adaptive Management Program (see *Appendix J*) for the RMV Open Space and is intended to be complementary to any NCCP/HCP program completed in the future for the Southern Subregion. Because of this desire for future coordination, and the fact that fire is a landscape process which does not recognize artificial boundaries (i.e., property boundaries), this WFMP addresses the entirety of the Southern Subregion, but places particular emphasis on RMV lands.

Implementation of an Adaptive Management Program is one of the three fundamental conservation planning principles set forth under the 1993 NCCP Conservation Guidelines. As stated in the NCCP Conservation Guidelines, "a status quo strategy of 'benign neglect' management will likely result in substantial further loss of CSS diversity…" The Guidelines concluded that habitat reserves…should be managed in ways responsive to new information as it accrues." Although the Conservation Guidelines were directed toward coastal sage scrub (CSS) in a habitat reserve context, the same adaptive management principles apply to the diversity of vegetation communities and habitat types in protected open space such as the proposed RMV Open Space.

The intent of this program and its associated management activity is to assist in accomplishing the following key goals on RMV Open Space:

- *Ensure the persistence of currently extant native-dominated vegetation communities and habitat types,*
- *Restore or enhance the quality and extent of degraded vegetation communities and other habitat types, and*
- *Maintain and restore biotic and abiotic processes.*

Draft Southern NCCP/HCP Planning Guidelines

Section 3.3 of the Draft EIR discusses the project history, including the development of Draft Southern NCCP/HCP Planning Guidelines (Draft NCCP/HCP Planning Guidelines) by the NCCP/SAMP Working Group. Using the broader NCCP Tenets as a framework and starting point, the Draft NCCP/HCP Planning Guidelines provide guidance for decision-makers that are keyed to local biologic, hydrologic and geomorphic conditions. Although considered a "work in progress" the guidelines represent the most current thinking regarding protection, restoration, and management priorities for the resources within the study area and, for this reason, are discussed here. These guidelines address resources at both the landscape level (watershed) and more detailed hydrologic/geomorphic sub-basin levels. For each sub-basin planning unit, the guidelines identify the important biological resources and key hydrologic/geomorphic processes. Protection, restoration, and management recommendations for each sub-basin also are included.

The Draft NCCP/HCP Planning Guidelines are comprised of three primary components: **(1)** NCCP Tenets outlined in the 1993 NCCP Conservation Guidelines; **(2)** Reserve Design Principles prepared by the panel of NCCP Science Advisors convened by The Nature Conservancy; and **(3)** A set of draft sub-basin specific planning recommendations prepared by the NCCP/SAMP Working Group.

In addition to these components, the Draft NCCP/HCP Planning Guidelines also set forth general policies for resource protection, management and restoration that apply at the planning (landscape) area scale. Sub-policies to General Policy 5 of the Guidelines (regarding management of indirect impacts through creation of an urban/wildlands interface zone) addresses fire management as follows:

- Create fuel management zones combining irrigated and non-irrigated native plantings separating the Habitat Reserve from adjacent urban uses.

- To the extent that fuel management zones are composed of native habitats and can support Identified Species and other species, or be enhanced or managed to support Identified Species and other species this should be encouraged.

- Fuel management zones and practices will be set forth in a fuel management plan as part of the NCCP/HCP and aquatic resources protection program.

- Prohibit plants identified by the California Exotic Pest Council as an invasive risk in Southern California from development and fuel management zones adjoining the Habitat Reserve.

Relationship to the San Juan Creek Watershed and Western San Mateo Creek Watershed SAMP/MSAA

The Adaptive Management Program and this WFMP are intended to be complementary to any SAMP/MSAA program that is completed in the future and, as such, have been structured to comply with the goals, objectives, tenets and principles of the SAMP/MSAA.

Draft Watershed and Sub-basin Planning Principles

Section 3.3 of the Draft EIR discusses the project history, including the development of Draft Watershed and Sub-basin Planning Principles (Draft Watershed Planning Principles) by the NCCP/SAMP Working Group. The Draft Watershed Planning Principles provide a link between the broader SAMP/MSAA Tenets for protecting and conserving aquatic and riparian resources and known, key physical and biological resources and processes. Although considered a "work in progress" the principles represent the most current thinking regarding protection, restoration, and management priorities for the resources within the study area and, for this reason, are discussed here. In particular the WFMP is directed towards complying with SAMP Tenet 8, which states, "Protect riparian areas and associated habitats of listed and sensitive species."

Overview and Structure of the Wildland Fire Management Plan

The Orange County Fire Authority worked with Firewise 2000, Inc. on the Short-Term Fire Management Plan, now referred to as **Part IV – Short-Term Tactical Fire Suppression Plan** of this Wildland Fire Protection Plan document. The Short-Term Tactical Fire Suppression plan focuses on minimizing the impacts of unplanned fire events and the associated suppression activities. The goals of the Short-term Tactical Fire Suppression Plan are met though detailed descriptions of the landscape and standardized fire response guidelines based on contemporary resource needs. All prescriptions provided in the tactical plan are directed at increasing fire-fighting efficiency with the protection of life and property and natural resources as its highest priorities.

Following completion of the Short-Term Tactical Fire Suppression Plan, a Long-Term Fire Management Plan was prepared. This plan, now referred to as **Part III – Long-Term Strategic Fire Protection Plan** of this Wildland Fire Protection Plan document, focuses on the appropriate application of fire to reduce the costs and losses of unplanned fire events while enhancing or maintaining habitat quality, vegetative structure and composition as well as landscape patterns. For these reasons, the plan is now referred to as "The Long-Term Strategic Fire Protection Plan".

The Long-Term Strategic Fire Protection plan provides details for implementation of managed fire as well as a structure for measuring success. These two plans are combined in this Wildland Fire Protection Plan document with the intent to work synergistically towards the minimizing of wildfire threats in the short term while utilizing fire as an ecological management tool in the long term. However, each part, when combined makes up the Wildland Fire Management Plan. Each part is designed to be used as a "Stand Alone" document.

Part IV – Short-Term Tactical Fire Suppression Plan will be used primarily by the wildland fire fighting agencies, while Part III – Long-Term Strategic Fire Protection Plan and Part V - Research and Monitoring Plan will be used by Rancho Mission Viejo in overall management of the RMV Open Space.

0.1 Fire Management Program

The Fire Management Program brings together all of the critical issues impacted both positively and negatively by fire emphasizing that wildland ecosystems are dynamic, evolutionary, and resilient, all at the same time. Coastal sage scrub received very little attention from researchers until the late 1970's. Consequently knowledge gaps exist. Managers must learn as they go which requires an adaptive management approach. With the fate of listed species in the balance there is little room for error.

0.2 Prescribed Fire Program

The basis for the prescribed fire program is developed throughout Parts I, II, III and Part V of this document. The fire history maps by 10 year decade in Part I clearly demonstrate that wildfire is a frequent visitor to the Southern Subregion. Wildfires do not necessarily burn in the way we would like them to and there is absolutely no control of the outcome. Prescribed fire results in a new paradigm, allowing the land manager to be in control of the outcome. The Orange County Fire Authority encourages the use of well-planned use of prescribed fire and will assist in the development and execution of burn plans.

0.3 Long-Term Strategic Fire Protection Plan

Fire is a natural part of the southern California landscape. Wildland fire can be a serious threat to life, property and natural resource values. The Strategic Fire Protection Plan was written to determine the role of fire, both negative and positive, on the Southern Subregion and to address the various management options to minimize the threat from wildland fire. The Strategic Fire Protection Plan is described in Part III of this document.

0.4 Short-Term Tactical Fire Suppression Plan

The Short-Term Tactical Fire Suppression Plan in Part IV has been prepared as a stand alone document to function as the fire management portion of the Adaptive Management Program. The Fire Management Compartments and Fire Management Units are the result of a joint planning effort with the Orange County Fire Authority (OCFA), who contracts with the California Department of Forestry and Fire Protection (CDF) for protection of State Responsibility Area (SRA) Lands within Orange County and by virtue of the authority given by this contract, OCFA has both wildland and structural fire suppression responsibilities within the Southern Subregion.

0.5 Research and Monitoring Criteria

Future research and monitoring of the fire and fuel treatment activities, both proposed and status quo, will be evaluated by routine long-term observations and management experiments to test the hypotheses proposed in Part V. Research and Monitoring Criteria is described in Part V of this document.

PART I – FIRE MANAGEMENT PROGRAM

PART I – FIRE MANAGEMENT PROGRAM

1.0 THE PLANNING CONTEXT

This Section discusses a framework of principles, concepts, processes, relationships, and methods that may be useful in implementing long-term fire management within the Southern Subregion. This framework places planning procedures within a broad, proactive management approach that considers societal values and the protection of biophysical components of ecosystems at the earliest stages of fire management program design.

The management approach suggested here is guided by four broad principles:

- Ecosystems are dynamic, evolutionary, and resilient;

- Ecosystems should be viewed spatially and temporally within organizational levels;

- Ecosystems have biophysical tolerances and social limits (societies willingness to financially support corrective actions); and

- Ecosystem processes are not completely understood and, therefore are not fully predictable.

Clearly, ecosystems are dynamic and change with or without human influence. Existing conditions are a product of natural and human history. Although ecosystems are dynamic, there are limits to their ability to withstand change and still maintain their integrity, diversity, and productivity. Our efforts are guided by an ever-increasing understanding of how large ecosystem patterns and processes relate to smaller ecosystem patterns and processes, however, there are limits to our ability to predict how ecosystems may change. These principles suggest the need for an adaptive approach to fire management, one that can be adjusted in response to new information and changing conditions.

Long-term ecosystem management requires completion of the following tasks:

- *Establishing measurable goals and objectives;*

- *Assessing resources at multiple resolutions and geographic scales;*

- *Defining a strategy for implementing decisions;*

- *Formulating and carrying out a monitoring program to evaluate the outcome of decisions; and*

- *Formulating and implementing adaptive management approaches*

1.1 Land Management Goals

The Orange County Southern Subregion NCCP Science Advisors acknowledged and supported a landscape/natural community focus for fire management as the scale most likely to produce success for this conservation effort. To implement fire management at this scale, it is important to set broad overall goals for land management. It is the intent of the Adaptive Management Program the RMV Open Space lands be managed in accordance with a fire management program that is ecologically based and designed to achieve the following overall goals:

- Ensure the persistence of a native-dominated vegetation mosaic in the RMV Open Space.

- Restore and enhance the quality of degraded vegetation communities and other habitat types in a manner consistent with the overall Conservation Strategy for Identified Species and associated natural communities.

- Maintain landscape functions at all identified scales within the RMV Open Space.

- Protect and manage identified target structural characteristics for selected species and their associated habitats.

Overall goals are needed to point the program in the right direction, but they may not provide sufficient guidance in defining target conditions for specific habitats and management activities on individual parcels. The following sections discuss development of a program designed to achieve the above goals by addressing species and community-specific objectives and conditions.

1.2 Keys to Fire Management

Ecosystem management presumes a working knowledge of system function and structure. Unfortunately, the timeline of management actions typically precedes the development of requisite management knowledge. Many habitats are represented in the Southern Subregion with little history of consumptive-resource value. Vegetation types, like coastal sage scrub, received very little attention from researchers until the late 1970's (see O'Leary et al. 1994). As a result, existing knowledge relies on experimentation as part of an Adaptive Management Program to manage the system, particularly in southern California, where habitat fragmentation and continuing urbanization compound already complex management issues. In this situation, land managers must learn through carefully designed adaptive management actions as a means of compensating for uncertainty.

A structured model for this learning process directs management and monitoring actions to increase the rate of information acquisitions and improve management in iterative steps (Lee 1993:9).

The fundamental elements of the Fire Management Program are as follows:

1.3 Management Objectives

- Identify appropriate spatial scales and patterns for the long-term management of fire;
- Develop active fire management prescriptions consisting of 1) Management Objectives, 2) Preparing Management Plans and Models for shrublands (coastal sage scrub and chaparral) and 3) identifying uncertainties for valley grasslands, focused on increasing diversity of native plants and promoting community structure and composition favored by target wildlife species;
- Quantify effects of varying fire regimes on selected wildlife species;
- Utilize prescribed fire to reduce unplanned fire events from known ignition corridors;
- Define fire prescriptions that aid in restoring degraded shrublands and riparian areas;
- Quantify active restoration techniques for application following fire treatments; and
- Develop public understanding and support for active fire management.

1.4 Preparing Management Plans and Models

Based on the best available information and the objectives described above, the second step in the fire management program is to prepare management plans for designated Southern Subregion sub-units. To do this successfully, some concept of how the natural system works is necessary.

Researchers at the Riverside Forest Fire Laboratory have brought together University and Agency scientists and managers to collect information on the functioning of natural systems and develop working models of those systems.

Because of the complexity of natural systems, even the best models must provide for flexibility as part of an adaptive management approach. Natural community models represent a set of assumptions or hypotheses, based on current knowledge, that are tested through the application of management techniques. Using a combination of the desired future conditions and natural community models, a working fire management plan is developed.

The current stated goals for the RMV Open Space indicate a desire to protect natural ecosystems, including those that support CSS, native grasslands, riparian and oak woodlands. It is also the desire of RMV enhance the currently degraded coastal sage scrub. In addition, existing valley needlegrass grasslands will be maintained and enhanced with the active use of prescribed fire if grazing is not an option as will oak woodland habitats. Fire is not a viable option in riparian zones except in some very specific situations. These management goals define a four-part fire management approach:

1. The reduction of unplanned fire events through the use of maintained firebreaks and strategic prescribed burns (VMP projects);

2. Implementation of a seasonally and frequency-focused fire regime as part of a management/restoration strategy for valley needlegrass grassland;

3. Careful experimentation using fire as part of restoration and management in currently degraded coastal sage scrub stands; and

4. Implementation of low to moderate intensity ground fires in the oak woodland habitats where undergrowth is too thick and dense for cattle. If a wildfire occurs there is a great chance of a stand replacement fire where the entire ecosystem is set back to zero. Goats could be used as an alternative to prescribed fire to reduce understory vegetation beneath the oaks.

Although the four described fire activities will be distributed throughout the Southern Subregion, areas of focus are clearly defined for the landscape. Much of the grassland burning is likely to take place within the eastern half of the Southern Subregion. Prescriptions targeted at CSS Restoration & Management will occur throughout the Southern Subregion. Chaparral/shrubland restoration will most commonly be directed toward the western half of the Southern Subregion. Oak woodland maintenance will be concentrated throughout the Southern Subregion while fire protection strategies will be deployed in both the southern portion and western half of the Southern Subregion.

These four described fire activities will not be implemented on currently undeveloped lands within the Southern Subregion without the concurrence and participation by the landowner or the agency with jurisdiction for the property within the Subregion.

1.4.1 Identifying Uncertainties and Knowledge Gaps in Management Plans

To create an effective fire management program, it is important to identify the gaps in knowledge about the natural system that may lead to uncertainties about the role of fire's effectiveness in meeting the management plan's desired objectives at an early stage.

Scrutiny of management actions, or in actions, during the implementation of the proposed fire plan model may determine the need for more basic research. For example, we may not know what happens to a natural community if prescribed fire is applied too frequently or the fuels are allowed to accumulate due to a no-action decision and a wildland wildfire occurs.

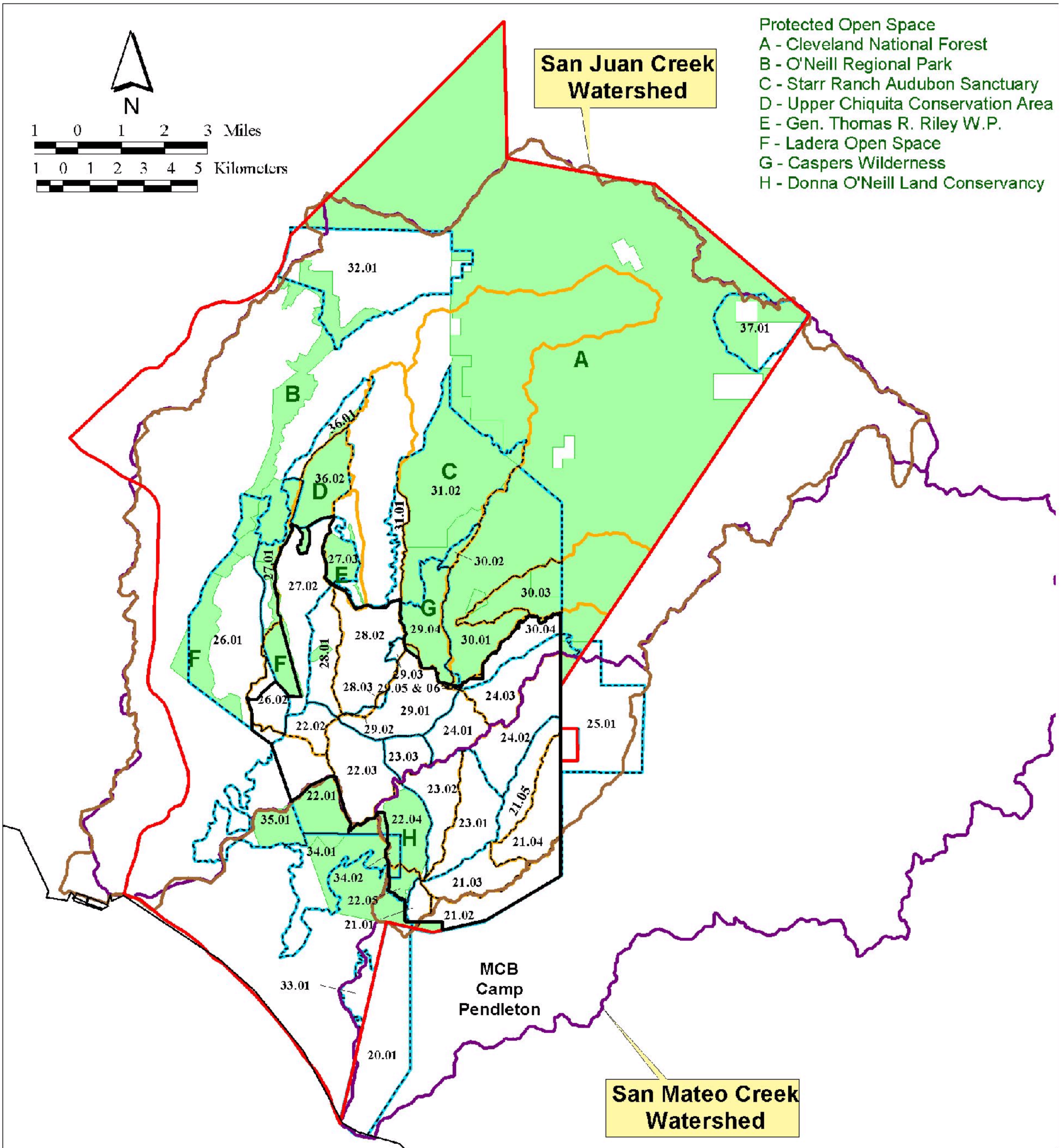
The purpose of identifying gaps in models and knowledge is to translate them into a set of questions (hypotheses) that can be addressed through experimentation, monitoring and research. This experimental approach to management recognizes the limitations of current knowledge about natural communities and encourages and provides opportunities to improve management efforts. As knowledge gaps are identified and hypotheses tested, our models and management decisions will improve, new gaps in knowledge will emerge, and additional questions and hypotheses will be developed and tested.

1.5 Site Description

1.5.1 Location

The 132,000-acre Southern Subregion is located in the south coast ecoregion of southern California. The Southern Subregion lies entirely within the boundaries of the County of Orange. Thirty (30) percent of the entire Southern subregion (about 40,000 acres, see *Figure 1-2*) is located within the Cleveland National Forest (CNF) while about 92,000 acres are located outside the CNF.

As shown in *Figure 1-1*, the Southern Subregion includes the southern portion of Orange County from the coast inland to the boundary with the counties of Riverside and San

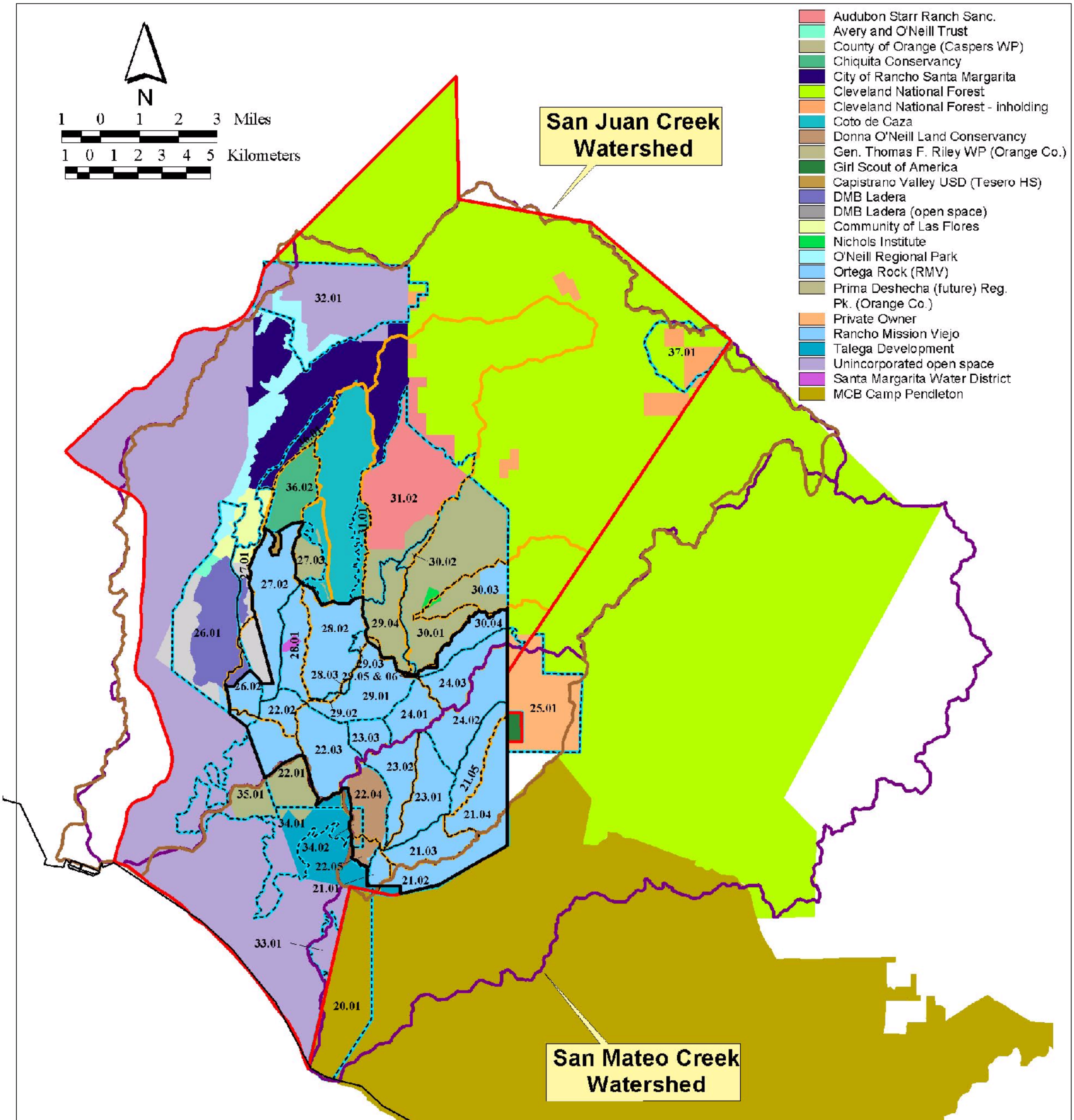


NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary

Protected Open Space
22.01 Fire Management Units*

*Numbers on map denote Fire Management Unit numbers

FIGURE 1-1
Protected Open Space
SOUTHERN SUBREGION
Orange County, California
SEPTEMBER 2003



NCCP/HCP Boundary

SAMP/MSAA Boundary

San Juan Creek/San Mateo Creek Watershed Boundaries

Sub-Watershed Boundaries

Compartment Boundaries

Rancho Mission Viejo Project Boundary

22.01 Fire Management Units*

Numbers on map denote Fire Management Unit numbers

FIGURE 1-2

Ownership

SOUTHERN SUBREGION

Orange County, California

SEPTEMBER 2003

Diego. Along the coast, the Subregion extends from the mouth of San Juan Creek in the City of Dana Point to the San Diego County boundary, in the City of San Clemente. The Subregion is bounded on the west and southwest by the Central and Coastal NCCP Subregion, where a separate NCCP/HCP was prepared by the County and approved by USF&WS and CDFG in 1996.

Starting at its southwest corner, the boundary of the Southern Subregion (*Figure 1-1*):

- extends from the mouth of San Juan Creek along the Creek inland to Interstate 5;
- northwest along Interstate 5 to El Toro Road;
- north along El Toro Road to the intersection of Live Oak Canyon Road;
- northeasterly on a straight line from the El Toro/Live Oak Canyon intersection to the northern apex of the boundary with Riverside County; and
- along the San Diego and Riverside county boundaries, southerly to the Pacific Ocean.

1.5.2 Maps of Land Use Classifications

1.5.2.1 Land Uses

Within the 92,000-acre portion of the Subregion located outside of the CNF, 36 percent (about 33,000 acres) has already been urbanized. Another 6 percent (about 5,800 acres) has been used for agricultural purposes for decades or has been significantly disturbed by other uses. Natural habitats comprise 58 percent (about 52,400 acres) of the remaining non-CNF area. The natural communities that are subject to potential development pressure include, but are not limited to, coastal sage and other sage scrub communities, chaparral, oak woodland and forest, riparian, wetlands, and native and annual grasslands.

1.5.2.2 Land Ownership

Figure 1-1 is a graphic of the current landownership within the Southern Subregion. Land owners include the Audubon Starr Ranch Sanctuary, the City of Rancho Santa Margarita, the Cleveland National Forest, the community of Coto de Caza, the Donna O'Neill Land Conservancy, County of Orange (Caspers Wilderness Park, General Thomas F. Riley Wilderness Park, O'Neill Regional Park, the future Prima Deshecha Regional Park and unincorporated open space lands), the Girl Scouts of America, Capistrano Valley Unified School District (Tesoro High School), DMB Ladera, the community of Las Flores, Nichols Institute, individual landowners, Rancho Mission Viejo, Talega Development, and the Santa Margarita Water District (Chiquita Wastewater Treatment Plant). MCB Camp Pendleton is the southerly landowner and is mentioned throughout this document because of the relationship of MCB Camp Pendleton to the fire history of the Southern Subregion.

1.5.3 Maps of Various Natural Resources

1.5.3.1 Topography and Soils

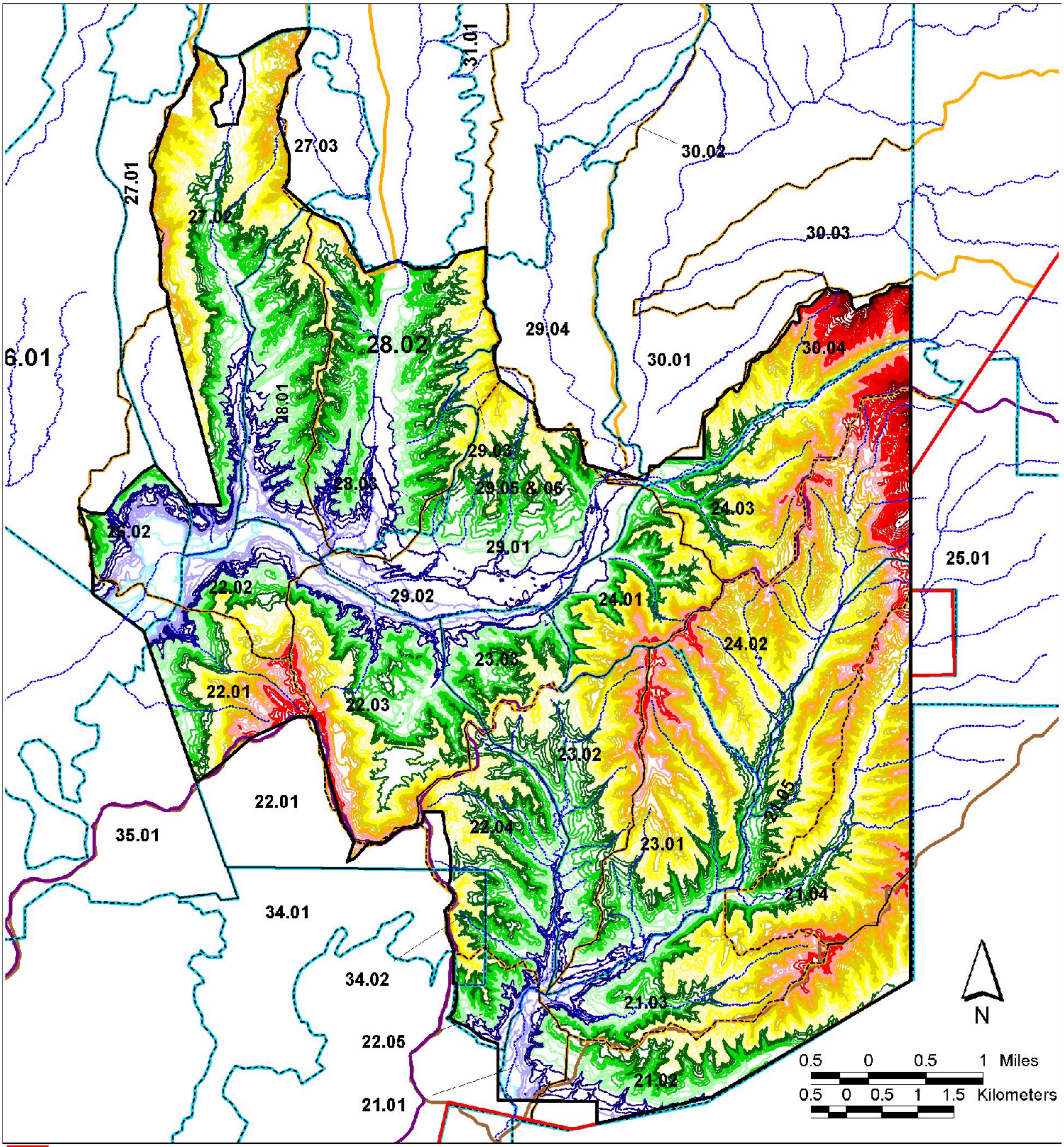
Elevations in the Southern Subregion run from 5,500 feet in the CNF to sea level. The highest elevation outside the CNF is approximately 1,758 feet on the Starr Ranch property. Topography for the Southern Subregion is characterized by rolling hills and a number of ridge systems that run from north to south from the slopes of the Santa Ana Mountains to the Pacific Ocean. Deep south and west facing canyons dissect the landscape with steep slopes and a representation of all aspects.

A rich mosaic of soil types exists within the Southern Subregion system (*Figure 1-3*). The Gabino gravelly clay loam, Soper loam, and Calleguas clay loam are found within the Southern Subregion at the higher elevations. Myford sandy loam, Capistrano sandy loam, Cieneba sandy loam, Also Clay and Anaheim clay loam occur in the lower portion of the Southern Subregion. The Cieneba Series is the most well represented soil series within the Southern Subregion.

1.5.3.2 Hydrology

Trabuco Creek, a major tributary of San Juan Creek, San Juan Creek and San Mateo Creek comprise the major drainages in the Southern Subregion. With the exception of a few man-made reservoirs, ephemeral drainages and stream courses characterize the landscape described in this plan. Rainfall and the resulting stream flow tend to be highly episodic in nature. For most Subregion streams, active flow occurs between the months of January and May. The upper reaches of San Juan Creek and San Mateo Creek have year round water. *Figure 1-4A* identifies the Southern Subregion's stream systems.

The soils in the Southern Subregion run from non-erosive to highly erosive (see *Figure 8* in the Draft Watershed and Sub-basin Planning Principles Report). Soil erosion can be accelerated following fire events. Factors effecting the type and amount of erosion include the erodibility of soil, steepness of slope, amount and intensity of rainfall, percentage of plant cover, severity of the fire and the length of time since the last burn. With much overland flow, erosion potential is



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Subwatershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary
22.01 Fire Management Units*

*Numbers on map denote Fire Management Unit numbers

Elevation Contours (feet)

125 - 200
200 - 275
275 - 350
350 - 425
425 - 500
500 - 575
575 - 650
650 - 725
725 - 800
800 - 875
875 - 950
950 - 1075
1075 - 1200
1200 - 1350
1350 - 1525

Streams and drainages

FIGURE 1-3A

Elevation Contours

Rancho Mission Viejo

Orange County, California

SEPTEMBER 2003

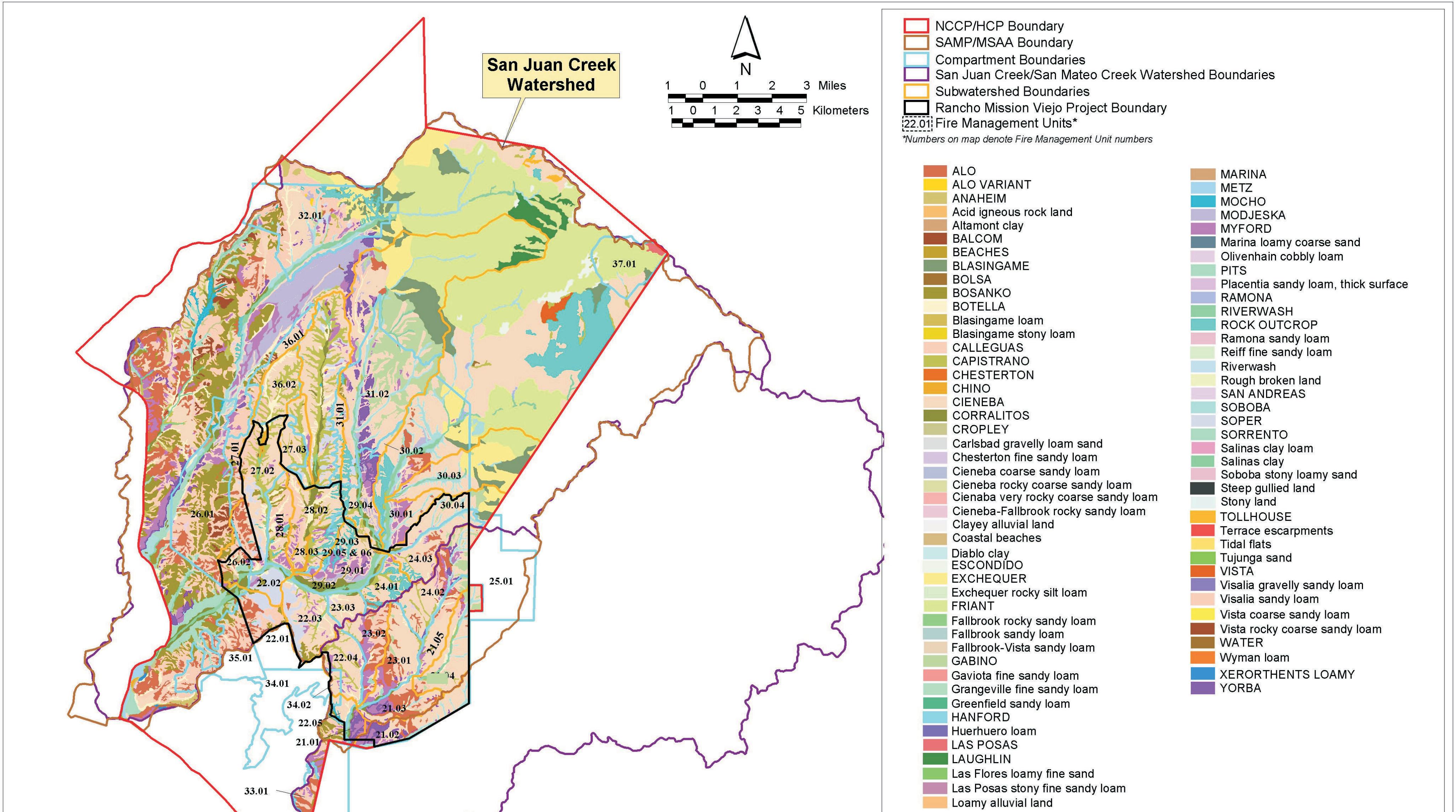
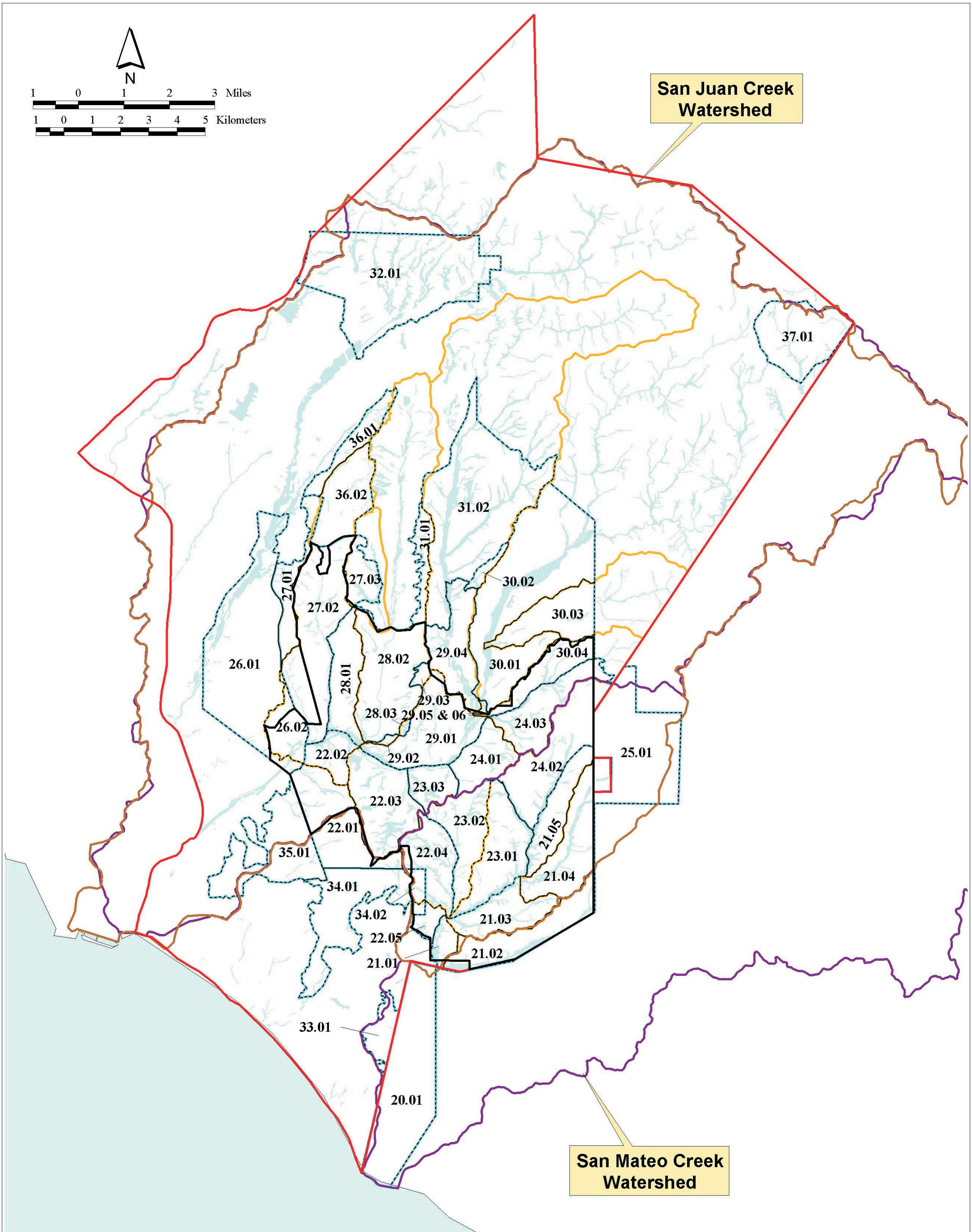


Figure 1-3B
SOILS

SOUTHERN SUBREGION
Orange County, California
SEPTEMBER 2003



NCCP/HCP Boundary

SAMP/MSAA Boundary

San Juan Creek/San Mateo Creek Watershed Boundaries

Sub-Watershed Boundaries

Compartment Boundaries

Rancho Mission Viejo Project Boundary

22.01 Fire Management Units*

Natural Watercourses, Lakes, & Ponds

*Numbers on map denote Fire Management Unit numbers

FIGURE 1-4A

WATER COURSES

SOUTHERN SUBREGION

Orange County, California

SEPTEMBER 2003

a significant planning variable to be considered prior to prescribed fire events. There are numerous examples of moderate gully erosion in the existing grasslands throughout the Southern Subregion.

A simple erosion index will be included within unit prescriptions (see *Figure 1-4B*). Within units with high erosion potential, pre and post fire management practices will be recommended.

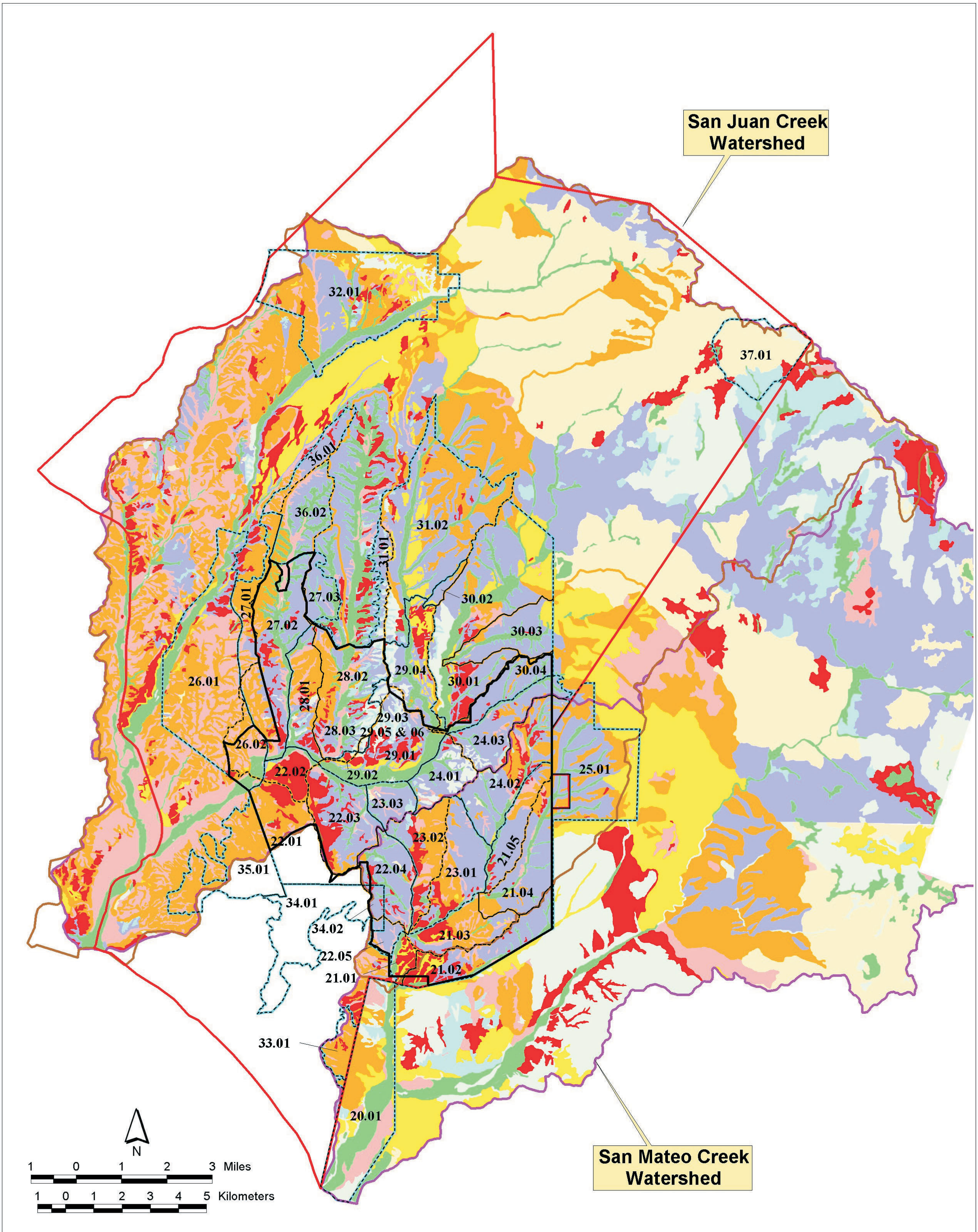
1.5.3.3 Climate

The Southern Subregion exhibits a characteristic Mediterranean climate with warm to hot summers and mild winters. Rainfall is concentrated in the winter. Summer seasons are characterized by extended periods of sunny weather. A strong marine air influence is experienced throughout the year and helps to lower local temperatures. The Southern Subregion's location, in relation to other significant topographic features such as the Santa Ana Mountains, may intensify the effect that these air masses have on local temperatures.

Local conditions may strongly affect fire behavior. The unique Mediterranean climate with its long dry summer produces many days of great fire potential (McCutchan 1977). Local Foehn winds know as "Santa Ana's" develop in conjunction with high-pressure systems in the Great Basin. When a low-pressure trough is located along the southern California coast, a strong pressure gradient is found across the southern California Mountains (Schroeder and Buck 1970). The resulting strong winds, along with warm temperatures and humidity sometimes lower than 5 percent, produce very serious fire weather.

Average annual rainfall on lands outside the CNF is 12 to 14 inches. The higher Elevation portion of the watershed (typically the headwater areas) typically receive Significantly greater precipitation due to orographic effects. In addition, rainfall patterns are subject to extreme variations from year to year and longer term wet and dry cycles.

In nearby Laguna Beach, a 74-year average computes annual rainfall to be 30.20 Centimeters (12.08 inches) between 1928 and 2002. *Figure 1-6* shows the seasonal distribution of precipitation for the period of record. Mean annual rainfall from an inland site (Santa Ana) appears slightly higher (*Figure 1-5*). A 54-year mean computes annual precipitation at 32.85 centimeters (13.14 inches). Figure 1-6 also displays the seasonal distribution of precipitation at the Laguna Beach Fire Station between 1948 and 2002.



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/ San Mateo Creek Watershed Boundaries
Compartment Boundaries
Sub-Watershed Boundaries
Rancho Mission Viejo Project Boundary
22.01 Fire Management Units*

**Numbers on map denote Fire Management Unit numbers*

Roads

Rocky or unclassified
Erodable sand
Alluvial
Less erodable upland sand
Erodable clay
Less erodable clay, mid to low slope
Less erodable clay, high slope
Erodable silt, low slope
Erodable silt, high slope

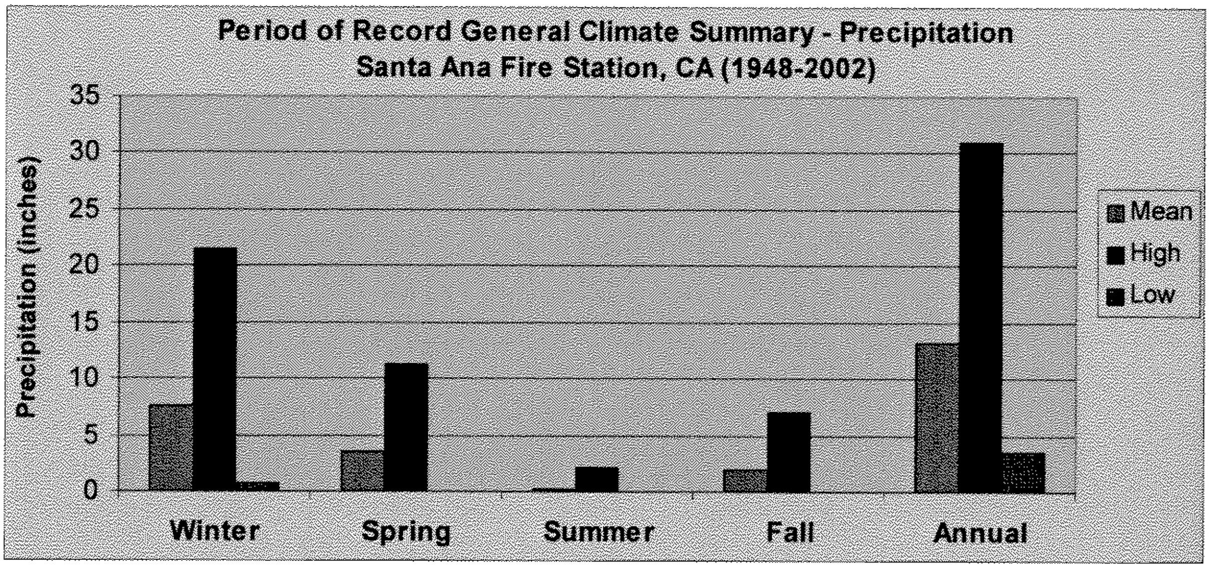
FIGURE 1-4B

ERODABILITY

SOUTHERN SUBREGION

Orange County, California

SEPTEMBER 2003



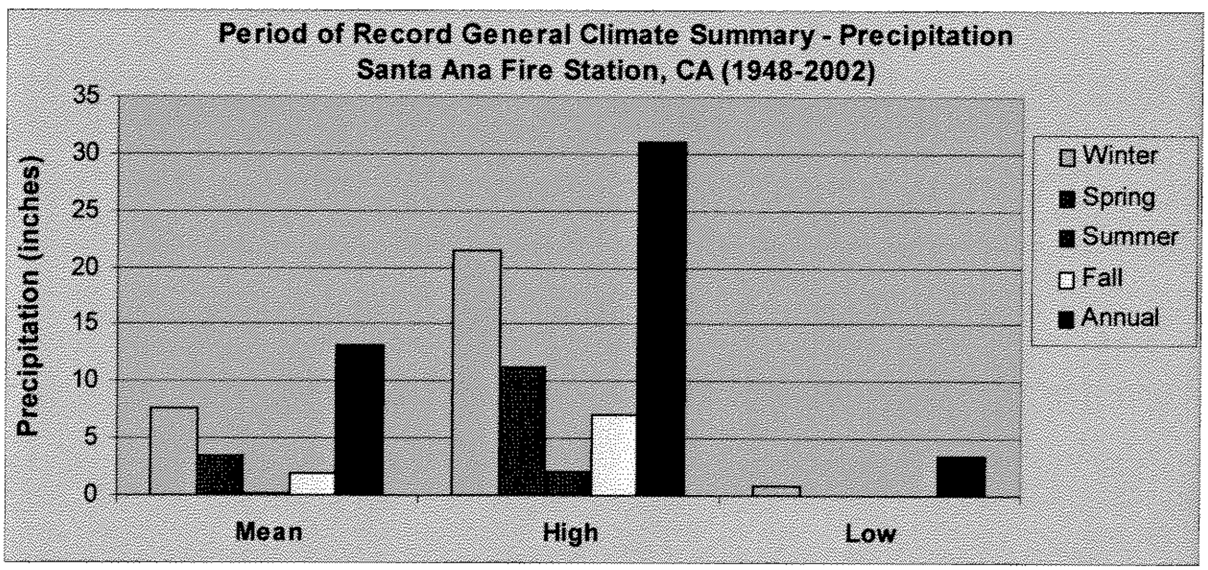
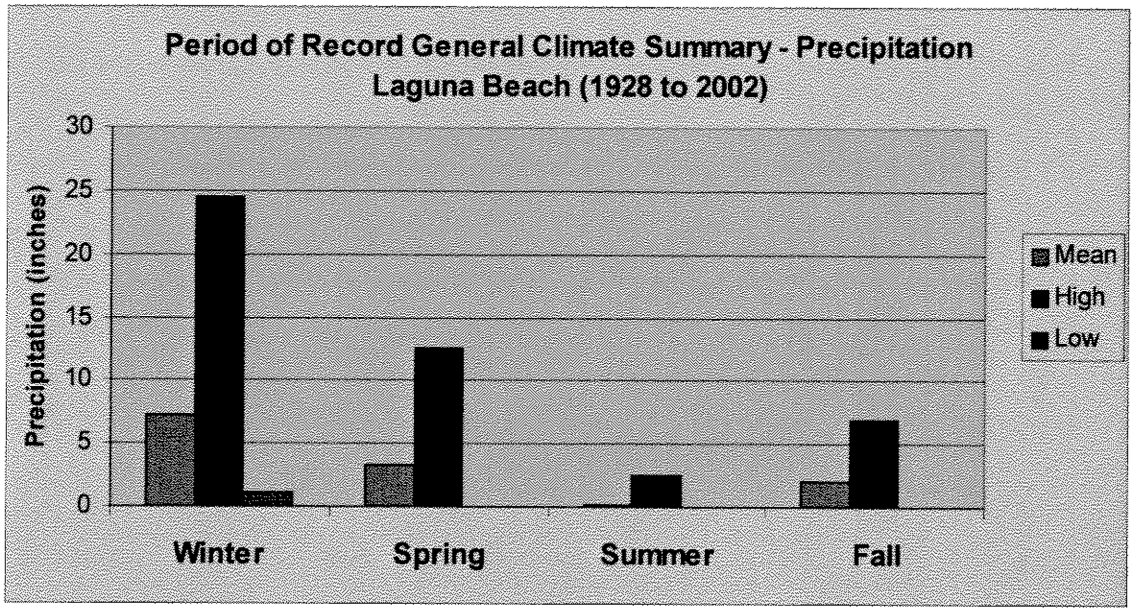


Figure 1-5: Rainfall data for a single site in Santa Ana, Ca. Rainfall records are partitioned here to reflect seasonal distributions.



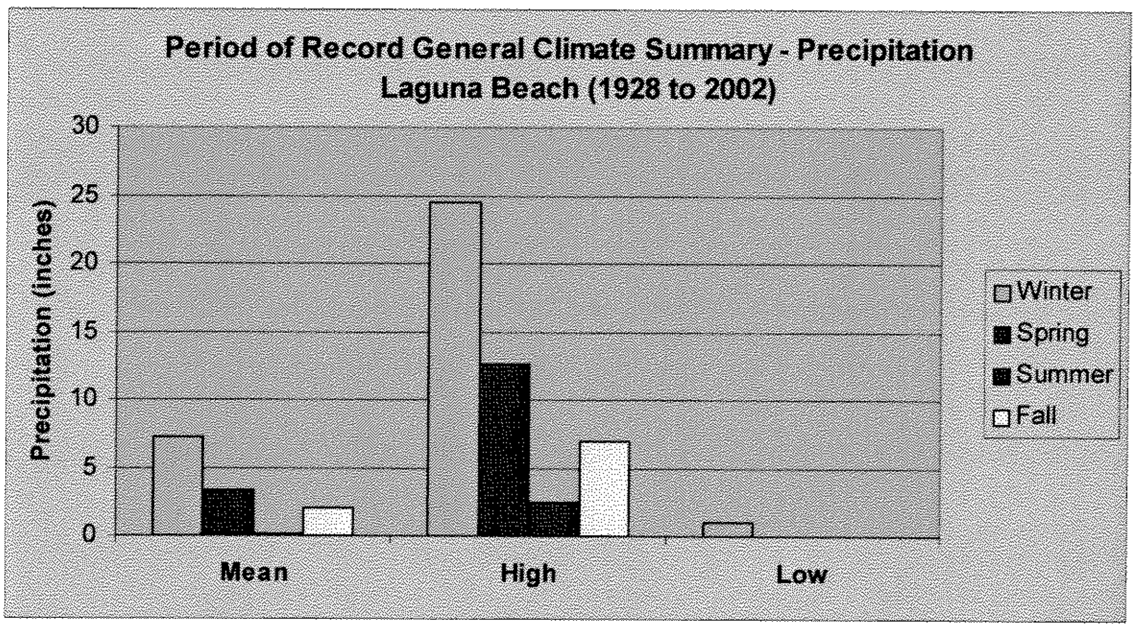


Figure 1-6: Rainfall data for a single site in Laguna Beach, Ca. Rainfall records are partitioned here to reflect seasonal distributions.

The majority of this rainfall is winter storm generated from cold frontal systems originating in the Gulf of Alaska. Although infrequent, thunderstorms derived from warm, wet southern air masses do develop in late summer or early fall. A typical thunderstorm event, resulting in multiple ignitions throughout southern California, occurred in the last days of August 1998.

1.5.3.4 Vegetation

Five types of upland vegetation are dominant within the Southern Subregion: grasslands (predominately non-native), coastal sage scrub, oak woodland, mixed chaparral, and riparian (*Figure 1-7*). These communities also represent most of the major upland vegetation types in southern California. These plant assemblages occur in a mosaic pattern across the Southern Subregion. Topography and soils likely drive this vegetation pattern. Non-native grasses generally occupy lowland valleys, with deep soils. Upland areas, with rocky soils, tend to be dominated by chaparral and sage scrub, with significant cover taken up by non-native grasses.

Due to limited spatial extent or lack of relevance to fire planning, additional vegetation types represented within the Southern Subregion's boundary have not been addressed in this plan. Rare assemblages that may be impacted by fire events will be identified at the unit plan level. Appropriate protection strategies will also be identified at that time.

1.5.3.4.1 Non-native grasslands

Non-native grassland types occurring within the boundary occupy a significant spatial extent of the vegetation. Many of the acres currently identified as non-native grasslands are likely to have been type converted from southern California bunchgrass prairie, native flower fields or coastal sage scrub. It should be noted that conversion of native plant communities to non-native grasslands dates back to before the arrival of the Spaniards in the 1500's.

Hendry (1931) suggested that red-stemmed filaree (*Erodium cicutarium)*, curly dock (*Rumex crispus)*, and prickly-sow thistle (*Sonchus asper)* may have preceded Europeans to California. Burcham (1956, 1957) and Robbins (1940) present evidence that suggest major replacement of native herbaceous plants with introduced annuals occurred in stages beginning in the 1850's and ending by the 1870's. In a Mediterranean climate, hot and moist conditions are scarce and decomposition rates are slow. This may lead to a negative feedback loop, where excess thatch can follow a year of high production (Huenke and Mooney 1989). This excess thatch and ground litter has significantly altered seedbed micro-environments. Native plants, such as purple needlegrass (*Stipa or Nassella pulchra)*, are more likely to successfully germinate in the presence of bare soil (Dyer and Rice 1999). Annual grass conversion has also taken place in coastal sage scrub. The conversion of native shrublands to annual grasslands is a more

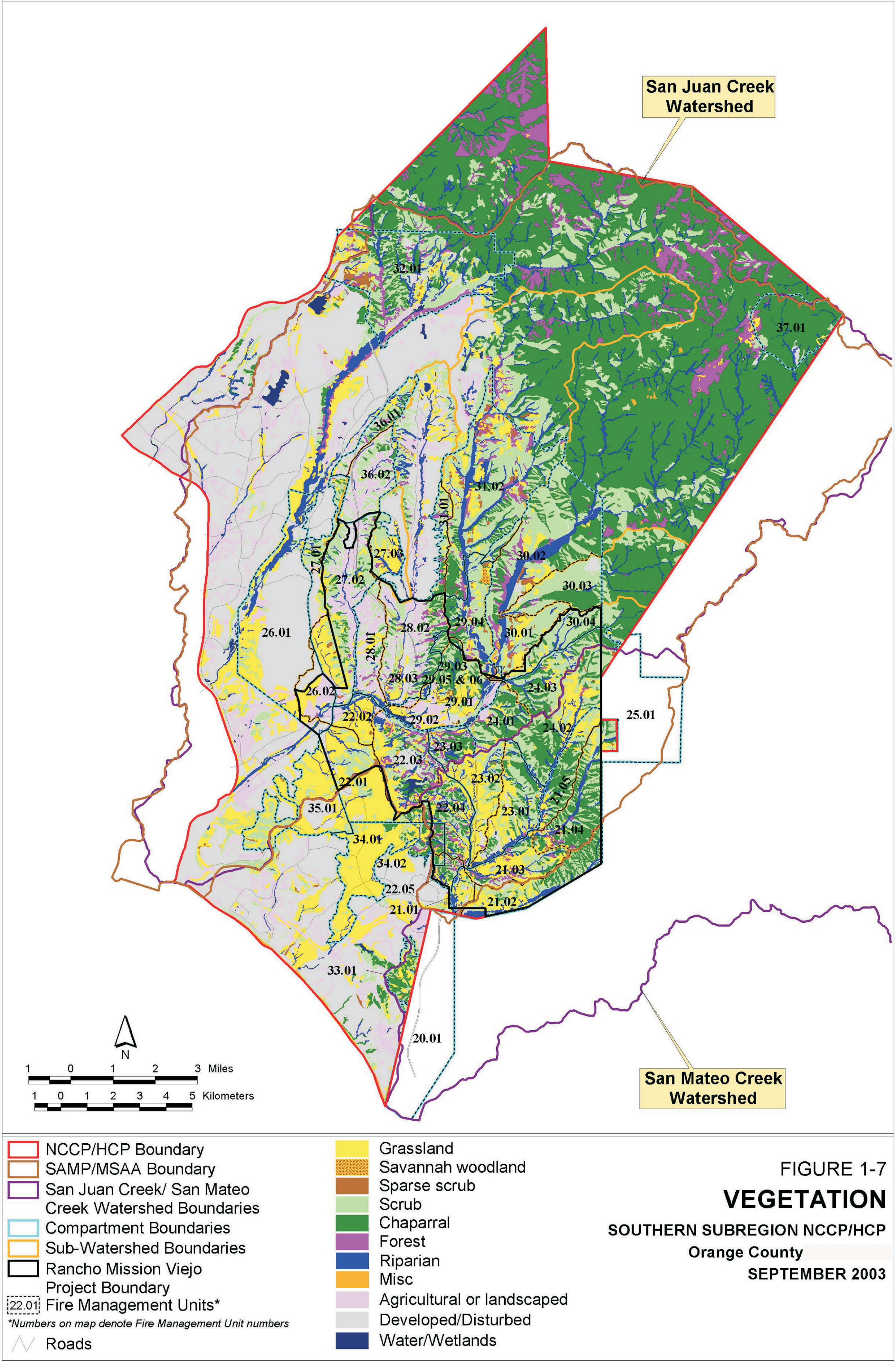


FIGURE 1-7
VEGETATION
SOUTHERN SUBREGION NCCP/HCP
Orange County
SEPTEMBER 2003

contemporary phenomenon, likely caused by elevated fire frequencies (Keeley and Keeley 1984).

In an extensive study of grasslands in Orange County, native perennial grasslands were found to occupy less rocky soils, with higher clay contents (Keeley 1993). Research indicates that shrublands may have been displaced on rocky sites, while native bunch grass prairies may have been lost on heavier clay soils. In a study of plant succession of central California transition rates between grassland and more woody vegetation was found to be similar on moderately drained sandy clay to clay soils. Still, burned areas experienced significantly lower shrub invasion on silty clay to clay soils (Callaway and Davis 1993). These results substantiate findings by Wells (1962) that fire in combination with soil types seems to influence the distribution of vegetation types in the Mediterranean climate areas of California.

Grassland composition within the Southern Subregion boundaries closely resembles sites throughout the state. Dominant species include wild oats (*Avena barbata*), red brome (*Bromus madritensis* ssp. *rubens*), soft chess grass (*Bromus mollis*), foxtail fescue (*Vulpia myuros*), and red-stemmed filaree (*Erodium cicutarium & E. botrys*). Additional common broad-leaf weeds include prickly lettuce (*Lactuca serriola*), tumbleweed (*Amaranthus albus)* and black mustard (*Brassica nigra*). Though these communities tend to have low species richness and a high proportion of their composition made up of alien species, with proper management they still provide important habitat for target species. As a result, these sites will be focused targets for fire management.

1.5.3.4.2 Diegan Sage Scrub

This series is often referred to as coastal sage scrub, which is better thought of as a collection of series. This approach allows stands of comparable composition to be described across a large geographic range. Much effort has gone into detailed mapping of Diegan Sage Scrub sub-associations within the Southern Subregion boundary. For the purpose of this plan Diegan Sage Scrub will be used to describe sage scrub types throughout the Southern Subregion. Dominant shrub species include; black sage (*Salvia mellifera*) California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), California encelia (*Encelia californica*), chaparral mallow (*Malacothamnus fasciculatum*), coast prickly-pear (*Opuntia littoralis*), laurel sumac (*Malosma laurina*) and coyote brush (*Baccharis pilularis*).

The shrubs, dominant in this vegetation type, have evolved adaptive mechanisms to exploit soil moisture in upper soil horizons during cool winter seasons. Most dominant shrubs in this community are winter-active and avoid the summer drought by shedding their leaves (Mooney 1977). Unlike evergreen sclerophyllous chaparral, sage scrub is characterized by malacophyllous subshrubs whose leaves abscise or shed during summer drought and are replaced by a lesser number of smaller leaves (Westman, 1981, Gray and Schlesinger, 1983)

Major factors influencing plant species distribution and composition include evapotranspirative stress, substrate type, soil nitrogen, and air pollution (Westman 1981c). The community composition of coastal sage scrub has been shown to consist of relatively few dominant shrub species, with the majority of species occurring in the herbaceous understory. Westman (1981b) found that of the 375 species encountered during his study, over 50 percent were herbaceous understory species with rare occurrence throughout the community's geographic range.

Studies of post-fire recovery of coastal sage scrub indicate that community response varies with differences in geographic location, species composition, disturbance history, aspect, fire intensity and fire interval (Wells 1962). Multiple successional pathways may exist following disturbance events in sage scrub. Cooper (1922) indicated that sage scrub might be successional to mixed chaparral types.

1.5.3.4.3 Chaparral

Several mixed chaparral types are represented in the Southern Subregion. The most common of these types may be described as chamisal. The term chamisal is applied to chaparral stands in which common chamise *(Adenostoma fasciculatum)* comprises 80% or more of the total shrub cover (Hanes 1977). Chamise chaparral is a dense, interwoven vegetation 1-2m high at maturity without a well-developed understory (Hotrod 1960, Hanes 1971). Stands within the Southern Subregion often have the additional, low frequency occurrence of the following shrubs: eastwood manzanita *(Arctostaphylos grandulosa),* flat-leaved lilac *(Ceanothus crassifolius),* toyon *(Heteromeles arbutifolia)* and black sage (*Salvia mellifera).*

Re-growth after fire may be slower between different chaparral types. Slower response may be due to poor site conditions such as soil depth, soil moisture, nutrient availability (Horton 1960), and the effects of fire intensity on root crown sprouting and response of viable seed in the remaining duff layer. A rich herbaceous flora is often associated with this community type during the first wet seasons following fire events (Horton and Kraebel 1955). Due to the compressed fire return intervals experienced on this site, the Southern Subregion chaparral tends to be more open and of lower stature then other mature stands of this type.

1.5.3.4.4 Riparian

Riparian vegetation in the Southern Subregion varies from well-developed forest types to shrub dominated series. The riparian vegetation occurring on any given site may be a function of disturbance history and/or edaphic (soil type, texture and drainage) conditions. Structural elements vary greatly between riparian series. Utilization of these sites as habitat is often closely correlated with structural change.

Arroyo willow (*Salix lasiolepis*), black cottonwood (*Populus balsamifera*), mulefat (*Baccharis salicifolia*) and additional willows (*Salix spp*) often dominate riparian scrub. In a shrubland form many emergent trees may be present.

These stands may or may not be dominated by a single species. The response of these stands to fire events is not well documented. Little is known of prescribed fire effects and although many stands have burned under wildfire conditions few efforts have been made to quantify response. There is some antidotal evidence that young stands respond more vigorously than sites with a dominance of mature vegetation.

1.5.3.4.5 Oak Woodland

Additional vegetation types of management concern are those sites dominated by coast live oak (*Quercus agrifolia).* Dense stands of mature trees occur on raised stream banks and terraces. Soils are generally sandstone or shale-derived. A mix of tree, shrub and herbaceous species characterize these types. California coffee berry (*Rhamnus californica*), California sagebrush (*Artemisia californica*), poison oak (*Toxicodendron diversilobum*), beardless wild ryegrass (*Elymus triticoides*) and Miners lettuce (*Claytonia parviflora*) may all be common in the understory of these stands. In addition, a significant portion of the herbaceous layer of these stands may be composed of non-native annual grasses. As with other riparian types little appears in the literature regarding fire effects. Many mature trees, within the Southern Subregion, have survived even high intensity fire events. With well-defined adaptations, it seems likely that fire has played a historic role in the development of these stands. Still, ecologically based fire regimes remain undefined. The relationship between tree and shrub recruitment and other stand development issues needs to be examined as burning efforts take place in these vegetation types.

1.5.3.5 Wildlife

199 species of vertebrates are known to exist within the Southern Subregion. This list includes 7 species of amphibians, 15 reptiles, 145 birds and 32 mammals. The Southern Subregion's fauna remains important, in a regional context, for several reasons. Though many of the species occurring within the Southern Subregion are typical of coastal Southern California, several clines of species (members of population) typical of inland sites, are also present. In addition, connectivity between remaining populations of some of the region's wildlife species can still be achieved with the Southern Subregion as an important node in a landscape network. Lastly, populations of selected wildlife species within the Southern Subregion are considered rare and declining. Rare species are distributed throughout the Southern Subregion. *Figures 1-8A*

through *1-8G* represent the distributions of the following federally listed species: California gnatcatchers, least Bell's vireo, southwestern willow flycatcher, arroyo toad Riverside fairy shrimp, San Diego Fairy shrimp and Thread-leaved brodiaea (these Figures are not shown in this appendices to the Draft NCCP/HCP Planning Guidelines but can be found in Chapter 4, *Figures 4-1* through *4-7* of the Draft NCCP/HCP Planning Guidelines).

Some of the Southern Subregion's other notable amphibian and reptile species include the western spadefoot toad (*Scaphiopus hammondii*), the western toad (*Bufo boreas*), Pacific treefrog (*Hyla regilla*), granite spiny lizard (*Sceloporus orcuttii*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), gopher snake (*Pituophis melanoleucus*), California kingsnake (*Lampropeltis getulus*), and the red diamond rattlesnake (*Crotalus viridis*). Selected avian species likely affected by this plan include the northern harrier (*Circus cyaneus*), the red-tailed hawk (*Buteo jamaicensis*), the California quail (*Callipepla californica*), the California gnatcatcher (*Polioptila californica californica*), the southwestern willow flycatcher (*Empidonax traillii*), the least Bell's vireo (*Vireo bellii*), the San Diego cactus wren (*Campylorhynchus brunneicapillus*) the horned lark (*Eremophila alpestris*), the California towhee (*Pipilo crissalis*), the grasshopper sparrow (*Ammodramus savannarum*) and the western meadowlark (*Sturnella neglecta*).

Significant mammals, which the fire program could conceivably impact, include California ground squirrel (*Spermophilus beecheyi*), valley pocket gopher (*Thomomys bottae*), desert woodrat (*Neotoma lepida*), and dusky-footed woodrat (*N. fuscipes).*

With the exception of the dusky-footed Woodrat, which occupies extremely decadent chaparral stands with very high dead to live fuel ratios and is essentially the only species utilizing these stands, the other mammal species respond favorably to fire due to the abundance of new sprouts and seed bearing annual and perennial fire followers.

1.5.3.6 Cultural Environment

1.5.3.6.1 Pre-Settlement

Prior to European contact (ca. mid to late 1500's), the valleys surrounding the Southern Subregion were inhabited by layers of Native Americans of several ethno-historical traditions (McKenna and Hatheway 1988). The earliest known occupants of coastal Southern California are referred to as the San Dieguito Tradition. This first group of coastal residents date from man's arrival until the establishment of post-glacial environments. The Encinitas Tradition follows with occupations of the Southern Subregion between 6000 to 3000 BC. Sites in the city of Irvine document an emphasis on grass seed procurement, with abundant milling equipment. A high likelihood exists that these people actively used fire to maintain a grass seed resource. The

Campbell tradition then occupied these sites from 3000 BC to 700 AD. It is during this period that acorn-processing technology was developed.

The Shoshonean Tradition begins around 500 AD and continues until the Spanish colonization of California. Following the development of the mission system, the term "Gabrielino" was applied to these people and their ancestors. They lived an intensive hunter-gather existences with permanent or semi-permanent villages along coastal estuaries. According to Bean and Shipek (1978), fauna comprised between fifteen and twenty percent of the subsistence resources.

Though the use of managed fire is not specifically documented for the Shoshonean Indians, much evidence exists for tribes throughout California. Several researchers maintain that there is evidence for almost every tribe in the western United States having used fire to modify their respective environments (Lewis 1993, Steward 1955).

Reynolds (1959) demonstrates the use of frequent fire by California tribes to increase the yield of desired seeds, drive game, stimulate the growth of wild tobacco, improve visibility and facilitate the collection of seeds. The combination of anthropogenic burning and natural fire likely created a pre-settlement fire regime characterized by frequent fire of variable intensity.

1.5.3.6.2 Settlement

The area currently within the Southern Subregion boundaries was originally settled during the late 1760's and was primarily used for grazing of cattle and sheep (Hudson 1981). Much of the Southern Subregion is contained within the historic boundaries of Rancho Mission Viejo which extended from Camp Pendleton to Cooks Corner. Cattle grazing and water use are documented from the early 1800's. It is believed the area experienced light to moderate seasonal grazing and infrequent fire. No evidence of managed fire has been documented for this period (1760 – 1800's).

Starting in 1860 additional land uses developed in and surrounding the Southern Subregion. Orchards were established, sheep grazing was initiated, while limited limestone and coal mining occurred.

1.5.3.6.3 Recent Land Use

Recent history has seen extensive residential and agricultural development throughout the landscape within and surrounding the Southern Subregion. With the exception of the eastern border of the Southern Subregion, the other three edges of the open space landscape within the Subregion have experienced some level of urban-wildland interface. Much of the contemporary development benefits from thoughtful fire planning. Defensible space and appropriate building materials characterize structures built during the last ten years. Still, the high density of human occupation has resulted in a highly altered fire environment. In addition, managed fire has been used successfully and was most recently used in a series of Vegetative Management Projects (VMP's) in 1985, 1986, 1987 and 1994 (see 1981-1990 Fire History Map, *Figure 1-9C* and 1991-2000 Fire History Map, *Figure 1-9B*).

1.6 Natural and Historic Role of Fire

1.6.1 Natural Fire

Little is known of pre-settlement fire events in the Southern Subregion. Many of the assemblages of plants known to occur in the Southern Subregion have documented fire adaptations. With an atmosphere full of oxygen, a surface stuffed with organic fuels and an endless source of ignition, it seems unlikely that these communities would experience significant fire free intervals (Pyne 1995).

The structural and compositional nature of the pre-settlement fuels also indicates frequent fire. Though grasslands may have their origins rooted in soils and climate, the selective forces of fire (Vogl 1974) likely maintained these communities. The widespread appearance of shrublands would also indicate repeated fire events. The spread of chaparral seems to be based chiefly in the Pliocene. The rapid rise of steep slopes, increasingly dry climates strengthened by Santa Ana winds have created extreme fire conditions. Fires from lightning and volcanism effectively eliminated trees and favored seral shrublands.

Contemporary research supports the concept of pre-settlement fire regimes. Comparing the size and pattern of fire events on either side of the Alta and Baja California borders, Minnich (1990) describes a regime of frequent, low to mid intensity fire events in the absence of fire suppression activities. In contrast Keeley (1999) describes contemporary fire regimes in Southern California shrublands as characterized by too frequent fire. These compressed fire return intervals are thought to be the source of type conversion and the reduction in shrub densities. Modern day fire ecologists most likely considered both theories to be acceptable; however, type conversion and reduction in shrub densities are more directly related to high intensity wildfires. Frequent, large sized low to moderate intensity wildland fire events (prior to the fall Santa Ana winds) of the past likely reduced the probability of high intensity wildland fires from occurring on the same landscape.

At the turn of the century citizens began petitioning the Federal and State Governments to do something about managing the remaining public lands that were the source for devastating wildfires that burned out settlements, or the denuded landscapes resulted in severe flooding of down stream towns and cities. A 10:00 AM policy was put into effect by the US Forest Service. This policy required that all wildfires be vigorously attacked and extinguished by 10:00 AM the following day. This policy resulted in most wildfires being extinguished with the lone exception of the unsuccessful suppression of wind driven wildfires that accounted for all of the acreage burned. Prior to the 1900's many of the early season fires burned large areas over several months with low to moderate intensity fires. Since the 1900's these low to moderate intensity wildfires occurring prior to the Santa Ana winds were quickly and easily suppressed allowing both living and dead vegetative fuels to build up.

In the early 1970's land managers began to realize that there were not as many wildfires, but when they did occur they were causing much more soil damage and chaparral stands were being type converted to very flammable stands of non-native grasses. It took about 70 years for managers to realize that well-meaning fire suppression policies were only postponing the inevitable and were causing unnatural ecosystem changes. Fire suppression policies were allowing wildland fuels to accumulate to unnatural levels so that when wildfires did occur they were of very high intensities and were very destructive. These realizations have brought us to the present day prescribed fire policy where fire is viewed as natural part of the ecological balance of wildland ecosystems.

1.6.2 Historical Uses of Fire

Aboriginal use of fire is often invoked as the disturbance maintaining open grasslands and oak savannas. Many authors support the view that Indian burning was frequent and widespread (Cooper 1922, Jepson 1910). Although Indians lived and utilized the area within the Southern Subregion, the extent and frequency of Indian burning is unknown, however, it is very likely that Indians did use fire. Although evidence is not clear, it is quite likely that countless fires were set during the settlement period. Early California newspapers document grassland and chaparral fires which burned for weeks and months.

During contemporary land management, in addition to the wildfire history, a small number of vegetative management burns have occurred within the Southern Subregion (see *Figure 1-9C*). The Orange County Fire Authority, California State Parks, the Cleveland National Forest and the Marine Corps Base at Camp Pendleton have all implemented successful prescribed burns in grassland and shrubland vegetation. These efforts were intended to both reduce fire hazards and improve habitat quality.

1.7 The Fire Environment

1.7.1 Fire Weather

The fire season in Orange County usually starts in May and ends in November, although critical fire weather can occur year round (Orange County Historical Records). Significant fires have been recorded in December and January (California Department of Forestry and Fire Protection).

Several synoptic weather conditions produce high fire danger. One is a cold front passage followed by winds from the northeast quadrant. Another is produced by high pressure systems in the Great Basin. This Great Basin high produces the foehn-type wind along the west slope of the Coast Ranges, known as "Santa Ana Winds". Peak "Santa Ana" wind occurrence is in November with a secondary peak in March, however, over time Santa Ana winds have been recorded in every month of the calendar year with the exception of August.

A third high fire danger situation occurs when a ridge or closed high aloft persists over the western portion of the United States. At the surface, this pattern produces very high temperatures, low humidity, and air-mass instability (Schroeder and Buck 1970).

1.7.2 Fire History

Historic fire data indicates that large wildland fires have been a frequent visitor to the Southern Subregion lands. Most of the Southern Subregion lands have experienced a wildfire one or more times in the past 50 years. Since the 1940s, the California Department of Forestry and Fire Protection (CDF) and later the Orange County Fire Authority (OCFA) have documented all wildland fire events for the entire county. *Figures 1-9A* through *1-9J* depict wildland fires by decade for the Southern Subregion. Most of these fire events were of human origin. The majority of ignitions have been associated with roadways, arson and person-related activities. Exceptions include the Santiago Canyon Fire of 1998, where multiple lighting strikes caused this fire.

1.8 Fuels

The Southern Subregion's vegetation, topography and disturbance history has created a mosaic of fuel types. Frequent disturbance has created low volume fuel beds throughout portions of the Southern Subregion. Open grasslands in the eastern portion of the Southern Subregion are an example of this respective fire type. In areas where fire and grazing has been excluded, fuel loads have reached moderate to high levels. Where fuels have burned within the last 10 years fuels can be generally characterized as low volume with a high percentage of fine, herbaceous fuels.

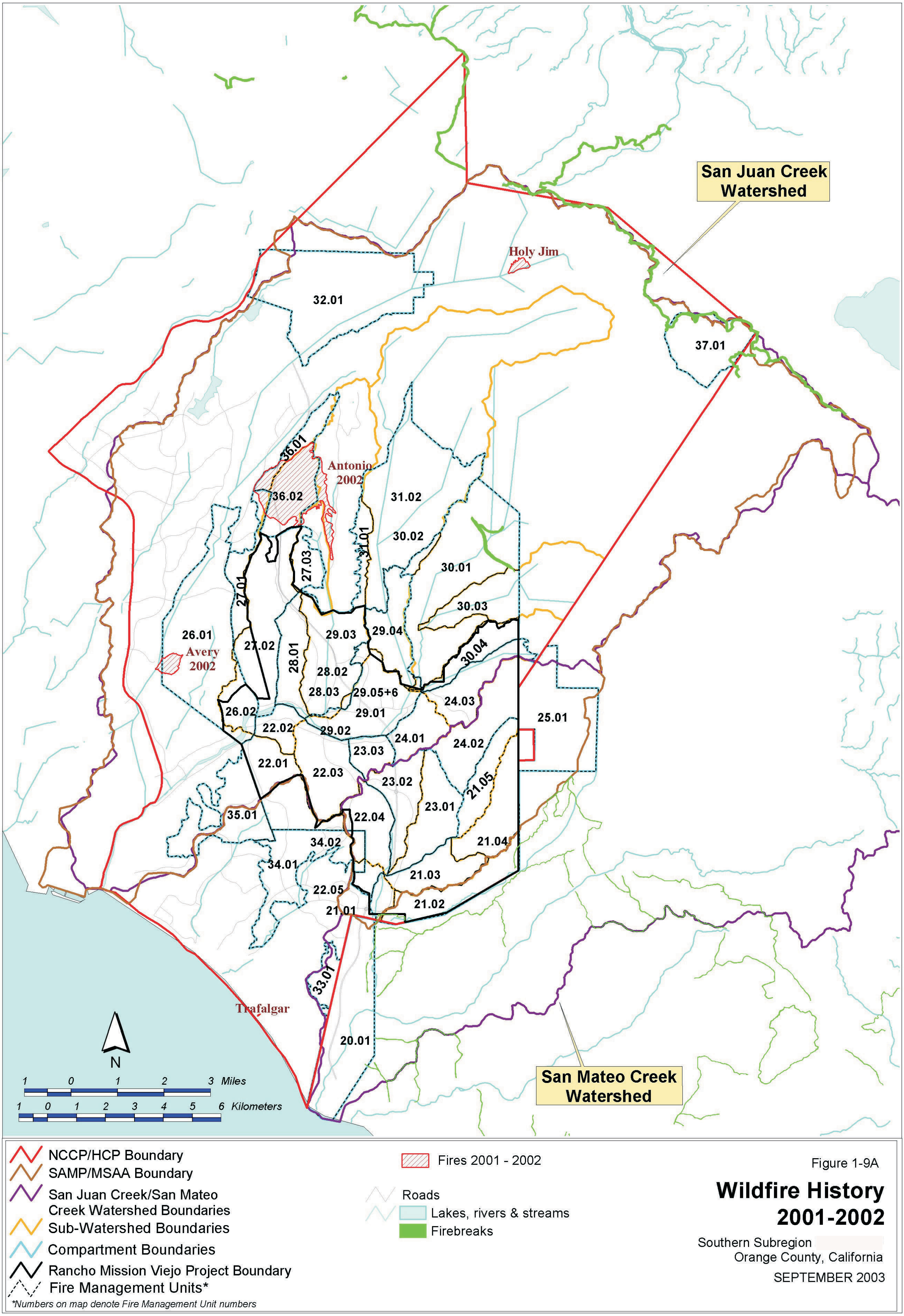


Figure 1-9A

Wildfire History 2001-2002

Southern Subregion
Orange County, California

SEPTEMBER 2003

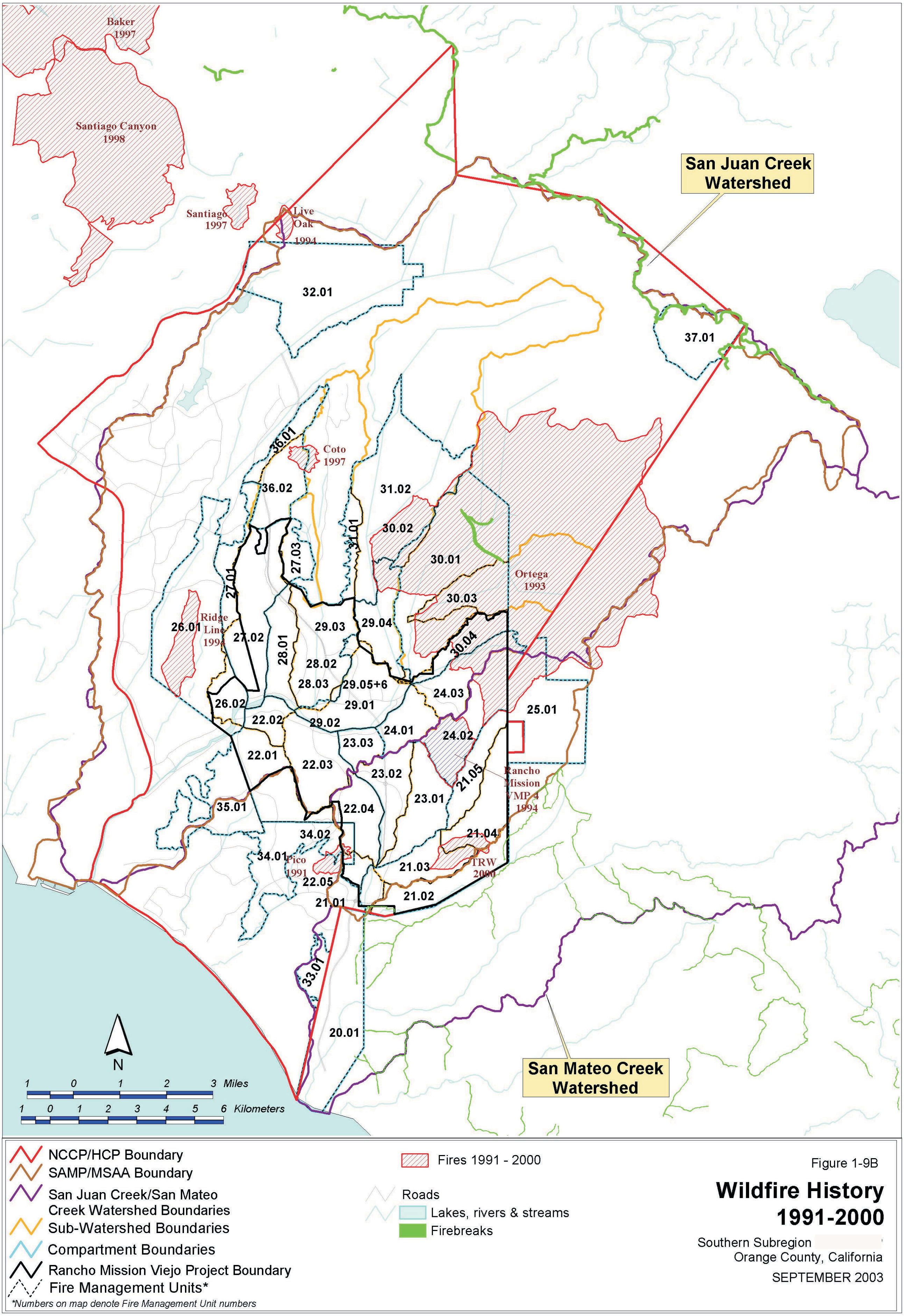
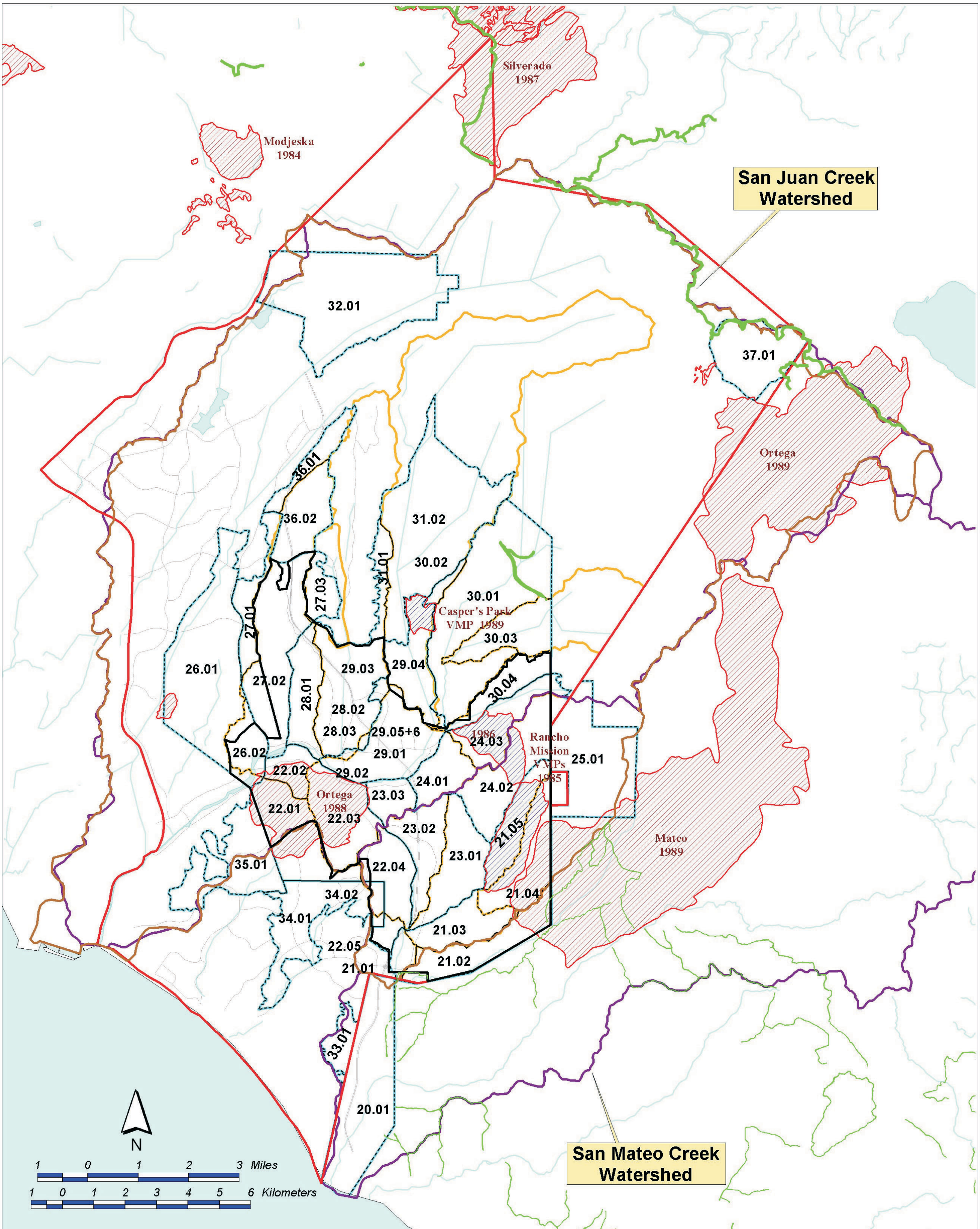


Figure 1-9B

Wildfire History 1991-2000

Southern Subregion
Orange County, California
SEPTEMBER 2003



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary
Fire Management Units*

*Numbers on map denote Fire Management Unit numbers

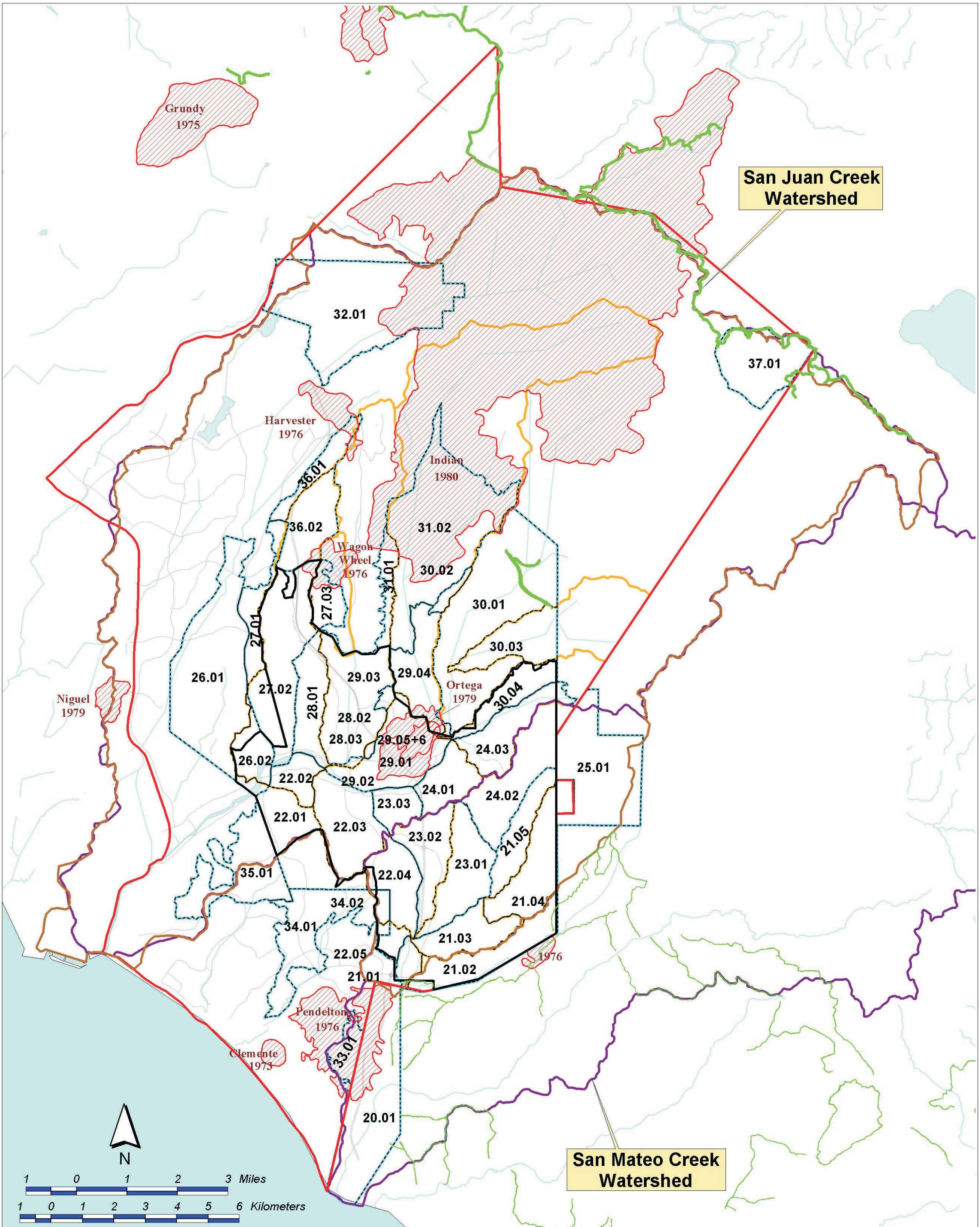
Fires 1981 - 1990

Roads
Lakes, rivers & streams
Firebreaks

Figure 1-9C

Wildfire History 1981-1990

Southern Subregion
Orange County, California
SEPTEMBER 2003



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary
Fire Management Units*

*Numbers on map denote Fire Management Unit numbers

Fires 1971 - 1980
Roads
Lakes, rivers & streams
Firebreaks

Figure 1-9D

Wildfire History 1971-1980

Southern Subregion
Orange County, California
SEPTEMBER 2003

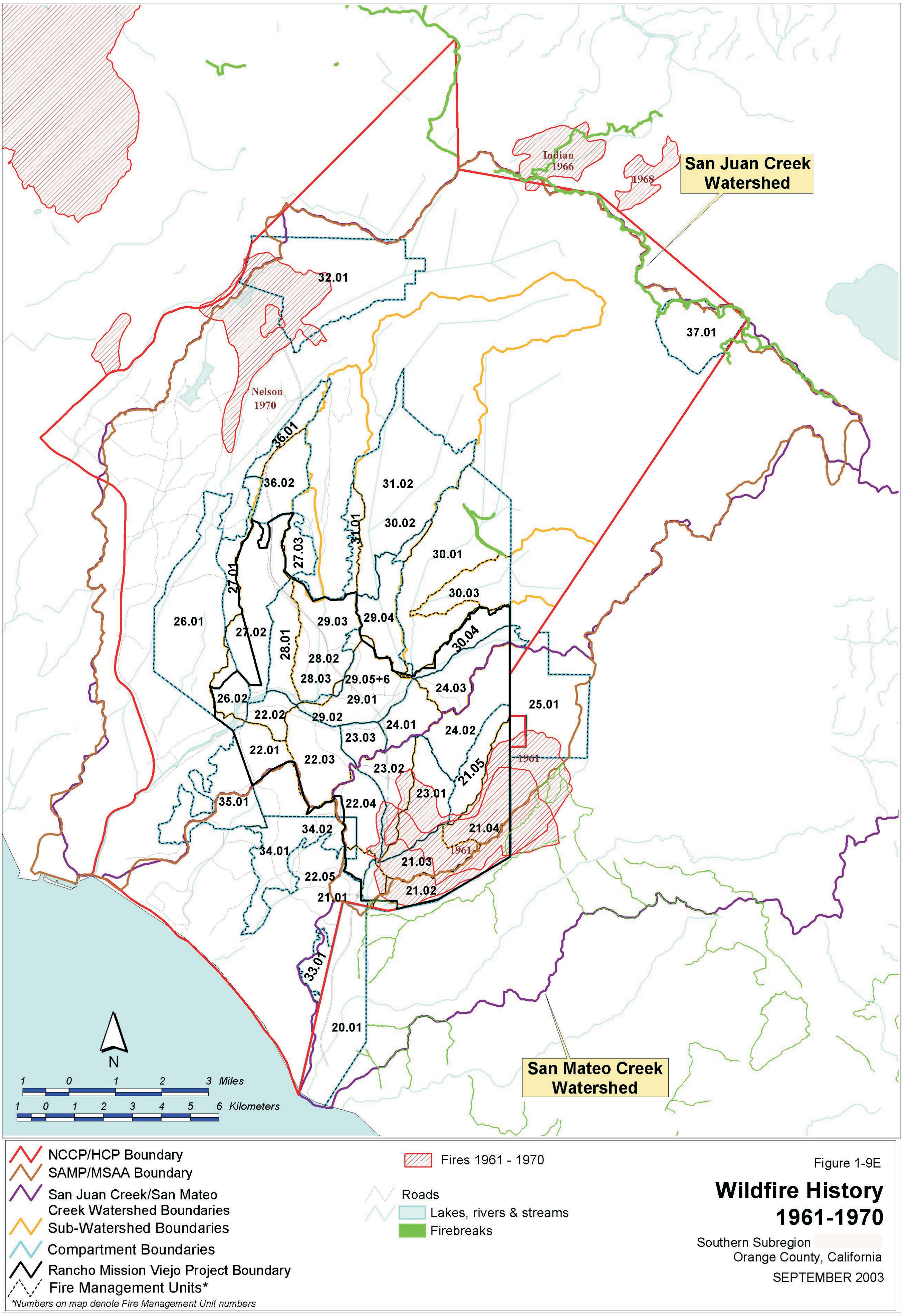
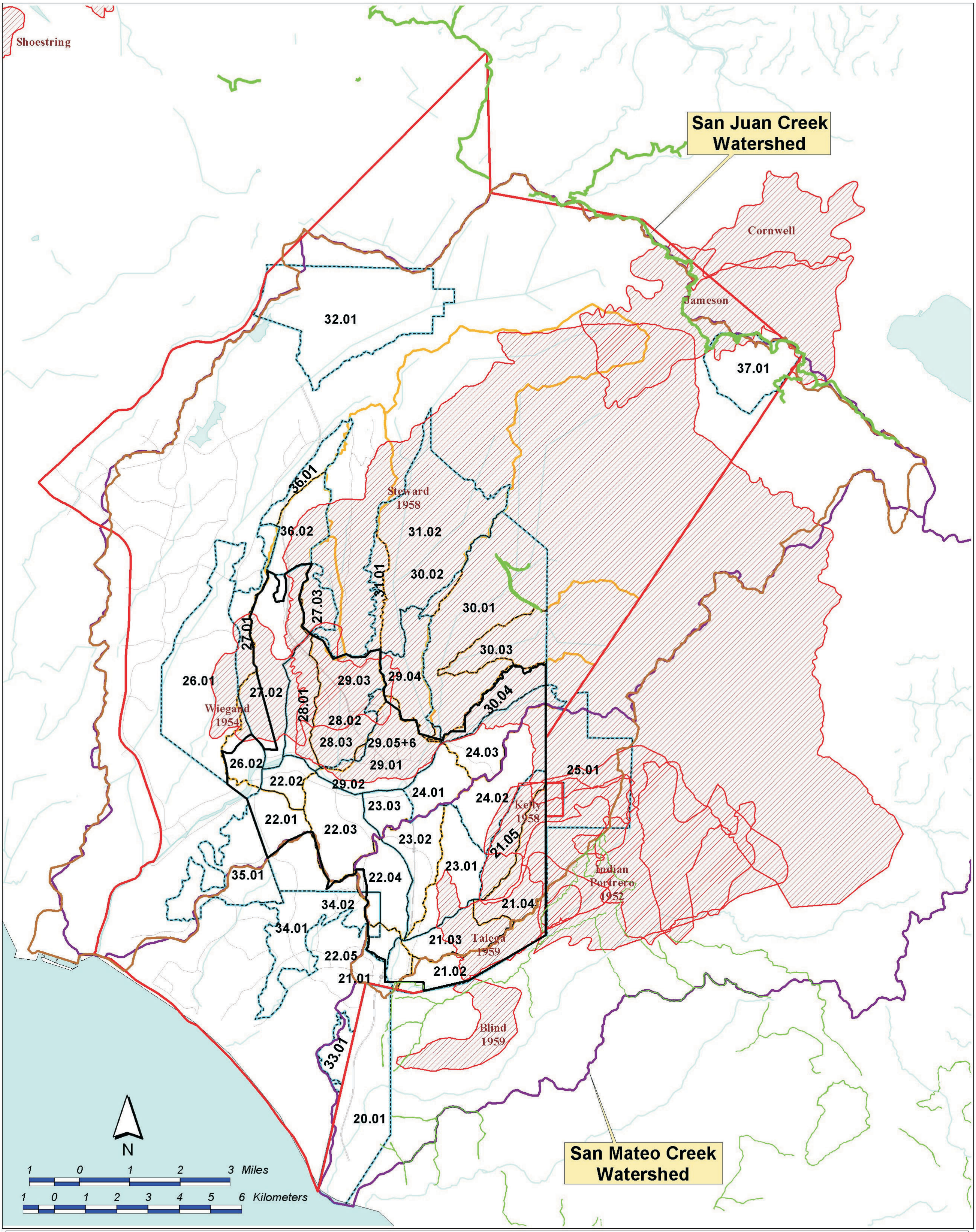


Figure 1-9E

Wildfire History 1961-1970

Southern Subregion
Orange County, California

SEPTEMBER 2003



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary
Fire Management Units*
*Numbers on map denote Fire Management Unit numbers

Fires 1951 - 1960
Roads
Lakes, rivers & streams
Firebreaks

Figure 1-9F

Wildfire History 1951-1960

Southern Subregion
Orange County, California
SEPTEMBER 2003

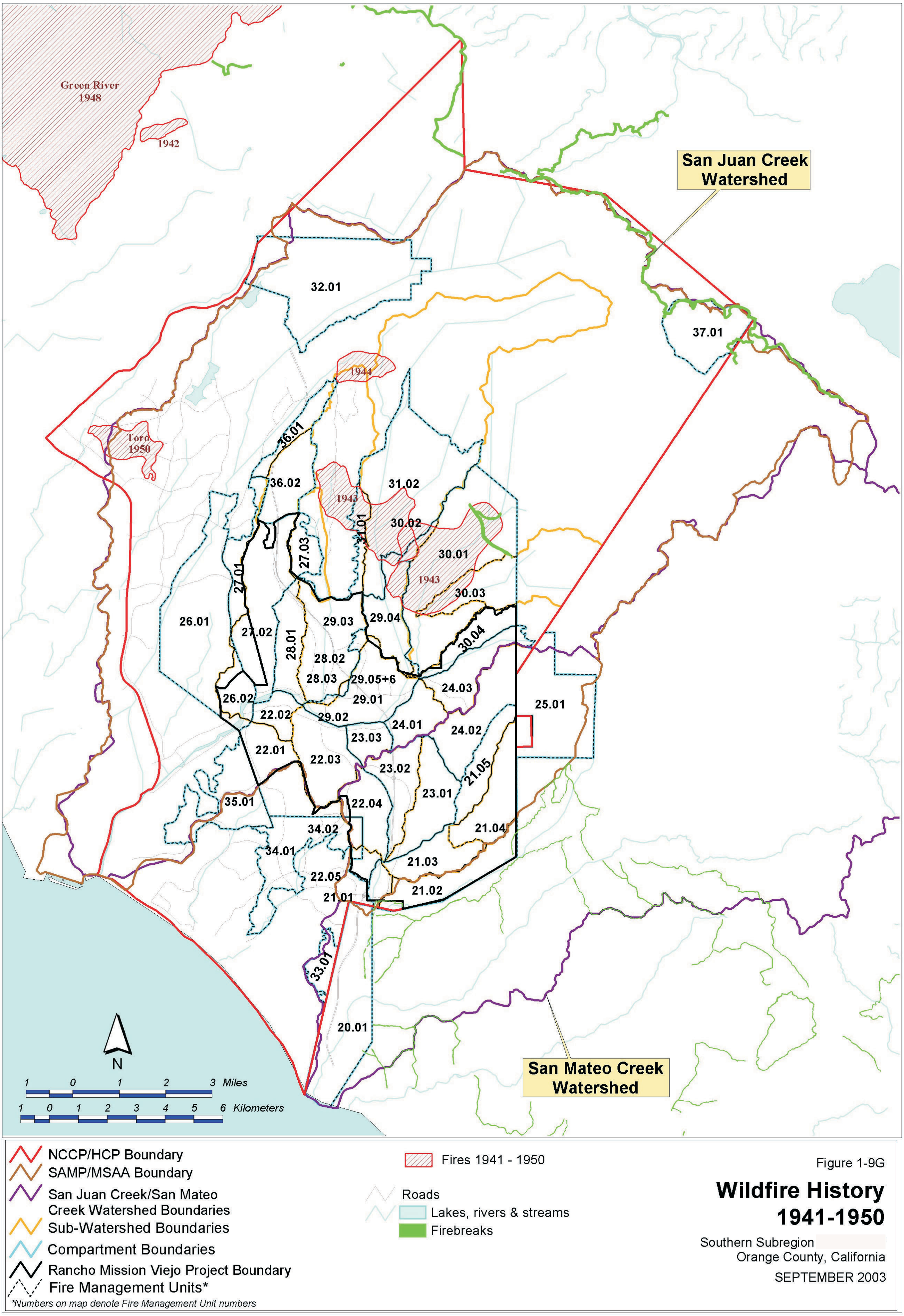
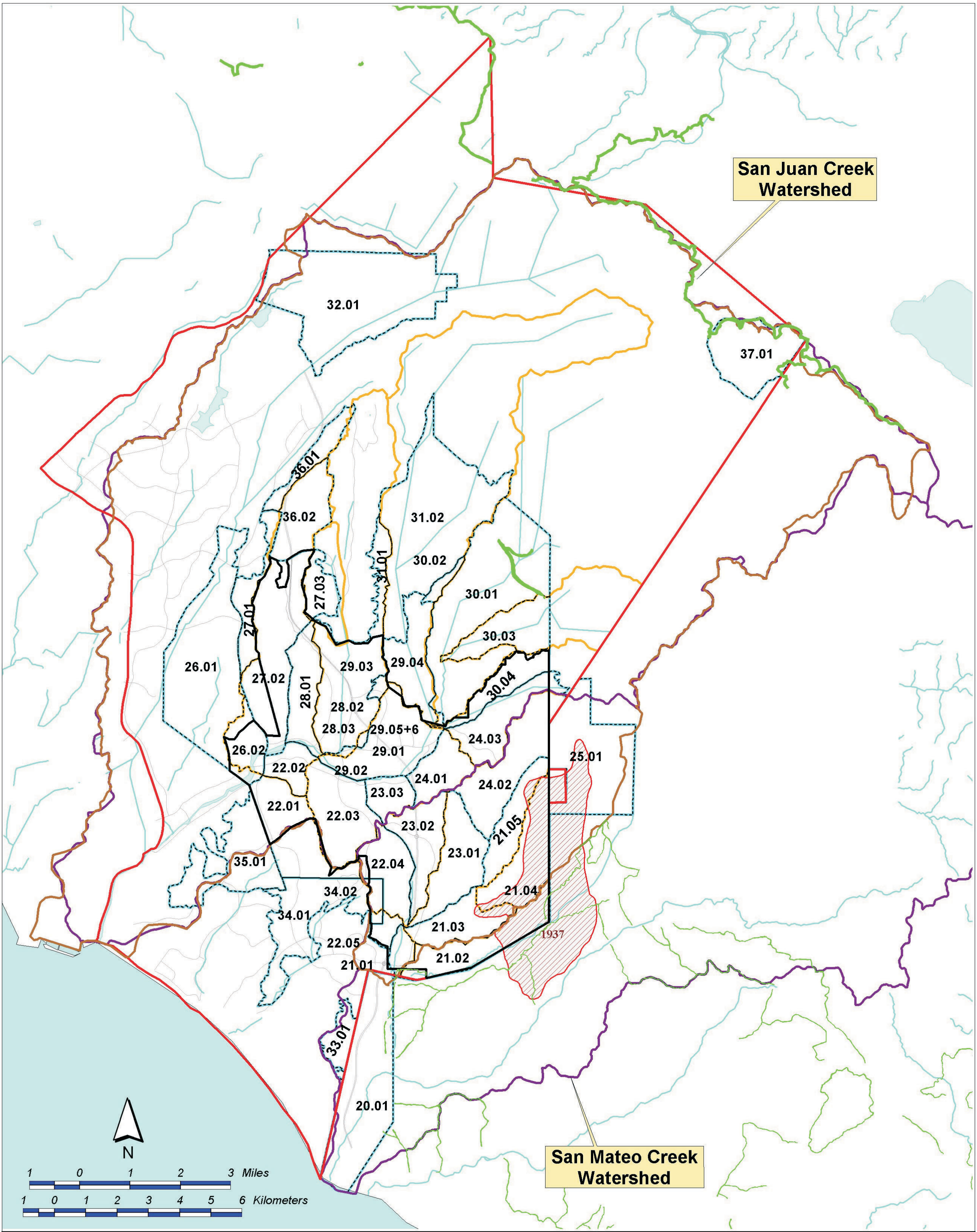


Figure 1-9G

Wildfire History 1941-1950

Southern Subregion
Orange County, California
SEPTEMBER 2003



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary
Fire Management Units*

*Numbers on map denote Fire Management Unit numbers

Fires 1931 - 1940

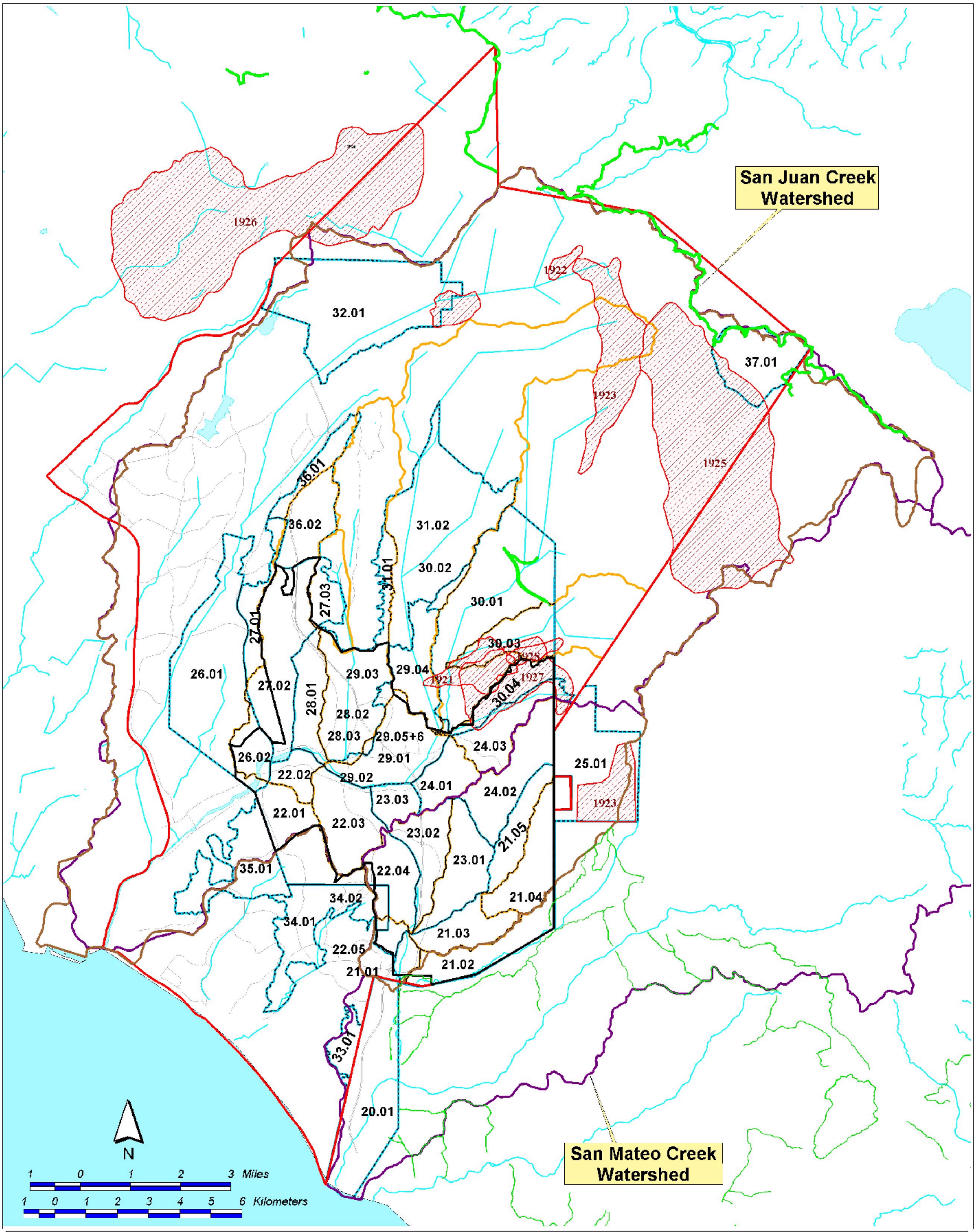
Roads
Lakes, rivers & streams
Firebreaks

Figure 1-9H

Wildfire History 1931-1940

Southern Subregion
Orange County, California

SEPTEMBER 2003



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary
Fire Management Units*
*Numbers on map denote Fire Management Unit numbers

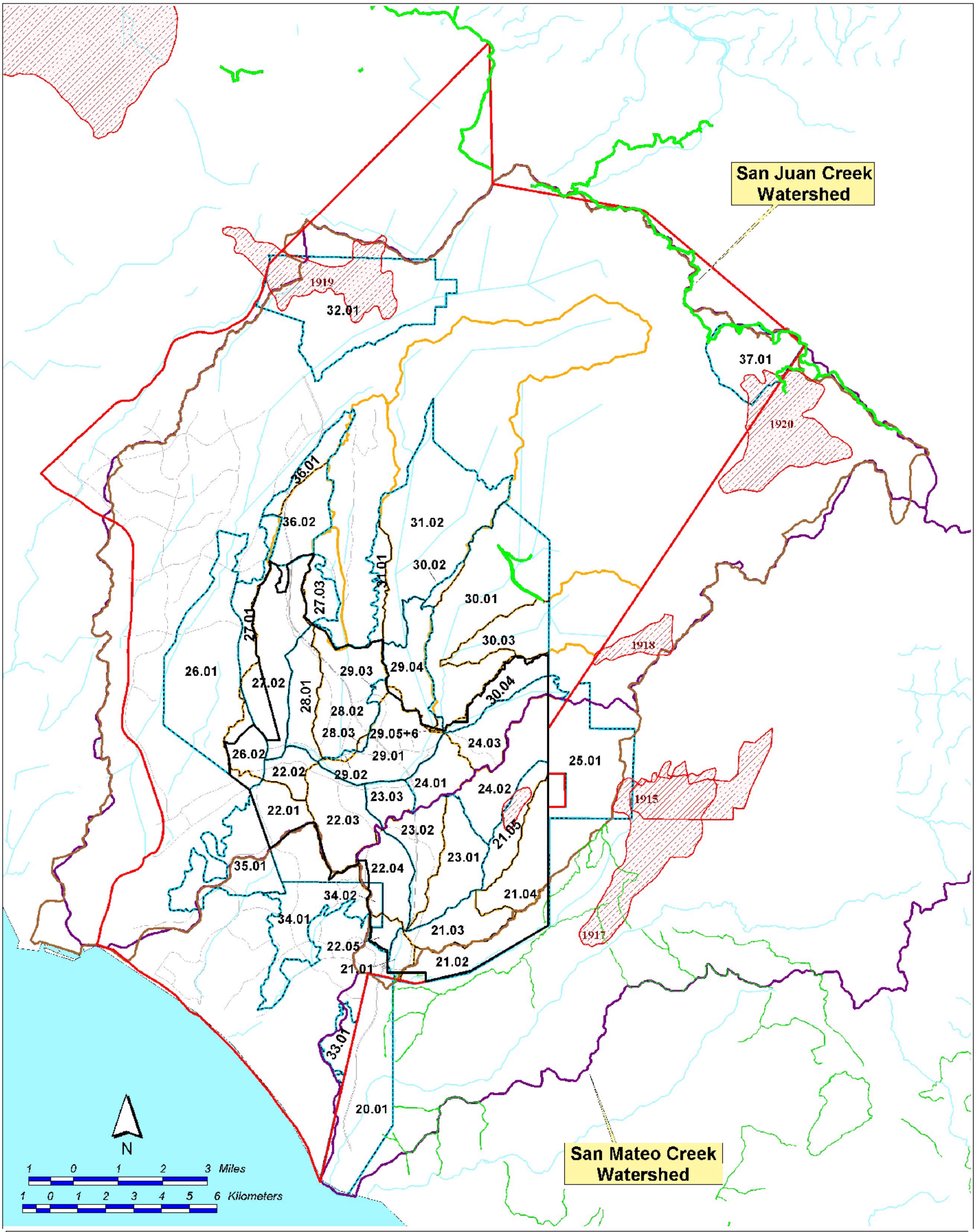
Fires 1921 - 1930
Roads
Lakes, rivers & streams
Firebreaks

Figure 1-9I

Wildfire History 1921-1930

Southern Subregion
Orange County, California

SEPTEMBER 2003



NCCP/HCP Boundary
SAMP/MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Compartment Boundaries
Rancho Mission Viejo Project Boundary
Fire Management Units*

*Numbers on map denote Fire Management Unit numbers

Fires 1911 - 1920

Roads
Lakes, rivers & streams
Firebreaks

Figure 1-9J

Wildfire History 1911-1920

Southern Subregion
Orange County, California

SEPTEMBER 2003

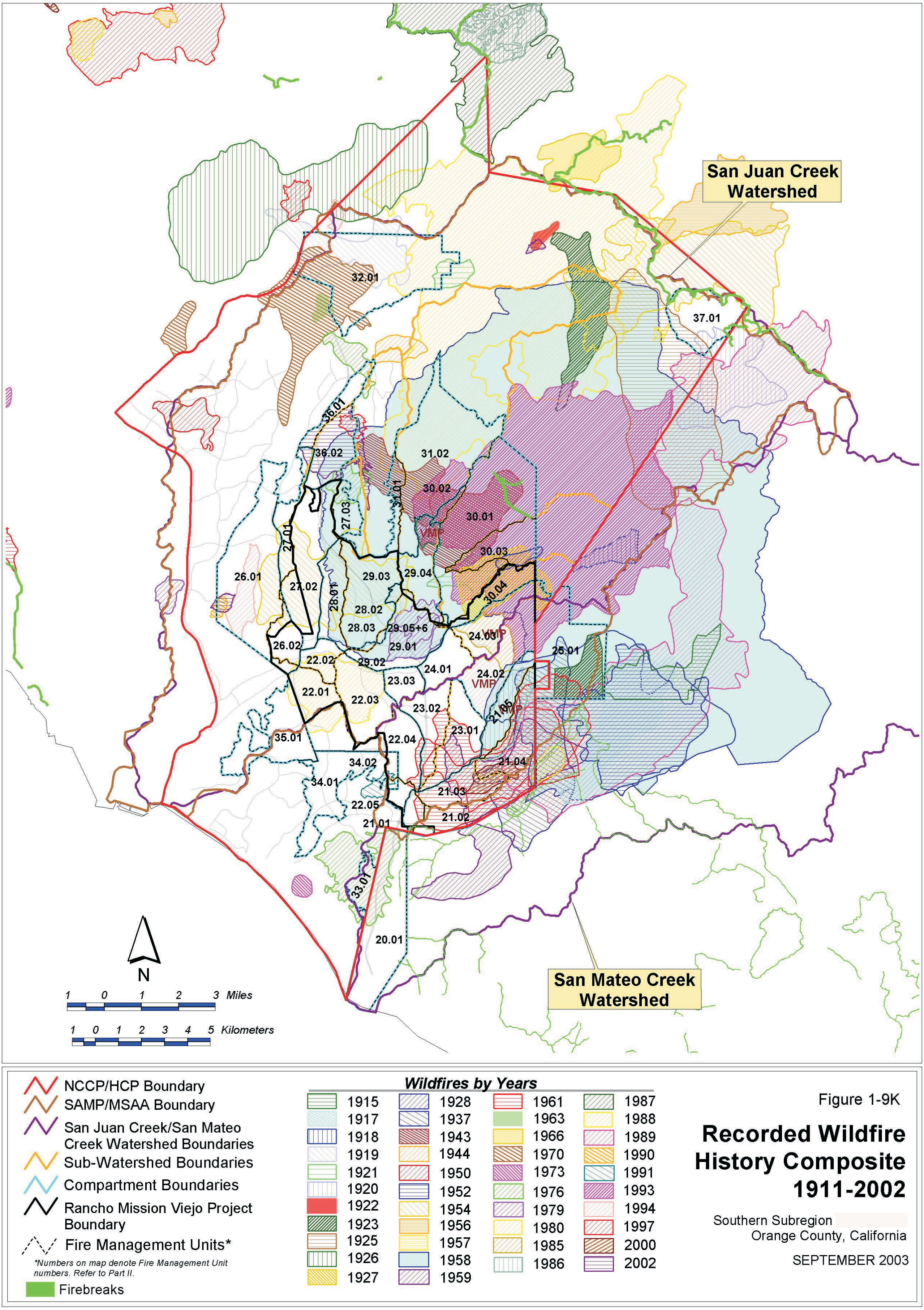


Figure 1-9K

Recorded Wildfire History Composite 1911-2002

Southern Subregion
Orange County, California

SEPTEMBER 2003

A variety of fuel classes are represented in the Southern Subregion. Although most fuels occur in the 1-hr and 10-hr size class, 100-hr and 1000-hr fuels do exist in the Southern Subregion's dense brush, riparian and tree fuel models located within the interior units. Two grass fuel models occur (Fuel Model 1 and Fuel Model 2), as well as three shrub fuel models (Fuel Model 4, Fuel Model 5 and Fuel Model 6) and one tree (hardwood) fuel model (Fuel Model 9). Part III of this Fire Management Plan discusses fuel models in detail.

1.9 Fire Effects

Fire is recognized as directly influencing the physical and chemical properties of soils. Many of the soils on the Southern Subregion are poor in some plant nutrients. Large portions of these nutrients are contained in actively growing plant stems. Mineral and nutrient cycling in fire type ecosystems is dominated by periodic ashing (Zinke 1977). Most nutrients are deposited on the soil surface where they are readily taken up by plants. Some portion of existing nitrogen will be volatilized. That remaining in ash is highly available in the form of ammonia nitrogen, or after nitrification, as nitrate nitrogen (DeBano et al. 1977).

Fire in shrubland communities may affect the soil infiltration rates. Large temperature gradients in the upper few centimeters of soil layer may cause vapor and gases containing hydrophobic substances to move downward in the soil profile where they condense on soil particles (DeBano 1966). Hydrophobicity may facilitate dry ravel and wet hillslope erosion processes.

Fire is effective in reducing on-site fuel loading including foliage, stems and woody portions of plants. Consumption rates may be high for litter and humus layers of soil. In addition, fire may create large amounts of dead organic matter by killing but not consuming vegetation (Wright and Heinselman 1973). This may be true within the Southern Subregion's riparian areas but is not the case on dry hillside slopes covered with dense chaparral.

Fire impacts on individual plant species and communities are often significant. Heat shock, presence of charite and change in photoperiods may all stimulate seed germination (Keeley and Keeley 1987). Post-fire response can include both vegetative reproduction and stimulation of flowering and fruiting (Malcolm 1977). Combustion of above ground biomass will alter seedbeds and temporarily eliminate competition for moisture, nutrients, heat, and light (Wright and Heinselman 1973).

On a community level, fire may also influence successional pathways through varying frequency and/or intensity.

Wildlife populations and their distribution are often regulated by fire. Fire can increase food resources for both grazers and browsers. Mass production of species, such as oaks, is also affected by fire. Insect populations, an important food source for birds and some mammals, may also be regulated by fire. Of particular consequence to wildlife is the mosaic of vegetation on the landscape. Vegetation type, structure and age class distributions are generally controlled by fire (Wright and Heinselman 1973).

Populations of insects, fungi and pathogens are also influenced by fire. Regulating stand age, sanitizing of plants and production of charcoal, which can stimulate ectomycorrhizae, can all impact the above-mentioned variables (Wright and Heinselman 1973).

1.9.1 Plant Community Response to Fire

Each plant community responds differently to wildland fire depending upon fire intensity and frequency. The key plant communities of concern in this document with regard to fire response are coastal sage scrub, grassland, oak woodlands and riparian.

1.9.1.1 Coastal Sage Scrub

Three floristic associations of coastal sage scrub are recognized in southern California: Venturan, Diegan, and Riversidian. Venturan coastal sage scrub occupies coastal sites in Santa Barbara, Ventura, and Los Angeles counties, while the Diegan association occupies coastal sites in Orange and San Diego counties. The Riversidian association occupies more inland sites in Los Angeles, Riverside, San Bernardino, and San Diego counties (Axelrod 1979; Kirkpatrick and Hutchenson 1977; Westman 1981c). Plant species common to these associations include California sagebrush (*Artemisia californica*), black sage (*Salvia mellifera*), white sage (*S. apiana*), purple sage (*S. Leucophylla*), California buckwheat (*Eriogonum fasciculatum*), brittlebush (*Encelia farinosa*) and California encelia (*E. californica*).

A complex composite of factors, particularly fire, was found to be significant in the maintenance of these habitat types (Wells 1962). With rapid crown sprouting and small wind dispersed seeds, sage scrub communities are often fire successional to chaparral at lower elevations (Cooper 1922; Wells 1962). Traditionally fires were likely to have burned hot, consuming most of the above ground biomass. Stand development periods seem to be short, with some longer period during which insufficient fuel is available to carry fire. Undisturbed stands may begin to open up their canopy in 20-25 years following periods of drought or competition for available nutrients and moisture. As canopy gaps begin to form, potential arises for invasion of annual grasses. It should be noted that major factors influencing sage scrub species distribution and composition include evapotranspirative stress, substrate type, soil nitrogen, and air pollution (Westman 1981c).

It appears that re-sprouting of dominant shrub species, particularly on coastal sites, enhances community succession in coastal sage scrub following fire (Mooney 1977). Keeley and Keeley (1982) studies within the Santa Monica Mountains estimated that 70 percent of pre-fire shrub populations re-sprouted the first year following fire, covering one-third of the ground surface by the end of the second season. The first year after a fire, herbaceous annuals dominate, with very little recruitment of perennial herbs from seed. Sprouts of dominant shrubs grow rapidly in height and dominate the site within several years. Shrub seedlings tend to be observed primarily two years after fire, possibly as a result of seed produced from first-year sprouts (Hanes 1971; Westman 1982).

Compared to coastal stands, inland stands of sage scrub recovered more slowly from fire and show greater change in post-fire composition because of reliance entirely upon seedling recruitment. Re-sprouting of dominant shrub species rarely occurs. Recovery of pre-fire species composition and cover on inland sites is therefore completely dependent upon an existing native seed bank or seeds brought onsite by wind or wildlife species (Myers and Ellstrand 1984). Generally, annual herbs dominate during the first year after a fire, but tend to decline in subsequent years as shrubs attain greater cover. Perennial herb understory species, which may grow from re-sprouts, show low recruitment for the soil seed bank. Unlike herbaceous annuals, the overall diversity of perennial understory herbs remains constant the first few years following fire. New species continue to recruit into recovering sage scrub, reaching a peak at 5 to 10 years after a fire. After the 5 to 10-year peaks in species diversity, there is a general decline in perennial understory herb species. This may be attributed to dominate shrub species increasing in cover, thereby shading out the understory herbs (Keeley and Keeley, 1984).

On coastal sites, Malanson and O'Leary (1985) suggested that early post-fire recovery on sites dominated by suffrutescent shrubs such as deer weed *(Lotus scoparius)* may suppress seedling establishment, thereby favoring re-sprouting as the dominant recovery strategy. Because suffrutescent shrubs are more abundant during shorter fire intervals, seedling establishment may be favored during less frequent fires or during fires of greater intensity.

The resilience of a particular stand of sage scrub largely depends on the re-sprouting vigor of dominant shrub species. Sites dominated by vigorous re-sprouters tend to be more competitive than sites with both weak and strong re-sprouters, although intense fires can kill even strong re-sprouters. Sites with both strong and weak re-sprouters are more likely to experience permanent alteration (Westman and O'Leary 1986). Malanson and O'Leary (1982) noted the variable nature of re-sprouting within species and suggested that it may be attributed to differences in rooting depth, carbohydrate storage, location of adventitious buds, size of plant, soil moisture conditions at the time of fire, and fire intensity.

O'Leary and Westman (1988a) compared post-fire herbaceous growth between sites with different disturbance regimes. It was found that herb species richness was similar for all sites immediately after the fire. The sites on the coast that were not affected by air pollution or close proximity to grazing rapidly returned to pre-fire levels of herb diversity in conjunction with rapid recovery of shrub re-sprouts. However, a coastal site adjacent to grazing tended to become dominated by introduced annual grasses with poor recovery of dominant shrubs. The introduction of competitive annuals on sites in proximity to grazed areas occurs due to the condition of the adjacent grazed area and the presence of annual grasses, seeds caught in the hair of cattle transported to the site from other areas and seed material in waste deposited on the ground.

Factors such as slope, aspect, and substrate type appear to have an effect on distribution patterns of herbs in sage scrub after fire. These variations in response may be driven by temperature and available moisture associated with insulation differences on opposing slopes. In addition, differences in soil temperature on opposing slopes may affect seed survival and also act as a factor in determining species distributions (O'Leary 1988).

Comparative analyses of fire response of two different sub-associations of Venturan sage scrub characterized by different soils and aspect revealed that species richness, cover, and equitability on north-facing slopes were higher than on south-facing slopes. This was attributed with relatively mesic conditions under which the particular sub-association develops (O'Leary 1990). Malanson's (1984) simulations of shrub response to fire interval and intensity indicate that long-term fire trends are unlikely to have caused the sharp boundary between these two sub-associations of coastal sage scrub.

Because of the close association of sage scrub and chaparral throughout their geographic range (Gray and Schlesinger 1980), fire management strategies for these two plant communities have largely been the same. Studies have indicated, however, that the successional processes, and therefore, fire intervals for these two plant communities may be different. Unlike chaparral, coastal sage scrub shrubs are able to establish by seed and re-sprout on a continual basis in the absence of fire. Thus, a stand of coastal sage scrub may be typically mixed aged. This indicates that the optimum fire interval for coastal sage scrub may be different than chaparral, which may also explain the need for longer fire-free intervals in chaparral plant communities (Malanson and Westman 1984; Malanson 1985).

While it may be true that fire intensity in chaparral increases with longer fire intervals, a decline in leaf litter in coastal sage scrub over time can decrease fire intensity at longer fire intervals. Although the total annual litter fall in coastal sage scrub is similar with that of chaparral the low productivity, soft wood, green tissue, and open vegetation structure of coastal sage scrub may favor more rapid decomposition and prevent large fuel accumulations beneath the plants (Grey and Schlesinger 1981). Fire intensity in coastal sage scrub is likely more dependant on weather conditions than on stand age (Malanson and O'Leary 1985). More intense fire suppresses crown sprouting and consequently promotes herb flora.

Malanson (1985) utilized a fire behavior computer model to analyze demographic competition of five coastal sage scrub species under different fire intervals. Short fire intervals of 10-20 years may greatly reduce or eliminate some species, while longer fire intervals allow for the maintenance of species diversity. Unusually short fire intervals produce anomalous vegetation responses in coastal sage scrub (Zedler, 1983). After 2 years, many shrub species failed to re-sprout or re-seed.

The Point Loma Ecological Reserve, which is managed by the Department of Defense, United States Navy and the National Park Service, Cabrillo National Monument has not had fire in this coastal sage scrub/chaparral ecosystem since 1871. Many of the coastal sage scrub and chaparral species are dropping out, specifically ceanothus (*Ceanothus verrucosus*). Yet soil samples taken throughout the Reserve contain viable seed from plants no longer observable on the Reserve. When short duration intense heat is applied to these samples species germinate that were once represented within the Reserve. A high intensity fire disturbance is needed to restore the Point Loma Reserve back to its pre-settlement vegetative condition (Zedler 1995).

1.9.1.2 Grasslands

After fire, cover, density, and seedling establishment of purple needlegrass (*Nassella pulchra*) often increases as a result of increased soil temperature, light intensity, and nutrient release, and decreased standing litter (Ahmed 1983, Brown 1982, Dyer 1993, Dyer 1996, and Langstroth 1991). Regeneration occurs from tillers at the soil surface, fragmentation of bunches, and/or by seedling establishment. Needlegrass stands that experience severe fire have larger decreases in individuals' basal area and foliage height in the 1st postfire year but are more likely to increase by fragmentation. These patterns are more pronounced with short-duration grazing, particularly in early spring (Dyer 1993 and Langstroth 1991).

Annual grasses have larger seeds than purple needlegrass and are better adapted to establishing in litter layers. For this reason, fire can increase purple needlegrass seedling establishment, particularly in old stands where litter accumulation is highest (Ahmed 1983, Dyer 1993 and Langstroth 1991). Adult individuals are also benefited by reduction of competition from annual grasses. Even though fire during periods of rapid growth can be detrimental to purple needlegrass, it is generally more damaging to nonnative annuals (Ahmed 1983 and Bartolome 1981). Some studies, however, have found fire and/or grazing effects on cover, density, or seedling establishment of purple needlegrass were highly variable or insignificant, suggesting a large influence of climate on purple needlegrass' response to fire (Dyer 1996 and Hatch 1999).

Fire regimes: There is little direct physical evidence of the historical extent of purple needlegrass and less about historic fire frequencies in the communities where it occurs. Most agree, however, that purple needle grass' abundance was historically greater, and fire exclusion has been a factor in its decline (Bartolome 1981, Brown 1982 and Langstroth 1991). In the coastal scrub, chaparral, and oak woodland, fire frequency declined in the early 1900s with restrictions against burning; in grasslands fire frequency declined in the 1840s when heavy grazing and intermittent drought reduced fuels (Brown 1982 and Greenlee 1990).

Before Spanish settlement, California prairie was used by tule elk, pronghorn antelope, and mule deer, but grazing was intermittent enough to allow dominant grasses to regrow and support fire (Brown 1982). In many areas where purple needlegrass and nonnative annuals now coexist, purple needlegrass and native annuals were historically mixed. Here, the interaction of fire and grazing likely reduced competition from annual grasses, reduced woody species encroachment, and improved purple needlegrass regeneration (Dyer 1997 and Langstroth 1991).

One study of vegetation dynamics in coastal sage scrub, chaparral, and coast live oak woodland near Santa Barbara found that without fire or livestock grazing, coastal sage scrub was replaced by oak woodland at a rate of 0.3% annually. Grassland to coastal sage scrub transition occurred at a rate of 0.69% per year, and oak woodland reverted to grassland at a rate of 0.08% per year. On burned areas without livestock grazing or on unburned sites with livestock grazing, rates of transition of grassland to coastal scrub and coastal scrub to oak woodland were lower. On areas burned without grazing or grazed without burning the rate of oak woodland reversion to grassland was higher than on areas with neither burning nor grazing (Callaway 1993).

In chaparral and coastal scrub, early postfire vegetation is dominated by native and nonnative annuals. Herbaceous vegetation is greatest in areas where fire eliminates nonsprouting shrubs (Keeley 1990 and Mensing 1998).

Purple needlegrass and other perennial grasses are more abundant after fire in coastal sage scrub than in chaparral. Fire repeated in less than approximately 3-year intervals often causes the herbaceous sere to persist (Keeley 1990). Conversion of purple needlegrass grassland to coyote bush/ripgut brome communities has been observed with 24 years of fire exclusion (Langstroth 1991).

Purple needlegrass is present in oak and pine woodlands and in the early seral stages of mixed evergreen forests, redwood and coast Douglas fir forests. Generally, purple needlegrass and other herbaceous species are present in later successional oak woodlands only in intercanopy areas. Closed stands have up to 5 inches (12.7 cm) of oak litter that essentially eliminates grass growth (Plumb 1983).

1.9.1.3 Oak woodland

Coast live oak (*Quercus agrifolia*) is exceptionally fire resistant, more so than other California oak species. Evergreens are often better able to conserve nutrients than deciduous species and are favored in fire prone environments (McDonald 1981). Low intensity surface fires have little effect on mature coast live oak. Saplings and seedlings generally recover quickly from low to moderate intensity fire (Dagit 2002, Plumb and McDonald 1981). Because of mortality among small diameter oak trees, frequent fire limits coast live oak invasion of grasslands (Mensing 1998). Mature oaks are more likely to be damaged by fall fires than early season fires. Severely burned oaks are vigorous sprouters (Plumb and Gomez 1983).

Acorns on the soil surface are killed by low intensity fire, where animal-buried acorns usually survive moderate intensity fire, sometimes resulting in high rates of post fire establishment (Davis, Keller, Parikh, and Florsheim 1989; Lawson, Zedler, and Seiger 1977).

Fire frequency largely defines the extent of coastal sage scrub, chaparral, and oak woodland; in these habitats decreasing fire frequency tends to favor the development of coast live oak. One study of vegetation dynamics in coastal sage scrub, chaparral and oak woodland near Santa Barbara, California found that without fire or livestock grazing, coastal sage scrub was replaced by coast live oak woodland at a rate of 0.3% annually. Again without fire, grassland to coastal sage scrub transition occurred at a rate of 0.69% per year, and oak woodland reverted back to grassland at a rate of 0.08% per year. On burned areas without livestock grazing, rates of transition of grasslands to coastal sage scrub and coastal sage scrub to oak woodland were much lower and the rate of oak woodland reversion to grassland was higher (Callaway and Davis1993). Sites without shrub increase are generally south facing and/or on shallow soils (Griffin 1977). Generally, grass is present in open stands while closed canopy stands have up to 5 inches of oak litter which prohibits the presence of grass (Plumb and Gomez 1983).

Fire exclusion in coastal sage scrub and mesic chaparral communities allows coast live oak to increase in density and reduce understory diversity and abundance (Mensing 1998; Van Dyke, Holl and Griffin 2001). Van Dyke and Holl recommend prescribed burning in coastal sage scrub to maintain scrub species and associated herbaceous species and to slow coast live oak expansion.

Flammability of coast live oak, coastal sage scrub and chaparral communities with a coast live oak component is of particular concern because of their high fuel loadings and proximity to developments in interface areas. Some fire-excluded chaparral habitats have fuel accumulations of 30 to 40 tons per acre (Hecht-Poinar, Costello and Parmeter 1987).

Fuel modification zones in the immediate areas of development provide the best measure of protection for structures encroaching into wildland areas. Recommendations for property protection include: planting trees away from the structures so at maturity the tree crowns are no closer than ten (10) feet to the structure, trimming up low branches up to six (6) feet from the ground, eliminating all shrubbery from beneath the canopy of the planted trees, selecting less flammable native plants for landscaping (see the Orange County Approved Plant List in Appendix A) and using non flammable construction materials (East Bay Municipal Utility District 1992; Franklin 1997).

Domestic goat grazing (at a rate of 240 goats per acre for 1 day) in conjunction with prescribed fire, has been used successfully to reduce fuel loadings and fuel continuity in dense coast live oak, coastal sage scrub scrub/chaparral near housing developments (Tsiouvaras, Havlik, and Bartolome 1989).

1.9.1.4 Riparian

Coast live oak associates in riparian areas include white alder (*Alnus rhombifolia*), California sycamore (*Platanus racemosa*) and Fremont cottonwood (*Populus fremontii*) all of which sprout vigorously after fire. Severe high intensity fires were apparently historically rare in riparian habitats. Currently most fire in riparian zones is accidental and of high severity, causing relatively high rates of top-kill and basal sprouting of all these species (Barro 1989; Davis, Keller, Parikh, and Florsheim 1989). Riparian zones comprise the least number of acres by vegetation type representing between 2 and 5% of the total acres in the Southern Subregion, yet they contain the greatest mix of biodiversity richness. Fires in riparian zones should be suppressed at the smallest size possible.

Fire managers in southern California utilize fire control lines in coast live oak riparian woodlands when planning broadcast burns of adjacent grassland, chaparral and coastal sage scrub. The control lines are burned out to create a fuelbreak between the riparian zone and the adjacent fuels targeted for treatment with prescribed fire (Dougherty and Riggan 1982).

1.9.2 Wildlife Response To Fire

Because so little has been published on the response of wildlife to fire in coastal sage scrub, this summary relies heavily on the fire ecology literature as it relates to other habitats, especially chaparral. Of the papers cited here, only Price and Waser (1984), Moriarty et al. (1985), and Stanton (1986) pertain specifically to coastal sage scrub. Writing in 1969, Udvardy stated that the literature on special adaptations toward fire resistance in animals is scarce, and the effect of recurring fires on their distribution has not yet been assessed. This account will address several general topics before discussing selected taxonomic groups in more detail.

The role of disturbance in creating early successional habitats, and how it relates to the overall health of wildlands, is receiving increasing attention in the conservation biology community (e.g., Litvaitis 1993). Under natural conditions, fire is the most common disturbance in many plant communities, including coastal sage scrub. The positive role of fire in maintaining a mosaic of habitats has often been emphasized (Fox and McKay 1981, Quinn 1982, Willan and Bigalke 1982, Pyne 1984). The latter author noted that the variable intensities of fire ensure that a variety of biotic ensembles, a mosaic, persists. The following summary was also provided:

"Free burning fire, it is argued, is a primary mechanism for ensuring complexity, variety, and ultimately stability in natural systems."

The indirect influence of fire (primarily the temporary loss of habitat) has long been recognized as being far more important than direct impacts (Leopold 1933). Still, considerable attention has been given to the fate of wildlife during fires. The negative observations of Chew et al. (1959) are the exception. They found 43 dead mammals and two dead birds in 1.7 acres following a Malibu, California chaparral fire and suggested that the fire's toll on wildlife was enormous. Howard et al. (1959), Stoddard (1903), Komarek (1969) and Biswell (1989) especially downplay the loss of life (birds and animals) due to wildfire, based largely on their experiences with controlled burns, which typically burn with less intensity and slower rates of spread than wildfires. Leopold (1933), Lawrence (1966), Catling et al. (1982), and Pyne (1984) took more moderate positions, suggesting that few birds and mammals die in wildfires, but acknowledging that under certain conditions, many animals may die.

Kaufman et al. (1990) listed direct causes of mortality in fire: burns, heat stress, asphyxiation, physiological stress, trampling, and predation while fleeing. Most insects are not believed capable of escaping wildfire (Komarek 1969, Hogue 1993).

Komarek (1969) provides considerable information concerning animal responses to fire, and included a lengthy appendix detailing specific species' reactions. Most of his observations were in the southeastern Untied States, in the general vicinity of the Tall Timbers Research Station in Tallahassee, Florida. He observed ants relocating their nests (including eggs and larvae) from burned areas to unburned vegetation within an hour after burning.

Komarek (1969) found frogs seeking moist areas to avoid fire and heard the spring chorus of certain species resume soon after a fire passed by a breeding pond. Similarly, he found little evidence of lizards or snakes killed by fire. He watched hispid cotton rats (*Sigmodon hispidus*) herding and carrying young to safety ahead of fires, and never found dead young in burned nests.

Recent surveys have shown large numbers of snakes being killed during coastal prescribed burns. Thirty-five dead snakes were collected in a 25-acre burn (Fisher, unpublished data). The majority of animals collected were western rattlesnakes (*Crotalus viridis*). Fisher has proposed that fire directly affects the heat sensors of these animals and increases the chance of individuals being killed. Still a large number of live snakes were observed in the same units, following fires. This can be attributed to those individuals that survived in rocky out crops or took refuge in ground squirrel, fox and rabbit burrows.

In a controlled experiment, Howard et al. (1959) measured the lethal temperature for several chaparral rodents at 138-145°F. Burrows a few inches deep were sufficient to insulate animals from these temperatures as fire burned on the surface. Lawrence (1900) examined this issue further, finding that three (3) inches of depth was probably enough to survive heat and increased vapor pressure in burrows. He suggested that post-burn predation is probably a more restrictive factor on small birds and mammals than the fire itself. Still, Wirtz (1995) found species requiring brush for cover and/or food, like the California gnatcatcher, are most severely impacted by fire, and require the longest time to recover to pre-fire densities.

Some animals are drawn to active fires. Biswell (1989) reported that birds have been observed to fly in back of a fire and begin feeding almost immediately. Raptorial birds and predatory mammals exploit birds and small mammals fleeing fires, while flycatchers, swallows and others aerial feeders prey on displaced insects (Stoddard 1963, Komarek, 1969). Other species, especially ground feeders, such as mourning doves (*Zenaida macroura*), northern flickers (*Colaptes auratus*), American robins (*Turdus migratorius*), bluebirds (*Sialia sp.*), sparrows, and finches may forage on burned areas immediately following fire (Stoddard 1963). Komarek (1969) noted many instances of birds and mammals consuming ash following fire, presumably as a dietary supplement.

Quinn (1982) lamented the fact that the study of insects in chaparral and other Mediterranean-type ecosystems has been largely ignored, especially in view of the strong influences insects have over plant communities.

Force (1982) conducted a four-year post-fire study in chaparral of the San Gabriel Mountains and found that pollen-nectar feeders and predatory insects can be very abundant beginning in the first spring after a burn. Phytophagous insects (other than flower feeders) and parasitic insects more slowly establish in the burn. Fourth year insect richness and diversity showed a dramatic increase after an overall three-year decreasing trend.

Hogue (1993; page 46) discussed "fire beetles" (genus *Melanophila*, family Buprestidae) and smoke flies (genus *Microsania*, family Platypezidae), noting that both are attracted to heat and smoke and may arrive on a burning plot before the flames recede. Lawrence (1966) found insects to be particularly susceptible to predation by California quail (*Callipepla californica*), California towhees (*Pipilo crissalis*), and western meadowlarks (*Sturnella neglecta*) following fire.

Birds, as a group, have received the most attention in wildlife fire studies. The benefits of fire in game management have been especially well covered. In attempting to summarize the effects of wildland fire on wildlife, Pyne (1984) stated that, in general, there tends to be a slight increase in avifauna and relatively constant number of mammal species following fire. The size of individuals tends to increase in both birds and mammals due to the abundance of both seeds and insects on burned over areas for the first several years following a fire.

Studying chaparral in the Sierra Nevada, Lawrence (1966) found that many species were severely exposed to predation in the bare ash following fire, and most small mammals and brush dwelling birds decreased rapidly; predatory birds and mammals were found to increase. Further, with time, brush-dwelling species declined as forbs and grasses increased, while grass-dwelling species increased. No species were eliminated altogether. This finding points out that nothing is static. Many species benefit with disturbance and then slowly decline in numbers as the species they replaced begin to increase as the site returns to pre-fire disturbance conditions.

Komarek (1969) pointed out that birds and mammals are often attracted to a "greening" burn site, where they feed on tender shoots unavailable elsewhere.

Without specifying habitats, Biswell (1989) claimed that one could expect an increase in bird numbers the first year after fire, especially seed-eating birds.

Lawrence (1966) and Wirtz (1982) present the results of two relatively long-term studies of bird response to fire in chaparral. Lawrence found mourning doves and western meadowlarks to be among the earliest users of burned areas at his Sierra Nevada study site, and the degree of habitat recovery in the first year following fire was sufficient to allow accelerated reproductive rates in these species. He documented an overall increase in nesting bird density following fire, especially among seed-eating birds. Increased numbers of predators following the fire included sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*) red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), great horned owl (*Bubo virginianus*), and common raven (*Corvus corax*).

Wirtz (1982) found both species richness and species diversity to increase in the 42 months following fire at his study site in the foothills of the San Gabriel Mountains. No increase was noted in the number of omnivorous birds or birds that take insects from the air (flycatchers), but increases were noted in the number of insect and seed-eating birds (towhees, quail and meadow larks). These differences were most pronounced in the first year following the fire. Species that glean insects from vegetation and insect and fruit-eating species exhibited a decrease in the use of burned areas.

Moriarty et al. (1985) and Stanton (1986) compared bird communities on a burned coastal sage scrub site and control site in Pomona, California. The initial study showed greater species richness on the control site, but similar numbers of individuals on both sites, due in large part to the presence of ground-feeding finches. Substantial similarity between the two sites was evident within one year of the fire. Wrentits (*Chamaea fasciata*), California thrashers (*Toxostoma redivivum*), and California towhees were more common on the control site, while mourning doves, scrub jays (*Aphelocoma coerulescens*), house finches (*Carpodacus mexicanus*), lesser goldfinches (*Carduelis psaltria*), and American goldfinches (*C. tristis*) were more common on the burned site.

The follow-up study by Stanton (1986) was completed less than three years following the fire. Reduced species richness was again found on the burned site, with similar numbers of individuals on the two sites. Most species preferred the control, with the following species among the exceptions: American kestrel, Say's phoebe (*Sayornis saya*), western kingbird (*Tyrannus verticalis*), yellow-rumped warbler (*Dendroica coronata*), lazuli bunting (*Passerina amoena*), house finch, and lesser goldfinch. Greater heterogeneity of habitat was offered as the explanation for greater bird use of the control site, and it was suggested that coastal sage scrub might not fit the general pattern of increased bird use following fire in chaparral.

Two sensitive birds that utilize coastal sage scrub polant communities, the coastal population of cactus wren (*Campylorhynchus burnneicapillus*) and coastal California gnatcatcher (*Polioptila californica californica*) show some negative correlation to fire. Rea and Weaver (1990) point out that fire is apparently the primary limiting factor in the distribution of cactus in southern California. In coastal California, cactus wrens are restricted to coastal sage scrub with tall cactus. On Camp Pendleton, in San Diego County, Tutton et al. (1991) found that 80 percent of known coastal California gnatcatcher locations were in areas that had not burned in at least 16 years. However, in other coastal sage scrub areas unburned in many years, fire may actually increase habitat suitability for gnatcatchers.

In the case of the 1993 Laguna Fire approximately 13,000 acres of natural vegetation in the San Joaquin Hills burned including 6,800 acres of coastal sage scrub. Only 470 acres of coastal sage scrub within the burned area was left unburned or only lightly burned. Prior to the fire an estimated 127 pairs of California gnatcatchers and 282 pairs of cactus wrens occupied this area. The fire resulted in the loss or displacement of many of the resident California gnatcatchers and cactus wrens. However, the coastal sage scrub plant community reestablished itself quickly and within two years the numbers of gnatcatchers and cactus wrens began to increase over post fire populations. In 2003, almost 10 years after the Laguna Fire, the numbers of California gnatcatchers were almost back to pre-fire population levels and could easily surpass those pre-fire population levels next year. The cactus wrens have also increased, but at a much slower rate.

The slower response is attributed to a lack of suitable cactus plants which were hit hard by the fire and recover at a much slower rate than the coastal sage scrub species.

Similar findings are being observed in the 1996 and 1997 burned areas in the Upper Chiquita Canyon Conservation Easement. A new wildfire occurred in May 2002 in the southern portion of the Conservation Easement. In spite of the recent droughts, the 1996 burned area is coming back to a mixed sage plant community and the 1997 burn is coming back to a coastal sage scrub plant community. Gnatcatchers nested in the 1997 burned area for the first time in the spring of 2003. In the May 2002 fire, population numbers declined as follows: before the fire gnatcatchers were estimated at 104 locations and after the fire were detected at 42 locations. Cactus wrens dropped from being detected at 65 locations to being detected at 30 locations. Population numbers are adequate to permit the re-colonization of the burned area as soon as the habitat recovers (Harmsworth Associates 2003).

The results of a number of studies, primarily on rodents, are hereby summarized.
Crowner and Barrett (1979) identified three major factors influencing reduced rodent numbers following fire: 1) reduced cover, 2) increased predation, and 3) reduced food availability. Kaufman et al. (1990) noted two additional behavioral factors: forced emigration and direct reduction in reproductive output.

In brush habitat in the east San Francisco Bay region, Cook (1959) found that rodents were apparently limited in the first year following a fall fire by a lack of cover, as seed was abundant by early spring. After initial "annihilation," brush-dwelling mice showed a population increase, exceeding that of a control site throughout the second year following the fire.

No small mammals were trapped immediately following a fire on a Sierra Nevada chaparral site studied by Lawrence (1966), and no marked animals from the burned area were captured in adjacent habitat. Three months following the fire, marked animals were again trapped on the burned site, confirming the survival of a resident population. The loss of adults and the degree of habitat recovery in the first year following the fire apparently stimulated the reproductive rate of brush mice, producing more young than the control site. The average ratio of body weight to body length of brush mice (*Peromyscus truei*) was reduced in the first year following the fire, but was nearly equal to control animals in the second and third years following the fire.

Blankenship (1982) found no significant difference in rodent weights between burned and unburned sites in montane chaparral in San Diego County.

Rodent species richness, biomass per hectare, and species diversity reached levels equal to, or exceeding, those in 16 to 20 year old chaparral within 15 to 24 months post-fire on Wirtz's (1982) study site in the San Gabriel Mountains. Heteromyids (Kangaroo rats and pocket mice) and California meadow mice (*Microtus californicus*) contributed significantly to early post-fire seres; woodrats (*Neotoma spp.*) and white-footed mice (*Peromyscus sp.*) contributed significantly in older stands. Because of above ground nesting, woodrats are particularly susceptible to fire, and may not recolonize burned areas for 1-2 years following fires. It is assumed that some refugia always remain, due to the normally patchy nature of burns.

A study in coastal southern California coastal sage scrub by Price and Waser (1984), suggests brush-dwelling species declined following disturbance by fire while Erickson (1993) suggested fire may have been beneficial in opening up habitat for the pacific pocket mouse (*Perognathus longimembris* pacificus) in coastal southern California coastal sage scrub.

In conclusion, our wildland ecosystems are not static, nor are the wildlife populations that inhabit these systems. Withholding fire benefits some plant and animal species and denies others and conversely, fire benefits many plant and animal species while adversely impacting others. Many species that have adapted to southern California over thousands of years need and, in fact, require fire to perpetuate themselves.

PART II – PRESCRIBED FIRE PROGRAM

PART II - PRESCRIBED FIRE PROGRAM

2.0 PRESCRIBED FIRE PROGRAM

The Southern Subregion ecosystem has been shaped by fire for thousands of years. The plants that thrive in this ecosystem are all fire adapted to the point that many of them require fire for their continued presence in this fire adapted ecosystem. The wildlife that inhabit these ecosystems are indirectly dependent upon fire to provide the habitats that these species require for continued survival.

Therefore, any strategy for the management of the vegetation in the Southern Subregion must include the use of fire on a planned and controlled basis.

2.1 Justification

Adaptive management planning must recognize the role of fire within a Mediterranean ecosystem. As previously stated, past fire events have played a decisive role in the origin and maintenance of the Southern Subregion 's current plant and animal communities. This alone does not justify the use of prescribed fire, but it does imply a need to consider fire use as a tool in an overall effort to manage the Southern Subregion ecosystem. Current literature, contemporary knowledge and the Southern Subregion's fire history further justify the active use of fire in the purposeful management of the Subregion's vegetation communities.

Although some alternatives are available, substituting the natural ecological role of fire with mechanical, chemical, or grazing treatments is not feasible over the long run. The synergistic effects of fire on any given ecosystem are complex. Charring of duff, increased insulation, heating of soils, smoke moving through vegetation layers, injuring and top killing individual plants, immediately available nutrient release and many other impacts occur during a fire event. The complexity of fire regimes is increased by the variability of fire events. Fire intensities, burn severity and fire size will vary with weather, fuel conditions, and ignition patterns. Though there will be many situations in which the use of fire is not the best management practice, it is impossible to duplicate all of the beneficial influences of a long-term pattern of fire on the wildland landscape.

With the terrain and fuel features that exist within the Southern Subregion's boundaries, fire is also considered the cheapest of all fuel management alternatives. Though cost per acre will vary between units, an average cost range of $150 to $1,500 acre, depending on the complexity of the burn, can be expected for grassland and chaparral prescribed burns.

2.2 Prescribed Fire Program Structure

All prescribed burning will be conducted with the aid of California's Vegetation Management Program (VMP). OCFA will provide resources and an overhead team for each planned burn. The Rancho Mission Viejo (RMV) staff will aid with individual plan completion and fire related monitoring for RMV Open Space. It will be the responsibility of the RMV staff to review monitoring results and adapt fire implementation. For other non-RMV lands within the Southern Subregion landowners and jurisdictions, as applicable, will aid in plan completion and fire related monitoring.

The lands within the Southern Subregion are currently classified into one of five (5) prescribed fire management categories: 1) CSS Management Sites, 2) Native Grassland Management Sites, 3) Chaparral/shrub Restoration Sites, oak woodland sites, and 5) Protection of Life and Property Sites. Each of the prescribed fire management categories has objectives and prescriptions specific to that category.

2.2.1 CSS Management (A) Sites

These sites are identified as areas in which low-density shrubs exist with a significant component of non-native grass cover. These sites would be burned selectively in an effort to reduce the cover of non-native grasses and increase the density of native shrubs.

CSS Management sites are to be burned selectively within an experimental design aimed at defining seasonal and frequency effects. Post fire grazing must be excluded from these sites in order to accurately monitor plant response to fire.

Initially, CSS units would be burned as part of an experimental design addressing specific hypothesis. This effort would be aimed at determining if fire could be used to improve composition and structure of this community. These experimental treatments would focus on fire variables within the control of management. Selected units would be burned in different seasons, varied fire intensities and varied return intervals.

2.2.2 Native Grassland Management (B) Sites

These sites are proposed to be managed by moderate intensity, high frequency fire events. Native Grassland sites will focus on maintenance of open grassland communities, providing habitat for grassland-dependent species.

Fall burning will be favored for most grassland within Southern Subregion areas. The initial fire intervals will be annually for three (3) years or less. The initial period of burning may be thought of as a restoration phase. As the site is treated with fire and species composition targets are neared, a fire regime more closely resembling the historic pattern of fire may be implemented. During this period of burning both the season and frequency of fire events will be variable. Though weighted towards the fall, spring and winter burns may also occur. After the initial 3 year burn cycle a mean fire rotation of 10 years is recommended during which units may burn multiple times or not at all during any 10 year period.

2.2.3 Chaparral/Shrub Management (C) Sites

Due to the wildland wildfire frequency, the VMP burns executed in the late 1980's and the early 1990's and the Ranch's cattle grazing program it is doubtful that any Chaparral/Shrub Management sites exist on the Rancho Mission Viejo property. However, other portions of the Southern Subregion may very well support Chaparral/Shrub sites. The objective would be to target chaparral and scrub habitats, while avoiding oak woodlands and riparian habitats. The goal would be a patchy burn (50-70% fuel volume consumption) with varying low to moderate fire intensities on a thirty (30) year rotation.

Another objective for use of prescribed fire in this vegetative type is to develop a low fuel profile zone around future planned developments located to the west of this vegetation type to minimize the probability of a high intensity wildfire entering the development under Santa Ana wind conditions.

2.2.4 Oak Woodland Management (D) Sites

Historically low to moderate intensity wildfires burned beneath oak woodland stands, reducing the amount of shrub like vegetation that could lead to crown fires and encouraging the propagation of native grassland species. Prescribed fire would be utilized to continue the presence of fire beneath these oak woodland stands on a controlled basis.

2.2.5 Protection of Life and Property (E) Sites

These sites are a mix of vegetation types in which prescribed burning may provide both fire protection for life and property and natural resource values. Some units close to residences may require additional pre-fire modifications to the vegetation (e.g. crushing, thinning, and limited mowing).Fire may also be used in combination with herbicides to increase the effectiveness of both fire and herbicides as management tools.

Burn treatments, described below, will be coordinated with activities defined in the Southern Subregion's CSS, native grassland, oak woodland and chaparral/shrub restoration and enhancement planning.

2.3 Prescribed Fire

Prescribed fire is defined as: *"the skillful application of fire to natural fuels under conditions of weather, fuel moisture, soil moisture, etc., that will allow confinement of the fire to a predetermined area and at the same time will produce the intensity of heat and rate of spread required to accomplish certain planned benefits to one or more objectives of silviculture, wildlife management, grazing, hazard reduction, etc." (Chandler et al. 1983).*

Prescribed fires fall into two categories, natural (unplanned) fires and managed (planned) ignitions as defined below:

2.3.1 Natural (Unplanned) Fire

Lightning-caused fires are an uncommon but a very possible event in the Southern Subregion. These unplanned types of fires usually do not occur under acceptable Orange County fire weather parameters conducive to wildland wildfire containment. The native vegetation is either too wet during a lighting storm or too dry to successfully plan for use of naturally ignited fires as a viable factor in shaping the ecosystem. Therefore, ignitions caused by lightning will not be utilized in the Southern Subregion.

Furthermore, any objective that could possibly be met by letting natural fires burn under a prescribed set of conditions can also be more safely accomplished in a controlled environment using prescribed fire as natural fires do not allow for the assemblage of monitoring and holding forces in a pre-planned manner.

2.3.2 Managed (Planned) Ignitions

Fires started by managed or planned ignition would be the primary source of prescribed fire in the Southern Subregion. OCFA and CDF, in order to meet the legal requirements of the State of California, have established the following guidelines. All prescribed burns must have written prescriptions and burn plans covering each specific burn unit.

2.4 Prescribed Fire Prescription Matrix

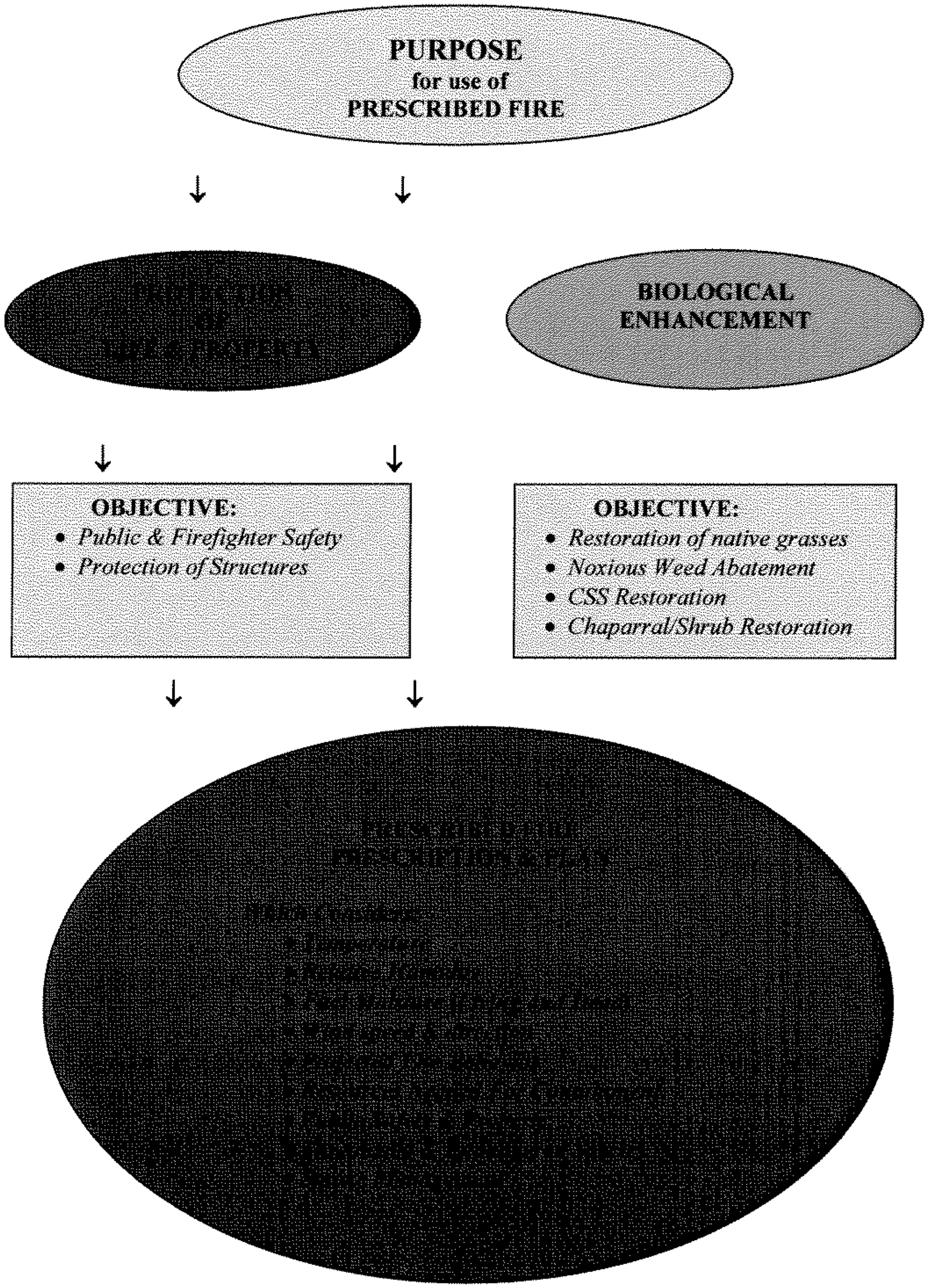
Table 2-1: This Prescribed Fire Prescription Matrix is presented to assist fire agencies and land managers in their planning of prescribed fire use within the various fuel models and fire weather parameters. *Table 2-1* depicts a range of weather parameters, which will allow for both low and moderate wildland fire behavior intensities.

Table 2-1

Prescribe Fire Prescription Matrix For Native Grassland Restoration & Maintenance, and CSS Restoration & Maintenance			
Fuel Model	1	1	2, 6 & 4
Vegetation	Grasslands	Restoration	CSS
Air Temperature (F)	**60-90**	**60-90**	**40-95**
Relative Humidity (%)	60-30	70-20	30-60
Wind Speed (mph @ 20ft)	4-8	4-8	5-8
Wind Speed (mph @ mid-fl)	1-4	2-4	2-5
1 hr Fuel Moisture (%)	**5-9**	**5-9**	**6-16**
10 hr Fuel Moisture (%)	**N/A**	**N/A**	**10-17**
Live Herbaceous			
Fuel Moisture (%)	---	---	100-300
Live Woody			
Fuel Moisture (%)	---	---	100-200
Head Fire:			
Rate of Spread (ft/min)	10-42	8-33	7-30
Flame Length (in feet)	3-8	3-8	6-22
Backing Fire			
Rate of Spread (ft/min)	3-5	3-5	3-5
Flame Length (in feet)	1-3	1-5	8-11

2.5 Prescribed Fire Planning Model

The following depicts the various elements within the Prescribed Fire Planning Model:



2.6 Pre-burn Planning Process and Checklist

2.6.1 Action Items 9 to 12 Months In Advance of Project

	Date Completed
Select burn site that meets Adaptive Management Objectives	
If VMP, sign up landowners	
Environmental review, wildlife, archaeology	
Confer with U.S. Fish & Wildlife Service	
Confer with California Fish & Game	

2.6.2 Action Items 6 to 9 Months in Advance of Project

	Date Completed
Develop burn plan and obtain burn permit	
Develop contingency plans	
Get burn plan approved by CDF if VMP burn	
Construct hand lines or dozer lines around perimeters	
Designate secondary control lines and safety zones	
Contact Southern California Edison or your utility company	

2.6.3 Action Items 3 to 6 Months in Advance of Project

	Date Completed
Develop list of required resources and volunteer help	
Involve Information Officer	
Develop Smoke Management Plan	
Approval from Air Quality Management District	
Develop contact list for prescribe burn opportunities	
Training opportunities identified with OCFA for OCFA personnel	

2.6.4 Action Items 1 to 3 Months in Advance of Project

	Date Completed
Set up portable weather station (Micro RAWS)	
Set up fuel stick at a representative site	
Take fuel moisture samples every 10 days (live and dead)	
Set up photo points and photograph before and after burn	
Develop Incident Action Plan	
Develop large briefing map	
Do fire predictions calculations	

Organize staff duties: phones, weather, biological, rovers	
Designate Landing Zone for medical emergency	
Complete handlines and interior edge preparation	
Develop test burn site	
Entry permits and gate keys issued	
Access closures for the public	
Identify radio and cell phone blind spots	
Do fire behavior predictions	
Do pre-burn vegetation transects	
Survey for nesting birds within the unit	

2.6.5 Action Items for the Last Week Prior to Project

	Date Completed
Send notifications to neighbors	
Send Press Release to local media	
Order radios from communication section	
Complete ICS forms and briefing package (Incident Action Plan)	
Put Drop Point signs in place	
Drip torches and extra parts and fuel are ready	
Have Prescribe Burn signs ready	
Move porta-potties in place	
Burn cache inventory	
Weather personnel placement	
Lookout placement	
Plan for fluids, food and coffee	
Phone list of neighbors day before and day of burn	
Call AQMD day before and day of	
Fax copy of Incident Action Plan to ECC	
Set up Check-in	
Contact Local Fire Agencies (done by dispatch center)	
Post Prescribe Burn Signs	
Conduct Operational Briefing	
Staging area organization	
Do Go-No Go Check List	
Do Test Burn	

2.6.6 "Go/No Go" check list (All items must be checked yes before the burn project can proceed)

Item	YES	NO
Prescribed burn plan (Incident Action Plan) completed and approved by appropriate jurisdictional authority(s)		
On site weather observations from preceding days indicate project will be in prescription		
Agreements with cooperating authorities are signed		
Public has been notified through Newspaper and postings on roads near the site		
OCFA and Orange County Sheriffs 911 Dispatchers notified		
Site specific current and long range weather forecasts received		
Medical Plan completed and nearest burn center location noted		
Med Evac notified about the location of the project and nearest heliport, all transmission and telephone lines are clearly marked on the map that OCFA and the Med Evac personnel have received		
Sufficient funding is on hand to execute the burning and mop up of the project		
A qualified Fire Behavior Officer is on site to take on going weather observations		
An organization chart indicating assignments is available for the pre fire briefing		
Radio communication is available for all personnel assigned to the project		
Air to ground radio frequencies are established		
All holding forces are available for initiation of the project and have been briefed		
All required equipment is in position and working properly		
The back up plan (fire suppression plan in the event of an escape) has been explained at the pre fire briefing		
A specific person is assigned on site to brief visitors and the press		
A safety briefing has been given to all personnel assigned to the project		

IF ALL ITEMS ARE MARKED "YES" THE TEST BURN CAN BE INITIATED

Location of test fire:____

Time of test fire:____

Results of test fire (Note flame length and rate of spread):

____

Item	YES	NO
Are the fuels and weather conditions representative of the burn unit?		
Is the fire behavior within the prescription parameters?		
With the existing holding forces, is fire behavior within means of control?		
Do test burn results indicate the burn objectives will be met?		
THE TEST BURN WAS SUCCESSFUL?		

IF TEST BURN WAS SUCCESSFUL, PROCEED WITH THE BURN

RX BURN BOSS:______________________________ DATE:_________

IGNITION SPECIALIST:__________________________________

HOLDING OPERATIONS SUPERVISOR:_____________________________

2.7 Post Burn Evaluation

	Date Completed
Do Post Burn Analysis and survey for dead species	
Do short Post Burn Report	
1. What we did	
2. What we burned	
3. How many acres	
4. Where the Management Objectives Obtained	
5. What didn't burn and why	
Operational debriefing conducted as a learning tool	

PART III - STRATEGIC FIRE PROTECTION PLAN

PART III – THE LONG-TERM STRATEGIC FIRE PROTECTION PLAN

3.0 THE LONG-TERM STRATEGIC WILDLAND FIRE PROTECTION PLAN

Part III, The Long-Term Strategic Wildland Fire Protection Plan, is a sub part of the overall Wildland Fire Management Plan and is written as a stand-alone document. This plan identifies those specific natural resource areas that will require enhanced fire protection through fuel management and treatment using a combination of techniques including the planned use of prescribed fire to manage habitat for Identified Species in the RMV Open Space.

3.1 Introduction

For many years protection of life and property (homes, businesses and other buildings) have been identified as the highest priority for wildland fire protection. Protection of life, public and firefighter, remains the single most important element in wildland fire protection. Resources and property now have equal weight as set out in the revised National Fire Plan (see Reducing Wildland Fire Risks to Communities and the Environment: A 10-year Comprehensive Strategy, June 2002) and comprise the second highest priority after protection of life.

The following Guiding Principles are fundamental to the successful implementation of the Strategic Fire Protection Plan and the Tactical Fire Suppression Plan discussed here:

1. Firefighter and public safety is the first priority in every fire management activity.

2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the overall land use planning process.

3. Fire management planning, projects and activities should support land and natural resource management plans and their implementation.

4. Sound risk management is the foundation for all fire management activities.

5. Fire management programs and activities must be economically viable, based upon values to be protected, costs and land and resource management objectives.

6. Fire management planning and activities must be based upon the best available science.

Natural resource values will be evaluated on an equal basis with property values and will not automatically be relegated to a lower priority.

The Strategic Fire Protection Plan identifies wildland fire management issues relating to the protection of life and property located on lands adjoining large areas of presently existing open space lands.

3.2 The Role of Fire in the Lands of Orange County

Fire is a natural part of the southern California landscape. Fire is a periodic source of disturbance to which certain habitat types have adapted during their evolution. The Southern Subregion contains large acreages of plant communities that depend on fire for rejuvenation and maintenance of natural biodiversity. Many plant species within these communities relied on a pre-settlement natural fire regime for germination or creation of gaps for colonization. Many Threatened and Endangered and other sensitive species rely on the vegetation in the Southern Subregion to support them.

The fuel loadings in the Southern Subregion have changed due to a reduction in grazing, successful fire prevention and suppression, social values that do not embrace or understand natural systems and increased urban encroachment within or surrounding the Southern Subregion wildlands. The combination of expanding wildland/urban interface, historic fire weather patterns, and aging native vegetation within the Southern Subregion all lead to the potential for large wildland fires with significant property, cultural and natural losses.

The role of fire, both negative and positive, has been thoroughly addressed in this plan.

3.3 The Threat of Wildfire to the Wildland Urban Interface (WUI) or Intermix

Throughout Orange County, it is common to see homes, businesses, and industries being built further into wildland environments. This trend is creating an expansion of wildland/urban interface areas where structures are located next to large areas of native vegetation. Because of their location, these structures have become highly vulnerable to wildland fire.

Unsafe past practices, such as placing structures too close to the property line which led to inadequate fuel modification (reduction) between structures and undisturbed native vegetation, installation *of* combustible roofing and siding, improper landscaping, and other building design features have all contributed to wildland fire spread. These unsafe conditions can be found throughout the County of Orange, including the southern portion of the Southern Subregion.

Due to the large numbers of homes lost to wildfires over the past 10 years building codes have been revised as have fuel modification requirements. The newer construction in the Southern Subregion has been designed and built to survive the periodic onslaught of wind driven wildfires provided the homeowner continues to maintain their fire resistant landscaping. Future developments will also meet these revised building and fuel modification standards.

Generally, it is older, non-compliant residences that are the leading cause for the high number of structure losses during any serious wildland fire incident. There are three ignition sources of concern regarding structures located in a wildland environment:

3.3.1 Structure Ignition Sources

Structures ignite and burn during wildfires from these three sources of ignition.

Radiation: where heat radiates from a heat source. The air is not heated, but solid objects close to the heat source will increase in temperature. Heat can radiate through a closed window or other glazed opening and ignite curtains, drapes or other combustible materials. It can also cause wood siding to char. If the radiant heat is sustained long enough the siding will ignite.

Convection: as super heated air rises it spreads ground fire up into the brush or tree canopy or up a slope by convection. Super heated air can carry firebrands for long distances. Firebrands need a receptive fuel bed [leaves, twigs, or other combustible materials (roofing, lawn furniture, etc.) to continue the spread of the wildfire.

Conduction: molecules move heat through a solid object. Heat will transfer through wood, although very slowly. Conduction is not considered a major factor in wildland fire spread and will not be discussed any further.

3.3.1.1 Radiation

Wildland fires can cause ignition of structures by radiating heat to the structure. Radiation exposure depends on the intensity and the duration of the flame front. The radiant heat exposure to a structure (and chance of ignition) will increase due to: 1) an increase in the size of the flames, 2) an increase in the amount of surface area exposed to the flames, 3) an increase in the duration of the exposure, and 4) a decrease in the distance between the flames and the structure.

3.3.1.2 Convection

Ignition of a structure by convective heat transfer requires the flame to come in direct contact with a combustible element of that structure. Direct contact with the convection column also can cause ignition but the temperature of the column is generally not hot enough to ignite a structure.

In the convective heat process, the duration of the exposure to the flame is more critical than the size of the flames. Therefore, "survivable space " clearing to prevent flame contact with structures must include any materials capable of producing even small flames (for example, cured grasses, low ground cover, leaves or pine needles on roofs and combustible yard furniture). Sufficient set backs from edge of slope also prevents the loss of structures due to convection.

Firebrands are pieces of burning materials that detach during a fire due to the strong convective drafts in the burning zone. Firebrands can be carried a long distance (one mile or more is not uncommon) by wildland fire drafts and/or strong fire generated winds or during strong Santa Ana winds. The chance of these firebrands igniting a structure will depend on the size of the firebrands, how long the fire brand burns after contact with a combustible fuelbed, and the design, materials used and construction of the structure.

Again, Orange County Fire Authority (OCFA) currently has ordinances and policies that have helped minimize these wildland fire threats on new developments built within the County. The biggest wildland fire problem presently facing OCFA and local fire jurisdictions is that there are still many residential structures that were built prior to the implementation of OCFA Wildland Urban Interface Ordinances. In the Southern Subregion there are numerous subdivisions and individual structures in the southern portion of the Southern Subregion that predate the revised building and fuel modification requirements.

3.4 Fire Management Compartments (FMC's) and Fire Management Units (FMU's)

Fire protection planning for the Southern Subregion Planning Area begins with the formulation of individual Fire Management Compartments (FMC's). Each compartment is further subdivided into one to six individual Fire Management Units (FMU's) depending on the size of the compartment.

3.4.1 Fire Management Compartments (FMC's)

The Southern Subregion Fire Management Compartment (FMC) boundaries are based upon the most likely locations to make a stand against an approaching wildfire and/or current regional park status. The boundary of each FMC was determined by its potential to contain a wildland wildfire. Roads, ridge tops, water courses (lakes, creeks or stream bottoms), key vegetation changes (brush to grass or grass to riparian) and other natural or physical barriers to wildland fire or key changes in fuel continuity helped to shape these boundaries. Two compartments, 20 and 25 are actually outside the County of Orange and outside the Southern Subregion. OCFA includes these two units as they, by agreement, provide fire protection to these two compartments. Additionally fires starting in these compartments typically burn into the Southern Subregion during periods of high intensity Santa Ana winds. The titles and acreages of the 18 compartments are displayed in *Table 3 -1.*

Table 3 -1 Fire Management Compartment Data

FMC No.	Title	Acres	No. of FMU's
20	San Onofre State Park	2,996	One
21	Talega/La Paz	5,150	Five
22	Central San Juan/Trampas/Cristianitos	5,102	Five
23	Lower Gabino/Blind	3,110	Three
24	Upper Gabino/Blind	3,869	Three
25	San Diego County	2,626	One
26	Ladera	4495	Two
27	Wagon Wheel/Chiquita Ridge	3,762	Three
28	Chiquadora/West Gobernadora	3190	Three
29	East Gobernadora/Bell Canyon	3178	Six
30	Caspers	6364	Four
31	Starr Ranch	4689	Two
32	Foothill/Trabuco Special Planning Area	4570	One
33	Presidential Heights	455	One
34	Donna O' Neill Land Conservancy	1957	Two

35	Prima Deshecha Regional Park	1845	One
36	Upper Chiquita	1750	Two
37	El Cariso Village	1594	One

3.4.2 Fire Management Units (FMU's)

Each compartment was divided into subunits called Fire Management Units (FMU's). A traditional FMU is any land management area definable by objectives, land features, access, values to be protected, political boundaries, fuel types or major fire regimes. In the case of the Southern Subregion, watershed boundaries were used to define the FMU's.

The fire suppression tactical strategy is that all wildland fires occurring within a FMU should be contained to that specific FMU and not be allowed to encroach upon another FMU if at all possible. It is fully understood that under severe wildland fire weather conditions (Santa Ana Winds, or other periods of extreme hot, dry weather and strong winds) wildland fires may not be able to be contained to the FMU or even within the compartment of origin. However, this is a reasonable fire suppression guideline for all other average or above average fire weather conditions.

Fire protection treatments (fuel modification by mechanical means, hand-labor means or prescribed fire or a combination of all three) have been planned by specific FMU's. The role that fire will play in maintaining or enhancing key target habitats will also be planned by individual FMU's.

Figure 3-1 depicts where the 18 Fire Management Compartments and their individual Fire Management Units are located within the Southern Subregion (note that the two areas to the east of the Southern Subregion, CNF and MCB Camp Pendleton have their own Wildland Fire Management Plans).

3.5 Fuel Treatment to Protect Life and Property

The protection of Life and Property begins at each individual residence. If the homeowner does not have: 1) the appropriate "survivable space", 2) a non-combustible roof, and the other California Firesafe requirements implemented, then the fire department does not stand a reasonable chance of protecting that home from a high intensity wildland fire. However, there are many situations where a homeowner does meet most of the Firesafe requirements, but does not have the necessary room on their property to comply with the OCFA or local fire jurisdiction requirement of 170 feet of low volume fuel modification treatment from their structure. Often this means that a homeowner must either encroach upon adjoining lands or not meet the 170-foot requirement.

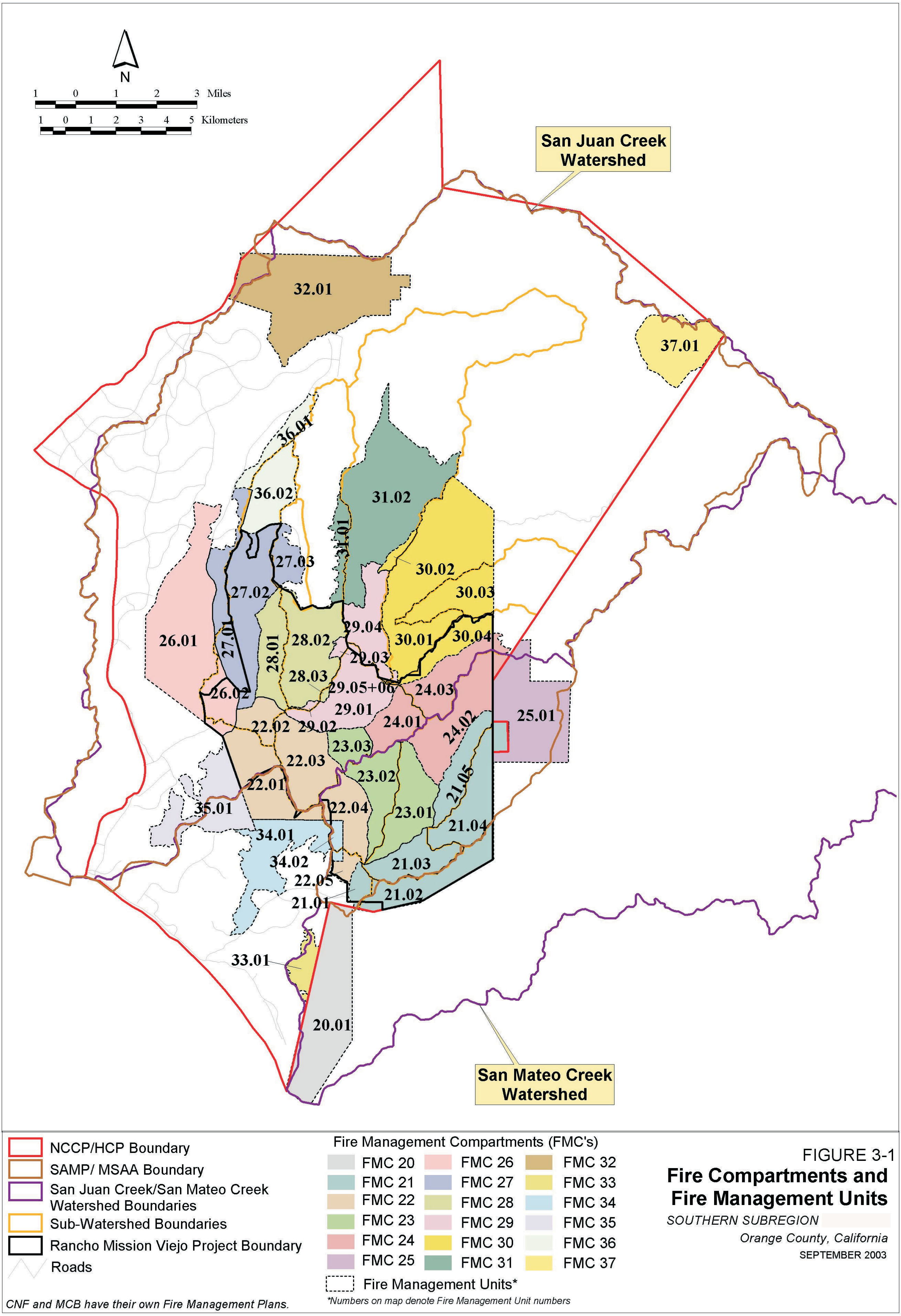


FIGURE 3-1
Fire Compartments and Fire Management Units
SOUTHERN SUBREGION
Orange County, California
SEPTEMBER 2003

In the case of proposed future RMV residential and business center development all proposed project areas will include all the necessary fuel modification treatments within the project boundaries. Fuel modification calculations are discussed in Section 3.5.1.2 that show the distance needed to safely protect future structures under the worst possible conditions is 110 feet and not 170 feet.

3.5.1 Recommended FMU's In Need of Fuel Treatment to Protect Life and Property in New Proposed Developments

This section is divided into those FMU's that occur within Rancho Mission Viejo boundaries and those that occur outside these boundaries and within the boundaries of other local jurisdictions which also may have pre-existing FMU's or a similar mechanism for prescribing required fuel treatment.

3.5.1.1 Rancho Mission Viejo

At the present time there are no FMU's that pose a threat to the protection of life and property on lands adjoining the RMV project boundary. Nor are there any threats to existing facilities within the project boundary. However, this will change as the RMV Open Space is established and residential communities adjacent to the RMV Open Space are built out over the next thirty (30) years.

3.5.1.2 Fuel Treatment Options to Protect Life and Property

Because of the high numbers of wildfires that have burned through Rancho Mission Viejo since the early 1900's, (see *Figures 3-10a-k*) plus an active cattle grazing program, and the late1980's and early 1990's Vegetative Management Program (prescribed burns) the wildland vegetation is fairly uniform throughout RMV. Most of the wildfires that have burned through the RMV property have originated on the Cleveland National Forest or the Marine Corps Base Camp Pendleton and were driven through the Ranch property by very strong Northeast/East Santa Ana winds, usually in October or November. Because of the generally light fuel loadings (scattered sagebrush over cured grass) these wildfires burned through the Ranch property very rapidly with low to moderate intensity.

The predominate vegetation over most of the Ranch is scattered coastal sage scrub over cured grass. This is a Fuel Model (FM) 2 as described in Section 3.7.2. The vegetation on the Ranch has stayed in a FM 2 because of the high frequency of wildfires burning over the Ranch property. Fortunately, this particular Fuel Model supports the high numbers of sensitive, threatened and endangered species found on the Ranch property. An FM 2 will require 100 feet of fuel modification/treatment between planned structures and the undisturbed native coastal sage scrub vegetation but there is no assurance that this area would stay in an FM 2. If the fire frequency is disrupted, i.e. longer intervals between fires occurs, the vegetation could easily densify, species composition would change and the Fuel Model would evolve into a FM 6 (chaparral fuels 6 ft. in height or less) and eventually a FM 4 (chaparral fuels greater than 6 feet in height).

This evolution from a FM 2 to a FM 4 has serious implications for the Ranch. Wildlife populations of obligate coastal sage scrub species, such as the California gnatcatcher, would decline, forage available for grazing would decline and wildfires, when they did occur, would burn with much more intensity and would be more destructive. The amount of firewise fuel treatment around the north and east sides of planned developments would need to increase from 100 feet to 110 feet. (OCFA currently requires 170 feet of fuel modification between structures and undisturbed native vegetation. However, OCFA will approve fuel treatments less than 170 feet where it can be demonstrated with fire modeling that less than 170 feet will protect the home from loss provided the home owner maintains the fuel treatment zones to the standard and maintains the structure in a fire resistant condition).

Because of the long term nature of future development within RMV lands and the rest of the Southern Subregion, and not knowing the frequency of future wildfires or the planned use of prescribed fire ***FIREWISE* 2000, Inc.** recommends fuel treatment measures based on a FM 4 configuration or 110 feet of fuel modification/treatment between planned structures and undisturbed coastal sage scrub vegetation.

3.5.1.3 Fuel Modification Zones by FMU

All future residential areas within RMV will need the same clearance requirements regardless of what FMU they will be in due to the fact that the vegetation throughout the Ranch is a fairly uniform FM 2. Fire Modeling and clearance requirements are based on a FM 4 vegetation configuration. An FM 4 provides a prudent safety factor and anticipates foreseeable changes in wildfire frequency and vegetation that may occur if fires decrease in frequency or increase in intensity. This clearance requirement applies equally to all planning areas for residential communities within the Southern Subregion.

Rancho Mission Viejo is within the Orange County Fire Authority's 5-minute initial action response time with Engine Companies stationed in the new Ladera development and in San Juan Capistrano. However, the reality is that when a wildfire occurs on southern California wildlands there are usually multiple fires occuring and fire fighting resources can be quickly drawn down and unavailable for extensive periods of time as additional new fires occur. Although there are several Orange County Fire Authority Stations several minutes away, there is no assurance that these Engine Companies will be in their stations the day a wildfire threatens development within Rancho Mission Viejo from an ignition outside or inside the development. On high/extreme fire danger days there are often multiple starts and engine companies are often already deployed on other incidents.

This is why "Firewise Communities"[1] use "*Survivable Space Strategies*" that enable their communities to survive a wildfire on their own without the loss of any lives or structures and with no intervention of the Fire Department.

The goal is for all future homes in RMV to be able to survive a wildland fire on their own, with no lives or structures lost and without any intervention from fire fighting personnel who may already be stretched to the maximum.

---

[1] See firewise.org for Firewise Community criteria

The following sections describe "Survivable Space Strategies."

3.5.1.4 Fuel Modification Zone A.

Zone A consists of the first 20 feet measured horizontally from the structure. No combustible structures are permitted in this zone. If a deck or patio cover is added to the house the structure must be non-combustible or the required distance is measured from the outside edge of the deck or patio cover.

3.5.1.5 Fuel Modification Zone B.

Zone B typically comprises the first 70 feet around a structure and is commonly called the "Survivable Space Zone". The 70 feet is measured horizontally from the edge of the structure.This firewise landscaped zone is usually irrigated and consists of fire resistant, maintained native or ornamental plantings usually less than 18 inches in height. This zone may contain occasional fire resistant trees and single well spaced native or ornamental shrubs up to 24 inches in height, intermixed with ground covers and lawn. Plants in this zone must be fire resistant and shall not include any pyrophytes that are high in oils and resins such as pines, eucalyptus, cypress, cedar and juniper species.

If trees are planted, they must be planted so that when they reach maturity their branches are at least 10 feet away from any structure. Refer to APPENDIX "A" *"FIREWISE"* Planting Considerations; Lists for Recommended Plants and Not-Recommended Plants. (Although the Recommended Plant List displays a large number of plants, the code next to each species must be reviewed to determine if that particular plant is suitable for all environments or is limited/prohibited in certain areas).

Thick, succulent or leathery leaf species are the most "fire resistant."

Regular maintenance and continued irrigation is most important in Zone B. Plants with high moisture content are less likely to burn. Non-flammable concrete patios, drive ways, swimming pools, walkways, boulders, rock, and gravel can be used to break up fuel continuity within Zone B provided the lot is large enough. Wooden privacy fencing must not be directly attached to any homes. Zone B can extend beyond the lot property line provided an easement can be obtained from the adjacent land owner for any required Fuel Modification that extends beyond the lot boundary. Lots should be laid out to accommodate all required Fuel Modification treatments within the lot property line.

3.5.1.6 Fuel Modification Zone C.

Zone C is the area beyond Zone B that typically extends an additional 40 feet or more out to 110 feet. In the case of this project, this zone will include native perennial grasses or the re-establishment of native coastal sage scrub species with the following exceptions: no chamise (*Adenostoma fasciculatum*), California sagebrush (*Artemisia californica*), pampas grass (*Cortaderia selloana*), common buckwheat (*Eriogonum fasciculatum*) or black sage (*Salvia mellifera*) will be permitted in Zone C. Native shrub species must be spaced at a minimum of 2 times the height of the shrub (a 12 inch shrub would need 24 inches between it and its neighbor, however, shrubs can be planted in clusters where the circumference is no more than 20 feet and all cured grasses must be removed from beneath the circumference of the shrub to eliminate a vertical fuel ladder). All dead material must be pruned out on an as needed basis, but at least annually each July. Trimmed material can be cut and scattered as mulch. "*Firewise*" landscaping criteria are important in this zone. Irrigation, partial irrigation or non-irrigation can be used in this zone depending upon the plant species selected. In the case where Open Space areas border residential structures the pruning of dead material and weed whipping or mowing will occur annually after August 31, which is after the nesting season and before the intense part of the annual wildfire season.

Mulches, chips and other small multi-cuttings (cut to less than 2 inches in diameter and 4-inches in length) should be evenly spread over the area (not to exceed 4 inches in depth) to prevent unwanted grass and weed encroachment within the treated areas. This mulching concept helps to maintain the soil moisture for the designated plants and minimizes any soil erosion on slopes. All native grasses or weeds should be mowed or weed-whipped to a 4 inch stubble height after heading out. In those cases where Zone C areas will lie outside the lot property lines but will still be within the planned development boundary the Project Home Owners Association will be responsible for the maintenance.

Lot owners will be responsible for maintaining all fuel modification Zones within their lots. Home Owner Associations will be responsible for all fuel modification required between the lot boundaries and the project boundary where these boundaries are not one and the same. Weed abatement regulations will be followed if the lot is not landscaped. In the event a lot is repossessed, the unit/agency holding title to the lot will be responsible for the maintenance.

All Fuel Modification Zones will be contained within the project boundary and in no case will these zones be permitted to encroach on RMV Open Space.

3.5.1.7 Required Building Setbacks from Edge of Slopes.

Residential development within non-RMV Open Space should capitalize on home setbacks from the edges of slopes (15 foot set back from edge of slope for 1 story homes, 30 feet set back from edge of slope for two story homes), where slopes will be below the home and building pad. In addition, the utilization of irrigated front, side and back yards, road widths and trails placed between homes and open space must be used to protect homes and to prevent adverse impacts to native coastal sage scrub species and to maximize the amount of area that can be unrestrictedly restored back to native coastal sage scrub species.

3.5.1.8 Fire Resistant Structure Requirements For Specific Perimeter Structures.

The following fire construction and design features are required for residential lots:

1) All exterior walls should be protected with 2-inch nominal solid blocking between rafters at all roof overhangs, under the exterior wall covering.

2) No attic ventilation openings or ventilation louvers shall be permitted in soffits, in eave overhangs, between rafters at eaves, or in other overhanging areas on those exposures facing hazardous vegetation.

3) All eaves of roof overhangs shall be enclosed with non-combustible materials.

4) Attic or foundation ventilation louvers or ventilation openings in vertical walls shall not exceed 144 square inches per opening and shall be covered with ¼-inch mesh corrosion-resistant metal screen or other approved material that offers equivalent protection. Attic ventilation shall also comply with the requirements of the Uniform Building Code (U.B.C.). Ventilation louvers and openings may be incorporated as part of access assemblies.

5) All projections (exterior balconies, carports, decks, patio covers, unenclosed roofs and floors, and similar architectual appendages and projections shall be of non-combustible construction, one-hour fire resistive construction on the underside, or heavy timber construction. When such appendages and projections are attached to exterior fire-resistive walls, they shall be constructed to maintain the fire-resistive integrity of the wall.

6) All glass or other transparent, translucent or opaque glazing materials, including skylights, shall be constructed of tempered glass or multi-layered (dual paned) glazed glass. No skylights will be allowed on the roof assembly facing hazardous vegetation.

7) Any chimney, flue or stovepipe will have an approved spark arrester. An approved spark arrester is defined as a device constructed of nonflammable materials, 12 gauge minimum thickness, or other material found satisfactory by the OCFA, and having 1/2 inch perforations for arresting burning carbon or sparks and installed to be visible for the purposes of inspection and maintenance.

8) Interior sprinkler systems will be installed in all homes when required by the OCFA. The Interior Sprinkler System shall meet National Fire Protection Standard (NFPA) 13d.

3.5.2 Jurisdictions outside the Rancho Mission Viejo property boundaries in the Southern Subregion

There are a number of owners and managers of large tracts of open space that surround Rancho Mission Viejo (see *Figure 1-2* in Section I). Most of these ownerships will remain in "open space". Those ownerships other than RMV that plan to include development on their properties will also need to comply with sections 3.5.1.2 through 3.5.1.8. which apply to the entire Southern Subregion.

According to the OCFA, "other than the Cleveland National Forest and Marine Corps Base, Camp Pendleton, which have Wildland Fire Management Plans, none of the other entities that directly impact Rancho Mission Viejo have Fire Management Plans". The caveat here is that the OCFA Fire Management Plan identified all open space areas by Subregion and developed Fire

Management Compartments based on defensible FMU's without consideration of ownership. OCFA took this approach since regardless of the level of planning by the various ownerships OCFA has the ultimate responsibility for the suppression of all wildland fires within the County of Orange.

The Cleveland National Forest and the Marine Corps, Camp Pendleton have addressed the NCCP/HCP guidelines. Both agencies utilize a combination of using prescribed fire and an Aggressive "**A**" Wildfire Suppression Operations Mode. The Cleveland National Forest and Camp Pendleton are the only entities in the Southern Subregion, or adjacent to the Southern Subregion, that have completed Fire Management Plans that consider the rich biodiversity found on the lands they manage.

Currently, the only non-federal Fire Plan that OCFA considers complete is the OCFA Wildland Fire Management Plan (WFMP). The OCFA WFMP does not presently address the Southern Subregion NCCP/HCP management guidelines, as the OCFA WFMP was written prior to the Southern Subregion NCCP/HCP. OCFA presently implements an aggressive "**A**" wildfire suppression strategy on all undeveloped lands without an approved Fire Management Plan (see 4.4.3. – 4.4.3.3 in Section IV). The OCFA WFMP was put together in a way that it can incorporate and recognize Fire Management Plans from other Agencies and land ownerships.

The OCFA's policy on wildfire suppression is sensible and weather driven. OCFA has a pre-planned "watershed dispatch" that determines what is initially sent to a reported wildland wildfire. That initial response can be held, increased or decreased based on a variety of conditions (weather, topography, time of year, proximity of structures, etc.). This watershed dispatch has ranged from the occasions where dozers have been turned around before arriving on an incident, to the all out effort during Santa Ana wind events.

An "Aggressive Initial Attack" on each and every wildfire is not etched in stone; good judgment and an appropriate wildfire suppression response based on the values involved while minimizing adverse environmental impacts is usually utilized. Please refer to Figure 1-2 in Section I for a display of all of the "Open Space" areas currently subject to the OCFA WFMP. Until adoption of the Southern Subregion NCCP/HCP WFMP, the OCFA WFMP will remain in effect.

Following suppression of any wildland wildfire in the Southern Subregion the wildfire response and actions taken will be reviewed with the appropriate landowner by the appropriate OCFA Officer.

3.6 Fuel Treatment to Protect Biological, Cultural and Historic Resource Values

Fuel treatment methods to protect high biological values is accomplished either by strategically placed fuelbreaks and/or prescribed fire units to breakup the highly flammable vegetative fuels so that key biological resources can be safely protected from high intensity wildland fire.

Fuelbreaks will usually consist of a minimum of ground disturbance by either hand labor or mechanical means (*e.g.* blade-up dozer crushing) followed by prescribed fire (strip burning) to widen and enhance the fuel break.

Well-planned use of prescribed fire applications, rather than unplanned random high-risk wildfire events, will become the principal as well as preferred method of using fire in these wildland ecosystems. The use of natural fire or wildland fire as a fuel management tool has limited opportunity within Southern Subregion lands. Natural fire (ignition started by lightning) is very infrequent and usually does not occur under acceptable Orange County weather parameters that permit containment. The native vegetation is either too wet during a lighting storm, or in the case of a dry lightning storm, too dry to successfully plan for use of naturally ignited fires as a viable factor in shaping the Southern Subregion ecosystem.

Any objective that could possibly be met by letting natural fires burn under a prescribed set of conditions can also be more safely accomplished in a controlled environment using prescribed fire. The use of prescribed fire can and will play a major role in meeting long-term management goals and objectives.

Accidental fires and deliberately set arson fires often occur under the very worst burning conditions. If possible, OCFA will use the suppression strategy listed in the Southern Subregion Rating Form (see Table 2-1). Weather conditions and resource shortages may result in OCFA using an "**A**" (aggressive) strategy to contain the unplanned wildfire event at the smallest size possible.

3.6.1 Recommended FMU's In Need of Fuel Treatment to Protect Biological Values

This section is divided into those FMU's that occur within RMV boundaries and those that occur outside these boundaries and within the boundaries of other local jurisdictions which also may have pre-existing FMU's or a similar mechanism for prescribing fuel treatment to protect biological values.

***FIREWISE* 2000, Inc.** has delineated units recommended for prescribed burning to protect biological values in the next decade. The concept is to use prescribed fire as an effort to restore fire back into the ecosystem on a planned basis. Prescribed fire will be one of the key tools used in coastal sage scrub management, rejuvenation and restoration, oak woodland maintenance, native grassland restoration and maintenance of chaparral/shrub sites. With the single exception of grasslands, from a control stand point, prescribed fire is best utilized as a vegetation management tool in the spring and early summer periods of the year.

Spring and early summer burning conflicts with the nesting season, however, if the vegetation is not managed on a rotational basis the plants will become senescent and of very low value to Identified Species. The tradeoff is risking a few members of the Identified population in a spring/early summer prescribed burn versus risking the loss of the entire habitat in a Santa Ana wind driven wildfire. Prescribed fire can also be utilized in the fall, however, this is also the infamous Santa Ana season. Prescribed fires ignited several days prior to an unforecasted Santa Ana wind event can be rekindled with disastrous results.

With grasslands, because of the very fine nature of the fuels, there is little danger of a hold over fire. Grasslands are more effectively burned in the fall prior to the rainy season. Newly released nutrients will be immediately available to the germinating seedlings.

3.6.1.1 Rancho Mission Viejo

FMU's requiring treatment to protect biological values within RMV are divided into four (4) categories: CSS Restoration Sites, Oak Woodland Sites, Native Grassland Management Sites and Riparian Restoration Sites as discussed below.

CSS Restoration Sites: The concept is to use both spring or fall prescribed fire in existing areas of degraded grassland habitat as part of an active coastal sage scrub restoration program for that particular site. This treatment would require intensive follow-up in terms of weed abatement (chemical or mechanical). The supposition is that these grassland areas at one time supported coastal sage scrub species. Viable seed may still remain on site in the soil. The radiant heat from a good hot prescribed fire would scarify the seed coat of numerous fire followers and coastal sage scrub obligate seeders. Plots large enough to produce a hot fire can be used to test for the availability of a viable seed bank. FMU's where prescribed fire is planned within restoration units are:

FMU 28.02: Sulphur Canyon: Coastal sage scrub restoration is planned in the grassland area in the bottom of Sulphur Canyon. This site would be restored back to a coastal sage scrub habitat. The approximate size of the proposed restoration unit is 100 acres. If the plots mentioned above do not produce desirable coastal sage scrub species all fire should be aggressively contained and confined to permit voluntary recruitment from the coastal sage scrub plant community surrounding the bottom of Sulphur Canyon.

Oak Woodland (raptor) Sites: The southeast quadrant of Rancho Mission Viejo, and especially the canyon bottoms, consists of an Oak Woodland over dense undergrowth. The Wildfire History Maps indicate that wildfires frequently come through this area. The last large wildfire occurred in 1961 which indicates a fire free interval of 32 years. The ground fuels are building up to the point that a wildfire would cause serious damage and possibly demise of the existing Oak Woodland. This vegetation type is utilized by raptors. In fact the raptor population for the Southern Subregion appears to be concentrated in this area. The health of this system is dependent upon frequent prescribed low intensity ground fires burning through and eliminating the undergrowth.

Burning releases nutrients that are immediately available to surviving vegetation, eliminates the vertical fuel ladder that will lead to the demise of the oaks and improves foraging opportunities for the raptor population. This condition exists in the following FMU's:

FMU's 21.01-21.05: Talega/La Paz

FMU's 23.01-23.03: Cristianitos/Gabino, Native Grassland Management Sites: The use of prescribed fire is proposed to restore, maintain and enhance existing and potential native grasslands within the system, especially if grazing is no longer an option on some sites. Fall prescribed burns would be used to promote existing native grass species. Again plots would be utilized to determine if desired effects can be achieved. Plots should be large (one quarter of an acre in size) and fenced to exclude the impacts of cattle grazing. Needlegrass (*Nasella spp.*), among others, responds well to fire and is a preferred perennial. FMU's where prescribed fire is planned for use within native grassland management sites are: **FMU's 22.04, 23.01-23.03:** Upper Cristianitos/Gabino valley grassland restoration areas. Following artichoke thistle control, prescribed fire will be used in the native valley grasslands of Upper Cristianitos and Gabino Sub-basins to remove dead biomass, including the seeds of annual grasses, and to promote the growth of native needlegrass species (see Section I, page 1-50). Prescribed fire would exclude existing patches of CSS.

There is a concern about using prescribed fire in watersheds located north of San Juan Creek because of the number of developments that surround the remaining RMV open space lands. It is a given that these open space areas will burn one way or the other. However, in the prescribed fire scenario there is control of the fire event where as in the case of a wildfire there is no control. In addition, the new homes surrounding RMV lands were all built to new fire safety standards and are further protected from wildfire due to the fuel modification zones required by the County of Orange that separate homes from undisturbed native fuels.

FMU 27.02: Chiquita and Narrow Canyons (see write up under FMU's 22.04, 23.01-23.03).

FMU's 28.01-28.03: Canada Gobernadora (see write up under FMU's 22.04, 23.01-23.03).

All burn units would require baseline monitoring for birds, reptiles and vegetation prior to initiation of the prescribed burn. Post burn monitoring would occur for at least two years following treatment with prescribed fire to capture positive and negative ecosystem responses to the burn.

Riparian Restoration Sites: It is recommended that the riparian areas be protected from fire encroachment by annually creating a mowed or disked firebreak between the outer edges of the riparian zones and native vegetation. Riparian areas should be kept fire free if at all possible.

FMU's where firebreaks/fuelbreaks are planned:

FMU 28.02: Canada Gobernadora Sub-basin: A large investment has been made in restoring the riparian area in the bottom of Canada Gobernadora. This investment has paid off in that least Bell's vireos and southwestern willow flycatchers increasingly utilize this zone. The fuel loading in this riparian area is increasing. There is an abundance of ladder fuels that will carry wildfire into the crowns of the planted oaks, willows and sycamores. The best strategy for protecting this critical riparian area is to keep wildfire out of it by annually mowing, plowing or disking a firebreak/fuelbreak between the outer edges of the riparian zone and the surrounding native or non-native fuels. In addition, low hanging branches on the oaks and sycamores can be pruned up to eliminate any ground fires from getting up into the crowns of the planted trees.

This condition also exists in the following FMU's. In addition, non-native rapidly spreading highly invasive exotics such as tamarisk, arundo and pampas grass, are increasing the flammability of the following riparian areas. These exotic species also have excessive evapotranspiration rates, drying up portions of riparian areas that a variety of wildlife species depend upon and should be removed. Native riparian communities with no intrusion of exotic species are reasonably fire resistant and in most cases will not burn because of the higher moisture contents of the vegetation and higher humidity within the riparian zone.

FMU's 22.01-22.05: San Juan Creek, and Trabuco Creek.

FMU's 23.01-23.03: San Mateo Creek (Cristianitos/Gabino Creeks).

3.6.1.2 Sensitive Species

In addition to the federally listed species there are a number of sensitive fauna and flora in the Southern Subregion. These additional sensitive species can be found in Draft NCCP/HCP Planning Guidelines prepared by the NCCP/SAMP Working Group. Several of these non-listed sensitive species also occur on RMV that are likely to be affected by the grazing management program either directly (e.g. species such as grasshopper sparrow that nest in grasslands with high structural diversity) or indirectly (species whose prey may be affected by grazing practices such as kite, horned lizard and whiptail). These species are: intermediate mariposa lily, cactus wren, yellow warbler, yellow-breasted chat, grasshopper sparrow, white-tailed kite, merlin, western spadefoot toad, southwestern pond turtle, San Diego horned lizard, and orange-throated whiptail. For a complete account for these species, the reader is referred to the Draft NCCP/HCP Planning Guidelines.

3.6.1.3 Historically Sensitive Areas

There are a number of historically significant Rancho Mission Viejo facilities in the Southern Subregion that must be protected. They are as follows: the O'Neill Ranch House, Cow Camp, Amantes Camp located just south of Ortega Highway (State Route 74), Campo Portola in Gabino Canyon, and the Rancho Mission Viejo Headquarters buildings located on both sides of Highway 74 and just west of Antonio Parkway. All known historic sites shall be mapped and an inventory of locations provided to OCFA as critical information for "first responders". All historic buildings that could be consumed by wildfire shall have 110 feet of fuel modification completed by May 15 of each year. Consideration should be given to removing the eucalyptus trees and replacing them with native fire resistant trees.

3.6.1.4 Culturally Sensitive Areas

In addition to the historical sites all known cultural site locations shall be mapped and an inventory of locations provided to OCFA as critical information for "first responders". If time permits cultural site locations should be flagged to avoid surface disturbance by vehicles, hand crews and dozers. Following both planned prescribed fires and wildfires all burned over areas should be surveyed to locate unknown sites obscured by vegetation.

3.6.2 Fuel Treatment to Protect Biological, Cultural and Historic Resource Values in the Southern Subregion Outside of the RMV Lands

In the non-RMV areas of the Southern Subregion it will be up to each jurisdiction or landowner to develop specific management objectives for the protection of the biological, cultural and historic values of each property. In the absence of a specific wildland fire management plan for a specific property OCFA will attack all wildfires utilizing an aggressive "**A**" strategy.

3.7 Fuel Models

Wildland fire suppression tactics and all fire use prescriptions are based upon expected fire behavior. The type of vegetation (fuels) where wildfire is currently burning, or where burning is planned, is one of the key elements in computing fire behavior calculations. The other two elements are fire weather and topography. Vegetative fuel types are normally described as a fuel model. A fuel model is a simulated fuel complex for which all the fuel descriptors required by the mathematical fire spread model have been specified. Different fuel models exhibit different fire behavior characteristics under the same fire weather and topographic parameters.

Fuel models are an approximate, not a precise representation of the fuel/vegetation complex. Consequently, some fuel/vegetation complexes exhibit fire behavior characteristics that may be in between two different specific fuel models. Also, many areas are not homogenous and do not react as a single fuel model. Usually in this case, a combined fuel model can be designated [i.e. Fuel Model 1 (60%) and Fuel Model 6 (40%)] will more closely represent the expected fire behavior.

Since it is impractical and of limited value to break down a planning unit into very small areas, a unit identified as a specific fuel model may in fact be an assortment of fuel models. The fire/resource, planner/manager must use judgment as to when it is necessary to map a change in the fuel model. On the other hand, during project planning smaller areas/units are commonly broken out for specific analysis and treatment.

3.7.1 Fuel Model Classifications

The Intermountain Forest & Range Experiment Station, USDA-Forest Service has been categorizing fuel complexes into fuel models since 1964.

Currently they have two (2) different classifications, which are:

- *The National Fire Danger Rating System (NFDRS)*
- *The National Forest Fire Laboratory System (NFFL)*

3.7.1.1 The National Fire-Danger Rating System (NFDRS) Fuel Models, USDA-Forest Service: General Technical Report INT- 39, 1978.

Fuel models under this system were developed to predict seasonal and daily fire danger over large areas. There are twenty (20) NFDRS fuel (A though U, except for M) models in this classification system. This fuel modeling system cannot be used for obtaining site specific fire behavior predictions.

3.7.2 Aids to Determining Fuel Models for Estimating Fire Behavior (NFFL or FBO Fuel Models), USDA- Forest Service General Technical Report INT- 122, April 1982 (A Publication of the National Wildfire Coordinating Group, NFES 1574).

Fuel models in this system were developed to predict site specific fire behavior. There are 13 FBO fuel models (1-13) which are divided into four (4) groups - grass, shrub, timber (tree), and slash.

The NFFL fuel models are used in the "BEHAVE" fire behavior modeling computer program to provide fire behavior outputs such as intensity, rate of spread, flame length, fire size and perimeter estimates under varying weather conditions such as dead fine fuel moisture, live fuel moisture, mid-flame wind speed, % slope and direction of fire spread based on a single, specific ignition.

Both systems have their place and can be valuable tools in classifying fuels. The fuel models are correlated between these two modeling systems in the "Aids to Determining Fuel Models for Estimating Fire Behavior" publication. Since this section of this Report applies specifically to wildland wildfire and prescribed fire behavior, only the NFFL Fuel Models will be referenced in this report.

Any resource management or fire management decision regarding the use of prescribed fire and/or wildland wildfire suppression tactics must be based upon authenticated fire behavior expectations using actual onsite weather observations and onsite fuel models. Wildfire suppression tactics are based upon fire behavior calculations using the BEHAVE program which calculates rate of spread and fireline intensity based upon the onsite and predicted weather conditions and the fuel model the wildfire is burning in.
Under extreme burning conditions (Santa Ana winds) the recommended rating for each FMU as shown in *Table 2- 1* may not always be possible to implement because of the intensities and rates of spread. OCFA will have little choice but to adopt an aggressive "**A**" strategy even though the rating may call for a standard "**S**" or a modified "**M**" suppression strategy.

In the case of prescribed fires once the objective for the burn is determined and a prescription is developed and formally approved, the on site weather factors must be monitored for several days prior to the burn to insure that the desired weather factors will be present on the day of the burn. In addition to onsite weather, forecasted weather is also factored in to determine if the burn will continue to stay in prescription and if it will take place as scheduled before personnel and equipment are diverted from other assignments to assist in the execution of the burn.

The following 6 pages are descriptions, with pictures, of the six most representative fuel models found on Southern Subregion lands.

Grass Group - Fuel Model 1

Fire Behavior Fuel Model 1 – Short Grass (<2 feet tall)

The fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured govern fire spread. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub is present, generally less than one-third of the area.

Grasslands, open Engelmann oak or Coast live oak savanna are representatives of this Fuel Model 1. Non-native annual grasslands, purple and Valley needlegrass are other excellent examples of this fuel model.

Refer to Photographs 1, 2 and 3 for visual illustrations of Fuel Model 1.

Fuel Model Values for Estimating Fuel Model 1 Fire Behavior

Total Fuel Load of <3-inch in diameter dead and live fuel (expressed in tons/acre)	**0.74**
Dead fuel load, ¼-inch and less (tons/acre)	**0.74**
Live fuel load, foliage (tons/acre)	**0.00**
Fuel bed depth, (expressed in feet)	**1.0**

Photo 1. Non-native Annual grasslands intermixed with islands of brush.

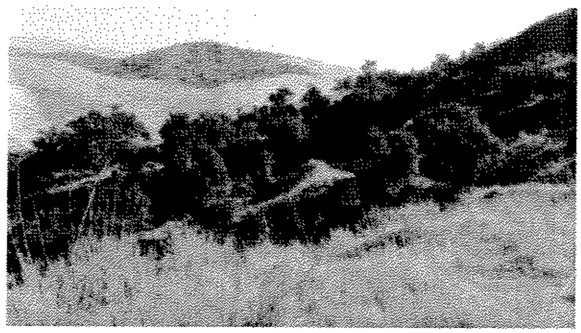


Photo 2. Native grasses/Oak woodland

Photo 3. Oak woodland

Grass Group - Fuel Model 2

Fire Behavior Fuel Model 2 – Scattered sage (<3feet tall) over cured grass

Fire spread is primarily through curing or dead herbaceous fuels. These are surface fires where the herbaceous material, in addition to litter and dead-down stem wood from the open shrub overstory, contribute to the fire intensity. Open sage shrub lands and shrub oak stands that cover one-third to two-thirds of the area may generally fit this fuel model; such stands may include clumps of fuels that generate higher fire intensities and that may produce firebrands.

Refer to Photographs 4 and 5 for visual illustrations of Fuel Model 2.

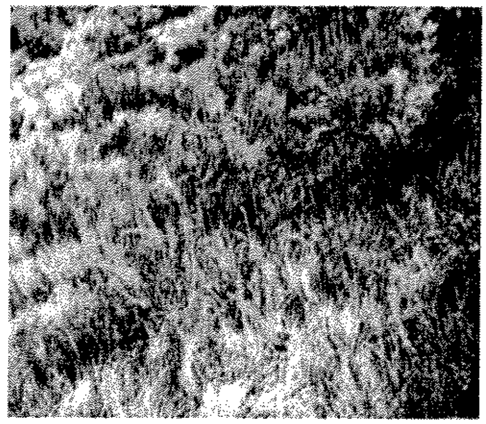


Photo 4. Scattered sage/grassland

Fuel Model Values for Estimating Fuel Model 2 Fire Behavior

Total Fuel Load of <3-inch in diameter dead and live fuel (expressed in tons/acre)	**4.0**
Dead fuel load, 1/4 inch, tons/acre	**2.0**
Live fuel load, foliage, tons/acre	**0.5**
Fuel bed depth, feet	**1.0**

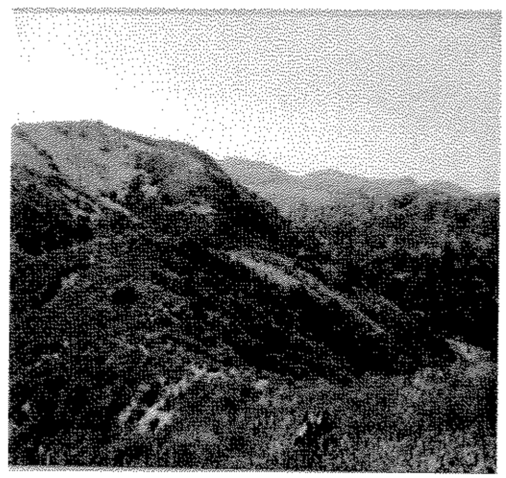


Photo 5. Young coastal sage scrub and grassland

Shrub Group - Fuel Model 4

Fire Behavior **Fuel Model 4 – Tall, dense, mature chaparral (>6 feet tall)**

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 shrubs, 6 or more feet tall, such as dense southern mixed chaparral, chamise chaparral and *Ceanothus crassifolius* chaparral are representative of this Fuel Model.

Besides flammable foliage, dead woody material in the stands significantly contributes to the fire intensity. A deep chaparral litter layer may also hamper fire suppression efforts.

Refer to Photographs 6, 7 and 8 depict examples of Fuel Model 4.

Photo 6. Ceanothus crassifolius Chaparral

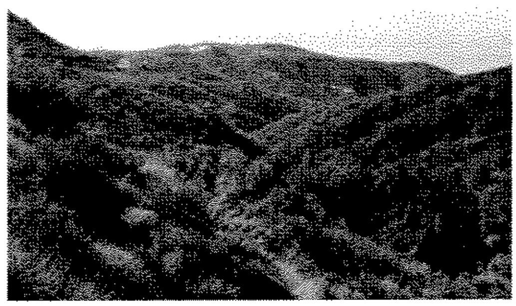


Photo 7. Southern mixed Chaparral

Photo 8. Dense Chaparral

Fuel Model Values for Estimating Fuel Model 4 Fire Behavior

Total Fuel Load of <3-inch in diameter dead and live fuel (expressed in tons/acre)	**13.0**
Dead fuel load, ¼-inch and less (tons/acre)	**5.0**
Live fuel load, foliage (tons/acre)	**5.0**
Fuel bed depth, (expressed in feet)	**6.0**

Shrub Group - Fuel Model 5

Fire Behavior Fuel Model 5 – Young, Mixed Shrub / Woodlands (<6 feet tall)

Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs, grasses, and forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead materials, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area.
Young green stands with no dead wood would qualify; laurel, vine maple, alder, or even young chaparral, manzanita or chamise. Shrub lands after a fire or other land disturbance which have a large component of green fuel qualify as this Fuel Model.

Young green stands may be up to 6 feet high but retain poor burning properties because of the large amount of live vegetation.

Photographs 9 & 10 depicts are examples of Fuel Model 5.

Fuel Model Values for Estimating Fuel Model 5 Fire Behavior

Total Fuel Load of <3-inch in diameter dead and live fuel (expressed in tons/acre)	**3.5**
Dead fuel load, ¼-inch and less (tons/acre)	**1.0**
Live fuel load, foliage (tons/acre)	**2.0**
Fuel bed depth, (expressed in feet)	**2.0**

Photo 9. Dense young Coastal sage scrub

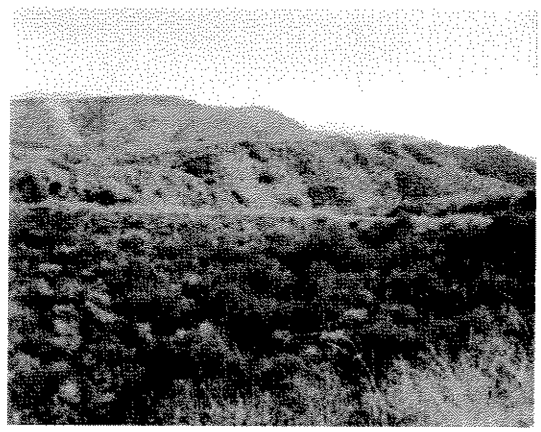


Photo 10. Young Coastal sage scrub and grasslands

Shrub Group - Fuel Model 6

Fire Behavior Fuel Model 6 – Intermediate, Dense, mature Shrubs (<6 feet tall)

Fires carry through the shrub layer of Fuel Model 6 where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mph at mid-flame height. Fire will drop to the ground at low wind speed or at openings in the stand. The shrubs are older, but not as tall as shrub types of fuel model 4. This fuel model covers a broad range of shrub conditions. Fuel situations to be considered include intermediate chamise, chaparral, oak brush and mature California sagebrush scrub.

Photos 11 and 12 are examples of Fuel Model 6.

Fuel Model Values for Estimating Fuel Model 6 Fire Behavior

Total Fuel Load of <3-inch in diameter dead and live fuel (expressed in tons/acre)	**6.0**
Dead fuel load, ¼-inch and less (tons/acre)	**1.5**
Live fuel load, foliage (tons/acre)	**0**
Fuel bed depth, (expressed in feet)	**2.5**

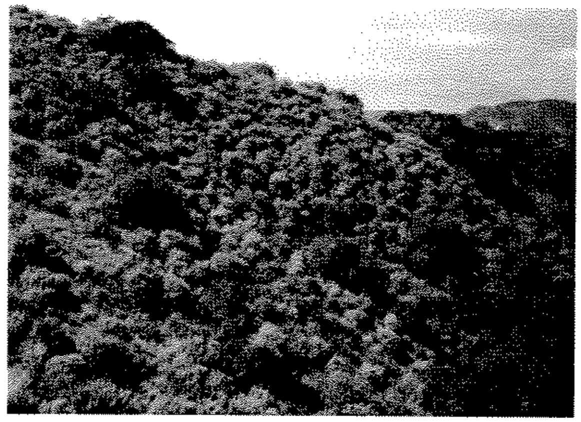


Photo 11. California sagebrush scrub

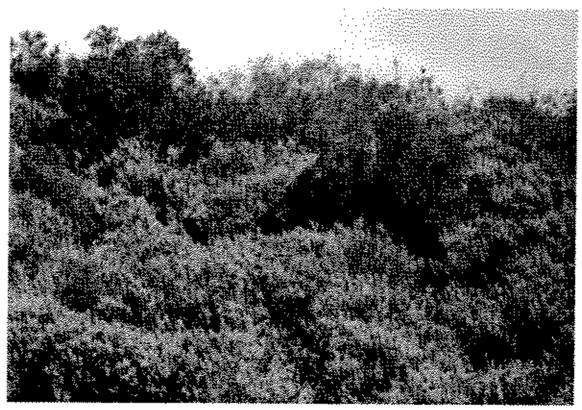


Photo 12. Mature Coastal sage scrub

Tree Group - Fuel Model 9

Fire Behavior Fuel Model 9 – Tall Riparian Shrub/Hardwoods

Fires run through the surface litter faster than other Shrub/Hardwood tree group fuel models and have longer flame height. Hardwood trees and hardwood shrub stands, especially the dense oak-willow scrub are typical Fuel Model 9 species. Fall fires produce the most intense fire behavior and strong winds are required for moderate rates of spread. High resistance to control and intense smoke can be expected due to the large amount of dead and down material intermixed with soil and duff material.

Photos 13 and 14 are examples of Fuel Model 9.

Fuel Model Values for Estimating Fuel Model 9 Fire Behavior

Total Fuel Load of <3-inch in diameter Dead and live fuel (expressed in tons/acre)	**3.5**
Dead fuel load, ¼-inch and less (tons/acre)	**2.9**
Live fuel load, foliage (tons/acre)	**0**
Fuel bed depth, (expressed in feet)	**0.2**

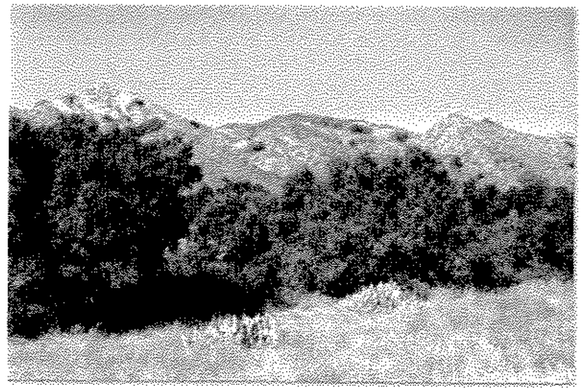


Photo 13. Woodland Oak Riparian Zone

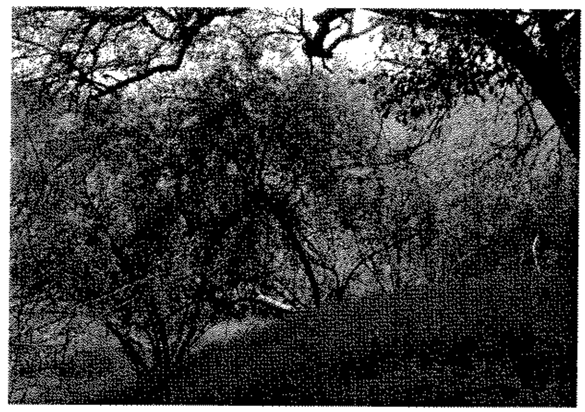


Photo 14. Southern willow scrub (Mulefat) Riparian Zone

3.7.3 Expected Fire Behavior Projections By Various Fuel Models

Expected wildland fire behavior for Southern Subregion fuel models are depicted in three categories: 1) Grass Group, 2) Shrub Group and 3) Tree Group:

3.7.3.1 Grass Group Fuel Models

Fires in the grass group fuel models exhibit some the fastest rates of spread of all the Fuel Models when exposed to similar weather conditions. With a wind speed of 10-mph and a1-hr fuel moisture content of 5 percent on a 30% slope, representative rates of spread (ROS), Heat per Unit Area and Flame Length are as follows:

Fuel Model	**Rate of Spread**		**Heat/Unit Area**	**Flame Length**
	Chains/Hour	***Feet/Minute***	***BTU/ft2***	***Feet***
1	81	89	92	4
2	31	34	491	6

3.7.3.2 Shrub Group Fuel Models

The fuel models of shrub groups exhibit a wide range of fire intensities and rates of spread. Using the same criteria of a 10-mph wind speed, 1-hr fuel moisture content of 5 percent and a live fuel moisture content of 100 percent on a 30% slope, the shrub fuel models have the following values:

Fuel Model	**Rate of Spread**		**Heat/Unit Area**	**Flame Length**
	Chains/Hour	***Feet/Minute***	***BTU/ft2***	***Feet***
4	112	123	2712	24
5	42	46	659	6
6	33	36	499	6

3.7.3.3 Tree Group Fuel Models

The fire behavior calculations of a hardwood tree/litter fuel model (riparian) are indicated by the following values when the weather characteristics are the same as the above Shrub Group but on a 5% slope:

Fuel Model	**Rate of Spread**		**Heat/Unit Area**	**Flame Length**
	Chains/Hour	***Feet/Minute***	***BTU/ft2***	***Feet***
9	7	8	390	3

NOTE: *Only Fuel Model 4 (Tall, dense brush) displays fire behavior characteristics (Heat/Unit Area and Flame Lengths) in the "serious control problem" category during wind speeds of 10 mph and lower.*

3.7.3.4 Additional Fire Behavior Influence of a 20-mph Wind Speed

With the wind speed increased to 20 mph and a 1-hr fuel moisture content of 5 percent on a 30% slope, the representative rates of spread (ROS), Heat per Unit Area and Flame Length increases are as follows:

3.7.3.5 Grass Group Fuel Model Fire Behavior with a 20-mph Wind Speed.

Grass Group fuel models are greatly influenced by increased wind speeds. Since grass fuel models consist almost entirely of fine fuels, increased wind speed causes a much faster fire spread (a 20 mph wind driven fire burns almost 2 times that of 10 mph), while the fire intensity does not substantially increase.

Fuel Model	Rate of Spread		Heat/Unit Area	Flame Length
	Chains/Hour	*Feet/Minute*	*BTU/ft2*	*Feet*
1	272	299	92	8
2	90	99	491	10

3.7.3.6 Shrub Group Fuel Model Fire Behavior with a 20-mph Wind Speed.

The shrub group fuel models exhibit a wide range of fire intensities and rates of spread. Using the same criteria of 20-mph wind speed, 1-hr fuel moisture content of 5 percent, a live fuel moisture content of 100 percent on a 30% slope, the shrub group models have the following values:

Fuel Model	Rate of Spread		Heat/Unit Area	Flame Length
	Chains/Hour	*Feet/Minute*	*BTU/ft2*	*Feet*
4	274	301	2712	36
5	50	55	659	9
6	73	80	499	9

3.7.3.7 Tree Group Fuel Model Fire Behavior with a 20-mph Wind Speed.

The fire behavior calculations of a hardwood tree/litter fuel model (riparian) are indicated by the following values when the weather characteristics are the same as the above Shrub Group but with a 5% slope:

Fuel Model	Rate of Spread		Heat/Unit Area	Flame Length
	Chains/Hour	***Feet/Minute***	***BTU/ft2***	***Feet***
9	20	22	390	5

NOTE: *All Fuel Models exceed the "serious fire control" problem criteria (flame lengths 8-feet in length), except for Fuel Model 9 (Riparian) and this fuel model almost (at 5-feet) reaches the lower end of the range. Refer to Table 3 -2 in Section 3.7.4.*

3.7.3.8 Additional Fire Behavior Influence of a 60-mph Wind Speed

With the wind speed increased to 60 mph and a 1-hr fuel moisture content of 2 percent (a Santa Ana wind event) on a 30% slope, the representative rates of spread (ROS), Heat per Unit Area and Flame Length increases are as follows:

3.7.3.9 Grass Group Fuel Model Fire Behavior with a 60-mph Wind Speed.

Grass Group fuel models are greatly influenced by increased wind speeds. Since grass fuel models consist almost entirely of fine fuels, increased wind speeds fail to increase the rate of spread and flame lengths.

Fuel Model	Rate of Spread		Heat/Unit Area	Flame Length
	Chains/Hour	***Feet/Minute***	***BTU/ft2***	***Feet***
1	666	732.6	1,415	12.7
2	968	1,065	10,808	32.3

3.7.3.10 Shrub Group Fuel Model Fire Behavior with a 60-mph Wind Speed.

The shrub group fuel models exhibit a wide range of fire intensities and rates of spread. Using the same criteria of 60-mph wind speed, 1-hr fuel moisture content of 2 percent, a live fuel moisture content of 60 percent on a 30% slope, the shrub group models have the following values:

Fuel Model	Rate of Spread		Heat/Unit Area	Flame Length
	Chains/Hour	***Feet/Minute***	***BTU/ft2***	***Feet***
4	2,104	22,154	130,077	101.3
5	367	403.7	5,437	23.5
6	398	438	4,493	21.5

3.7.3.11 Tree Group Fuel Model Fire Behavior with a 60-mph Wind Speed.

The fire behavior calculations of a hardwood tree/litter fuel model (riparian) are indicated by the following values when the weather characteristics are the same as the above Shrub Group but with a 5% slope:

Fuel Model	Rate of Spread		Heat/Unit Area	Flame Length
	Chains/Hour	*Feet/Minute*	*BTU/ft2*	*Feet*
9	180	198	1,615	13.5

3.7.4 Fire Suppression Capability Interpretations Based on Flame Lengths and Fire Intensity

***CAUTION**: The following Table 3-2 information should only be used as a guide when personnel safety is involved. Fires can be dangerous at any level of intensity. Studies have shown that with most fatalities burns occur in very light fuels on small fires or isolated sectors of large fires.*

Table 3-2 depicts some general guides for estimating successful containment of a wildland fire based by visual observation of flame lengths and/or calculated fire intensity levels.

Table 3-2

Fire Suppression Capability Interpretations Based on Observed Flame Lengths and Calculated Fire Intensity Levels		
Flame Length (Feet)	**Fireline Intensity (BTU/ft/sec.)**	**Interpretation**
< 4	**<100**	**Persons using handtools can generally attack fires at the head or flanks.** **Handline should hold the fire.**
4 – 8	**100 – 500**	**Fires are too intense for direct attack on the head by persons using handtools.** **Hand line cannot be relied on to hold fire.** **Equipment such as dozers, engines, and aircraft with fire chemicals can be effective.**
8 – 11	**500 – 1000**	**Fires may present serious control problems – torching out, crowning, and spotting.** **Control efforts at the fire head will probably be ineffective.**

>11	**> 1000**	**Crowning, spotting and major fire runs are probable.** **Control efforts at head of fire are ineffective. Indirect fire suppression strategies will be most effective.**

Table 3.2 information was based on research by: Roussopoulos, Peter J., Johnson, Von. *Help in Making Fuel Management Decisions, Research Paper NC-112, USDA-Forest Service. 1975.*

The Incident Command System (ICS) and National Wildland Coordinating Group (NWCG) certified wildland fire Incident Commanders and Prescribed Fire Managers understand the value of fuel models and the BEHAVE: Fire Behavior Prediction and Fuel Modeling System and use these tools in all their fire management and protection decision making processes. Orange County Fire Authority is a leader in the State of California's use of ICS for wildland fire incidents.

It is also very important that all Natural Resource Managers understand the value of fuel models and their use for accurate prediction of expected wildfire and/or prescribed fire behavior in all their natural resource planning and management decision making.

PART IV - TACTICAL FIRE SUPPRESSION PLAN

PART IV – SHORT-TERM TACTICAL FIRE SUPPRESSION PLAN

4.0 BACKGROUND

This short-term Tactical Fire Suppression Plan has been prepared to function as the fire management portion of the Southern Subregion NCCP/HCP Adaptive Management Program. General Policy 5 of the Draft NCCP/HCP Planning Guidelines states:

> Long-term indirect impacts to the Habitat Reserve and other areas being preserved for species protection shall be managed through creation of an urban/wildlands interface zone separating the Habitat Reserve system from the non-reserve/urban areas.

General Policy 5 further states regarding management of the interface zone would:

- Create fuel management zones combining irrigated and non-irrigated native plantings separating the Habitat Reserve system from adjacent urban uses.
- To the extent that fuel management zones are composed of native habitats and can support Identified Species and other species, or be enhanced or managed to support Identified Species and other species, this should be encouraged. For example, using prickly-pear in the fuel management zone may provide habitat for the cactus wren, as well as enhance the buffering effect between the Habitat Reserve and developed areas.
- Fuel management zones and practices will be set forth in a "fuel management plan" as part of the NCCP/HCP and aquatic resources protection program.
- Prohibit plants identified by the California Exotic Pest Plant Council as an invasive risk in Southern California from development and fuel management zones adjoining the Habitat Reserve;

This Tactical Fire Suppression Plan has been prepared to establish appropriate fire response tactics for all wildfires in the Fire Management Compartments (FMC's), Fire Management Units (FMU's), and Fuel Management Zones (FMZ's) discussed in Section III-Strategic Fire Protection Plan (see pages 3-4 through 3-12). All wildfires will be suppressed as quickly as possible. Unplanned wildfires will not be used in the Southern Subregion as a management strategy.

4.1 Preparation of the Fire Management Plan

This short-term Tactical Fire Suppression Plan was prepared by ***FIREWISE* 2000, Inc.** in cooperation with the Orange County Fire Authority (OCFA).

4.2 Structure of the Plan

The following elements must be included in the preparation of the Short-Term Tactical Fire Suppression Plan:

- *Defining fire management "compartments" that encompass major populations of Identified Species and the overall sub-regional reserve system, and preparing specific fire attack measures that would protect these areas as "refugia" in the event of a wild fire with the least impact on sensitive habitat in or near the refugia.*

***FIREWISE* 2000, Inc.** and the Orange County Fire Authority have established eighteen (18) Fire Management Compartments (FMC's) that were further subdivided into Fire Management Units (FMU's). In addition, specific fire suppression measures were identified for each FMU.

- *Preparation of suppression plans for each fire management compartment or unit.*

As noted above, the Tactical Fire Suppression Plan prescribes a specific fire suppression operational mode for each unit (*see page 4-11 and 4-12*).

- *Identify urban fuel modification zone criteria which achieve effective protection for urban development while minimizing impacts on sensitive habitat types.*

As a result of the frequency of wildfires burning through Rancho Mission Viejo and cattle grazing there is very little dense natural vegetation on the Ranch. The young age of the existing vegetation and low to moderate shrub density intermixed with annual and perennial grasses helps account for the high species populations and excellent biodiversity found on Rancho Mission Viejo. The Fire Behavior and Fuel Modeling System – BURN Subsystem, Parts 1 & 2, known as BEHAVE, were used to assess the flammability characteristics of the vegetation on Rancho Mission Viejo. BEHAVE calculations were run for the various fuel models that could conceivably interface with future urban interface areas within Rancho Mission Viejo. The vegetation on the Ranch falls into one of the following Fuel Models (FM's) FM 1, cured grass, one foot tall; FM 2, sagebrush over cured grass; FM 4, coastal sage scrub/chaparral at or greater than six feet in height and FM 6, coastal sage scrub/chaparral at or less than six feet in height. FM 4 exhibits the highest intensity and flame lengths; however, there is very little FM 4 on Rancho Mission Viejo. FM 2 exhibits the second highest intensity and flame lengths and is the most abundant Fuel Model found on Rancho Mission Viejo. Structures built with fire resistant materials and features (*see pages 3-10 through 3-11*) coupled with seventy (70) feet of Zone A irrigated "firewise landscaping" plus an additional forty (40) feet of thinned native fuels with no chamise (*Adenostoma fasciculatum*), California sagebrush (*Artemisia californica*), pampas grass (*Cortaderia selloana*), common buckwheat (*Eriogonum fasciculatum*) or black sage (*Salvia mellifera*) will provide adequate protection from wildfire without the intervention of Fire Department Equipment and Personnel.

The Orange County Fire Authority Fire Management Plant Palette was revised as part of an earlier effort in cooperation with the California Department of Fish and Game, U.S. Fish and Wildlife Service, State Parks, Planning and Development Services Department/Resources Planning, Public Facilities and Resources Department/Harbors, Beaches and Parks, private landowners, and landscape architecture firms. The plant palette (see Appendix A for all plants coded with an **X** plus the list of undesirable plants and weeds) identifies non-native invasive plant species that may escape into the RMV Open Space and displace native habitats, impact sensitive wildlife species and overall diversity, and increase the cost of management. The revised plant palette now emphasizes the use of native plant species that enhance the biological integrity of the RMV Open Space, establishes an appropriate transition at the urban/wildland interface, and provides an acceptable level of wildland fire protection.

- *Defining fire suppression compartments that encompass major populations of Identified Species.*

As noted above, the eighteen (18) FMC's were established based upon fire history and those "open space" areas that are subject to frequent wildfires.

4.2.1 How Part IV is Developed

Part IV is designed in such a way that it can be pulled out of the overall plan and be used as a stand alone plan by OCFA line officers as their wildland fire protection direction by specific FMU's.

4.3 Fire Suppression Policies For Biologically Sensitive Areas

The following eight (8) fire suppression policies are taken from the Coastal/Central NCCP/HCP Subregion Plan and are evaluated here for their applicability in the preparation of Fire Management Plans for Biologically Sensitive Areas in the RMV Open Space:

4.3.1 Bulldozer Policy

- *To the extent practicable, the use of bulldozers or other mechanical land altering equipment will be restricted to the widening and improving of existing fire roads.*

Application of Policy: During the preparation of the NCCP/HCP for the Central/Coastal Subregion, The Nature Conservancy (TNC) re-evaluated this policy and determined that it was far too limiting and effectively eliminates the value of bulldozers as a tool for minimizing fire size. TNC further stated that the use of bulldozers should be an option for any location in which the short term loss or long term conversion of habitat presents a high risk for Identified Species.

Summary Policy Statement: ***FIREWISE 2000, Inc.*** *recommends adoption of the above Application of Policy for the RMV Open Space. During periods of extreme fire behavior OCFA must use an Aggressive Suppression Strategy, including the use of bulldozers, to limit wildfire size and wildfire spread into urban areas. The immediate confined damage often is less costly than a large temporary loss (zero to fifteen years for certain targeted species) of suitable habitat.*

4.3.2 New Fire Roads Policy

- *To the extent practicable, new fire roads or firebreaks/fuelbreaks will not be created by mechanical methods. Hand crews will be used to create any necessary new firebreaks/fuelbreaks wherever practicable or feasible.*

Application of Policy: ***FIREWISE 2000, Inc.*** *evaluated this policy and determined that although the limitation of new roads and trails is a very important issue for the RMV Open Space, this fire policy should be expanded to include the potential for mechanically-created firebreaks/fuelbreaks. In situations where wildfire threats would result in type conversion and habitat loss, the spatial limited impacts of a bulldozer may be the preferred biological alternative to the consumption of additional RMV Open Space lands. Fuelbreaks can be mechanically created on main and lateral ridgelines in a low impact manner in areas with a repeated very high wildfire frequency by crushing the standing vegetation with a bulldozer with the blade up. The crushed brush is later burned using prescribed (Rx) fire under suitable conditions.*

Summary Policy Statement: Utilize bulldozers for "blade up" fuelbreak construction by crushing standing vegetation and later burning the dried crushed vegetation.

4.3.3 Backfiring Policy

- *When conditions are suitable, backfiring from existing roads, natural barriers or trails will be considered preferable to constructing new fire control lines and other methods.*

Application of Policy: ***FIREWISE 2000, Inc.*** *evaluated this policy and determined that the use of backfiring in coastal sage scrub and other habitats should be weighed against short and potential long-term loss of RMV Open Space lands and particularly the loss of riparian habitat. Backfiring should remain a possible fire management tool but should not be mandated by the Plan. Backfiring is very different than firing out. Backfiring is a last ditch effort to cut off the forward rate of spread of a rapidly advancing wildfire front by falling back to a ridge line or road a considerable distance ahead of the fire front. Necessary holding lines are constructed and the vegetative fuels between the newly constructed backfiring line and the advancing wildfire front are ignited. Ignition is timed to suck the backfire into the advancing fire front, thereby incinerating all vegetative fuels in the wildfires path, including riparian areas, which halts the wildfires advance.*

Firing out utilizes elements of the backfiring technique, however, it is mostly used where it is necessary to construct indirect fireline because the flanks, or edges of the wildfire, are too hot to construct direct line on the active edge of the wildfire. As the indirect line is constructed the unburned vegetation between the wildfire edge and the indirect line is fired out. Often existing roads are also used to fire out standing vegetation between the wildfire edge and the road that is serving as the containment line or fireline. Backfiring and firing out are two very distinct kinds of operations. Firing out is a minimal impact means of containment and is readily utilized by all wildland fire suppression agencies.

Summary Policy Statement: Firing out should be included as an acceptable containment technique where the edge or flank of the wildfire is too hot to permit direct fireline construction. Backfiring should not be mandated by the Fire Management Plan.

4.3.4 Ground Tactical Units Policy

- *To the extent practicable, ground tactical operations will use natural features such a ridgelines, as well as roads and pre-fire constructed firebreaks/fuelbreaks for containment lines.*

Application of Policy: ***FIREWISE 2000, Inc.*** *evaluated this policy and determined that the use of natural firebreaks/fuelbreaks should be encouraged only when the consumption of additional acres is considered to have ecological benefits, i.e. letting the wildfire burn up to the ridgeline instead of a direct attack because the vegetation really needs renewing, or if the use of natural* *firebreaks/fuelbreaks presents less of an impact than the construction of new wildfire suppression control lines at the time of and out ahead of the wildfire.*

<u>Summary Policy Statement</u>: *Use of natural firebreaks/fuelbreaks should be encouraged under two conditions. 1) When the consumption of additional acres is considered to have ecological benefits, i.e. letting the wildfire burn up to the ridgeline instead of a direct attack because the vegetation really needs renewing. 2) If the use of indirect natural firebreaks/fuelbreaks presents less of an impact than the construction of new wildfire suppression control lines to directly contain the wildfire.*

4.3.5 Off-Road Policy

- *The minimum number of fire suppression vehicles considered necessary for effective fire control by the command fire agency or ground tactical units will be allowed to drive off roads and firebreaks/fuelbreaks.*

<u>Summary Policy Statement</u>: *The Tactical Fire Suppression Plan (Short-Term Fire Management Plan) establishes appropriate standardized fire service response guidelines that describe conditions under which fire suppression vehicles will be allowed to conduct wildfire suppression operations off-road (see Section 2.4.3 and Table 2-1).*

4.3.6 Grading Techniques and Erosion Control Policy

- *To the extent practicable, proper grading techniques and erosion control methods will be used to minimize soil erosion on fire roads.*

<u>Summary Policy Statement</u>: *The Tactical Fire Suppression Plan (Short-Term Fire Management Plan) establishes appropriate guidelines for pre and post-fire suppression that will identify regrading of disturbed areas and implementation of erosion control measures as part of OCFA's wildfire suppression responsibilities in consultation with the RMV Open Space Resource Advisor(s).*

4.3.7 Water Saturation as Mop-Up Technique Policy

- *To the extent practicable, ground tactical units will use water saturation as a mop-up technique rather than digging out and stirring hot spots in locations with significant CSS or other natural resources such as the biologically rich riparian areas and/or in areas potentially subject to post-fire erosion.*

<u>Application of Policy</u>: *In the Central/Coastal Sub Region TNC evaluated this policy and determined that the use of water saturation can result in extensive steam damage to feeder roots,*

seeds and other plant materials, and that mop-up of any kind should be completed to a minimum level of safety and control. Also, felling and bucking of mature trees should be discouraged. ***FIREWISE* 2000, Inc.** *recommends adoption of this Application of Policy for the Southern Subregion NCCP/HCP.*

<u>Summary Policy Statement</u>: *Dry mopping techniques will be utilized to extinguish "hot spots" and smoldering plant materials as opposed to water saturation techniques. Fire killed trees will be left standing and will not be felled and bucked.*

4.3.8 Fire Prevention Techniques Policy

- *Until such time as a specific set of fire-related recreational use policies is prepared by the County of Orange Fire Department/Department of Harbors, Beaches and Parks, the interim Chino Hills State Park policies (set forth in Appendix F) shall serve as the policies for "fire prevention techniques", "pre-suppression activities" and the fire season "step-up plan".*

<u>Application of Policy</u>: *The current fire program shall be implemented in compliance with this policy.*

<u>Summary Policy Statement</u>: *See Appendix F, pages 2-3.*

4.4 Elements Of The Tactical Fire Suppression Plan

The Tactical Fire Suppression Plan contains the following elements:

- Intent.
- Delineation of Fire Compartments and Fire Management Units.
- RMV Open Space Ratings/Tactical Operation Modes/Fire Suppression Guidelines.
- Procedures for implementing the plan.
- Post-Fire Evaluation.
- Plan Maintenance and Update

4.4.1 Intent

The intent of the Tactical Fire Suppression Plan (Short-Term Fire Management Plan) is to establish appropriate standardized fire service response guidelines for use by the Orange County Fire Authority and other fire agencies responsible for managing wildland fire events within the RMV Open Space that causes the least amount of damage to natural resources while providing the effective fire-fighting controls needed to protect human life and property. Standard wildland fire fighting considerations, such as resource responses, strategies, and tactics used in the RMV Open Space will emphasize measures aimed at minimizing the impacts of wildfire on sensitive wildlife and wildlife habitats. These wildfire-fighting considerations may be revised as appropriate to address changes to the existing environmental conditions and circumstances as determined by the designated RMV Open Space Resource Advisor(s). In the RMV Open Space, when human life and property are not threatened the Fire Authority and/or appropriate fire agency will initiate the implementation of pre-determined specific fire suppression tactics that will support environmental preservation criteria. If extreme weather conditions are present (high watershed dispatch levels, Red Flag conditions, etc.), normal fire fighting strategies and tactics will be employed to ensure the highest probability of success.

4.4.2 Delineation Of Fire Management Compartments (FMC's) and Fire Management Units (FMU's)

The Strategic Fire Protection Plan established eighteen (18) Southern Subregion Fire Management Compartments (FMC's) (see page 3-5 of Section III). For the purpose of this short-term Tactical Fire Suppression Plan the FMC's are divided into those FMC's within the RMV boundaries and those outside RMV boundaries.

FMC's within Rancho Mission Viejo

21. Talega/La Paz FMC
22. Central San Juan/Trampas/Cristianitos FMC
23. Lower Gabino/Blind Canyon FMC
24. Upper Gabino/Blind Canyon FMC
26. Ladera FMC
27. Wagon Wheel/Chiquita Ridge FMC
28. Chiquadora/West Gobernadora FMC
29. East Gobernadora/Bell Canyon FMC
34. Donna O' Neill Land Conservancy FMC
36. Upper Chiquita FMC

FMC's Outside of Rancho Mission Viejo

20. San Onofre State Park FMC (this is land leased to State Parks by MCB Camp Pendleton, but is outside the Subregion, OCFA provides wildfire protection, as discussed in Section III FMC is an ignition source)
25. Riverside County FMC (outside the Subregion, but as discussed in Section III is an ignition source.
30. Caspers FMC
31. Starr Ranch FMC

32. Foothill/Trabuco Specific Planning Area
33. Presidential Heights FMC
35. Prima Deshecha Regional Park FMC (currently a landfill)
37. El Cariso Village FMC

All of the FMC's were further subdivided into smaller units called Fire Management Units (FMU's) identified with numbers 01, 02, 03, 04, etc. The FMC's and FMU's were established in the field by OCFA and ***FIREWISE* 2000, Inc.** by utilizing natural ridgelines, riparian areas, lakes and streams, roads, trails and development edges. It should be noted that in many instances, the FMC's and FMU's extend beyond the boundaries of the Southern Subregion to achieve acceptable defensible spaces.

Figure 4 -1 is a map depicting the Southern Subregion FMC and FMU locations.

4.4.3 Southern Subregion Open Space Lands Ratings/Tactical Operation Modes/Fire Suppression Guidelines

The Plan establishes three (3) distinct Tactical Operations Modes/Fire Suppression Guidelines for application to all Southern Subregion Open Space lands, "Aggressive", "Standard" and "Modified". Tactical Operations Modes are dynamic and may change periodically based upon fuels, weather, topography and other environmental, natural resource and habitat conditions. Tactical Operations Modes may also change based upon conditions within contiguous FMU's. These guidelines correspond to "Direct Attack", "Combination Attack" and "Indirect Attack" operational modes and were assigned by The ***FIREWISE* 2000, Inc** and Orange County Fire Authority staffs to each FMU as follows:

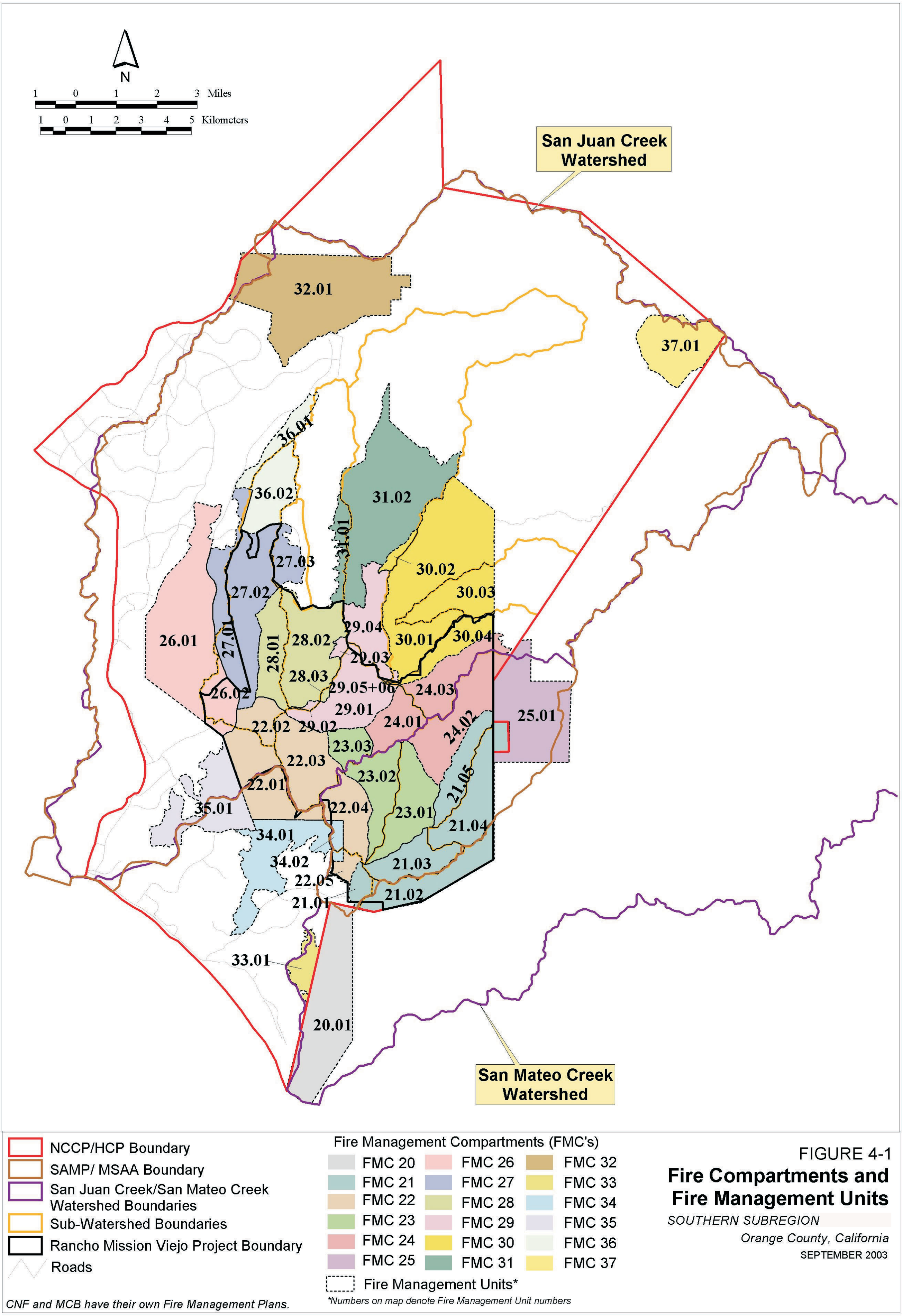


FIGURE 4-1

Fire Compartments and Fire Management Units

SOUTHERN SUBREGION

Orange County, California

SEPTEMBER 2003

4.4.3.1 Aggressive (Tactical Operations Mode "Direct Attack")

FMU's that are identified as "**A**" will receive immediate containment and control using all available resources (i.e., aircraft, bulldozers, engines, hand crews, etc.) in response to the resource values of the watershed which justifies an increased allocation of resources for an aggressive response and rapid intervention to contain the wildfire. Also, these FMU's must be protected as "Refugia" for the Habitat Reserve Identified Species. Therefore, immediate containment and control are the objectives of the Incident Action Plan (IAP). In many FMU's there is no separation between the ground fuels and the existing tree cover, raptor perches. Because there is a vertical fuel ladder into the crowns of most of the trees on RMV and other portions of the Habitat Reserve, any ground fire burning into these areas will kill or severely damage existing trees. The aggressive **"A"** strategy will apply to the following FMU's because of key habitat values and/or preservation strategies: FMU's 20.01–25.01, 27.01-27.03, 30.01-35.01 and 37.01.

Control objectives will also identify necessary post fire suppression activities such as mop-up, erosion control, habitat rehabilitation/remediation, etc.

4.4.3.2 Standard (Tactical Operations Mode "Combination Attack")

FMU's that are identified as "**S**" will receive a standard tactical wildfire response with minimal disruption to natural resources. The primary objective of this operational mode is to manage the wildfire in a manner that will not allow the fire to escape or spread to an adjacent FMU. This may involve a combination of all of the wildfire suppression responses.

Normal fire fighting tactics are employed. These FMU's receive standard tactical fire fighting response to the threat of wildfire with minimal disruption to the natural ecology. The use of heavy equipment and excessive backfiring operations are discouraged.

Engine Companies are encouraged to stay on roads and use operations and techniques that minimize negative impacts on the environment. Also, the primary tactical objective is to contain and control the fire with the least amount of impact to the FMU's natural habitat and overall ecology. Suppression strategies will not include extraordinary efforts to control the wildfire but will include water or retardent dropping aircraft.

The standard **"S"** strategy will apply to the following FMU's because of key habitat values that could be temporarily lost with aggressive line building with bulldozers and large scale backfiring: FMU's 26.01, 26.02, 28.01-28.03, 29.01–29.06 and 36.01, 36.02.

Tactical operations will also identify necessary post fire suppression activities such as mop-up, erosion control, habitat rehabilitation/remediation, in full consultation with the RMV Resource Advisor(s).

4.4.3.3 Modified (Tactical Operations Mode "Indirect Attack")

FMU's that are identified as "**M**" for "Modified" fire suppression response will be allowed to burn naturally up to the pre-determined natural and man-made control lines and barriers. No extraordinary equipment such as aircraft or bulldozers will be used. At this time, none of the FMU's in the Southern Subregion have an "M" modified rating.

The wildfire will be steered toward pre-existing control lines or natural barriers and allowed to burn naturally when there is a high probability of successful containment. No destructive fire fighting actions will be taken that may impact the ecology of the FMU. Bulldozers, aircraft and off-road driving should be discouraged except at pre-planned and agreed to containment lines. Hose lines and water application are permitted at non-erosive levels. Hand tools are allowed to reduce flame heights potential with no grubbing or removal of root structure. The primary objective of the IAP is containment of hostile wildfires within the FMU with no destruction or disturbance to the natural ecology. Any FMU's to be identified as an "**M**" will need to be verified on the ground with the appropriate Resource Advisor(s) and OCFA personnel. At this point we are not able to determine where free running fire that can be herded to a viable control point to meet resource management objectives other than in the grasslands. None of the FMU's are 100% Fuel Model 1, i.e. annual or perennial grasses

Standard wildland fire fighting considerations (resources, strategies and tactics) for these three (3) operational modes as prescribed by this plan shall be used in the Open Space and shall emphasize minimizing impacts of fire suppression tactics on sensitive wildlife and wildlife habitats. It should be noted that the operational mode for each FMU might change based upon environmental conditions as determined by the appropriate Resource Advisor(s). In addition, the Orange County Fire Authority and affected wildland fire agencies will attempt to implement the pre-determined fire suppression tactics unless human life and property are threatened. Should human life and property become threatened or if "**extreme**" weather conditions exist, normal fire fighting strategies and tactics will be employed, strategy "**A**", to ensure the highest probability of success and control of the wildfire at the smallest size possible.

4.4.4 Southern Subregion Open Space Lands Rating Form

The Southern Subregion Open Space Lands (SSR) ratings that form the basis for the resource response, strategies and tactics to be used by the Orange County Fire Authority Wildland Fire Defense Planner (WFDP) will be updated as needed by the appropriate Resource Advisor(s), using the SSR Rating Form (Please refer to the following suggested SSR Rating Form shown in

Table 2-1. The WFDP forwards the SSR Rating classification to the Emergency Communication Center (ECC), all Field Battalions, and Divisions in the Fire Authority, and other cooperating agencies. SSR Ratings, shown on SSR Rating Forms, correspond to existing tactical operations, or fire fighting modes.

Table 4-1 on the following page is a suggested SSR Rating Form. ***FIREWISE* 2000, Inc.** coordinated with OCFA in the development of the recommended suppression strategy ratings shown on *Table 4-1.*

Table 4-1

(*Note that these ratings are based on present conditions today and not future build out*)

Southern Subregion Open Space Lands (SSR) Rating Form			
Compartment	**Rating**	**Compartment**	**Rating**
20. San Onofre State Park		**29. East Gobernadora/Bell Canyon**	
FMU 20.01	**A**	FMU 29.01	**S**
		FMU 29.02	**S**
		FMU 29.03	**S**
(*very high habitat value, undisturbed Coastal Sage Scrub since the time of the last wildfire plus a pocket mouse that lives in loose sand*)		FMU 29.04	**S**
		FMU 29.05	**S**
		FMU 29.06	**S**
21. Talega/La Paz Canyons		**30. Caspers**	
FMU 21.01	**A**	FMU 30.01	**A**
FMU 21.02	**A**	FMU 30.02	**A**
FMU 21.03	**A**	FMU 30.03	**A**
FMU 21.04	**A**	FMU 30.04	**A**
FMU 21.05	**A**		
(*these canyons are important for raptor habitat*)		(*this FMU is managed for preservation of existing values*)	
22. Central San Juan/Trampas/Cristianitos Canyons		**31. Starr Ranch**	
FMU 22.01	**A**	FMU 31.01	**A**
FMU 22.02	**A**	FMU 31.02	**A**
FMU 22.03	**A**		
FMU 22.04	**A**		
FMU 22.05	**A**		
(*very high fuel loadings, hasn't burned since 1911, this FMC has important grassland areas, riparian areas and raptor habitat*)		(*very dense vegetation, FM 4*)	
23. Lower Gabino/Blind Canyons		**32. Foothill/Trabuco Specific Planning Area** (*State Responsibility Area*)	
FMU 23.01	**A**		
FMU 23.02	**A**	FMU 32.01	**A**
FMU 23.03	**A**		
(*this FMC has important grassland areas, riparian areas and raptor habitat*)		(*Open Space Lands above Lake Forest and Rancho Santa Margarita –disturbed land, good habitat values*)	
24. Upper Gabino/Blind Canyons		**33. Presidential Heights**	
FMU 24.01	**A**	FMU 33.01	**A**
FMU 24.02	**A**		
FMU 24.03	**A**		
25. Riverside County		**34. Donna O' Neill Land Conservancy**	
FMU 25.01	**A**	FMU 34.01	**A**
		FMU 34.02	**A**

26. Ladera FMU 26.01 **S** FMU 26.02 **S**	**35. Prima Deshecha Regional Park** FMU 35.01 **A** *(currently an active landfill)*
27. Wagon Wheel/Chiquita Ridge FMU 27.01 **A** FMU 27.02 **A** FMU 27.03 **A**	**36. Upper Chiquita** FMU 36.01 **S** FMU 36.02 **S** *(this FMC has important Coastal Sage Scrub areas)*
28. Chiquadora/West Gobernadora FMU 28.01 **S** FMU 28.02 **S** FMU 28.03 **S** *(this FMC has important grassland and riparian areas)*	**37. El Cariso Village** FMU 37.01 **A** *(this FMC has very little habitat value)*

SRL Ratings

Aggressive (**A**): Direct Attack
Standard (**S**): Combination Attack
Modified (**M**): Indirect Attack

Revision Date: ____________________

By: ____________________

When responding to vegetation fires in the Southern Subregion Open Space lands the Emergency Communication Center notifies the initial attack Battalion Chief that the fire is in the Southern Subregion, provides the compartment and FMU number, and announces the SSR Rating. Based on this information, Battalion Chiefs determine if the recommended tactical operations mode can be implemented, based on current weather conditions. Battalion Chiefs will announce, or may request ECC to announce, what mode of operation will be used. Division Chief and field Battalion Chief Command vehicles are equipped with a folder containing maps of the Southern Subregion Compartments and the most current SSR Rating Form. These reference materials are used to assist in the managing of the incident.

4.4.5 Fire Response Procedures

4.4.5.1 Notification

The Emergency Communication Center (ECC) shall notify the initial attack units that the fire is in Southern Subregion Open Space lands and identify the affected FMC and FMU and the rating (i.e., Aggressive, Standard or Modified). For example, the ECC will make the following announcement: ***"All units responding to the vegetation fire be advised that this is on Southern Subregion Open Space lands, Compartment 21.02, Aggressive".*** The ECC will also page the OCFA Wildland Fire Defense Planner any time that a wildfire is reported in Southern Subregion Open Space lands. The Wildland Defense Planner will respond to the wildfire to work as a liaison with the Incident Commander (IC) to insure that the (IC) is aware of the rating form and Tactical Operations Modes called for by Fire Management Compartment and Fire Management Unit and to coordinate with the appropriate Resource Advisor.

4.4.5.2 Initial Attack Response:

The Battalion Chief (BC) shall make one of the following determinations:

The recommended tactical operations mode **can** be implemented based on current weather conditions and other considerations, or

The recommended tactical operations mode **cannot** be implemented, and the BC will announce, or may request that the ECC announce, the appropriate mode of operation or tactical plan to be implemented.

If the recommended tactical operations mode **can** be implemented, the Division and Battalion Chief refer to the Tactical Fire Suppression Plan and associated SSR Rating Forms which are maintained in a binder in their command vehicles.

If the incidents are expected to escalate to extended attack fires beyond the first operational period (12 hours), the appropriate Resource Advisor(s) is requested to respond to the Incident Command Post (ICP). The Resource Advisor(s) shall be a biologist and/or resource ecologist with training in wildland fire management. The appropriate Resource Advisor(s) will be notified of fires occurring within Southern Subregion Open Space lands by pager provided by the Orange County Fire Authority. The Resource Advisor will serve as a Technical Advisor ("Tech Ads") within the Plans Section.

4.5 Resource Advisor (Lead Resource Advisor Role)

Each landowner or jurisdiction with open space within the Southern Subregion shall designate a Lead Resource Advisor. This individual shall be the sole point of contact with the Incident Commander (IC). The Lead Resource Advisor shall also be responsible for notifying OCFA of an alternate Lead Resource Advisor to serve in his/her absence. The Resource Advisor shall coordinate with the affected land manager prior to communication with the IC or any OCFA personnel. No one shall enter the fire line without prior authorization from the IC, in consultation with the Lead Resource Advisor.

Table 4-2

Fire Management Compartments	Landowner/Jurisdiction With Decision Making Authority	Contact Name	Phone Number
20. San Onofre State Park	State Park Superintendent		
21. Talega/La Paz	RMV		
22. Central San Juan/Trampas/Cristianitos	RMV		
23. Lower Gabino/Blind Canyon	RMV		
24. Upper Gabino/Blind Canyon	RMV		
25. Riverside County	OCFA		
26. Ladera	RMV		
27. Wagon Wheel/Chiquita Ridge	RMV		
28. Chiquadora/West Gobernadora	RMV		
29. East Gobernadora/Bell Canyon	RMV		
30 Caspers	OC Parks & Rec		
31. Starr Ranch	Audubon Society		
32. Foothill/Trabuco Specific Planning Area	OCFA		
33. Presidential Heights	OC Parks & Rec		
34. Donna O' Neill Land Conservancy	RMV		
35. Prima Dechecha Regional Park (now a landfill)	OC Parks & Rec		
36. Upper Chiquita	RMV		
37. El Cariso Village	OCFA		

4.5.1 Notification and Coordination of Other Designated Resource Advisors

The Lead Resource Advisor shall be notified by pager of all fire events affecting their open space lands and shall be responsible for contacting, consulting and coordinating with all other Resource Advisors and land managers as necessary. The Lead Resource Advisor shall also maintain a list of all Resource Advisors and notify OCFA of any changes to the list of Resource Advisors including a designated alternate Lead Resource Advisor.

4.5.2 Lead Resource Advisor Response

In response to the initial pager notification, the Lead Resource Advisor shall report to the Incident Command Post if requested to do so by the IC and be available to provide technical advice as necessary to the IC.

The Lead Resource Advisor(s) will review the Tactical Fire Suppression Plan and the "Environmentally Sensitive Areas" (ESA) mapping and advise the BC. For the RMV Open Space, the ESA mapping has been prepared by Dudek and Associates, Inc. and Archeological Resource Management Corporation and includes the following data:

- Vernal pool locations
- Archeological sites
- Paleontological Resource Areas

The ESA mapping will be updated as required by the Resource Advisor(s) and as new locations are discovered.

4.6 Post-Fire Evaluation

The Tactical Fire Suppression Plan was created as part of a cooperative effort involving the Orange County Fire Authority, ***FIREWISE* 2000, Inc.** and the NCCP/SAMP Working Group. The plan is intended to be a "dynamic, living document" that remains effective as a management tool throughout the life of the RMV Open Space and other Southern Subregion Open Space lands.

Following each fire event on Southern Subregion Open Space lands, fire suppression forces will review the effectiveness of the tactical operations recommended in the plan. The suppression forces may recommend changes to the WFDP to better achieve the goals and objectives of the plan.

Also, the Lead Resource Advisor will monitor natural resource conditions regularly, update the SSR Ratings (Aggressive, Standard and Modified) for each FMU on an as-needed basis, and recommend plan revisions to address these changing conditions.

The Lead Resource Advisor in consultation with an OCFA representative shall evaluate all fire events occurring in the Southern Subregion as follows:

- Date & Time of Fire;
- Fire Management Compartment/Fire Management Unit (FMC/FMU) affected;

- SSR Rating for the affected FMC/FMU;
- Actual Fire Suppression Tactics used;
- Estimated Size of Fire (Acres);
- Affected Habitat(s)
- Types of Disturbances (i.e., new fire roads, hand clearing, erosion, etc.);
- Measures Undertaken to Correct Disturbances; and
- Other as determined by the Lead Resource Advisor.

4.7 Training Sessions

Annual Resource Advisor training sessions should be conducted by May 15th to review these roles and responsibilities and the overall design of the program.

4.8 Review and Approval

The WFDP will review all recommendations in consultation with the Resource Advisor(s) and approve appropriate additions and revisions to the Tactical Fire Suppression Plan (Short Term Fire Management Plan).

4.9 Post Fire Reporting

All fire incidents and responses occurring on Southern Subregion Open Space lands, and specifically RMV Open Space, shall be reported to the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG) the US Army Corps of Engineers and the County of Orange. The report shall include the cause of the incident, number of acres of habitat by type burned, types of resources effected, and post fire evaluation.

4.10 Tactical Fire Suppression Plan Maintenance

4.10.1 FMC/FMU Mapping Maintenance

The Orange County Fire Authority (OCFA) shall maintain the FMC's/FMU's mapping and SSR Rating Forms. Updates to the mapping shall be made on an on-going basis. The mapping shall be comprehensively reviewed and revised as needed on an annual basis.

4.10.2 Southern Subregion Open Space Lands (SSR) Rating Form Maintenance

OCFA shall maintain the SSR Rating forms and all subsequent updates as required by the Resource Advisor(s).

4.10.3 Resource Sensitive Areas Mapping

Name (entity to be determined) shall update the Resource Sensitive Areas mapping, as new data become available and incorporate as approved by the Resource Advisor(s)

4.11 Tactical Fire Suppression Plan Interagency Coordination and Training

OCFA, Resources Planning and appropriate Habitat Reserve Resource Advisor(s) shall conduct a training session for the affected OCFA Battalion Chief and other wildland fire agencies.

4.11.1 OCFA Battalion Chief Training Sessions

Battalion Chief training sessions will be conducted on an annual basis prior to the wildfire season.

4.11.2 Coordination with Other Wildland Fire Agencies

Annual training sessions with these agencies shall be conducted on an annual basis prior to the wildfire season.

4.11.3 Open Space Land Managers

Open Space Land Manager training will occur prior to the wildfire season. The Open Space Land Managers generally possess the greatest knowledge concerning the location of sensitive natural and scientific resources within their properties and will assist in the completion of Resource Sensitive Areas mapping.

PART IV - TACTICAL FIRE SUPPRESSION PLAN

PART IV – SHORT-TERM TACTICAL FIRE SUPPRESSION PLAN

4.0 BACKGROUND

This short-term Tactical Fire Suppression Plan has been prepared to function as the fire management portion of the Southern Subregion NCCP/HCP Adaptive Management Program. General Policy 5 of the Draft NCCP/HCP Planning Guidelines states:

> Long-term indirect impacts to the Habitat Reserve and other areas being preserved for species protection shall be managed through creation of an urban/wildlands interface zone separating the Habitat Reserve system from the non-reserve/urban areas.

General Policy 5 further states regarding management of the interface zone would:

- Create fuel management zones combining irrigated and non-irrigated native plantings separating the Habitat Reserve system from adjacent urban uses.
- To the extent that fuel management zones are composed of native habitats and can support Identified Species and other species, or be enhanced or managed to support Identified Species and other species, this should be encouraged. For example, using prickly-pear in the fuel management zone may provide habitat for the cactus wren, as well as enhance the buffering effect between the Habitat Reserve and developed areas.
- Fuel management zones and practices will be set forth in a "fuel management plan" as part of the NCCP/HCP and aquatic resources protection program.
- Prohibit plants identified by the California Exotic Pest Plant Council as an invasive risk in Southern California from development and fuel management zones adjoining the Habitat Reserve;

This Tactical Fire Suppression Plan has been prepared to establish appropriate fire response tactics for all wildfires in the Fire Management Compartments (FMC's), Fire Management Units (FMU's), and Fuel Management Zones (FMZ's) discussed in Section III-Strategic Fire Protection Plan (see pages 3-4 through 3-12). All wildfires will be suppressed as quickly as possible. Unplanned wildfires will not be used in the Southern Subregion as a management strategy.

4.1 Preparation of the Fire Management Plan

This short-term Tactical Fire Suppression Plan was prepared by ***FIREWISE* 2000, Inc.** in cooperation with the Orange County Fire Authority (OCFA).

4.2 Structure of the Plan

The following elements must be included in the preparation of the Short-Term Tactical Fire Suppression Plan:

- *Defining fire management "compartments" that encompass major populations of Identified Species and the overall sub-regional reserve system, and preparing specific fire attack measures that would protect these areas as "refugia" in the event of a wild fire with the least impact on sensitive habitat in or near the refugia.*

***FIREWISE* 2000, Inc.** and the Orange County Fire Authority have established eighteen (18) Fire Management Compartments (FMC's) that were further subdivided into Fire Management Units (FMU's). In addition, specific fire suppression measures were identified for each FMU.

- *Preparation of suppression plans for each fire management compartment or unit.*

As noted above, the Tactical Fire Suppression Plan prescribes a specific fire suppression operational mode for each unit (*see page 4-11 and 4-12*).

- *Identify urban fuel modification zone criteria which achieve effective protection for urban development while minimizing impacts on sensitive habitat types.*

As a result of the frequency of wildfires burning through Rancho Mission Viejo and cattle grazing there is very little dense natural vegetation on the Ranch. The young age of the existing vegetation and low to moderate shrub density intermixed with annual and perennial grasses helps account for the high species populations and excellent biodiversity found on Rancho Mission Viejo. The Fire Behavior and Fuel Modeling System – BURN Subsystem, Parts 1 & 2, known as BEHAVE, were used to assess the flammability characteristics of the vegetation on Rancho Mission Viejo. BEHAVE calculations were run for the various fuel models that could conceivably interface with future urban interface areas within Rancho Mission Viejo. The vegetation on the Ranch falls into one of the following Fuel Models (FM's) FM 1, cured grass, one foot tall; FM 2, sagebrush over cured grass; FM 4, coastal sage scrub/chaparral at or greater than six feet in height and FM 6, coastal sage scrub/chaparral at or less than six feet in height. FM 4 exhibits the highest intensity and flame lengths; however, there is very little FM 4 on Rancho Mission Viejo. FM 2 exhibits the second highest intensity and flame lengths and is the most abundant Fuel Model found on Rancho Mission Viejo. Structures built with fire resistant materials and features (*see pages 3-10 through 3-11*) coupled with seventy (70) feet of Zone A irrigated "firewise landscaping" plus an additional forty (40) feet of thinned native fuels with no chamise (*Adenostoma fasciculatum*), California sagebrush (*Artemisia californica*), pampas grass (*Cortaderia selloana*), common buckwheat (*Eriogonum fasciculatum*) or black sage (*Salvia mellifera*) will provide adequate protection from wildfire without the intervention of Fire Department Equipment and Personnel.

The Orange County Fire Authority Fire Management Plant Palette was revised as part of an earlier effort in cooperation with the California Department of Fish and Game, U.S. Fish and Wildlife Service, State Parks, Planning and Development Services Department/Resources Planning, Public Facilities and Resources Department/Harbors, Beaches and Parks, private landowners, and landscape architecture firms. The plant palette (see Appendix A for all plants coded with an **X** plus the list of undesirable plants and weeds) identifies non-native invasive plant species that may escape into the RMV Open Space and displace native habitats, impact sensitive wildlife species and overall diversity, and increase the cost of management. The revised plant palette now emphasizes the use of native plant species that enhance the biological integrity of the RMV Open Space, establishes an appropriate transition at the urban/wildland interface, and provides an acceptable level of wildland fire protection.

- *Defining fire suppression compartments that encompass major populations of Identified Species.*

As noted above, the eighteen (18) FMC's were established based upon fire history and those "open space" areas that are subject to frequent wildfires.

4.2.1 How Part IV is Developed

Part IV is designed in such a way that it can be pulled out of the overall plan and be used as a stand alone plan by OCFA line officers as their wildland fire protection direction by specific FMU's.

4.3 Fire Suppression Policies For Biologically Sensitive Areas

The following eight (8) fire suppression policies are taken from the Coastal/Central NCCP/HCP Subregion Plan and are evaluated here for their applicability in the preparation of Fire Management Plans for Biologically Sensitive Areas in the RMV Open Space:

4.3.1 Bulldozer Policy

- *To the extent practicable, the use of bulldozers or other mechanical land altering equipment will be restricted to the widening and improving of existing fire roads.*

Application of Policy: During the preparation of the NCCP/HCP for the Central/Coastal Subregion, The Nature Conservancy (TNC) re-evaluated this policy and determined that it was far too limiting and effectively eliminates the value of bulldozers as a tool for minimizing fire size. TNC further stated that the use of bulldozers should be an option for any location in which the short term loss or long term conversion of habitat presents a high risk for Identified Species.

Summary Policy Statement: ***FIREWISE 2000, Inc.*** *recommends adoption of the above Application of Policy for the RMV Open Space. During periods of extreme fire behavior OCFA must use an Aggressive Suppression Strategy, including the use of bulldozers, to limit wildfire size and wildfire spread into urban areas. The immediate confined damage often is less costly than a large temporary loss (zero to fifteen years for certain targeted species) of suitable habitat.*

4.3.2 New Fire Roads Policy

- *To the extent practicable, new fire roads or firebreaks/fuelbreaks will not be created by mechanical methods. Hand crews will be used to create any necessary new firebreaks/fuelbreaks wherever practicable or feasible.*

Application of Policy: ***FIREWISE 2000, Inc.*** *evaluated this policy and determined that although the limitation of new roads and trails is a very important issue for the RMV Open Space, this fire policy should be expanded to include the potential for mechanically-created firebreaks/fuelbreaks. In situations where wildfire threats would result in type conversion and habitat loss, the spatial limited impacts of a bulldozer may be the preferred biological alternative to the consumption of additional RMV Open Space lands. Fuelbreaks can be mechanically created on main and lateral ridgelines in a low impact manner in areas with a repeated very high wildfire frequency by crushing the standing vegetation with a bulldozer with the blade up. The crushed brush is later burned using prescribed (Rx) fire under suitable conditions.*

Summary Policy Statement: Utilize bulldozers for "blade up" fuelbreak construction by crushing standing vegetation and later burning the dried crushed vegetation.

4.3.3 Backfiring Policy

- *When conditions are suitable, backfiring from existing roads, natural barriers or trails will be considered preferable to constructing new fire control lines and other methods.*

Application of Policy: ***FIREWISE 2000, Inc.*** *evaluated this policy and determined that the use of backfiring in coastal sage scrub and other habitats should be weighed against short and potential long-term loss of RMV Open Space lands and particularly the loss of riparian habitat. Backfiring should remain a possible fire management tool but should not be mandated by the Plan. Backfiring is very different than firing out. Backfiring is a last ditch effort to cut off the forward rate of spread of a rapidly advancing wildfire front by falling back to a ridge line or road a considerable distance ahead of the fire front. Necessary holding lines are constructed and the vegetative fuels between the newly constructed backfiring line and the advancing wildfire front are ignited. Ignition is timed to suck the backfire into the advancing fire front, thereby incinerating all vegetative fuels in the wildfires path, including riparian areas, which halts the wildfires advance.*

Firing out utilizes elements of the backfiring technique, however, it is mostly used where it is necessary to construct indirect fireline because the flanks, or edges of the wildfire, are too hot to construct direct line on the active edge of the wildfire. As the indirect line is constructed the unburned vegetation between the wildfire edge and the indirect line is fired out. Often existing roads are also used to fire out standing vegetation between the wildfire edge and the road that is serving as the containment line or fireline. Backfiring and firing out are two very distinct kinds of operations. Firing out is a minimal impact means of containment and is readily utilized by all wildland fire suppression agencies.

Summary Policy Statement: *Firing out should be included as an acceptable containment technique where the edge or flank of the wildfire is too hot to permit direct fireline construction. Backfiring should not be mandated by the Fire Management Plan.*

4.3.4 Ground Tactical Units Policy

- *To the extent practicable, ground tactical operations will use natural features such a ridgelines, as well as roads and pre-fire constructed firebreaks/fuelbreaks for containment lines.*

Application of Policy: ***FIREWISE 2000, Inc.*** *evaluated this policy and determined that the use of natural firebreaks/fuelbreaks should be encouraged only when the consumption of additional acres is considered to have ecological benefits, i.e. letting the wildfire burn up to the ridgeline instead of a direct attack because the vegetation really needs renewing, or if the use of natural* *firebreaks/fuelbreaks presents less of an impact than the construction of new wildfire suppression control lines at the time of and out ahead of the wildfire.*

Summary Policy Statement: *Use of natural firebreaks/fuelbreaks should be encouraged under two conditions. 1) When the consumption of additional acres is considered to have ecological benefits, i.e. letting the wildfire burn up to the ridgeline instead of a direct attack because the vegetation really needs renewing. 2) If the use of indirect natural firebreaks/fuelbreaks presents less of an impact than the construction of new wildfire suppression control lines to directly contain the wildfire.*

4.3.5 Off-Road Policy

- *The minimum number of fire suppression vehicles considered necessary for effective fire control by the command fire agency or ground tactical units will be allowed to drive off roads and firebreaks/fuelbreaks.*

Summary Policy Statement: *The Tactical Fire Suppression Plan (Short-Term Fire Management Plan) establishes appropriate standardized fire service response guidelines that describe conditions under which fire suppression vehicles will be allowed to conduct wildfire suppression operations off-road (see Section 2.4.3 and Table 2-1).*

4.3.6 Grading Techniques and Erosion Control Policy

- *To the extent practicable, proper grading techniques and erosion control methods will be used to minimize soil erosion on fire roads.*

Summary Policy Statement: *The Tactical Fire Suppression Plan (Short-Term Fire Management Plan) establishes appropriate guidelines for pre and post-fire suppression that will identify regrading of disturbed areas and implementation of erosion control measures as part of OCFA's wildfire suppression responsibilities in consultation with the RMV Open Space Resource Advisor(s).*

4.3.7 Water Saturation as Mop-Up Technique Policy

- *To the extent practicable, ground tactical units will use water saturation as a mop-up technique rather than digging out and stirring hot spots in locations with significant CSS or other natural resources such as the biologically rich riparian areas and/or in areas potentially subject to post-fire erosion.*

Application of Policy: *In the Central/Coastal Sub Region TNC evaluated this policy and determined that the use of water saturation can result in extensive steam damage to feeder roots,* *seeds and other plant materials, and that mop-up of any kind should be completed to a minimum level of safety and control. Also, felling and bucking of mature trees should be discouraged.* ***FIREWISE* 2000, Inc.** *recommends adoption of this Application of Policy for the Southern Subregion NCCP/HCP.*

<u>Summary Policy Statement</u>: Dry mopping techniques will be utilized to extinguish "hot spots" and smoldering plant materials as opposed to water saturation techniques. Fire killed trees will be left standing and will not be felled and bucked.

4.3.8 Fire Prevention Techniques Policy

- *Until such time as a specific set of fire-related recreational use policies is prepared by the County of Orange Fire Department/Department of Harbors, Beaches and Parks, the interim Chino Hills State Park policies (set forth in Appendix F) shall serve as the policies for "fire prevention techniques", "pre-suppression activities" and the fire season "step-up plan".*

<u>Application of Policy</u>: The current fire program shall be implemented in compliance with this policy.

<u>Summary Policy Statement</u>: See Appendix F, pages 2-3.

4.4 Elements Of The Tactical Fire Suppression Plan

The Tactical Fire Suppression Plan contains the following elements:

- Intent.
- Delineation of Fire Compartments and Fire Management Units.
- RMV Open Space Ratings/Tactical Operation Modes/Fire Suppression Guidelines.
- Procedures for implementing the plan.
- Post-Fire Evaluation.
- Plan Maintenance and Update

4.4.1 Intent

The intent of the Tactical Fire Suppression Plan (Short-Term Fire Management Plan) is to establish appropriate standardized fire service response guidelines for use by the Orange County Fire Authority and other fire agencies responsible for managing wildland fire events within the RMV Open Space that causes the least amount of damage to natural resources while providing the effective fire-fighting controls needed to protect human life and property. Standard wildland fire fighting considerations, such as resource responses, strategies, and tactics used in the RMV Open Space will emphasize measures aimed at minimizing the impacts of wildfire on sensitive wildlife and wildlife habitats. These wildfire-fighting considerations may be revised as appropriate to address changes to the existing environmental conditions and circumstances as determined by the designated RMV Open Space Resource Advisor(s). In the RMV Open Space, when human life and property are not threatened the Fire Authority and/or appropriate fire agency will initiate the implementation of pre-determined specific fire suppression tactics that will support environmental preservation criteria. If extreme weather conditions are present (high watershed dispatch levels, Red Flag conditions, etc.), normal fire fighting strategies and tactics will be employed to ensure the highest probability of success.

4.4.2 Delineation Of Fire Management Compartments (FMC's) and Fire Management Units (FMU's)

The Strategic Fire Protection Plan established eighteen (18) Southern Subregion Fire Management Compartments (FMC's) (see page 3-5 of Section III). For the purpose of this short-term Tactical Fire Suppression Plan the FMC's are divided into those FMC's within the RMV boundaries and those outside RMV boundaries.

FMC's within Rancho Mission Viejo

21. Talega/La Paz FMC
22. Central San Juan/Trampas/Cristianitos FMC
23. Lower Gabino/Blind Canyon FMC
24. Upper Gabino/Blind Canyon FMC
26. Ladera FMC
27. Wagon Wheel/Chiquita Ridge FMC
28. Chiquadora/West Gobernadora FMC
29. East Gobernadora/Bell Canyon FMC
34. Donna O' Neill Land Conservancy FMC
36. Upper Chiquita FMC

FMC's Outside of Rancho Mission Viejo

20. San Onofre State Park FMC (this is land leased to State Parks by MCB Camp Pendleton, but is outside the Subregion, OCFA provides wildfire protection, as discussed in Section III FMC is an ignition source)
25. Riverside County FMC (outside the Subregion, but as discussed in Section III is an ignition source.
30. Caspers FMC
31. Starr Ranch FMC

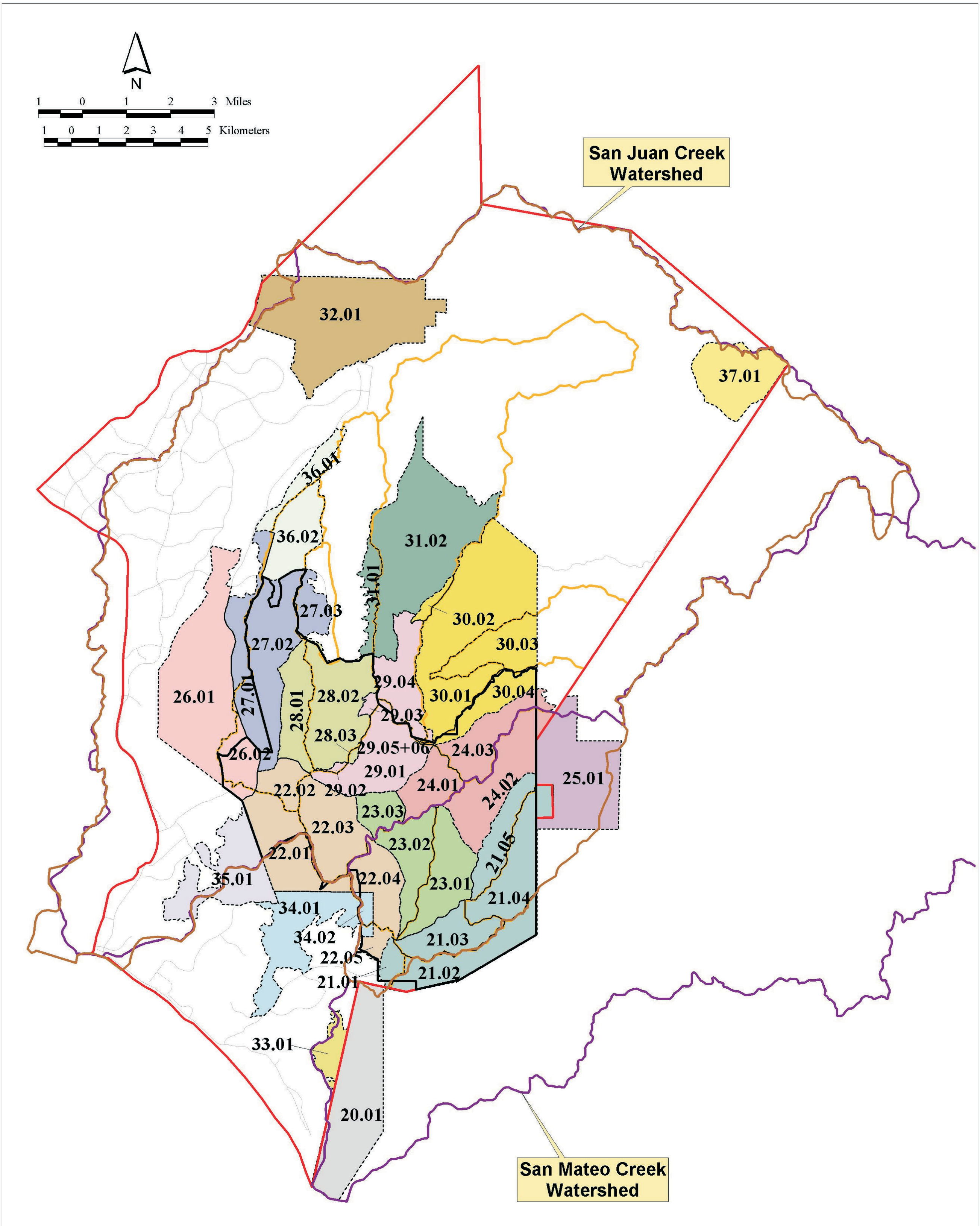
32. Foothill/Trabuco Specific Planning Area
33. Presidential Heights FMC
35. Prima Deshecha Regional Park FMC (currently a landfill)
37. El Cariso Village FMC

All of the FMC's were further subdivided into smaller units called Fire Management Units (FMU's) identified with numbers 01, 02, 03, 04, etc. The FMC's and FMU's were established in the field by OCFA and ***FIREWISE* 2000, Inc.** by utilizing natural ridgelines, riparian areas, lakes and streams, roads, trails and development edges. It should be noted that in many instances, the FMC's and FMU's extend beyond the boundaries of the Southern Subregion to achieve acceptable defensible spaces.

Figure 4 -1 is a map depicting the Southern Subregion FMC and FMU locations.

4.4.3 Southern Subregion Open Space Lands Ratings/Tactical Operation Modes/Fire Suppression Guidelines

The Plan establishes three (3) distinct Tactical Operations Modes/Fire Suppression Guidelines for application to all Southern Subregion Open Space lands, "Aggressive", "Standard" and "Modified". Tactical Operations Modes are dynamic and may change periodically based upon fuels, weather, topography and other environmental, natural resource and habitat conditions. Tactical Operations Modes may also change based upon conditions within contiguous FMU's. These guidelines correspond to "Direct Attack", "Combination Attack" and "Indirect Attack" operational modes and were assigned by The ***FIREWISE* 2000, Inc** and Orange County Fire Authority staffs to each FMU as follows:



NCCP/HCP Boundary
SAMP/ MSAA Boundary
San Juan Creek/San Mateo Creek Watershed Boundaries
Sub-Watershed Boundaries
Rancho Mission Viejo Project Boundary
Roads

CNF and MCB have their own Fire Management Plans.

Fire Management Compartments (FMC's)

FMC 20	FMC 26	FMC 32
FMC 21	FMC 27	FMC 33
FMC 22	FMC 28	FMC 34
FMC 23	FMC 29	FMC 35
FMC 24	FMC 30	FMC 36
FMC 25	FMC 31	FMC 37

Fire Management Units*

**Numbers on map denote Fire Management Unit numbers*

FIGURE 4-1

Fire Compartments and Fire Management Units

SOUTHERN SUBREGION

Orange County, California

SEPTEMBER 2003

4.4.3.1 Aggressive (Tactical Operations Mode "Direct Attack")

FMU's that are identified as "**A**" will receive immediate containment and control using all available resources (i.e., aircraft, bulldozers, engines, hand crews, etc.) in response to the resource values of the watershed which justifies an increased allocation of resources for an aggressive response and rapid intervention to contain the wildfire. Also, these FMU's must be protected as "Refugia" for the Habitat Reserve Identified Species. Therefore, immediate containment and control are the objectives of the Incident Action Plan (IAP). In many FMU's there is no separation between the ground fuels and the existing tree cover, raptor perches. Because there is a vertical fuel ladder into the crowns of most of the trees on RMV and other portions of the Habitat Reserve, any ground fire burning into these areas will kill or severely damage existing trees. The aggressive **"A"** strategy will apply to the following FMU's because of key habitat values and/or preservation strategies: FMU's 20.01–25.01, 27.01-27.03, 30.01-35.01 and 37.01.

Control objectives will also identify necessary post fire suppression activities such as mop-up, erosion control, habitat rehabilitation/remediation, etc.

4.4.3.2 Standard (Tactical Operations Mode "Combination Attack")

FMU's that are identified as "**S**" will receive a standard tactical wildfire response with minimal disruption to natural resources. The primary objective of this operational mode is to manage the wildfire in a manner that will not allow the fire to escape or spread to an adjacent FMU. This may involve a combination of all of the wildfire suppression responses.

Normal fire fighting tactics are employed. These FMU's receive standard tactical fire fighting response to the threat of wildfire with minimal disruption to the natural ecology. The use of heavy equipment and excessive backfiring operations are discouraged.

Engine Companies are encouraged to stay on roads and use operations and techniques that minimize negative impacts on the environment. Also, the primary tactical objective is to contain and control the fire with the least amount of impact to the FMU's natural habitat and overall ecology. Suppression strategies will not include extraordinary efforts to control the wildfire but will include water or retardent dropping aircraft.

The standard **"S"** strategy will apply to the following FMU's because of key habitat values that could be temporarily lost with aggressive line building with bulldozers and large scale backfiring: FMU's 26.01, 26.02, 28.01-28.03, 29.01–29.06 and 36.01, 36.02.

Tactical operations will also identify necessary post fire suppression activities such as mop-up, erosion control, habitat rehabilitation/remediation, in full consultation with the RMV Resource Advisor(s).

4.4.3.3 Modified (Tactical Operations Mode "Indirect Attack")

FMU's that are identified as "**M**" for "Modified" fire suppression response will be allowed to burn naturally up to the pre-determined natural and man-made control lines and barriers. No extraordinary equipment such as aircraft or bulldozers will be used. At this time, none of the FMU's in the Southern Subregion have an "M" modified rating.

The wildfire will be steered toward pre-existing control lines or natural barriers and allowed to burn naturally when there is a high probability of successful containment. No destructive fire fighting actions will be taken that may impact the ecology of the FMU. Bulldozers, aircraft and off-road driving should be discouraged except at pre-planned and agreed to containment lines. Hose lines and water application are permitted at non-erosive levels. Hand tools are allowed to reduce flame heights potential with no grubbing or removal of root structure. The primary objective of the IAP is containment of hostile wildfires within the FMU with no destruction or disturbance to the natural ecology. Any FMU's to be identified as an "**M**" will need to be verified on the ground with the appropriate Resource Advisor(s) and OCFA personnel. At this point we are not able to determine where free running fire that can be herded to a viable control point to meet resource management objectives other than in the grasslands. None of the FMU's are 100% Fuel Model 1, i.e. annual or perennial grasses

Standard wildland fire fighting considerations (resources, strategies and tactics) for these three (3) operational modes as prescribed by this plan shall be used in the Open Space and shall emphasize minimizing impacts of fire suppression tactics on sensitive wildlife and wildlife habitats. It should be noted that the operational mode for each FMU might change based upon environmental conditions as determined by the appropriate Resource Advisor(s). In addition, the Orange County Fire Authority and affected wildland fire agencies will attempt to implement the pre-determined fire suppression tactics unless human life and property are threatened. Should human life and property become threatened or if "**extreme**" weather conditions exist, normal fire fighting strategies and tactics will be employed, strategy "**A**", to ensure the highest probability of success and control of the wildfire at the smallest size possible.

4.4.4 Southern Subregion Open Space Lands Rating Form

The Southern Subregion Open Space Lands (SSR) ratings that form the basis for the resource response, strategies and tactics to be used by the Orange County Fire Authority Wildland Fire Defense Planner (WFDP) will be updated as needed by the appropriate Resource Advisor(s), using the SSR Rating Form (Please refer to the following suggested SSR Rating Form shown in

Table 2-1. The WFDP forwards the SSR Rating classification to the Emergency Communication Center (ECC), all Field Battalions, and Divisions in the Fire Authority, and other cooperating agencies. SSR Ratings, shown on SSR Rating Forms, correspond to existing tactical operations, or fire fighting modes.

Table 4-1 on the following page is a suggested SSR Rating Form. ***FIREWISE* 2000, Inc.** coordinated with OCFA in the development of the recommended suppression strategy ratings shown on *Table 4-1.*

Table 4-1

(*Note that these ratings are based on present conditions today and not future build out*)

Southern Subregion Open Space Lands (SSR) Rating Form			
Compartment	**Rating**	**Compartment**	**Rating**
20. San Onofre State Park		**29. East Gobernadora/Bell Canyon**	
FMU 20.01	**A**	FMU 29.01	**S**
		FMU 29.02	**S**
		FMU 29.03	**S**
(*very high habitat value, undisturbed Coastal Sage Scrub since the time of the last wildfire plus a pocket mouse that lives in loose sand*)		FMU 29.04	**S**
		FMU 29.05	**S**
		FMU 29.06	**S**
21. Talega/La Paz Canyons		**30. Caspers**	
FMU 21.01	**A**	FMU 30.01	**A**
FMU 21.02	**A**	FMU 30.02	**A**
FMU 21.03	**A**	FMU 30.03	**A**
FMU 21.04	**A**	FMU 30.04	**A**
FMU 21.05	**A**		
(*these canyons are important for raptor habitat*)		(*this FMU is managed for preservation of existing values*)	
22. Central San Juan/Trampas/Cristianitos Canyons		**31. Starr Ranch**	
FMU 22.01	**A**	FMU 31.01	**A**
FMU 22.02	**A**	FMU 31.02	**A**
FMU 22.03	**A**		
FMU 22.04	**A**		
FMU 22.05	**A**		
(*very high fuel loadings, hasn't burned since 1911, this FMC has important grassland areas, riparian areas and raptor habitat*)		(*very dense vegetation, FM 4*)	
23. Lower Gabino/Blind Canyons		**32. Foothill/Trabuco Specific Planning Area** (*State Responsibility Area*)	
FMU 23.01	**A**	FMU 32.01	**A**
FMU 23.02	**A**		
FMU 23.03	**A**		
(*this FMC has important grassland areas, riparian areas and raptor habitat*)		(*Open Space Lands above Lake Forest and Rancho Santa Margarita –disturbed land, good habitat values*)	
24. Upper Gabino/Blind Canyons		**33. Presidential Heights**	
FMU 24.01	**A**	FMU 33.01	**A**
FMU 24.02	**A**		
FMU 24.03	**A**		
25. Riverside County		**34. Donna O' Neill Land Conservancy**	
FMU 25.01	**A**	FMU 34.01	**A**
		FMU 34.02	**A**

26. Ladera FMU 26.01 **S** FMU 26.02 **S**	**35. Prima Deshecha Regional Park** FMU 35.01 **A** (*currently an active landfill*)
27. Wagon Wheel/Chiquita Ridge FMU 27.01 **A** FMU 27.02 **A** FMU 27.03 **A**	**36. Upper Chiquita** FMU 36.01 **S** FMU 36.02 **S** (*this FMC has important Coastal Sage Scrub areas*)
28. Chiquadora/West Gobernadora FMU 28.01 **S** FMU 28.02 **S** FMU 28.03 **S** (*this FMC has important grassland and riparian areas*)	**37. El Cariso Village** FMU 37.01 **A** (*this FMC has very little habitat value*)

SRL Ratings

Aggressive (**A**): Direct Attack
Standard (**S**): Combination Attack
Modified (**M**): Indirect Attack

Revision Date: ____________________

By: ______________________________

When responding to vegetation fires in the Southern Subregion Open Space lands the Emergency Communication Center notifies the initial attack Battalion Chief that the fire is in the Southern Subregion, provides the compartment and FMU number, and announces the SSR Rating. Based on this information, Battalion Chiefs determine if the recommended tactical operations mode can be implemented, based on current weather conditions. Battalion Chiefs will announce, or may request ECC to announce, what mode of operation will be used. Division Chief and field Battalion Chief Command vehicles are equipped with a folder containing maps of the Southern Subregion Compartments and the most current SSR Rating Form. These reference materials are used to assist in the managing of the incident.

4.4.5 Fire Response Procedures

4.4.5.1 Notification

The Emergency Communication Center (ECC) shall notify the initial attack units that the fire is in Southern Subregion Open Space lands and identify the affected FMC and FMU and the rating (i.e., Aggressive, Standard or Modified). For example, the ECC will make the following announcement: ***"All units responding to the vegetation fire be advised that this is on Southern Subregion Open Space lands, Compartment 21.02, Aggressive".*** The ECC will also page the OCFA Wildland Fire Defense Planner any time that a wildfire is reported in Southern Subregion Open Space lands. The Wildland Defense Planner will respond to the wildfire to work as a liaison with the Incident Commander (IC) to insure that the (IC) is aware of the rating form and Tactical Operations Modes called for by Fire Management Compartment and Fire Management Unit and to coordinate with the appropriate Resource Advisor.

4.4.5.2 Initial Attack Response:

The Battalion Chief (BC) shall make one of the following determinations:

The recommended tactical operations mode **can** be implemented based on current weather conditions and other considerations, or

The recommended tactical operations mode **cannot** be implemented, and the BC will announce, or may request that the ECC announce, the appropriate mode of operation or tactical plan to be implemented.

If the recommended tactical operations mode **can** be implemented, the Division and Battalion Chief refer to the Tactical Fire Suppression Plan and associated SSR Rating Forms which are maintained in a binder in their command vehicles.

If the incidents are expected to escalate to extended attack fires beyond the first operational period (12 hours), the appropriate Resource Advisor(s) is requested to respond to the Incident Command Post (ICP). The Resource Advisor(s) shall be a biologist and/or resource ecologist with training in wildland fire management. The appropriate Resource Advisor(s) will be notified of fires occurring within Southern Subregion Open Space lands by pager provided by the Orange County Fire Authority. The Resource Advisor will serve as a Technical Advisor ("Tech Ads") within the Plans Section.

4.5 Resource Advisor (Lead Resource Advisor Role)

Each landowner or jurisdiction with open space within the Southern Subregion shall designate a Lead Resource Advisor. This individual shall be the sole point of contact with the Incident Commander (IC). The Lead Resource Advisor shall also be responsible for notifying OCFA of an alternate Lead Resource Advisor to serve in his/her absence. The Resource Advisor shall coordinate with the affected land manager prior to communication with the IC or any OCFA personnel. No one shall enter the fire line without prior authorization from the IC, in consultation with the Lead Resource Advisor.

Table 4-2

Fire Management Compartments	Landowner/Jurisdiction With Decision Making Authority	Contact Name	Phone Number
20. San Onofre State Park	State Park Superintendent		
21. Talega/La Paz	RMV		
22. Central San Juan/Trampas/Cristianitos	RMV		
23. Lower Gabino/Blind Canyon	RMV		
24. Upper Gabino/Blind Canyon	RMV		
25. Riverside County	OCFA		
26. Ladera	RMV		
27. Wagon Wheel/Chiquita Ridge	RMV		
28. Chiquadora/West Gobernadora	RMV		
29. East Gobernadora/Bell Canyon	RMV		
30 Caspers	OC Parks & Rec		
31. Starr Ranch	Audubon Society		
32. Foothill/Trabuco Specific Planning Area	OCFA		
33. Presidential Heights	OC Parks & Rec		
34. Donna O' Neill Land Conservancy	RMV		
35. Prima Dechecha Regional Park (now a landfill)	OC Parks & Rec		
36. Upper Chiquita	RMV		
37. El Cariso Village	OCFA		

4.5.1 Notification and Coordination of Other Designated Resource Advisors

The Lead Resource Advisor shall be notified by pager of all fire events affecting their open space lands and shall be responsible for contacting, consulting and coordinating with all other Resource Advisors and land managers as necessary. The Lead Resource Advisor shall also maintain a list of all Resource Advisors and notify OCFA of any changes to the list of Resource Advisors including a designated alternate Lead Resource Advisor.

4.5.2 Lead Resource Advisor Response

In response to the initial pager notification, the Lead Resource Advisor shall report to the Incident Command Post if requested to do so by the IC and be available to provide technical advice as necessary to the IC.

The Lead Resource Advisor(s) will review the Tactical Fire Suppression Plan and the "Environmentally Sensitive Areas" (ESA) mapping and advise the BC. For the RMV Open Space, the ESA mapping has been prepared by Dudek and Associates, Inc. and Archeological Resource Management Corporation and includes the following data:

- Vernal pool locations
- Archeological sites
- Paleontological Resource Areas

The ESA mapping will be updated as required by the Resource Advisor(s) and as new locations are discovered.

4.6 Post-Fire Evaluation

The Tactical Fire Suppression Plan was created as part of a cooperative effort involving the Orange County Fire Authority, ***FIREWISE* 2000, Inc.** and the NCCP/SAMP Working Group. The plan is intended to be a "dynamic, living document" that remains effective as a management tool throughout the life of the RMV Open Space and other Southern Subregion Open Space lands.

Following each fire event on Southern Subregion Open Space lands, fire suppression forces will review the effectiveness of the tactical operations recommended in the plan. The suppression forces may recommend changes to the WFDP to better achieve the goals and objectives of the plan.

Also, the Lead Resource Advisor will monitor natural resource conditions regularly, update the SSR Ratings (Aggressive, Standard and Modified) for each FMU on an as-needed basis, and recommend plan revisions to address these changing conditions.

The Lead Resource Advisor in consultation with an OCFA representative shall evaluate all fire events occurring in the Southern Subregion as follows:

- Date & Time of Fire;
- Fire Management Compartment/Fire Management Unit (FMC/FMU) affected;

- SSR Rating for the affected FMC/FMU;
- Actual Fire Suppression Tactics used;
- Estimated Size of Fire (Acres);
- Affected Habitat(s)
- Types of Disturbances (i.e., new fire roads, hand clearing, erosion, etc.);
- Measures Undertaken to Correct Disturbances; and
- Other as determined by the Lead Resource Advisor.

4.7 Training Sessions

Annual Resource Advisor training sessions should be conducted by May 15th to review these roles and responsibilities and the overall design of the program.

4.8 Review and Approval

The WFDP will review all recommendations in consultation with the Resource Advisor(s) and approve appropriate additions and revisions to the Tactical Fire Suppression Plan (Short Term Fire Management Plan).

4.9 Post Fire Reporting

All fire incidents and responses occurring on Southern Subregion Open Space lands, and specifically RMV Open Space, shall be reported to the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG) the US Army Corps of Engineers and the County of Orange. The report shall include the cause of the incident, number of acres of habitat by type burned, types of resources effected, and post fire evaluation.

4.10 Tactical Fire Suppression Plan Maintenance

4.10.1 FMC/FMU Mapping Maintenance

The Orange County Fire Authority (OCFA) shall maintain the FMC's/FMU's mapping and SSR Rating Forms. Updates to the mapping shall be made on an on-going basis. The mapping shall be comprehensively reviewed and revised as needed on an annual basis.

4.10.2 Southern Subregion Open Space Lands (SSR) Rating Form Maintenance

OCFA shall maintain the SSR Rating forms and all subsequent updates as required by the Resource Advisor(s).

4.10.3 Resource Sensitive Areas Mapping

Name (entity to be determined) shall update the Resource Sensitive Areas mapping, as new data become available and incorporate as approved by the Resource Advisor(s)

4.11 Tactical Fire Suppression Plan Interagency Coordination and Training

OCFA, Resources Planning and appropriate Habitat Reserve Resource Advisor(s) shall conduct a training session for the affected OCFA Battalion Chief and other wildland fire agencies.

4.11.1 OCFA Battalion Chief Training Sessions

Battalion Chief training sessions will be conducted on an annual basis prior to the wildfire season.

4.11.2 Coordination with Other Wildland Fire Agencies

Annual training sessions with these agencies shall be conducted on an annual basis prior to the wildfire season.

4.11.3 Open Space Land Managers

Open Space Land Manager training will occur prior to the wildfire season. The Open Space Land Managers generally possess the greatest knowledge concerning the location of sensitive natural and scientific resources within their properties and will assist in the completion of Resource Sensitive Areas mapping.

PART V – RESEARCH AND MONITORING

PART V - FIRE ECOLOGY RESEARCH AND MONITORING CRITERIA

5.0 GENERAL

This section addresses the need for further fire ecology research and monitoring procedures for the proposed and/or status quo management decisions addressed in the overall Wildland Fire Management Plan. Part I – Fire Management Program, Part II – Prescribed Fire Program, Part III - Strategic Fire Protection Plan, Part IV – Short Term Tactical Fire Suppression Plan, and Part V - Research and Monitoring have each been designed and written to be an integral part of the Wildland Fire Management Plan or used as "Stand Alone" documents to guide the OCFA and various Land Owners and Managers in the overall management of their lands.

5.1 Relationship of the Wildland Fire Management Plan to a Stressor Based Adaptive Management Program

The Wildland Fire Management Plan is based on the stressor-based Adaptive Management Program described in *Appendix J.* The underlying principle of the stressor-based Adaptive Management Program is that management and monitoring should be directed primarily towards environmental factors known or thought to be directly or indirectly responsible for ecosystem changes. Because fire is one of the more obvious major stressors on the southern California ecosystem, fire management is the key factor in the Adaptive Management Program (prolonged drought, disease, air pollution and very competitive invasive species are also stressors but are not as easily modeled and are a lessor impact than the positive and negative impacts of fire). *Appendix J* presents conceptual stressor models that depict known and potential relationships between fire and the vegetation community and individual species responses. These conceptual models provide the framework for the Wildland Fire Management Plan with regard to maintaining healthy ecosystems within the RMV Open Space and potentially other protected open space in the Southern Subregion. For example, as described in detail in Section 3.9.1 Plant Community Responses to Fire, each vegetation community responds differently to fire depending upon the frequency and intensity. In order to maintain healthy vegetation communities, these differential responses need to be considered in both the tactical and strategic aspects of managing fire, including controlling wildfires and conducting purposeful prescribed burns.

5.2 Monitoring to Test Hypotheses

Through the iterative process of adaptive management, evaluating basic assumptions about how natural systems operate will continually test the "stressor-based model' of ecosystem function with regard to fire. This will require adequate "baseline data" and a process for monitoring the effects of the management plan and comparing it to the stated assumptions in the conceptual model.

The monitoring program should accommodate both routine long-term observations and on-going management experiments, since some crucial hypotheses may not be easily tested in a simple management/observation context. Some questions may be better explored in more traditional scientific studies and the answers to these questions may be critical for success of the Adaptive Management Program. What is clear is that a successful fire management program must include both routine monitoring and experimentation, or observation beyond what is possible solely on the basis of observing management actions. A combination of long-term monitoring and hypothesis testing experiments are further outlined in this section. It should be noted that many additional research questions remain to be addressed. Through the Adaptive Management process the non-profit management corporation and reserve managers, possibly in collaboration with outside scientists, or other suitable group, will need to prioritize and implement management actions.

With the significant number of studies underway on similar landscapes, efforts should be made to learn from the work of others and apply findings to lands in the Southern Subregion. There already is a large amount of inventory work underway in the Southern Subregion. In addition, The Nature Conservancy (TNC) is carrying out a number of research projects on the Habitat Reserve that TNC manages in the Central and Coastal NCCP/HCP Subregion.

5.3 Plant and Animal Community Responses

5.3.1 Plant Community Response

Successful land management requires an understanding of the degree of species interdependence within communities, how the distribution of communities depends upon past and present environmental factors, and what the role is of various plant communities in the system processes such as succession and landscape pattern. Before we can address these complex questions, plant communities must first be measured and summarized. Monitoring of vegetation change and correlating the impact of those changes on selected taxa will provide relevant management information as well as a measure of RMV Open Space effectiveness. The overall Adaptive Management Program provides for periodic RMV Open Space-wide vegetation communities updates using remote imagery and selected sampling of vegetation transects within each of the five major vegetation communities.

The Southern Subregion NCCP/HCP database contains a detailed description and quantification of the vegetation types present within the entire Subregion and, therefore, of the vegetation types present within the RMV Open Space.

5.3.2 Animal Community Response

As with vegetation Monitoring, focal species monitoring will be conducted in the same plots that are selected for vegetation monitoring. The Adaptive Management Program provides a detailed description of the selection of focal species for the purpose of management and monitoring. Focal species taxa include birds, reptiles, amphibians, large mammals and invertebrates.

Prior to initiating all prescribed burns and after each wildfire, focal species sampling should be carried out. In the case of the prescribed burns the purpose of sampling is to compare before and after occupation of the burn site by focal species, and in the case of unplanned wildfires, the purpose of sampling is to measure occupation of the site by focal species as the burn site recovers from the fire.

Independent pre- and post-fire sampling by an outside scientific group for additional non-focal species (e.g., small mammals) also may be conducted. These independent studies must be authorized by RMV and coordinated for consistency with the ongoing adaptive management of the RMV Open Space.

5.4 Plant Sampling Techniques

Consistent with the methodology applied to the RMV Open Space in general, botanists will conduct annual floral surveys along belt-transects in selected burn sites, typically within the March-May timeframe, or at a time that maximizes the detection of perennial and especially annual plants in any given year. While many floral sampling regimes are possible (e.g. Elzinga et al. 1998) based on the sample plots and belt-transects established for wildlife monitoring, the following method is suggested:

> Semi-permanent 25-m segments along the center of the belt transect will be established in a pseudo-random fashion. Based on the baseline data for the belt-transects, these segments will cover the diversity/gradient along the transect. Data will be collected by recording each species that intersects an imaginary vertical plane at each 0.5-m mark along the 25-m segment of the sample transect. All species present within a 5-m band centered on the transect line will be recorded. Relative species cover and species diversity will be derived from these data. Each sample transect will be photographed to document the status of the vegetation at the site on an annual basis.

5.5 Data-Management

To reduce errors, the researcher who takes measurements will be responsible for reviewing the datasheets to eliminate recording errors at the completion of each segment. In addition, the researcher should review all data sheets for errors at the end of each field day. Reviewed data shall be submitted directly to RMV or their designated data administrator and will be entered directly into the Southern Subregion database. All entered data should be compared against data sheets for data-entry errors/quality control.

The database must have complete information on the geographic position of each transect, as well as all relevant biological and identification/attribute information.

5.6 Management Hypotheses

5.6.1 Management Hypotheses for Valley Grasslands

Based on the model depicted in Figure 5-1, the following initial adaptive management hypotheses can be postulated. Some of these hypotheses may be better addressed through independent research studies, but others may easily be tested as part of the management and monitoring program of the RMV Open Space.

The following initial hypotheses are proposed:

1. Fire intervals of 6 to 12 years will result in an increase in the diversity of native plant and animal species and a decrease in the frequency of non-native grasses, native grasses and forbs.

2. A non-deterministic, weighted-random application of fire will result in an increase in native plant and animal diversity for the target landscape.

3. Spring burning with return intervals of less than 6 years will result in a decrease in diversity and abundance of native perennial grasses.

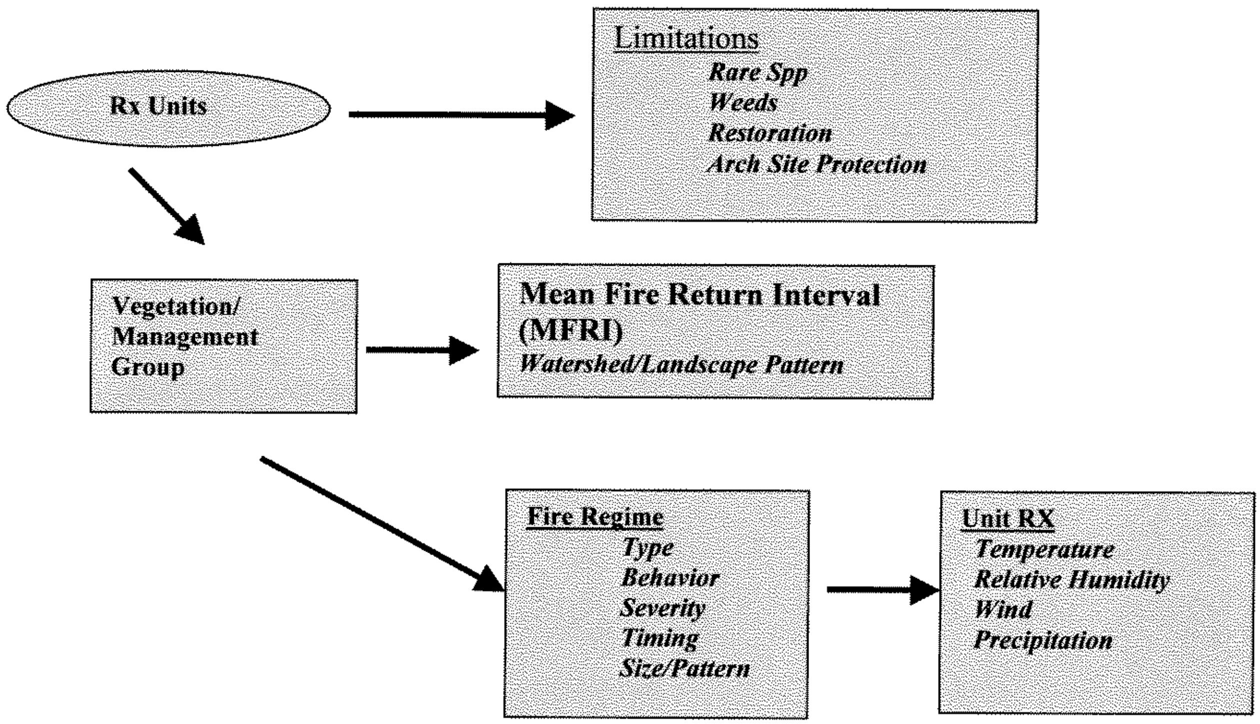
4. Fall burning with return intervals of less than 6 years will result in an increase in diversity and abundance of native perennial grasses.

5. An established grassland community that has not been subject to grazing will have a higher overall post-burn native species diversity than a same-aged stand that has been grazed (will need to establish enclosures to exclude grazers).

6. Structural and compositional components of required habitat, for selected species, will decline in quality with fires occurring at intervals greater then every 12 years.

7. Grassland communities with urban/developed edges will experience higher rates of exotic species establishment and lower representations of associated species then other vegetation types with developed edges.

Figure 5-1: Research Study Model.



5.6.2 Continued Fire Management for Grassland and Restoration Sites

Following the 6-year initial round of prescribed fires described above, continued fire management will be structured to identify those areas in particular need for re-burning, and to experimentally determine optimal fire frequency. There is a total of 4 initial FMU's (FMU's 22.04, 23.01, 23.02, and 24.02) where multiple native grassland management sites are suitable and recommended for prescribed fire. Since it is desired to provide native bunch grasses with the best hope of survival, once non-native grasses and forbs have been controlled, the frequency of prescribed fire on these sites needs to be established based upon the monitoring data.

Following the initial prescribed fires a determination should be made as to which units, if any, are high priorities for future or repeat burning. This evaluation will be based upon the visual inspection of the units, a qualitative measure of non-native grass/forb coverage, and the need to protect existing growths of native grasses and small forbs. Fenced large plots (100 meters x 100 meters) should be utilized to sample post fire recovery and protect the site from grazing impacts. Often where grazing has been utilized for a number of years, a hot fall fire will still cause native seed banks to germinate. Without test plot enclosures many plants that have not been observed for years will be immediately browsed. Fenced test plots will also allow for an ungrazed fuel loading that will provide for a different fire dynamic than the planned burning of a grazed plot. Fenced test plots will not disrupt normal grazing practices on the remainder of the grasslands while studies are underway.

Santa Catalina Island serves as an excellent example of the impacts of over-grazing, and now wildfire, on the islands grassland, oak woodland, coastal sage scrub, and chaparral vegetation. The island has had a history of 150 years of heavy over-grazing, first by sheep and then by goats and feral pigs with an out of control and rapidly expanding herd of mule deer thrown into the mix. The sheep and goats were gone by 1990 with the mule deer rapidly filling the void. With the goats gone the vegetation has dramatically responded. In 1999 a high intensity wildfire started at Goat Harbor and burned over 300 hundred acres before being brought under control. During post fire monitoring the Conservancy staff noticed that all of the new plants were immediately consumed. As a result they fenced off large areas to exclude all grazers and browsers. They began to observe plants that had not been seen on Catalina Island in the last 100 years and recorded one species that had never been seen before. One such plant, aptly named fire poppy (*Papaver californicum*), was recorded for the first time. In addition the following rare plants were found within the burned area: large-flowered phacelia (*Phacelia grandiflora*) and white mallow (*Eremalche exilis*). These two plants had not been seen on Santa Catalina Island for about a century (Knapp 2002).

Since wildland fire is a frequent visitor to the Southern Subregions native grassland and CSS management sites, the need to test high intensity fire effects on native grassland and/or CSS may be accomplished without the use of prescribed fire. In areas not already selected for monitoring, monitoring plots should be established on all wildland fire areas where high fire intensity fires have impacted native grassland or CSS vegetation. Prescribed fire can thus be used to determine the fire effects on low and moderate fire intensity burn plots with a high probability of fire containment. (Low intensity fire is often detrimental on many landscapes, including grasslands, as insufficient heat is generated to crack the seed coat of desirable species that may be present in the soil.) In contrast, high intensity wildfires can be used to determine their differential effects on both native grassland and coastal sage scrub communities.

These units should be followed through time until enough data are gathered to make a definitive judgment on fire frequency and intensity. This monitoring study is expected to be ongoing for quite some time, (e.g., several decades to determine appropriate fire return intervals) and represents continued fire management efforts for the grassland habitat of the RMV Open Space.

5.7 Management Hypotheses for Oak Woodland

The study design discussed for grasslands applies directly to-non riparian oak woodlands. The oak woodland stands can be thought of as two stories or levels; the grassland ground fuels and the crowns or canopies of mature oak trees. The key to successful oak woodland management is eliminating any fuel ladders that will carry ground fires into the canopies of the mature oaks.

Without periodic ground fires shade-tolerant shrub species will invade, out compete and shade out the native grasses. If the shade tolerant shrub species can be eliminated with fire the success of native grasses will than be dependent upon the density of the oak woodland canopy. A closed canopy will be detrimental to grasses as most species require direct sunlight. The more open the canopy the greater the success of native grasses. High intensity fires have no place in oak woodland management.

The following initial hypotheses are proposed:

1. Summer/fall burning using low intensity fire with return intervals of less than 6 years will result in a decrease in diversity and abundance of annual grasses and herbaceous understory. The more open the canopy the greater the success of perennial grasses.

2. Fall burning with low intensity fire prior to acorn drop will encourage recruitment of oak seedlings

5.8.1 Management Hypotheses for Riparian Areas

Fire has no place in Riparian area management. Therefore, no hypotheses are put forward for the benefits of fire in this ecosystem.

5.9 Management Hypotheses for CSS

Based on the general research study model depicted in Figure 5-1, the following initial adaptive management hypotheses for CSS can be postulated. As with native grassland discussed above, some of these hypotheses may be better addressed through independent research studies, but others can be readily tested as part of the management and monitoring program for the RMV Open Space.

The following initial hypotheses are proposed:

1. Spring fire intervals of less than 10 years will result in a decrease in diversity of native CSS species and an increase in the frequency of non-native grasses and forbs.

2. Fall fire intervals of less than 10 years will result in a decrease in diversity of native CSS species and an increase in the frequency on native perennial grasses.

3. Winter and spring fire events will result in a decrease in the density and diversity of native CSS shrub species.

4. Grazing in post-fire, early and mid-successional coastal sage scrub will result in decreased species diversity over time.

5. An established (late successional) stand of coastal sage scrub that has not been subject to grazing will have a higher overall post-burn native species diversity than a same-aged stand that has been grazed.

6. Structural and compositional components of required habitat, for selected species, will decline in quality with fires occurring at least every 10 years.

7. Habitat quality, for associated species, will decline with grazing or grazing/fire events during early seral stages of succession.

8. Fire treatments will increase survivorship of shrub and herbaceous species planted in post-treatment restoration efforts

5.9.1 CSS Season and Frequency Pilot Experiment

A long-term monitoring program is critical to the successful use of fire as a management tool. Measuring response through two (2) or three (3) fire cycles is the only way to objectively evaluate fire effects. Still, some applied questions are best addressed in directed studies designed to test specific hypotheses. The questions relating to appropriate fire regimes in CSS are appropriate for this approach. It is this plan's recommendation to identify a minimum of nine (9) CSS units in the RMV Open Space as a pilot test to determine the long-term effect of varying the season, frequency and intensity of burn treatments.

The recommended factorial design should include: Fall and Spring seasonal treatments, 10, 15 and 20-year return intervals, as well as low and high intensity fire behavior. Initial treatments should begin once this plan is approved and the sites have been identified.

Of the nine plots three (3) units should be prescribed burned between May and June, three (3) should be burned between September and November, while three (3) units will be left as unburned controls.

Each unit will be partitioned by a fire intensity treatment. One portion of the unit will be burned under the lowest intensity as can be safely generated given fuels and holding considerations. The remaining portion of the unit will be burned under the highest intensity possible. This partitioning of the units may or may not be of equal size, though plots will be equally distributed with three (3) in each intensity treatment. The location of intensity treatments should be driven by factors effecting fire behavior and holding considerations. Firing patterns will be determined prior to plot placement. Plots will be randomly located within these broadly defined areas. All plots should be fenced to eliminate any grazing and browsing impacts.

Following the initial seasonal and intensity treatments, return intervals should be randomly assigned to each unit. One unit from each of the spring and fall treatments should be burned on 10, 15 and 20-year return intervals. Within these return interval treatments, intensity patterns should be repeated.

Figure 5-2: Sampling design for CSS Season, Frequency and Intensity Experiment.

Each Plot will be 100 Meters Square

Plots will consider Plant:

Structure
- Density
- Height

Composition
- Cover
- Diversity

Planned Prescribed Fire Treatments For:

Fall Burning	= 3 units
Spring Burning	= 3 units
Control	= 3 units

Burn Every:

10 years	= 6 plots **1/**
15 years	= 6 plots **1/**
20 years	= 6 plots **1/**

1/; **3 Plots** High Intensity & 3 plots Low Intensity

In an effort to maintain consistency between plots and the ability to compare data from different sites, the same methods outlined above are recommended for this study. Fire intensity should be included. Fire Intensity can be quantified through observation (Flame Length and Rate of Spread), as well as through specific measures of temperature. A combination of both methods is recommended for this study. Observation points should be recorded for each plot. In addition, each plot should have an associated data-logger with thermo-couples. Thermo-couples should measure temperature within the shrub canopy, the herbaceous layer, the duff layer and two (2) places within the soil profile.

Sample size analyses will be conducted after one-year's data have been collected. If data sets are analyzed via ANOVA, sample-size analyses will follow Cohen (1988). Simulations will be conducted similar to those described above, with the differences that: 1) means (or medians) will be calculated across years for each segment rather than linear contrasts and 2) simulations will include pulsed disturbance following prescribed fire events. A relative difference of 15% in relative cover of native species between parcel types will be used as the minimal detectable difference for the sample-size analysis for Hypotheses 5 and 6. Sample-size analyses will be performed again after five (5) years of data have been collected.

The sample size may need to be expanded over the size of this initial pilot study. With any interaction effects, simple main effects could be masked by the existing variance; e.g. low intensity fires at a set season of the year could be more beneficial with short return intervals and higher intensity fires could be more beneficial with longer fire return intervals, so the optimum fire intensity may vary depending on the return interval. Without a larger sample size the optimum intensity and return interval may not be readily apparent under the proposed pilot study for CSS.

APPENDIX "J-5A"

"*FIREWISE*" Landscape Planting Considerations, Recommended & Not-Recommended Plant Lists

APPENDIX J-5A

FIREWISE 2000 Recommended Plant List

For Fuel Modification Projects in San Diego, Riverside, and Orange Counties

	Code	Botanical Name	Common Name	Plant Form
1.	**W**	*Abelia x grandiflora*	Glossy Abelia	Shrub
2.	☐	*Acacia redolens desert carpet*	Desert Carpet	Shrub
3.	☐	*Acer macrophyllum*	Big Leaf Maple	Tree
4.	**X**	*Achillea millefolium*	Common Yarrow	Low shrub
5.	**W**	*Achillea tomentosa*	Wooly Yarrow	Low shrub
6.	**X**	*Aeonium decorum*	Aeonium	Ground cover
7.	**X**	*Aeonium simsii*	ncn	Ground cover
8.	**W**	*Agave attenuata*	Century Plant	Succulent
9.	**W**	*Agave shawii*	Shaw's Century Plant	Succulent
10.	**N**	*Agave victoriae-reginae*	ncn	Ground cover
11.	**X**	*Ajuga reptans*	Carpet Bugle	Ground cover
12.	**W**	*Alnus cordata*	Italian Alder	Tree
13.	☐	*Alnus rhombifolia*	White Alder	Tree
14.	**N**	*Aloe aborescens*	Tree Aloe	Shrub
15.	**N**	*Aloe aristata*	ncn	Ground cover
16.	**N**	*Aloe brevifolia*	ncn	Ground cover
17.	**W**	*Aloe vera*	Medicinal Aloe	Succulent
18.	**W**	*Alyogyne huegelii*	Blue Hibiscus	Shrub
19.	☐	*Ambrosia chamissonis*	Beach Bur-Sage	Perennial
20.	☐	*Amorpha fruticosa*	Western False Indigobush	Shrub
21.	**W**	*Anigozanthus flavidus*	Kangaroo Paw	Perennial accent
22.	☐	*Antirrhinum nuttalianum ssp. nuttalianum*	ncn	Subshrub
23.	**X**	*Aptenia cordifolia x 'Red Apple'*	Red Apple Aptenia	Ground cover
24.	**W**	*Arbutus unedo*	Strawberry Tree	Tree
25.	**W**	*Arctostaphylos 'Pacific Mist'*	Pacific Mist Manzanita	Ground cover
26.	**W**	*Arctostaphylos edmundsii*	Little Sur Manzanita	Ground cover
27.	☐	*Arctostaphylos glandulosa ssp.glandulosa*	Eastwood Manzanita	Shrub
28.	**W**	*Arctostaphylos hookeri 'Monterey Carpet'*	Monterey Carpet Manzanita	Low shrub

	Code	Botanical Name	Common Name	Plant Form
29.	**N**	*Arctostaphylos pungens*	ncn	Shrub
30.	**N**	*Arctostaphylos refugioensis*	Refugio Manzanita	Shrub
31.	**W**	*Arctostaphylos uva-ursi*	Bearberry	Ground cover
32.	**W**	*Arctostaphylos x 'Greensphere'*	Greensphere Manzanita	Shrub
33.	**N**	*Artemisia caucasica*	Caucasian Artemisia	Ground cover
34.	**X**	*Artemisia pycnocephaia*	Beach Sagewort	Perennial
35.	**X**	*Atriplex canescens*	Four-Wing Saltbush	Shrub
36.	**X**	*Atriplex lentiformis ssp. Breweri*	Brewer Saltbush	Shrub
37.	□	*Baccharis emoryi*	Emory Baccharis	Shrub
38.	**W** □	*Baccharis pilularis ssp. Consanguinea*	Chaparral Bloom	Shrub
39.	**X**	*Baccharis pilularis var. pilularis "Twin Peaks #2'*	Twin Peaks	Ground cover
40.	□	*Baccharis salicifolia*	Mulefat	Shrub
41.	**N**	*Baileya multiradiata*	Desert Marigold	Ground cover
42.	**W**	*Beaucarnea recurvata*	Bottle Palm	Shrub/Small tree
43.	**N** □	*Bougainvillea spectabilis*	Bougainvillea	Shrub
44.	**N** □	*Brahea armata*	Mexican Blue Palm, Blue Hesper Palm	Palm
45.	**N** □	*Brahea brandegeei*	San Jose Hesper Palm	Palm
46.	**N** □	*Brahea edulis*	Guadalupe Palm	Palm
47.	□	*Brickellia californica*	ncn	Subshrub
48.	**W** □	*Bromus carinatus*	California Brome	Grass
49.	□	*Camissonia cheiranthifolia*	Beach Evening Primrose	Perennial subshrub
50.	**N**	*Carissa macrocarpa*	Green Carpet Natal Plum	Ground cover/Shrub
51.	**X**	*Carpobrotus chilensis*	Sea Fig Ice Plant	Ground cover
52.	**W**	*Ceanothus gloriosus 'Point Reyes'*	Point Reyes Ceanothus	Shrub

	Code	Botanical Name	Common Name	Plant Form
53.	W	*Ceanothus griseus "Louis Edmunds'*	Louis Edmunds Ceanothus	Shrub
54.	W	*Ceanothus griseus horizontalis*	Yankee Point	Ground Cover
55.	W	*Ceanothus griseus var. horizontalis*	Carmel Creeper Ceanothus	Shrub
56.	W	*Ceanothus griseus var. horizontalis "Yankee Point"*	Yankee Point Ceanothus	Shrub
57.	□	*Ceanothus megacarpus*	Big Pod Ceanothus	Shrub
58.	W	*Ceanothus prostratus*	Squaw carpet ceanothus	Shrub
59.	□	*Ceanothus spinosus*	Green bark ceanothus	Shrub
60.	W	*Ceanothus verrucosus*	Wart-Stem Ceanothus	Shrub
61.	W	*Cerastium tomentosum*	Snow-in-summer	Ground cover/shrub
62.	W	*Ceratonia siliqua*	Carob	Tree
63.	W	*Cercis occidentalis*	Western Redbud	Tree/shrub
64.	X	*Chrysanthemum leucanthemum*	Oxeye Daisy	Groundcover
65.	W	*Cistus crispus*	ncn	Shrub
66.	W	*Cistus hybridus*	White Rockrose	Shrub
67.	W	*Cistus incanus*	ncn	Shrub
68.	W	*Cistus incanus ssp. corsicus*	ncn	Shrub
69.	W	*Cistus salviifolis*	Sageleaf Rockrose	Shrub
70.	W	*Cistus x purpureus*	Orchid Rockrose	Shrub
71.	W	*Citrus species*	Citrus	Tree
72.	□	*Clarkia bottae*	Showy Fairwell to Spring	Annual
73.	□	*Cneoridium dumosum*	Bushrue	Shrub
74.	□	*Collinsia heterophylla*	Chinese Houses	Annual
75.	W □	*Comarostaphylis diversifolia*	Summer Holly	Shrub
76.	N	*Convolvulus cneorum*	Bush Morning Glory	Shrub

	Code	Botanical Name	Common Name	Plant Form
77.	W	*Coprosma kirkii*	Creeping Coprosma	Ground cover/Shrub
78.	W	*Coprosma pumila*	Prostrate Coprosma	Low Shrub
79.	□	*Coreopsis californica*	California Coreopsis	Annual
80.	W	*Coreopsis lanceolata*	Coreopsis	Ground cover
81.	N	*Correa pulchella*	Australian Fuchsia	Ground cover
82.	W	*Cotoneaster buxifolius*	ncn	Shrub
83.	W	*Cotoneaster congestus 'Likiang'*	Likiang Cotoneaster	Ground cover/Vine
84.	W	*Cotoneaster parneyi*	ncn	Shrub
85.	X	*Crassula lactea*	ncn	Ground cover
86.	X	*Crassula multicava*	ncn	Ground cover
87.	X	*Crassula ovata*	Jade Tree	Shrub
88.	X	*Crassula tetragona*	ncn	Ground cover
89.	W □	*Croton californicus*	California Croton	Ground cover
90.	X	*Delosperma 'alba'*	White Trailing Ice Plant	Ground cover
91.	□	*Dendromecon rigida*	Bush Poppy	Shrub
92.	□	*Dichelostemma capitatum*	Blue Dicks	Herb
93.	N	*Distictis buccinatoria*	Blood-Red Trumpet Vine	Vine/Climbing vine
94.	N	*Dodonaea viscosa*	Hopseed Bush	Shrub
95.	X	*Drosanthemum floribundum*	Rosea Ice Plant	Ground cover
96.	X	*Drosanthemum hispidum*	ncn	Ground cover
97.	X	*Drosanthemum speciosum*	Dewflower	Ground cover
98.	□	*Dudleya lanceolata*	Lance-leaved Dudleya	Succulent
99.	□	*Dudleya pulverulenta*	Chalk Dudleya	Succulent
100.	W	*Elaeagnus pungens*	Silverberry	Shrub
101	□	*Encelia californica*	California Encelia	Small shrub

	Code	Botanical Name	Common Name	Plant Form
102.	□ •	*Epilobium canum [Zauschneria californica]*	Hoary California Fuchsia	Shrub
103.	□	*Eriastrum sapphirinum*	Mojave Wooly Star	Annual
104.	**N**	*Eriobotrya japonica*	Loquat	Tree
105.	□	*Eriodictycon crassifolium*	Thick-Leaf Yerba Santa	Shrub
106.	□	*Eriodictycon trichocalyx*	Yerba Santa	Shrub
107.	**W** □	*Eriophyllum confertiflorum*	ncn	Shrub
108.	**W**	*Erythrina species*	Coral Tree	Tree
109.	**N**	*Escallonia species*	Several varieties	Shrub
110.	**W** □	*Eschscholzia californica*	California Poppy	Flower
111.	**X**	*Eschscholzia mexicana*	Mexican Poppy	Herb
112.	**N**	*Euonymus fortunei*	Winter Creeper Euonymus	Ground cover
113.	**N**	*Feijoa sellowiana*	Pineapple Guava	Shrub/Tree
114.	**N**	*Fragaria chiloensis*	Wild Strawberry/ Sand Strawberry	Ground cover
115.	□	*Frankenia salina*	Alkali Heath	Ground cover
116.	**W**	*Fremontodendron californicum*	California Flannelbush	Shrub
117.	**X**	*Gaillardia x grandiflora*	Blanketflower	Ground cover
118.	**W**	*Galvezia speciosa*	Bush Snapdragon	Shrub
119	**W**	*Garrya ellipta*	Silktassel	Shrub
120.	**X**	*Gazania hybrids*	South African Daisy	Ground cover
121.	**X**	*Gazania rigens leucolaena*	Trailing Gazania	Ground cover
122.	□	*Gilia capitata*	Globe Gilia	Perennial
123.	**W**	*Gilia lepthantha*	Showy Gilia	Perennial
124.	**W**	*Gilia tricolor*	Bird's Eyes	Perennial
125.	**W**	*Ginkgo biloba*	Maidenhair Tree	Tree
126.	□	*Gnaphalium californicum*	California Everlasting	Annual
127.	**W**	*Grewia occidentalis*	Starflower	Shrub
128.	□	*Grindelia stricta*	Gum Plant	Ground cover

	Code	Botanical Name	Common Name	Plant Form
129.	N □	*Hakea suaveolens*	Sweet Hakea	Shrub
130.	W	*Hardenbergia comptoniana*	Lilac Vine	Shrub
131.	N	*Helianthemum mutabile*	Sunrose	Ground cover/Shrub
132.	□	*Helianthemum scoparium*	Rush Rose	Shrub
133.	□	*Heliotropium curassavicum*	Salt Heliotrope	Ground cover
134.	X	*Helix canariensis*	English Ivy	Ground cover
135.	W	*Hesperaloe parviflora*	Red Yucca	Perennial
136.	□ □	*Heteromeles arbutifolia*	Toyon	Shrub
137.	X	*Hypericum calycinum*	Aaron's-Beard	Shrub
138.	N	*Iberis sempervirens*	Edging Caandytuft	Ground cover
139.	N	*Iberis umbellatum*	Globe Candytuft	Ground cover
140.	□	*Isocoma menziesii*	Coastal Goldenbush	Small shrub
141.	□	*Isomeris arborea*	Bladderpod	Shrub
142.	W	*Iva hayesiana*	Poverty Weed	Ground cover
143.	N	*Juglans californica*	California Black Walnut	Tree
144.	□	*Juncus acutus*	Spiny Rush	Perennial
145.	□	*Keckiella antirrhinoides*	Yellow Bush Penstemon	Subshrub
146.	□	*Keckiella cordifolia*	Heart Leaved Penstemon	Subshrub
147.	□	*Keckiella ternata*	Blue Stemmed Bush Penstemon	Subshrub
148.	W	*Kniphofia uvaria*	Red Hot Poker	Perennial
149.	W	*Lagerstroemia indica*	Crape Myrtel	Tree
150.	W	*Lagunaria patersonii*	Primrose Tree	Tree
151.	X	*Lampranthus aurantiacus*	Bush Ice Plant	Ground cover
152.	X	*Lampranthus filicaulis*	Redondo Creeper	Ground cover
153.	X	*Lampranthus spectabilis*	Trailing Ice Plant	Ground cover
154.	W	*Lantana camara cultivars*	Yellow Sage	Shrub
155.	W	*Lantana montevidensis*	Trailing Lantana	Shrub
156.	□	*Lasthenia californica*	Dwarf Goldfields	Annual

	Code	Botanical Name	Common Name	Plant Form
157.	**W**	*Lavandula dentata*	French Lavendar	Shrub
158.	**W**	*Leptospermum laevigatum*	Australian Tea Tree	Shrub
159.	**W**	*Leucophyllum frutescens*	Texas Ranger	Shrub
160.	☐	*Leymus condensatus*	Giant Wild Rye	Large grass
161.	**N**	*Ligustrum japonicum*	Texas Privet	Shrub
162.	**X**	*Limonium pectinatum*	ncn	Ground cover
163.	**X**	*Limonium perezii*	Sea Lavender	Shrub
164.	**W** ☐	*Liquidambar styraciflua*	American Sweet Gum	Tree
165.	**W**	*Liriodendron tulipifera*	Tulip Tree	Tree
166.	**X**	*Lonicera japonica 'Halliana'*	Hall's Japanese Honeysuckle	Vining shrub
167.	☐	*Lonicera subspicata*	Wild Honeysuckle	Vining shrub
168.	**X**	*Lotus corniculatus*	Bird's Foot Trefoil	Ground cover
169.	☐	*Lotus heermannii*	Northern Woolly Lotus	Perennial
170.	☐	*Lotus scoparius*	Deerweed	Shrub
171.	**W**	*Lupinus arizonicus*	Desert Lupine	Annual
172.	**W**	*Lupinus benthamii*	Spider Lupine	Annual
173.	☐	*Lupinus bicolor*	Sky Lupine	Flowering annual
174.	☐	*Lupinus sparsiflorus*	Loosely Flowered Annual Lupini/Coulter's Lupine	Annual
175.	**W**	*Lyonothamnus floribundus ssp. asplenifolius*	Fernleaf Ironwood	Tree
176.	**W**	*Macadamia Integrifolia*	Macadamia Nut	Tree
177.	**W**	*Mahonia aquifolium 'Golden Abundance'*	Golden Abundance Oregon Grape	Shrub

	Code	Botanical Name	Common Name	Plant Form
178.	**W**	*Mahonia nevinii*	Nevin Mahonia	Shrub
179.	□	*Malacothamnus fasciculatus*	Chaparral Mallow	Shrub
180.	**X**	*Malephora luteola*	Trailing Ice Plant	Ground cover
181.	**W**	*Maytenus boaria*	Mayten Tree	Tree
182.	**W**	*Melaleuca nesophila*	Pink Melaleuca	Shrub
183.	**N**	*Metrosideros excelsus*	New Zealand Christmas Tree	Tree
184.	□ •	*Mimulus species*	Monkeyflower	Flower
185.	□	*Mirabilis californica*	Wishbone Bush	Perennial
186.	**N**	*Myoporum debile*	ncn	Shrub
187.	**N**	*Myoporum insulare*	Boobyalla	Shrub
188.	**W**	*Myoporum parvifolium*	ncn	Ground cover
189.	**W**	*Myoporum 'Pacificum'*	ncn	Shrub
190.	□	*Nassella [stipa] lepida*	Foothill needlegrass	Ground cover
191.	□	*Nassella [stipa] pulchra*	Purple needlegrass	Ground cover
192.	□	*Nemophila menziesii*	Baby Blue Eyes	Annual
193.	**X**	*Nerium oleander*	Oleander	Shrub
197.	□	*Oenothera hookeri*	California Evening Primrose	Flower
198.	**W**	*Oenothera speciosa*	Showy Evening Primrose	Perennial
199.	**X**	*Ophiopogon japonicus*	Mondo Grass	Ground cover
200.	□ •	*Opuntia littoralis*	Prickly Pear	Cactus
201.	□ •	*Opuntia oricola*	Oracle Cactus	Cactus
202.	□ •	*Opuntia prolifera*	Coast Cholla	Cactus
203.	**W**	*Osmanthus fragrans*	Sweet Olive	Shrub
204.	**X**	*Osteospermum fruticosum*	Trailing African Daisy	Ground cover
205.	**X**	*Parkinsonia aculeata*	Mexican Palo Verde	Tree
206.	**W**	*Pelargonium peltatum*	Ivy Geranium	Ground cover

	Code	Botanical Name	Common Name	Plant Form
207.	**X**	*Penstemon species*	Beard Tongue	Shrub
208.	**W**	*Photinia fraseri*	ncn	Shrub
209.	**W**	*Pistacia chinensis*	Chinese Pistache	Tree
210.	**X**	*Pittosporum undulatum*	Victorian Box	Tree
211.	□	*Plantago erecta*	California Plantain	Annual
212.	• •	*Plantago insularis*	Woolly Plantain	Annual
213.	**X**	*Plantago sempervirens*	Evergreen Plaintain	Ground cover
214.	**W**	*Platanus racemosa*	California Sycamore	Tree
215.	**W**	*Plumbago auriculata*	Plumbago Cape	Shrub
216.	□	*Populus fremontii*	Western Cottonwood	Tree
217.	**X**	*Portulacaria afra*	Elephant's Food	Shrub
218.	□	*Potentilla glandulosa*	Sticky Cinquefoil	Subshrub
219.	**X**	*Potentilla tabernaemontanii*	Spring Cinquefoil	Ground cover
220.	**X**	*Prunus caroliniana*	Carolina Cherry Laurel	Shrub/Tree
221.	□	*Prunus ilicifolia ssp. ilicifolia*	Holly Leaved Cherry	Shrub
222.	**X**	*Prunus lyonii*	Catalina Cherry	Shrub/Tree
223.	**N**	*Punica granatum*	Pomegranate	Shrub/Tree
224.	**W**	*Puya species*	Puya	Succulent/shrub
225.	**W**	*Pyracantha species*	Firethorn	Shrub
226.	□	*Quercus agrifolia*	Coast Live Oak	Shrub
227.	□ □ •	*Quercus berberdifolia*	California Scrub Oak	Shrub
228.	□ □ •	*Quercus dumosa*	Coastal Scrub Oak	Shrub
229.	**X**	*Quercus engelmannii*	Engelmann Oak	Tree

	Code	Botanical Name	Common Name	Plant Form
230.	**X**	*Quercus suber*	Cork Oak	Tree
231.	**X**	*Rhamnus alaternus*	Italian Buckthorn	Shrub
232.	□	*Rhamnus californica*	California Coffee Berry	Shrub
233.	□	*Rhamnus crocea*	Redberry	Shrub
234.	□	*Rhamnus crocea ssp. ilicifolia*	Hollyleaf Redberry	Shrub
235.	**N**	*Rhaphiolepis species*	Indian Hawthorn	Shrub
236.	□	*Rhus integrifolia*	Lemonade Berry	Shrub
237.	**N**	*Rhus lancea*	African Sumac	Tree
238.	□□	*Rhus ovata*	Sugarbush	Shrub
239.	□	*Ribes aureum*	Golden Currant	Shrub
240.	□	*Ribes indecorum*	White Flowering Currant	Shrub
241.	□	*Ribes speciosum*	Fuchsia Flowering Gooseberry	Shrub
242.	**W**	*Ribes viburnifolium*	Evergreen Currant	Shrub
243.	□ •	*Romneya coulteri*	Matilija Poppy	Shrub
244.	**X**	*Romneya coulteri 'White Cloud'*	White Cloud Matilija Poppy	Shrub
245.	**W** □	*Rosmarinus officinalis*	Rosemary	Shrub
246.	**W** □	*Salvia greggii*	Autumn Sage	Shrub
247.	**W** □	*Salvia sonomensis*	Creeping Sage	Ground cover
248.	□	*Sambucus mexicana*	Mexican Elderberry	Tree
249.	**W**	*Santolina chamaecyparissus*	Lavender Cotton	Ground cover
250.	**W**	*Santolina virens*	Green Lavender Cotton	Shrub
251.	□	*Satureja chandleri*	San Miguel Savory	Perennial
252.	□	*Scirpus acutus*	Hard-Stem Bulrush	Perennial
253.	□	*Scirpus californicus*	California Bulrush	Perennial

	Code	Botanical Name	Common Name	Plant Form
254.	X	*Sedum acre*	Goldmoss Sedum	Ground cover
255.	X	*Sedum album*	Green Stonecrop	Ground cover
256.	X	*Sedum confusum*	ncn	Ground cover
257.	X	*Sedum llineare*	ncn	Ground cover
258.	X	*Sedum x rubrotinctum*	Pork and Beans	Ground cover
259.	X	*Senecio serpens*	ncn	Ground cover
260.	□	*Sisyrinchium bellum*	Blue-Eyed Grass	Ground cover
261.	□	*Solanum douglasii*	Douglas Nightshade	Shrub
262.	□	*Solanum xantii*	Purple Nightshade	Perennial
263.	W	*Stenocarpus sinuatus*	Firewheel Tree	Tree
264.	W	*Strelitzia nicolai*	Giant Bird of Paradise	Perennial
265.	W	*Strelitzia reginae*	Bird of Paradise	Perennial
266.	□	*Symphoricarpos mollis*	Creeping Snowberry	Shrub
267.	W	*Tecoma stans [Stenolobium stans]*	Yellow Bells	Shrub/Small tree
268.	X	*Tecomaria capensis*	Cape Honeysuckle	Ground cover
269.	N	*Teucrium chamaedrys*	Germander	Ground cover
270.	N	*Thymus serpyllum*	Lemon Thyme	Ground cover
271.	N	*Trachelospermum jasminoides*	Star Jasmine	Shrub
272.	□	*Trichostema lanatum*	Woolly Blue-Curls	Shrub
273.	X	*Trifolium hirtum 'Hyron'*	Hyron Rose Clover	Ground cover
274.	X	*Trifolium fragiferum 'O'Connor's'*	O'Connor's Legume	Ground cover
275.	□	*Umbellularia californica*	California Laurel	Tree
276.	□	*Verbena lasiostachys*	Western Vervain	Perennial

	Code	Botanical Name	Common Name	Plant Form
277.	N	*Verbena peruviana*	ncn	Ground cover
278.	X	*Verbena species*	Verbena	Ground cover
279.	X	*Vinca minor*	Dwarf Periwinkle	Ground cover
280.	□	*Vitis girdiana*	Desert Wild Grape	Vine
281.	X	*Vulpia myuros 'Zorro'*	Zorro Annual Fescue	Grass
282.	W	*Westringia fruticosa*	ncn	Shrub
283.	W	*Xanthorrhoea species*	Grass Tree	Perennial accent/ Shrub
284.	W	*Xylosma congestum*	Shiny Xylosma	Shrub
285.	X	*Yucca species*	Yucca	Shrub
286.	□	*Yucca whipplei*	Yucca	Shrub

X = Plant species prohibited in wet and dry fuel modification zones adjacent to native open space lands. Acceptable on all other fuel modification locations and zones.

W = Plant species appropriate for use in wet fuel modification zones adjacent to native open space lands. Acceptable in all other wet and irrigated dry (manufactured slopes) fuel modification locations and zones.

□ = Plant species native to Riverside, Orange and San Diego Counties. Acceptable in all fuel modification (wet or dry zones) in all locations.

N = Plant species acceptable on a limited basis (maximum 30% of the area at time of planting) in wet fuel modification zones adjacent to native open space reserve lands. Acceptable in all other fuel modification locations and zones.

• If seed collected from local seed source.

•• Not native plant species but can be used in all fuel modification zones.

□ = Plant species acceptable on a limited use basis. Refer to qualification requirements starting on page 14.

QUALIFICATION STATEMENTS FOR SELECT PLANT SPECIES

□ = **Plant species acceptable on a limited use basis:**

2. **Acacia redolens desert carpet**
May be used in the upper 1/2 of fuel modification zone 2 (30 to 70 feet). The plants may Be planted at 8 feet on center minimum spacing in meandering zones not to exceed a Mature width of 24 feet or a mature height of 24 feet.

43. **Bougainvillea spectabilis [procumbent varities]**
Procumbent to mounding varieties may be used in the mid fuel modification zone 2 (30 to 70 feet). The plants may be planted in clusters at 6 feet once center spacing not to exceed

8 plants per cluster. Mature spacing between individual plants or clusters shall be 30 feet minimum.

44. **Brahea armata**
45. **Brahea brandegeei**
46. **Brahea edulis**

May be used in the upper and mid fuel modification zone 2 (30 to 70 feet). The plants shall be used as single specimens with mature spacing between palms of 30 feet minimum.

129. **Hakea suaveolens**

May be used in the mid fuel modification zone 2 (30-70 feet). The plants shall be used as single specimens with mature spacing between plants of 30 feet minimum.

136. **Heteromeles arbutifolia**

May be used in the mid to lower fuel modification zone 2 (30 to 70 feet). The plants may be planted in clusters of up to 3 plants per cluster. Mature spacing between individual plants or cluster shall be 30 feet minimum.

164. **Liquidambar styraciflua**

May be used in the mid to lower fuel modification zone 2 (30 to 70 feet). The plant shall be used as a single specimens with mature spacing between trees at 30 feet minimum.

227. **Quercus berberdifolia**

228. **Quercus dumosa**

May be used in the mid to lower fuel modification zone 2 (30 to 70 feet). The plants may be planted in clusters of up to 3 plants per cluster. Mature spacing between individual plants or clusters shall be 30 feet minimum.

238. **Rhus ovata**

May be used in the mid to lower fuel modification zone 3 (30 to 70 feet) within inland areas only. The plants may be planted in clusters of up to 3 plants per cluster. Mature spacing between individual plants or clusters shall be 30 feet minimum.

245. **Romarinus officinalis**
246. **Salvia greggii**
247. **Salvia sonomensis**

May be used in the mid to upper fuel modification zone 2 (30 to 70 feet). The plants may be planted in clusters of up to 3 plants per cluster. Mature spacing between individual plants or clusters hall be 15 feet minimum.

FIREWISE 2000 Not-Recommended Plant List

For Fuel Modification Projects in San Diego, Riverside, and Orange Counties

	Botanical Name	Common Name	Plant Form
1.	*Acacia species •*	Acacia	Shrub/Tree
2.	*Adenostoma fasciculatum*	Chamise	Shrub
3.	*Adenostoma sparsifolium*	Red Shank	Shrub/Tree
4.	*Artemisia californica*	California Sagebrush	Shrub
5.	*Bamboos*	Bamboo	Shrub
6.	*Cedrus species*	Cedar	Tree
7.	*Cupressus species*	Cypress	Tree
8.	*Eriogonum fasciculatum*	Common Buckwheat	Shrub
9.	*Eucalyptus species*	Eucalyptus	Shrub/Tree
10.	*Juniperus species*	Junipers	Succulent
11.	*Pennisetum*	Fountain Grass	Ground cover
12.	*Pinus species*	Pines	Tree
13.	*Rosmarinus species*	Rosemary	Shrub
14.	*Salvia species • •*	Sage	Shrub

• Except:
Acacia redolens desert carpet (Desert Carpet ground cover)

• • Except:
Salvia colubariae (chia)
Salvia sonomensis (Creeping Sage)

APPENDIX J-5B

INVASIVE PLANT & WEED LIST

APPENDIX J-5B

FIREWISE 2000 Undesirable Plants and Weeds

For Fuel Modification Projects in San Diego, Riverside, and Orange Counties
(Very Invasive Plant List)

	Botanical Name	Common Name	Plant Form
1.	*Anthemix cotula*	Mayweed	Weed
2.	*Arundo donax*	Giant Reed	Bamboo
3.	*Brassica nigra*	Black Mustard	Weed
4.	*Brassica rapa*	Yellow Mustard	Weed
5.	*Cardaria draba*	Perennial Peppergrass	Weed
6.	*Centaurea solstitialis*	Star Thistle	Weed
7.	*Cirsium vulgare*	Wild Artichoke	Weed
8.	*Conyza canadensis*	Horseweed	Weed
9.	*Cortaderia selloana*	Pampas Grass	Weed
10.	*Foeniculum vulgare*	Sweet Fennel	Weed
11.	*Heterotheca grandiflora*	Telepraphplant	Shrub
12.	*Lactuca serriola*	Prickly Lettuce	Weed
13.	*Nicotiana bigelovii*	Indian Tobacco	Weed
14.	*Nicotiana glauca*	Tree Tobacco	Weed
15.	*Ricinus communis*	Castor Bean	Shrub
16.	*Salsola australis*	Russian-Thistle	Weed
17.	*Silybum marianum*	Milk Thistle	Weed
18.	*Urtica urens*	Burning Nettle	Weed

APPENDIX J5-C

FIRE BEHAVIOR CALCULATIONS

APPENDIX J-5C

WILDLAND FIRE BEHAVIOR CALCULATIONS FOR THE OFF-SITE HAZARDOUS VEGETATIVE FUELS.

Wildland fire behavior calculations have been projected for the hazardous vegetative fuels on the undeveloped sites adjacent to and bordering the Rancho Mission Viejo proposed development. These projections were based on the following "Worst Case" (extreme) Orange County area fire weather condition assumptions:

South, Southwest and West Wind Condition Fuel Moisture Assumptions:
a typical Prevailing (normal summer) Afternoon Wind Pattern.

* 1-Hour Fine Fuel Moisture of.............4%
* 10-Hour Fuel Moisture of..................6%
* 100-Hour Fuel Moisture of 8%
* Live Woody Fuel Moisture of.............60%

South, Southwest and West Wind Condition Fuel Moisture Assumptions:
Late fire season above-average southwest wind pattern. ***A rare even Under the following fuel moisture conditions which sometimes occur with the breakdown of an intense Santa Ana condition.***

* 1-Hour Fine Fuel Moisture of 2%
* 10-Hour Fuel Moisture of..................3%
* 100-Hour Fuel Moisture of 5%
* Live Woody Fuel Moisture of.............50%

North, Northeast and East Wind Condition Fuel Moisture Assumptions:
(Santa ana Wind Conditions). ***An annual event often occuring two or three times a year.***

* 1-Hour Fine Fuel Moisture of 2%
* 10-Hour Fuel Moisture of..................3%
* 100-Hour Fuel Moisture of 5%
* Live Woody Fuel Moisture of.............50%

*Tables 6.3.*1 through *6.3.3* display the expected Rate of Fire Spread (expressed in feet per minute), Fireline Intensity (expressed in British Thermal Units per foot per second) and Flame Length (expressed in feet) for three separate BEHAVE–Fire Behavior Prediction and Fuel Modeling System Computer Calculations. We used a Fuel Model (FM) 2 for these calculations.

Fuel Models 1, 2, 4, and 6 apply directly to the native vegetation that occupies southern California landscapes. FM-1 is one foot tall grass. FM-2 is one foot tall grass and scattered sage brush. FM-4 is chaparral vegetation over 6-feet in height. FM-6 is chaparral vegetation less than 6-feet in height. We chose FM-4 to represent the Rancho Mission Viejo site in its most volatile worst case condition.

As the dedicated open space is restored back to a healthy coastal sage scrub plant community the maximum projected flame lengths will actually diminish (see the following tables 6.3.5 - 6.3.6 displaying rates of spread under "Santa Ana wind conditions for FM-1 and FM-6).

Table 6.3.1 **Expected fire behavior for a prevailing summer season Southwest Wind Pattern for a Fuel Model 2 - Scattered Sage Brush with Tall Grass**	
Rate of Spread	**75.9 feet/minute**
Fireline Intensity	**656 BTU's/foot/second**
Flame Length	**8.9 feet in length**
Additional Fire Behavior Calculation Input: • **30 percent slope** • **15 mph 20-foot wind speed (6.0 mph mid-flame wind speed)** • **30° direction of wind vector to uphill slope**	

This equates to 1.4 acres in 6 minutes, 5.4 acres in 12 minutes, and 12.0 acres in 18 minutes, assuming no initial attack.

Table 6.3.2 **Expected fire behavior for an above average Southwest afternoon wind for a Fuel Model 2 – Scattered Sage Brush with Tall grass**	
Rate of Spread	**312.4 feet/minute**
Fireline Intensity	**3173 BTU's/foot/second**
Flame Length	**18.4 feet in length**
Additional Fire Behavior Calculation Input: • **30 percent slope** • **30 mph 20-foot wind speed (12.0 mph mid-flame wind speed)** • **30° direction of wind vector to uphill slope**	

This equates to 16 acres in 6 minutes, 65 acres in 12 minutes and 146 acres in 18 minutes, assuming no initial attack.

Table 6.3.3 Expected fire behavior for a late season Santa Ana wind condition for a Fuel Model 2 – Scattered Sage Brush with Tall Grass	
Rate of Spread	**1,065 feet/minute**
Fireline Intensity	**10,808 BTU's/foot/second**
Flame Length	**32.3 feet in length**
Additional Fire Behavior Calculation Input: • 30 percent slope • 60 mph 20-foot wind speed (24.0 mph mid-flame wind speed) • 210° direction of wind vector to uphill slope	

This equates to 107 acres in 6 minutes, 427 acres in 12 minutes and 960 acres in 18 minutes, assuming no initial attack.

Table 6.3.4 Expected Fire Behavior for an above average Southwest wind condition for a Fuel Model 1 – Native Grass Stubble 4-inches in height	
Rate of Spread	**732.6 feet/minute**
Fireline Intensity	**1415 BTU's/foot/second**
Flame Length	**12.7 feet in length**
Additional Fire Behavior Calculation Input: • 30 percent slope • 30 mph 20-foot wind speed (12.0 mph mid-flame wind speed) • 30° direction of wind vector to uphill slope	
COMMENTS: The above fire behavior projections are based on grass fuels one-foot tall. Therefore, Rates of Spread, Fireline Intensity and Flame Lengths should be reduced one-third for 4-inch stubble grass fuels, i.e. Rate of Spread = 224 feet/minute Fireline Intensity = 471 BTU's/ft/sec Flame Length = 4.21 feet in length	

Table 6.3.5 Expected fire behavior for a late season Santa Ana Wind Condition For a Fuel Model 1 – one-foot tall cured grass	
Rate of Spread	732.6 feet/minute
Fireline Intensity	1415 BTU's/foot/second
Flame Length	12.7 feet in length
Additional Fire Behavior Calculation Input: • 30 percent slope • 60 mph 20-foot wind speed (24.0 mph mid-flame wind speed) • 210° direction of wind vector to uphill slope	

Table 6.3.6 Expected fire behavior for a late season Santa Ana Wind Condition for a Fuel Model 6 – Chaparral Brush less than 6-feet in height	
Rate of Spread	438 feet/minute
Fireline Intensity	4493 BTU's/foot/second
Flame Length	21.5 feet in length
Additional Fire Behavior Calculation Input: • 30 percent slope • 60 mph 20-foot wind speed (24.0 mph mid-flame wind speed) • 210° direction of wind vector to uphill slope	

Table 6.3.7 Expected fire behavior for a late season Santa Ana Wind Condition for a Fuel Model 4 – Chaparral Brush greater than 6-feet in height	
Rate of Spread	2591.6 feet/minute
Fireline Intensity	149,053 BTU's/foot/second
Flame Length	107.9 feet in length
Additional Fire Behavior Calculation Input: • 30 percent slope • 60 mph 20-foot wind speed (36.0 mph mid-flame wind speed) • 210° direction of wind vector to uphill slope	

APPENDIX J-5D

GLOSSARY

APPENDIX J-5D

GLOSSARY

DEFINITIONS:

Appropriate Management Response – Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Appropriate Management Strategy – A plan or direction taken by an agency administrator to guide wildland fire management actions and meet protection and fire use objectives.

Contain – To surround a fire, and any spot fires therefrom, with control line down to mineral soil as needed, which can reasonably be expected to check a fire's spread under prevailing and predicted weather conditions.

Confine – To limit fire spread within a predetermined area principally by use of natural and pre-constructed barriers or environmental conditions. Suppression action may be minimal and limited to surveillance or monitoring under appropriate conditions.

Control – To complete a control line around a fire down to mineral soil, any spot fires therefrom, and any interior islands to be saved and cool down all hot spots that are immediate threats to the control line.

Energy Release Component – A number that expresses the rate of heat release (in BTU's/sec) per unit area (in square feet) within the flaming zone of the fire.

Expected Weather Conditions – Weather conditions indicated as common, likely, or highly probable based on current and expected trends and their comparison to historical weather records. These are the most probable weather conditions for this location and time.

Experienced Severe Weather Conditions – Weather conditions that occur infrequently, but have been experienced during the period of weather record keeping. For example, rare weather conditions that significantly influence fires may have occurred only once, but their record can be used to establish a baseline for worst case scenario.

Fire Frequency – The historic return interval of fire in a defined environment.

Fire Management Unit (FMU) – Any land management area definable by objectives, topographic features, access, values to be protected, political boundaries, fuel types, major fire regimes, etc., that sets it apart from the management characteristics of an adjacent unit. FMU's are delineated in Fire Management Plans.

Firebreaks – A fireline constructed with a bulldozer on or down a ridgeline to mineral soil, two to three blade widths wide for, use in containing an eventual wildfire.

Fuelbreaks – Usually a ridge top where the fuels have been modified to provide a break in the fuel continuity. Fuelbreaks continue to support vegetation as opposed to a completely cleared firebreak, except for a cleared fireline about the width of a vehicle. Fuelbreaks are most functional when they incorporate an access road down the middle of the fuelbreak. Fuelbreaks can easily be maintained with prescribed fire.

Fuel - Fuel is comprised of living and dead vegetation that can be ignited. It is often classified as dead or alive and as natural fuels or activity fuels (resulting from human actions, usually from logging operations). Fuel components refer to such items as downed dead woody material by various size classes, litter, duff, herbaceous vegetation, live foliage etc.

Fuel Continuity - A qualitative description of the distribution of fuel both horizontally and vertically. Continuous fuels readily support fire spread. The larger the fuel discontinuity, the greater the fire intensity required for fire spread (Brown 2000).

Fuel Loading - The weight per unit area of fuel, often expressed in tons per acre or tones per hectare. Dead woody fuel loadings are commonly described for small material in diameter classes of 0 to 1/4-, 1/4 to 1-, and 1 to 3-inches and for large material in one class greater than 3 inches (Brown 2000).

Fuel Moisture - Percent or fraction of oven dry weight of fuel. It is the most important fuel property controlling flammability. In living plants it is physiologically bound. Its daily fluctuations vary considerably by species but are usually above 80 to 100%. As plants mature, moisture content decreases. When herbaceous plants cure, their moisture content responds as dead fuel moisture content, which fluctuates according to changes in temperature, humidity, and precipitation (Brown 2000).

Ground Fire - Fire that burns in the organic material below the litter layer, mostly by smoldering combustion. Fires in duff, peat, dead moss and lichens, and punky wood are typically ground fires (Brown 2000).

Head Fire - A fire spreading or set to spread with the wind (National Wildfire Coordinating Group 1995).

Holding Actions – Planned actions required to achieve wildland and prescribed fire management objectives.

Initial Attack – An aggressive suppression action consistent with firefighter, public safety and values to be protected.

Invasive Species - Species that can move into an area and become dominant numerically or in terms of cover, resource use, or other ecological impacts (Randall 1987).

Ladder Fuels - Shrubs and young trees that provide continuous fine material from the forest floor into the crowns of dominant trees (Smith 2000).

Layering - A form of vegetative reproduction in which an intact branch develops roots as the result of contact with soil or other media (Helms 1998).

Lignotuber - A woody storage structure forming a swelling, more or less at ground level, from which dormant buds can develop (Helms 1998).

Litter - The top layer of the forest floor (01 soil horizon); includes freshly fallen leaves, needles, fine twigs, bark flakes, fruits, matted dead grass and other vegetative parts that are little altered by decomposition. Litter also accumulates beneath rangeland shrubs. Some surface feather moss and lichens are considered to be litter because their moisture response is similar to that of dead fine fuel.

Management Action Points – (also called "Trigger Points") – Either geographic points on the ground or specific points in time when escalation or alteration of management actions is necessitated. These points are defined and the management actions taken are clearly described in an approved Wildland Fire Plan or Prescribed Fire Plan. Timely implementation of plans when the fire reaches the action point is generally critical to successful accomplishment of the objectives.

Mesic - Pertaining to conditions of moderate moisture or water supply (Smith 2000).

Mitigation Actions – On the ground actions that check, direct or delay the spread of fire, and minimize threats to life, property and resources. This can include mechanical and physical non-fire tasks, specific fire applications and limited suppression actions. These actions will be used to construct firelines, reduce excessive fuel concentrations, reduce vertical fuel continuity, create fuelbreaks or barriers around critical or sensitive sites or resources, create "blacklines" through controlled burnouts, and to limit fire spread and behavior.

Non-native Species - An introduced species evolved elsewhere that has been transported and purposefully or accidentally disseminated by humans (for our purposes, in North America) (Li 1995).

Prescribed Fire – Any fire ignited by management actions to met specific objectives. A written, approved prescribed fire plan must exist and NEPA requirements must be met prior to ignition.

Prescribed Fire Plan – A plan required for each fire ignited by managers. It must be prepared by qualified personnel and approved by the appropriate agency Administrator prior to implementation.

Prescription – Measurable criteria, which guide the selection of, appropriate management responses and actions. Prescription criteria may include safety, economic, public health, and environmental, geographic, administrative, social or legal considerations.

Presettlement Fire Regime - The time from about 1500 to the mid- to late-1800s, a period when Native American populations had already been heavily impacted by European presence and before extensive settlement by European Americans in most parts of North America, before extensive conversion of wildlands for agricultural and other purposes, and before fires were effectively suppressed in many areas (Smith 2000).

Sere - A succession of plant communities leading to a particular plant association (Smith 2000).

Smoke Management – Any situation which creates a significant public response, such as smoke in a metropolitan area or visual pollution in high-use scenic areas.

Stand-Replacement Fire Regime - Fire regime in which fires kill or top-kill aboveground parts of the dominant vegetation, changing the aboveground structure substantially. Approximately 80% or more of the aboveground, dominant vegetation is either consumed or dies as a result of fires. Applies to forests, shrublands, and grasslands (Smith 2000).

Succession - The gradual, somewhat predictable process of community change and replacement leading toward a climax community; the process of continuous colonization and extinction of populations at a particular site (Smith 2000).

Surface Fire - Fire that burns in litter and other live and dead fuels at or near the surface of the ground, mostly by flaming combustion (Brown 2000).

Threatened and Endangered Species – Threat to habitat of such species, or in the case of flora, a threat to the species itself.

Tiller - An erect or ascending stem that branches from the base of another at or below the ground surface; especially in Poaceae and other monocotyledons (Hunt Institute for Botanical Documentation).

Top-Kill - Kills aboveground tissues of plant without killing underground parts from which the plant can produce new stems and leaves (Smith 2000).

Total Heat Release - The heat released by combustion during burnout of all fuels, expressed in BTU per square foot or kilocalories per square meter (Brown 2000).

Underburn - Understory fire.

Understory Fire Regime - Fire regime in which fires are generally not lethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. Approximately 80% or more of the aboveground dominant vegetation survives fires. Applies to forest and woodland vegetation types (Smith 2000).

Wildfire – An unwanted wildland fire.

Xeric - Having very little moisture; tolerating or adapted to dry conditions (Smith 2000).

Appendix J5-E

CHINO HILLS STATE PARK
PREVENTION & WILDFIRE MANAGEMENT

6.0

CHINO HILLS STATE PARK

PREVENTION & WILDFIRE MANAGEMENT PLAN

APPENDIX J-5F

LITERATURE CITED

APPENDIX J-5F

LITERATURE CITED

Anderson, Hal E., 1982. Aids to Determining Fuel Models for Estimating Fire Behavior; General Technical Report INT-122; NFES 1574.

Andrews, Patricia L., 1986. BEHAVE: Fire Behavior Prediction and Fuel Modeling System - BURN Subsystem, Part 1, USDA-Forest Service General Technical Report INT-194.

Axelrod, D.I., 1978. The origin of coastal sage scrub vegetation, Alta and Baja California. American Journal of Botany 65:1117-1131.

Barro, Sue. 1989. [Email to Bill Fischer]. April 29. Riparian vegetation after fire - a case study. Riverside, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, Forest Fire Laboratory. On file at: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT; RWU 4403 files.

Bean, L.J. and F.C. Shipek 1978. Luiseno. IN: Handbook of North American Indians, vol. 8 Calif. Ed by R.F. Hertzen, Pp. 550-564. The Smithsonian Institution, Wash., D.C.

Biswell, H.H 1989. Prescribed Burning in California Wildlands Vegetation Management. University of California Press, Berkeley.

Blankenship, D.J. 1982. Influence of prescribed burning on small mammals in Cuyamaca Rancho State Park, California. Page 587 IN: C.E. Conrad and W. C. Oechel (technical coordinators). Proceedings of the Symposium on Dynamics and Management of Mediterranean-type Ecosystems. Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58. Berkeley, California.

Burkhardt, J.W. and E.W. Tisdale 1969. Nature and successional status of western juniper vegetation in Idaho. J. of Range Manage. 22: 264-270.

Burcham, L.T. 1956. Historical backgrounds of range land use in California. J.Range Manage. 9:81-86.

___________ 1957. California Rangeland. Calif. Forestry, Sacramento. 261p.

Callaway, Ragan M.; Davis, Frank W. 1993. Vegetation dynamics, fire, and the physical environment in coastal central California. Ecology. 74(5): 1567-1578.

Catling, P.C., A.E. Newsome and G. Dudzinski. 1982. Small mammals, habitat components, and fire in southeastern Australia. Pages 199-206 IN: C.E. Conrad and W. C. Oechel technical coordinators). Proceedings of the Symposium on Dynamics and Management of

Mediterranean-type Ecosystems. Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58. Berkeley, California.

Chandler, C., P. Cheney, P. Thomas, L. Trabaud, D. Williams. 1983. Fire in forestry: Volume I. Forest fire behavior and effects. John Wiley and Sons, New York, New York. 450 pp.

Chew, R.M., B.B. Butterworth, and R. Grechman. 1959. The effects of fire on the small mammal population of chaparral. Journal of Mammalogy 40:253.

Cochran WG. 1977. Sampling techniques. Third edition. John Wiley & Sons, Inc. New York.

Cohen, J. 1969. Statistical power analysis for the behavioral sciences. Academic Press, New York.

Cooper, W.S. 1922. The broad-scherophyll vegetation of California.Carnegie Inst. Wash. Pub. 319. 124p.

______________ Fireline Handbook, NWCG, Handbook 3; PMS 410-1, NFES 0065.

Dagit, Rosi. 2002. Post-fire monitoring of coast live oaks (Quercus agrifolia) burned in the 1993 Old Topanga Fire. In: Standiford, Richard B.; McCreary, Douglas; Purcell, Kathryn L., technical coordinators. Proceedings of the 5th symposium on oak woodlands: oaks in California's changing landscape; 2001 October 22-25; San Diego, CA. Gen. Tech. Rep. PSW-GTR-184. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 243-249.

Davis, Frank W.; Keller, Edward A.; Parikh, Anuja; Florsheim, Joan. 1989. Recovery of the Chaparral riparian zone after wildfire. In: Protection, management, and restoration for the 1990's:Proceedings of the California riparian systems conference; 1988 September 22-24; Davis, CA. Gen. Tech. Rep. PSW-110. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station: 194-203.

Deeming, John E., Robert E. Burgan, and Jack D. Cohen, 1978. The National Fire-Danger Rating System USDA- Forest Service General Technical Report INT-39.

Dougherty, Ron; Riggan, Philip J. 1982. Operational use of prescribed fire in southern California chaparral. In: Conrad, C. Eugene; Oechel, Walter C., technical coordinators. Proceedings of the symposium on dynamics and management of Mediterranean-type ecosystems; 1981 June 22-26; San Diego, CA. Gen. Tech. Rep. PSW-58. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station: 502 510.

______________ East Bay Municipal Utility District. 1992. The fire-fighting landscape. Oakland, CA: East Bay Municipal Utility District. 3 p. Pamphlet.

______________1977. Fire Management Preparedness Analysis Handbook; USDI: Bureau of Indian Affairs; Division of Forestry, Branch of Fire Management.

______________ Fire Safe - Inside and Out; California Department of Forestry.

Franklin, Scott E. 1997. Chaparral management techniques for development: public and governmental perceptions. In: Greenlee, Jason M., ed. Proceedings, 1st conference on fire effects on rare and endangered species and habitats; 1995 November 13-16; Coeur d'Alene, ID. Fairfield, WA: International Association of Wildland Fire: 145-148.

Griffin, James R. 1977. Oak woodland. In: Barbour, Michael G.; Malor, Jack, eds. Terrestrial vegetation of California. New York: John Wiley and Sons: 383-415.

Gray, J.T. and W.H. Schlesinger. 1983. Nutrient use by evergreen and deciduous shrubs in California. II. Experimental investigations of the relationship between growth, nitrogen uptake and nitrogen availability.Journal of Ecology 71:43-56.

Gurevitch J and Chester ST. 1986. Analysis of repeated measures experiments. Ecology 67:251-255.

Hanes, T.L. 1977. California Chaparral, Pp 417-469, IN: M.G. Barbour and J.Major (eds), Terrestrial vegetation of California. Wiley Intersciences. New York.

Hanes, T.L. 1971. Succession after fire in the chaparral of southern California. Ecol. Monogr. 41:27-52.

Hecht-Poinar, Eva I.; Costello, L. R.; Parmeter, J. R., Jr. 1987. Protection of California oak stands from diseases and insects. In: Plumb, Timothy R.; Pillsbury, Norman H., technical coordinators. Proceedings of the symposium on multiple-use management of California's hardwood resources; 1986 November 12-14; San Luis Obispo, CA. Gen. Tech. Rep. PSW 100. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station: 110-113.

Hendry, G.W. 1931. The adobe brick as a historical source. Agric. Hist. 5:110 127.

Horton, J.S. 1960. Vegetation types of the San Bernardino Mountains. USDA For. Ser., Pac SW Forest and Range Exp. Sta., Tech, Paper PSW-44. Berkeley, Calif. 29p.

Horton, J.S. and C.J. Kraebel. 1955. Development of vegetation after fire in the Chamise chaparral of southern California. Ecology 36:244-262.

Jepson, W.L. 1910. The silica of California. Univ. Calif. Men., Vol. 2, 480p.

Keeley, J.E. and S.C. Keeley. 1984. Postfire recovery of California sage scrub. American Midland Naturalist 111:105-117.

Keller, J.S., and D.F. McCarthy 1985. Data recovery at the Cole Canyon (Ca Riv-1139) Riverside County, California. Prepared for the Joaquin Ranch Company, LA California. MS. Univ. of Calif., Riverside.

Knapp, Denise, 2003. Conservancy Times, A publication of the Catalina Island Conservancy Spring 2003 Edition, pgs. 1-4.

Lathrop E.W. and R.F. Throne. 1985. A flora of the Santa Rosa Plateau. Southern California Botanists, Spec. Publ. 1,39 pp.

Lawson, Dawn M.; Zedler, Paul H.; Seiger, Leslie A. 1997. Mortality and growth rates of seedlings and saplings of Quercus agrifolia and Quercus engelmannii: 1990-1995. In: Pillsbury, Norman H.; Verner, Jared; Tietje, William D., technical coordinators. Proceedings of a symposium on oak woodlands: ecology, management, and urban interface issues; 1996 March 19-22; San Luis Obispo, CA. Gen. Tech. Rep. PSW-GTR-160. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 642-645.

Lewis, H.T. 1993. Patterns of Indian burning in California: Ecology and Ethnohistory. IN: Before the Wilderness. Environmental management by native California. Ed. T.C. Blackburn and K. Anderson. Ballena Press, Menlo Park, Ca.

McDonald, Philip M. 1981. Adaptations of woody shrubs. In: Hobbs, S. D.; Helgerson, O. T., eds. Reforestation of skeletal soils: Proceedings of a workshop; 1981 November 17-19; Medford, OR. Corvallis, OR: Oregon State University, Forest Research Laboratory: 21-29.

McKenna , J.A. and R.G Hatheway 1988. An archeological survey of a portion ofthe Santa Rosa Springs development property Rancho California, Riverside County, California. Report prepared for : Johnson and Johnson Development, 29400 Rancho California Rd. Rancho California, Ca.

Mensing, Scott A. 1998. 560 years of vegetation change in the region of Santa Barbara, California. Madrono. 45(1): 1-11. [30134]

Mooney, H.A. 1977. Southern coastal scrub, pp. 471-489, IN: M.G. Barbour and J. Major (eds), Terrestrial vegetation of California. Johns Nily &Sons, New York.

Palmer MW. 1990. The estimation of species richness by extrapolation. Ecology 71:1195-1198.

___________ 1994. <u>Planning For Water Supply and Distribution In the Wildland/Urban Interface</u>, Produced by the National Fire Protection Association, August 1994.Ordered through: National Interagency Fire Center, ATTN: Supply, 3833 S. Development Ave. Boise ID 83705. Order NFES #2295.

___________ 1990. (Now referenced as the "Fire Use Handbook") <u>Prescribed Fire Handbook</u>; USDI: Bureau of Indian Affairs; Revised May 1; 1990.

Plumb, Timothy R.; Gomez, Anthony P. 1983. Five southern California oaks: identification and postfire management. Gen. Tech. Rep. PSW-71. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 56 p.

Plumb, Timothy R.; McDonald, Philip M. 1981. Oak management in California. Gen. Tech. Rep. PSW-54. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 11 p.

Pyne, S. J. 1995. World Fire. The culture of fire on earth, Henry Holt and Company, New York.

Reynolds, R.D. 1959. The effects upon the forest of natural fire and aboriginal burning in the Sierra Nevada. MA thesis, University of Calif., Berkeley.

Robbins, W.W. 1940. Alien plants growing without cultivation in California. Calif. Agric. Exp. Sta. Bull. 637. 128 p.

Roussopoulos, Peter J., Johnson, Von. 1975.Help in Making Fuel Management Decisions, Research Paper NC-112, USDA-Forest Service.

Schroeder, M.J. and C.C. Buck 1970. Fire weather-A guide for application of meteorological information to forest fire control operation. USDA Forest.Service., Agr. Handbook 36D.

Smith EP and van Belle G. 1984. Nonparametric estimation of species richness. Biometrics 40: 119-129.

__________ 1997. Status of the Sierra Nevada; Sierra Nevada Ecosystem Project; Final Report to Congress, Wildland Resources Center Report No. 40; University of California, Davis.

Steward, O.C. 1955. Forest fires with a purpose. Southwestern Lore 20:59-64.

Thompson SK. 1992. Sampling. John Wiley and Sons, Inc., New York.

Tsiouvaras, C. N.; Havlik, N. A.; Bartolome, J. W. 1989. Effects of goats on understory vegetation and fire hazard reduction in coastal forest in California. Forest Science. 35(4): 1125-1131.

Van Dyke, Eric; Holl, Karen D.; Griffin, James R. 2001. Maritime chaparral community transition in the absence of fire. Madrono. 48(4): 221-229.

Vogl, R.J. 1974. Effects of fire on grasslands, Pp. 139-194. IN: T.T. Kozlowskiand C.E. Ahlgren (eds), Fire and ecosystems, Academic press, New York.

Wells, P. V. 1962. Vegetation in relation to geological substrate and fire in the San Luis Obispo Quandrangle, California. Ecol. Monogr. 32:79-103.

Westmen, W.E. 1981. Seasonal dimorphism of foliage in Californian coastal sage scrub. Oecologia 51:385-388.

__________ 1998. Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide; National Interagency Fire Center, Boise, Idaho.

__________ 2000. Wildland and Prescribed Fire Qualification System Guide, National Interagency Incident Management System, A Publication of the National Wildfire Coordinating Group, PMS 310-1 (NFES 1414).

Wills, Robbin, R.E. Montague, 2002. NCCP/HCP Wildland Fire Management Plan, Central/Coastal Subregion, Orange County, CA., 103 pgs.

Wirtz, W. O., II 1995. Responses of rodent populations to wildfire and prescribed fire in southern California chaparral. IN; J.E. Keeley and T. Scott (eds). Brushfires in California wildlands: Ecology and resource management.

Young, J.A. and R.A. Evans. 1981. Demography and fire history of a Western juniper stand. J. Range Manage. 34(6) 501-506.

Zedler, Paul H., 1995. Fire frequency in southern California shrublands: biological effects and management options. Pages 101-112 in J. E. Keeley and T. Scott (eds.), Brushfires in California: Ecology and Resource Management. International Association of Wildland Fire, Fairfield, Washington.