
PART II – THE LONG-TERM STRATEGIC WILDLAND FIRE PROTECTION PLAN

2.0 The Long-Term Strategic Wildland Fire Protection Plan

Part II, The Long-Term Strategic Wildland Fire Protection Plan, is a sub part of the overall Wildland Fire Management Plan that 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 Covered Species and Covered Vegetation Communities in the Southern Subregion. The specifics of prescribed fire are discussed in Part IV of this WFMP.

2.1 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 Lon-term Strategic Wildland Fire Protection Plan and the Short-term Tactical Fire Suppression Plan (Part III of this WFMP) 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 Long-term Strategic Wildland 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.

2.2 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 listed species and other sensitive species rely on the vegetation in the Southern Subregion for their individual and very specific habitat needs.

The fuel loadings in the Southern Subregion have increased over time since the 1900's due to a reduction in grazing throughout the Subregion, which has led to increased fuel loadings due to encroachment of shrubs into former grasslands and the current existence of vertical fuel ladders due to unabated undergrowth beneath oak woodlands, successful wildfire prevention and suppression actions by OCFA and their cooperators, changing social values that do not embrace or understand natural systems and the natural role of fire in these fire adapted plant communities and increased urban encroachment within or surrounding the Southern Subregion wildlands. Although large wildfires have burned through the Southern Subregion in recent years there has not been a very large wildfire that burned most of the Southern Subregion since the 1958 Steward Fire. The combination of expanding wildland/urban interface, historic fire weather patterns, expansion of flammable shrublands into former grasslands, the existence of abundant understory fuels that create vertical fuel ladders into the canopies of overstory trees and aging native vegetation within the Southern Subregion all lead to the potential for large wildland wildfires that will result in significant property, cultural and natural losses.

The subject of landscape-level fire regimes remain controversial and not universally accepted among all scientists and wildland managers. Adopting one model or the other

is really over-simplistic and does not focus on meeting objectives in the context of a synergistic set of disturbance processes that includes fire. A fire regime has many components (synergism with other disturbances (including treatments), frequency, size, pattern, seasonality, intensity, etc.) and as such it is helpful to discuss the effect of each. Simply changing one component, e.g. frequency, could potentially enhance or deteriorate the system. There is no historic precedent in the Rancho Mission Viejo Planning Area for the fire regime we are now encountering and expect to encounter based on the matrix of existing plant communities and likely ignition sources and the seasonality of these ignition sources. The role of fire, both positive and negative, has been thoroughly addressed in this plan.

2.3 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.

2.3.1 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.

2.3.1.1 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.

2.3.1.2 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 firebrand 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.

2.4 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. These compartments build on the compartments already established in the Central/Coastal Subregion Fire Management Plan. The Fire Compartments and Fire Management Units in the Southern Subregion Fire Plan were developed with coordination and assistance from the OCFA.

2.4.1 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. 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 names and acreages of the 18 compartments are displayed in Table 2 -1 and shown in Figure N-4.

Table 2 -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

2.4.2 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 (see Figure N-4).

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 N-5 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, the Cleveland National Forest (CNF) and MCB Camp Pendleton have their own Wildland Fire Management Plans as required under the 1995 Interagency National Fire Policy). The large areas to the north and east of the RMV Planning Area that do not have designated Fire Management Compartments are CNF and MCB Camp Pendleton lands. The large areas to the west and south are developed and are no longer wildland open space and, therefore, do not have designated Fire Management Compartments.

2.5 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 wildfire. 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.

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 2.5.1.2, which show the distance needed to safely protect future structures under the worst possible conditions is 110 feet and not 170 feet.

Participants in the NCCP/HCP and San Juan Creek and Western San Mateo Creek watersheds SAMP/MSAA are concerned about the liability of a wildland fire coming off Southern Subregion Planning Area lands and threatening life and property adjoining these lands. The intent of this section is to identify those areas adjacent to the presently undeveloped lands within the Southern Subregion that must be treated by either the adjacent homeowner/Homeowners Association or the Southern Subregion

Land Manager(s) to protect life and property. Recommended treatments include hand cutting and chipping or piling, mechanical means (crushing), prescribed fire or a combination of all three to reduce this liability.

2.5.1 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 primarily within the RMV Planning Area and those that primarily 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.

2.5.1.1 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 Planning Area. Nor are there any threats to existing facilities within the RMV Planning Area. However, this will change as the Habitat Reserve is established and residential communities adjacent to the Habitat Reserve are built out over the next twenty (20) years.

2.5.1.2 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 N-5a-k) plus an active cattle grazing program, and the late 1980'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 and resulted in very little ecological damage.

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 2.7.2. The vegetation on the Ranch has stayed in a FM 2 because of the high frequency of wildfires burning over the Ranch property and the continuation of well-managed grazing practices on the RMV 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., if longer intervals between fires occurs, the vegetation could easily densify, species composition would change and the Fuel Model would evolve into either an FM 6 (mature coastal sage scrub fuels less than 6 ft. in height) or eventually an FM 4 (chaparral fuels greater than 6 feet in height).

This evolution from a FM 2 to a hardened chaparral/chamise FM 4 at higher elevations has serious implications for the Ranch. Wildlife populations of obligate coastal sage scrub species, such as the California gnatcatcher, would decline along with the decline of the coastal sage scrub plant community, 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 approved standard and maintains the structure in a fire resistant condition).

From a gnatcatcher habitat standpoint it is important to retain the FM 6 closed canopy stands of coastal sage scrub. However, there is great variation on how these coastal sage scrub plant communities respond to wildfire.

Fire regime plays a role because many coastal sage scrub species are considered to be "pioneer species," which are present in early successional stages following disturbances (Mooney 1977, Zedler et al. 1983). O'Leary (1995) estimated that fire return intervals of five to ten years can result in chaparral replacement by coastal sage scrub. It appears that the seeds of most coastal sage-scrub species are killed by an intense fire. Three species of subshrubs are facultative seeders: California sagebrush, California buckwheat, and black sage. In these species first-year seedlings are common but resprouting is variable and there may be complete mortality of the burned plants at some sites. Post-fire resprouting in coastal sage scrub subshrubs tends to be more successful in younger, rather than in older shrubs and at coastal rather than at inland sites (Keeley 1998).

If the goal is gnatcatcher support, then laurel sumac could be considered an obstacle. At the Weapons Station at Fallbrook as well as neighboring Camp Pendleton, it has been found that gnatcatchers use but tend to avoid coastal sage scrub that has a significant presence of laurel sumac (*Malosma laurina*) (data of Haas et al. and Tierra

Data for U.S. Navy). The preferred habitat appears to be closed-canopy California sagebrush or California sagebrush/buckwheat at these locations.

Because of the long term planning horizon for future development within the RMV Planning Area, 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 “worst case” FM 4 configuration or 110 feet of fuel modification/treatment between planned structures and undisturbed coastal sage scrub vegetation.

2.5.1.3 Fuel Modification Zones by FMU

All future residential areas within the RMV Planning Area 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 potential “worst case” 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 and increase in intensity. This clearance requirement applies equally to all planning areas for residential communities within the Southern Subregion. These fuel modification zones shall be considered part of the development footprint and shall not be considered part of the Habitat Reserve (see *Part IV, Figure 195*).

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 occurring 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. Again, 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.

¹ See firewise.org for Firewise Community criteria

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.

The following sections describe “Survivable Space Strategies”.

2.5.1.4 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.

2.5.1.5 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 always 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.

2.5.1.6 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 be cleared of all native vegetation and hydroseeded to native annual and perennial grasses. The re-establishment of the following native coastal sage scrub species and exotics will not be permitted: 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 Zones A, B or C. All dead grass material must be removed on an as needed basis, but at least annually by May 1. “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. All native grasses or weeds shall be mowed or weed-whipped to a 4 inch stubble height after heading out and the cut material must be removed to avoid a buildup of thatch. In those cases where Zone C areas will lie outside of the individual 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. These lot owner and Homeowner Association maintenance requirements will be written into the CC&R’s and documented in the Disclosure Statement that each homeowner will receive. 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 future Habitat Reserve lands.

2.5.1.7 Required Building Setbacks from Edge of Slopes. Residential development within non-Habitat reserve areas of RMV 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 the 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 shall 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.

2.5.1.8 Fire Resistant Structural Requirements For All Structures. The following fire construction and design features are required for all structures on all residential lots for protection from wind blown embers and because the Southern Subregion is designated as a Very High Fire Hazard Area by OCFA:

- 1) Class A roof assemblies shall be required on all structures. For roof coverings where the profile allows a space between the roof covering and roof decking, the space at the eave ends shall be fire stopped to preclude entry of flames or embers.
- 2) Exterior walls in the Wildland/Urban Interface Area shall comply with the provisions of the Uniform Building Code (U.B.C.) and with the following additional requirements:
 - a. Wall Surfacing Materials. The exterior wall surface materials shall be non-combustible or an approved alternate. In all construction, exterior walls are required to be protected with 2-inch nominal solid blocking between rafters at all roof overhangs. Wood shingle and shake wall covering shall be prohibited.
 - b. Wood siding of 3/8-inch plywood or 3/4-inch drop siding is permitted but must have an underlayment of 1/2-inch fire-rated gypsum sheathing that is tightly butted or taped and mudded.
- 3) a. Attic ventilation openings or ventilation louvers shall not be permitted in soffits, rakes, in eave overhangs, between rafters at eaves, or in other similar exterior overhanging areas in the Wildland/Urban Interface Area.

EXCEPTION: Attic vents in soffits may be permitted by the FAHJ on those areas of the building that do not face wildland fuels, when the FAHJ determines it is not a hazard.
- 4) In the Wildland/Urban Interface Area, paper-faced insulation shall be prohibited in all attics or ventilated spaces.
- 5) Roof vents, dormer vents, gable vents, foundation ventilation openings, ventilation openings in vertical walls, or other similar ventilation openings shall be louvered and covered with 1/4-inch, noncombustible, corrosion-resistant metal mesh or other approved material that offers equivalent

protection. Turbine attic vents shall be equipped to allow, one-way direction rotation only; they shall not free spin in both directions.

- 6) Combustible eaves, fascias and soffits shall be enclosed as required in guidance documents prepared by the Planning Agency Having Jurisdiction (PAHJ).

EXCEPTION: Eaves of heavy timber construction are not required to be enclosed as long as attic venting is not installed in the eaves. For the purposes of this section heavy timber construction shall consist of a minimum of 4x6 rafter ties and 2x decking.

- 7) 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. Ventilation louvers and openings may be incorporated as part of access assemblies.
- 8) Buildings or structures shall have all underfloor areas enclosed to the ground with exterior walls.
- 9) Skylights within one-half mile of the Wildland/Urban Interface Area shall be tempered glass except when the structure is protected with an automatic fire sprinkler system. No skylights will be allowed on the roof assembly facing hazardous vegetation.
- 10) Glass or other transparent, translucent or opaque glazing shall be tempered glass, multi-layered glass panels, glass block, have a fire-protection rating of not less than 20 minutes, or other assemblies approved by the Fire Agency Having Jurisdiction (FAHJ). Glazing frames made of vinyl materials shall have welded corners, metal reinforcement in the interlock area, and be certified to ANSI/AAMA/NWDA 101/I.S.2-97 structural requirements.
- 11) 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 Fire Authority, and having 1/2 inch perforations for arresting burning carbon or sparks and installed to be visible for the purposes of inspection and maintenance.

- 12) Attic ventilation openings or ventilation louvers shall not be permitted in soffits, rakes, in eave overhangs, between rafters at eaves, or in similar exterior overhanging areas.
- 13) Rain gutters and downspouts shall be constructed of noncombustible material. Gutters shall be designed to reduce the accumulation of leaf litter and debris that contributes to roof edge ignition.
- 14) Exterior doors shall be approved non-combustible construction, solid core wood not less than 1 ¾ inches thick or have a fire protection rating of not less than 20 minutes. Windows within doors and glazed doors shall be in compliance with Item # 10 above.
- 15) The first five feet of fences and other items attached to a structure shall be constructed of non-combustible material or meet the same fire-resistive standards as the exterior walls of the structure.
- 16) All projections (exterior balconies, carports, decks, patio covers, unenclosed roofs and floors, and similar architectural appendages and projections shall be of non-combustible construction, one-hour fire resistive construction on the underside, fire retardant-treated wood 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. Construction details shall comply with the methods specified in guidance documents prepared by the Planning Agency Having Jurisdiction.

EXCEPTION: In lieu of the fire protection outlined above, decks, balconies, and similar projections shall be enclosed from floor level to ground level, enclosing the projection to the exterior wall of the building with materials approved for one-hour construction or protected by an approved automatic fire sprinkler system.
- 17) Skylights shall be tempered glass or a class “A” rated assembly.
- 18) All structures in Wildland Urban Interface Area shall be sprinklered, including all garages. The Interior Sprinkler System shall meet National Fire Protection Standard (NFPA) 13d.

- 19) All hydrants, mains, and water pressures shall be designed to comply with the Orange County Consolidated Fire Code requirements. Water supply must meet a 2-hour fire flow requirement of 2500 g.p.m. with 20-psi residual pressure over and above maximum daily requirements.

2.5.2 Jurisdictions outside the Rancho Mission Viejo Planning Area in the Southern Subregion

There are a number of owners and managers of large tracts of open space that surround the RMV Planning Area (see *Part IV, Figure 168*). Those ownerships other than RMV that plan to include development on their properties will also need to comply with sections 2.5.1.2 through 2.5.1.8, which apply to the entire Southern Subregion. Once OCFA approves this plan for the Southern Subregion all properties within the Subregion will be required by OCFA to meet these requirements through the submission of a Fire Plan.

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”. As of 1995 all Federal Agencies that manage wildlands are required to have a Fire Plan for the management and protection of their properties. 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 other 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 Base 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 (please refer to Section III for the description of the three Wildfire Suppression Operational Modes). 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.

The Fire Management Plan at Camp Pendleton was finalized and adopted as the “General’s Intent” in 1998, though not signed (due to the high cost of some of the requirements). Some aspects of the Fire Management Plan have been implemented and some have not.

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/MSAA/HCP management guidelines, as the OCFA WFMP was written prior to the Southern Subregion NCCP/MSAA/HCP.

OCFA presently implements an aggressive “A” wildfire suppression strategy on all undeveloped lands without an approved Fire Management Plan (see 3.4.2. – 3.4.2.3 in Section III for the presentation on various wildfire suppression strategies used by OCFA). 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 occasions where dozers have been turned around before arriving on an incident, to the all out effort where engines, dozers, hand crews and aircraft are immediately dispatched 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. Until adoption of the Southern Subregion NCCP/MSAA/HCP WFMP by OCFA, 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.

2.6 Fuel Treatment to Protect Biological, Cultural and Historic Resources

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 lightning 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 3-1). 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.

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

This section is divided into those FMU's that occur primarily within the RMV Planning Area and those that occur primarily outside the RMV Planning Area and within the boundaries of other ownerships within the Southern Subregion, which also may have pre-existing FMU's or a similar mechanism for prescribing fuel treatment to protect biological values. Recall that the designation of FMC's and therefore FMU's was made by OCFA without regard to ownership.

FIREWISE 2000, Inc. has started the process of delineating units recommended for prescribed burning to protect biological values through the next decade. This delineation can be completed once the footprint for the various communities / neighborhoods can be agreed to. Once planning is firmed up a more thorough inventory of vegetation condition and habitat requirements can be completed. The concept is to use prescribed fire in an effort to restore fire back into the Southern Subregion fire adapted ecosystems on a planned basis. Prescribed fire will be one of the key tools used to met the following objectives for:

- staying within the resilience regime for each plant community such that there is no type conversion;
- at-risk species if coastal sage scrub is always in a closed canopy condition;
- controlling exotics;
- maintaining a minimum acreage of stands to support some baseline of gnatcatcher territories, then planning strategic fire control measures to protect the size and continuity of these stands;
- experimental thinning using prescribed fire in stands of coastal sage scrub that are immediately adjacent to concentrated urban areas for fuel management purposes and for sustaining wildlife species that benefit from this condition (a patchy continuous stand with lots of interior edge area with large areas with closed canopies).

In addition, prescribed fire will be used for oak woodland maintenance, native grassland restoration and maintenance of chaparral/shrub sites. With the single exception of grasslands, from a fire control standpoint, prescribed fire is best utilized as a vegetation management tool in the spring and early summer periods of the year. Prescribed fire can also be utilized in the fall however, this is also the infamous season for Santa Ana winds. 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 and low volume 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 seeds. However, there are situations, as already described in Section I, where spring burns in grasslands will be utilized to restore perennial native grasses where the predominate non-native annual grass on the site to be burned sets seed early. The time of burning and frequency will be based on site specific considerations, including the relative abundance of a particular non-native species on the site.

Spring and early summer burning conflicts with the nesting season, however, if large expanses of coastal sage scrub vegetation are not protected by strategically placed fuel treatments to slow the advance of wildfires and to reduce the area of critical habitat loss for the protection of strategic wildlife populations there is a good chance that all of the critical habitat could be lost all at once as recently happened in the October 2003 Cedar Fire where tens of thousands of acres of set aside, unmanaged Multiple Species Conservation Plan (MSCP) lands comprising a continuous, unbroken fuel bed not only

completely burned, but provided the conduit for this wildfire to burn into urban areas resulting in the loss of all of the MSCP habitat plus taking the lives of 14 citizens attempting to escape the Cedar Fire, destroyed 2,232 homes, 556 other structures, 22 commercial properties and seriously damaged countless other homes without totally destroying them. An unplanned ignition at the worst possible time, when critical suppression resources were already heavily committed to 7 or eight other major wildfires in southern California that had started before the Cedar Fire, coupled with a continuous expanse of 33 year old unmanaged, set aside MSCP open space was directly responsible for the worst wildfire disaster in San Diego County's history.

Coastal sage scrub stands do simplify over time with canopy closure, and wildlife that depends on herbaceous or suffrutescent plants must depend on natural stand openings that develop as a result of edaphic factors, fire or other reasons.

Mature stands of coastal sage scrub are typically highly dominated by one or very few species, due at least in part to the shade intolerance of the herbaceous understory and to reduced levels of soil nitrogen (Westman 1981). With the exception of a few scattered herbaceous individuals, the understory is often barren. It is not uncommon to find areas of one hectare or more dominated by one or two shrub species. The dominant shrubs often die within 25–35 years on sites which have not burned in 60 years or more. At 40 years, the stand diversity is much reduced, and annuals have completely disappeared, though they may remain viable within the seed bank. In general, we know less about seed longevity of coastal sage species compared to chaparral.

The strategic use of prescribed fire should be considered to slow the advance of wildfires and to keep wildfire size under control. However, it is incorrect to classify wildfires as either Santa Ana fires or non-Santa Ana fires. Many wildfires can fall into both categories on different days. It is not just the fall, high-wind conditions that are a threat. Strategic populations and sensitive areas need to be identified, and minimum territories or numbers that can be protected and sustained need to be identified. A range of "desired conditions" for coastal sage scrub Covered Species should be identified. Such conditions should be present on the Ranch if it is functioning as its own island in a sea of development.

2.6.1.1 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 consider the use of both spring and fall prescribed fire in existing areas of degraded grassland habitat as part of an active coastal sage scrub restoration program for selected sites. This treatment would require intensive follow-up in terms of weed abatement (chemical or mechanical). The supposition is that these non-native 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. Test plots large enough to produce a hot fire can be used to determine whether a viable seed bank is available.

Before setting up test plots it will be important to examine old aerial photos to note vegetation changes if any, plus maps and records of previous agricultural operations, grazing, disking and fires, which are essential to interpreting the landscape today and how that landscape might respond when burned. Test plots will proceed any landscape scale burns and will be utilized to predict landscape scale results. Because it is rather easy to seed coastal sage scrub, seeding remains a viable, cost-effective option. Exotics present a challenge that also must be addressed. Most coastal sage scrub seed is wind-dispersed, so it is possible to obtain a significant amount of voluntary recruitment if conditions are right, but this can take a while for seed dispersal and/or appropriate weather conditions to come together. Planting will turn the site around faster (seed is very cheap, container plants and especially irrigation is not). The planting of native legumes and forbs (understory and gaps species) rather than just the dominants should also be considered. Another option may be repeated burns plus the use of herbicides.

This document is to be considered a framework document that looks at potential management actions. Site specific project planning will be required which begins with site visits and a thorough examination of historical records of past plant cover and management practices.

FMU's where the potential use of prescribed fire is being considered for CSS restoration on a limited test basis follows:

FMU 28.02: Sulfur Canyon: Coastal sage scrub restoration is planned in the grassland area in the bottom of Sulfur 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 test plots mentioned above do not produce preferred coastal sage scrub species all future use of fire on this site for coastal sage scrub restoration purposes will be curtailed in favor of seeding or voluntary recruitment from the coastal sage scrub plant

community surrounding the bottom of Sulfur Canyon. Herbicides will be used to spot kill exotics.

Oak Woodland (raptor) Sites: The southeast quadrant of Rancho Mission Viejo and especially the canyon bottoms, consist 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 34 years. The ground fuels are building up to the point that a wildfire would cause serious damage and quite possibly the total loss of the existing Oak Woodland. The RMV Ranch Manager has begun addressing this vertical fuel ladder/undergrowth problem by bringing in goats that are kept on an area until the ground fuels are sufficiently abated. 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 to moderate intensity ground fires burning through and eliminating the undergrowth and exotics while leaving the oaks intact.

Cool ground fires that clear out dead material and underbrush can be beneficial to management objectives in oak woodlands, as well as moderate-intensity burns that can be used to help control exotics and take advantage of the fact that most native seeds are more adapted to fire than the seeds of exotic plants.

Stand-replacing fires were never natural in oak woodlands, unless they were in a chaparral matrix. The frequent ground fires that burned beneath the oaks prior to the 1900's are now routinely extinguished, which created the current situation of dense undergrowth that now fuels severe and unnatural stand replacement wildfires. Oak woodland stands tend to occur on north facing slopes and in shaded ravines where there is ample moisture. In areas where oaks or other tree species are located in proximity to mature chaparral, the chaparral shrubs can act as "nurse plants" for oak seedlings, which may eventually overtop and kill their hosts (Callaway and D'Antonio 1991). Coast live oaks (*Quercus agrifolia*) are vigorous crown sprouters, but these oaks should be managed for stable canopy cover and long-term recruitment and not for stand-replacing wildfires. These oaks may only effectively recruit once in 50-100 years. Any Engelmann oaks should be treated with special care. Research on Engelmann oaks (*Quercus engelmannii*) at neighboring Camp Pendleton indicates that these oaks are more susceptible to mortality following spring fires than fall fires (Lawson 1993). Since controlled burns are normally conducted in the spring, consideration needs to be given to this situation.

Post-fire survival of oaks is facilitated by fire-resistant, thick bark, and massive root systems that allow fast regeneration of lost canopy (Plumb 1980), even with crown fire.

However, coast live oak seedlings and saplings less than 3 inches (7.6 cm) in diameter may be top-killed by low- to moderate-severity fire, and severe fire kills trees of this size (Dougherty and Riggan 1982; Plumb 1980; Plumb and Gomez 1983). Trees greater than 6 to 8 inches in diameter resist top-kill. The most common fire damage to the trunk is a basal wound resulting in potential cambium death. Large trees may need up to three growing seasons to basal sprout (Plumb and Gomez 1983).

Mortality of oaks from fire is greater when there is a shrub understory or adjacent chaparral. Mortality of seedlings and saplings occurs differentially according to their height and position in relation to the mature oak canopy. This was observed on Camp Pendleton by Lawson and others (1997), who documented mortality from low- to moderate-severity fire of small-diameter coast live oaks and Engelmann oaks over five years. Fire mortality of Engelmann oak and coast live oak (in a woodland with herbaceous and coastal sage scrub species in the understory) was studied for trees less than 2.9 inches (10 cm) in diameter: of 1,214 small trees surveyed, 531 survived 5 years after fire. Both species survived at about the same rate. In the same location on Camp Pendleton, a light- to moderate-severity fire in an Engelmann oak/coast live oak stand enhanced coast live oak seedling establishment. In the two years preceding fire there was no establishment. In 5 post fire years 1,118 oak seedlings established, of which 1,025 were coast live oak. In contrast, following a severe fire in Ventura County, severely-burned sites supported no coast live oak germination from acorns the following spring, while adjacent unburned areas produced new seedlings (Davis et al.1989).

Mature coast live oaks recover rapidly from moderate-severity fire, and light-severity fire has little effect on them. Basal sprouting is common (Tietje et al. 2001; Pavlik 1991; and Paysen 1993).

The range of naturally viable, fully functional oak woodlands does not express itself in any single simple form, and can include age structure; basal sprouts; responses to natural environmental events; shade intolerance; and possible disturbance dependency. There are also historic and current land management factors that may affect the natural viability of stands. Key indicators of stand condition are overall stand structure, unique stand management issues, and a ranking of factors that might be putting stands at risk.

Wildfires today in oak woodlands are becoming more intense and more damaging because of a lack of early season fires that used to burn until the 1900's and are now routinely but not easily put out due to the accumulation of undergrowth. Planned prescribed fires in the spring and early summer would replace what use to be a regular occurrence. Burning releases nutrients that are immediately available to surviving vegetation, eliminates the vertical fuel ladders that will lead to the demise of the oaks

and improves foraging opportunities for the raptor population. Granted, there is potential for disruption of raptor breeding by spring burning. This is one of those small, short term losses for potentially major long-term gain conundrums. The potential for disrupted nesting should be balanced against the potential for immediate enhanced foraging afterwards. It is better to manage habitat and in the long run this is the most cost-efficient as well as effective approach for species that do not appear to be in a state of decline.

At risk oak woodlands with an abundance of understory vegetation are located in the following FMU's:

FMU's 21.01-21.05: Talega/La Paz

FMU's 23.01-23.03: Cristianitos/Gabino,

There are additional oak woodlands in other FMU's (for example in 30.01-30.04) that need to be inventoried before recommendations for their long term management can be formulated. Again, this Fire Plan for the Southern Subregion is meant to be a Framework Document that will require specific project plans for vegetation management activities other than suppression of wildfires.

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 experimental 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 OCFA 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).

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.*** The USFWS desire to maintain coastal sage scrub between the riparian edge and the fuelbreak for use by riparian dependent avian species for augmentation of their foraging and nesting needs seriously puts the riparian zones at risk for potential loss from a wind driven wildfire. The coastal sage scrub buffer will provide a ready avenue for wildfires to spread into the riparian zone. For example, the approved Fire Plan for the Fallbrook Naval Weapons Station addresses riparian zones as follows:

- *Prescribed burning will not occur in willow riparian areas that could be suitable habitat for LBVs except to protect these areas from loss. However, there are two reasons that prescribed fire may be necessary within a riparian habitat not suitable for occupation by least Bell's vireo: 1) to break up long strings of riparian woodland that could act as a "fuse" under the right conditions and be destroyed in a single fire; or 2) to reduce extreme fire hazards from excessive build-up of dead woody material next to the property perimeter or other high-value area. This may occur when 50% of the riparian vegetation is comprised of dead fuels, including "ladder" fuels (those that connect the canopy and lower structural elements of the vegetation).*
- *If it is determined that these conditions exist, then strips of riparian habitat, no wider than 150 feet (and no wider than 10 ft of bare ground without canopy), that do not contain suitable LBV habitat, or that will not contain suitable conditions in the near future, may be burned. This treatment would also provide an anchor point for firefighters during an incident. Only ground fuels and shrub and tree "dead fuels" would be treated, leaving the canopy vegetation.*

Along the adjacent riparian edges, the fuel treatment may extend from the uplands into the riparian edge a short distance, then cross over the riparian at the up to 150-ft wide crossing point. The 10-ft wide break with bare ground will be within the 150-ft wide strip. The 10-foot wide strip will be maintained by dragging the topsoil to keep it free of vegetation.

- *Such a burn would occur no more often than once in 15–35 years.*
- *The OCFA will help determine the areas where burning within a riparian area may be necessary due to their indefensibility, including locations where fuel loads near the property perimeter may permit fire to escape to adjoining properties. The property owner’s qualified resource advisor will then review the site to determine the most effective and least damaging stretch to burn. This information will be provided to the USFWS prior to burning. However, if the property owner determines there is no “may affect”, then concurrence will not be sought.*
- *Fire may be needed adjacent to high-value riparian areas to reduce fuel loads and the risk of an unplanned wildland wildfire burning the riparian habitat. Caution would be needed to avoid accelerating siltation into the riparian area from indiscriminate use of heavy equipment, or from excessive removal of plant cover by high intensity fires directly in riparian areas or on sites adjacent to riparian areas. Coastal sage scrub adjacent to willow riparian areas may be burned to protect willow riparian areas. When compatible with fire safety objectives, a limited buffer (> 100 ft) will be maintained between riparian habitat and any “firelines” or “fuel reduction activities” occurring in adjacent coastal sage scrub. This would provide adequate adjacent uplands required by LBVs and avoid activity in and adjacent to occupied riparian habitat. Burns will only occur in uplands adjacent to riparian habitat when fuel loads, based on fuel models, will result in predicted flame lengths greater than 11 feet.*
- *All burning in or adjacent to riparian habitat that is potentially suitable for LBV will be conducted outside the LBV nesting season. Riparian areas will be assessed and mapped every five years to determine their suitability for LBV occupation.*

FMU's where firebreaks/fuelbreaks are planned adjacent to riparian areas and the associated buffer:

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 above the willow thickets to eliminate any ground fires from getting up into the crowns of the larger shade providing trees.

The approved Fire Plan for the Fallbrook Naval Weapons Station addresses southwestern willow flycatcher and least Bells vireo habitat requirements as follows:

- *This Plan assumes that natural flood regimes and not fire will be the primary disturbance agent for maintaining younger age classes in the riparian zone.*
- *Losses of natural resource values due to wildfire in riparian areas will be minimized by managing the surrounding habitat to reduce the likelihood that fires enter the riparian zone. Also, some riparian birds use adjacent upland habitats for feeding and nesting. Backfires should be set to keep fire out of riparian zones. Hand lines are preferred to bulldozer lines within riparian habitat. Only use bulldozers when necessary to minimize fire size.*
- *Avoid mechanical disturbance or medium-intensity fires in upslope situations that may result in siltation.*
- *Avoid the use of aerial fire retardant or Class A foams within 100 ft of the riparian habitat watercourse strip. However, consider their use as an environmentally friendly alternative to disking in the pre-suppression planning environment.*
- *No firebreaks will be established in a riparian community, with exceptions as described under Riparian Restoration under "Firebreaks and Fuelbreaks".*

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- *Ameliorate existing and prevent future channel down cutting, which lowers the water table for support of willows.*
 - *Avoid siltation of drainages by continuing to manage grazing for minimum residual dry matter. Control other land use practices that may also result in siltation of drainages.*
 - *Protect breeding populations of least Bell's vireo and associated riparian species.*
 - *Maintain riparian condition to sustain willow-alder shrub habitats with a dense understory, as well as adjacent upland areas used for supplemental foraging.*
 - *Identify LBV management areas based on relative habitat values (Map 3-13), and protect them as the first priority.*
 - *Continue fencing or otherwise addressing grazing impacts in LBV Priority Areas if grazing is determined to be a problem at these locations (Map 3-4).*
 - *Allow fires to burn through occupied habitat for the CAGN in order to protect core areas for LBV. Impacts allowed to gnatcatcher habitat for the purpose of avoiding impacts to vireo habitat should consider time of year. Specifically, vireos are not present from mid-September through mid-March, and disturbances that do lead to habitat loss are likely to be acceptable.*
 - *Consider prescribed fire and livestock grazing as tools for establishing a buffer area between shrublands and LBV core areas.*
 - *Protect the southwestern willow flycatcher, which occupies a subset of LBV habitat, through protection of LBV priority management areas. Populations of southwestern willow flycatchers are extremely depressed, and all current locations probably do not represent the full range of habitats in which the species could potentially successfully breed.*
 - *LBV will be designated the umbrella indicator species for other obligate dependents on willow riparian, including the southwestern willow flycatcher, yellow-breasted chat, and yellow warbler. Chats and LBV need more understory compared to warblers. Protect other riparian species including the song sparrow, blue grosbeak, and common yellowthroat.*

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. *Part I, Appendix J* identifies the locations of exotics within the RMV Planning Area and Caspers Regional Park, sets priorities for removal of specific species and recommends removal methods.

2.6.1.2 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 *Part I, Chapters 3, 4 and 5*. 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 *Part I, Chapter 4 and Appendix E*. This Fire Management Plan does not specifically address these sensitive species.

2.6.1.3 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.

2.6.1.4 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.

2.6.2 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 to contain wildfires to the smallest size possible.

2.7 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.

2.7.1 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)*

2.7.1.1 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 through U, except for M) models in this classification system. This fuel modeling system cannot be used for obtaining site specific fire behavior predictions.

2.7.2 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” and “BEHAVE PLUS” 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. In addition to the 13 Fuel Models, BEHAVE PLUS includes 5 additional Fuel Models designed specifically for southern California shrublands.

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 13 NFFL Fuel Models and the 5 southern California 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 or BEHAVE PLUS 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 3-1 may not always be possible to implement because of the high intensities and extreme 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 the burn 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. The descriptions include the fuel characteristics that go into each of these Fuel Models such as the total amount of fuel by size class expressed in tons of fuel per acre, the amount of dead fuel less than ¼ inch in size expressed in tons per acre, the amount of live fuel expressed in tons per acre and the fuel bed depth which are all built into a particular fuel model. The fuel bed depth will give an indication that the fuels are tightly packed or loosely packed. A 6-inch fuel bed will be tightly packed with a very low surface to volume ratio indicating poor burning characteristics while a 4-foot deep fuel bed will be loosely packed with a very high surface to volume ratio. If the fuel moisture in the fine fuels, less than ¼ inch, is low these fuels will burn explosively. The more the amount of fine fuels the more explosively the fuel will burn. These fuel characteristics will be what drives the various Fuel Models shown in Section 2.7.3 plus wind, aspect and slope. This is why a grass fuel will produce a different rate of spread, flame length and heat output/square foot

than shrub fuels. This explanation is a very large oversimplification as there are many other variables to consider other than arrangement, surface to volume ratio and size classes, such as the resin content of the fuel, the live fuel moisture content of the fuel, etc.

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 2. 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 shrublands 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.

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 4. Scattered sage/grassland



Photo 5. Young coastal sage scrub and grassland

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 for visual illustrations of Fuel Model 4.

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



Photo 6. Ceanothus crassifolius Chaparral



Photo 7. Southern mixed



Photo 8. Dense Chaparral

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. Shrublands 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.

Refer to Photographs 9 & 10 for visual illustrations 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.

Refer to Photos 11 and 12 for visual illustrations 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.

Refer to Photos 13 and 14 for visual illustrations 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

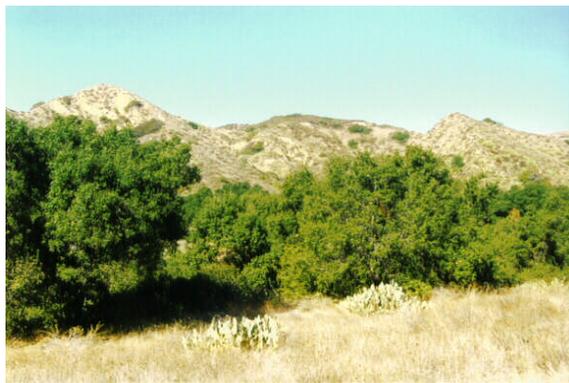


Photo 12. Woodland Oak Riparian Zone



Photo 14. Southern willow scrub (Mulefat) Riparian Zone

Fuel Models can be easily distinguished from one another by viewing the representative photographs for each Fuel model shown in this section. The photographs for Fuel Model 1 can be confusing because the photographs depict vegetation other than 1-foot tall grass. The photographs are actually isolated islands of shrubs on grasslands or are depicting oak woodland. Grasslands are usually found in association with other vegetation. The important component in these photographs is not the other vegetation, but rather the grasslands. Fuel Model 1 is annual and perennial grasses 2 feet or less in height.

A Fuel Model 2 is 3-foot tall clumps of scattered sage over cured grass 2 feet or less in height. The sage plants are usually mature with some small diameter dead stems. In this Model the herbaceous material carries the fire to the scattered clumps of sage, which burn vigorously.

A Fuel Model 5 is a young thrifty stand of coastal sage scrub with little to no dead plant material, less than 6 feet in height and still has a mix of other plants, fire followers, etc., ground fuels are still present with some openings between plants. The light mix of grasses and other fuels help provide a continuous fuel bed, however a Fuel Model 5 is fairly resistant to burning even with a wind due to the thrifty, vigorous state of the vegetation.

A Fuel Model 6 is a dense mature stand of coastal sage scrub less than 6 feet in height with crown closure and contains dead plant material with few other species, including an absence of ground fuels, grasses and forbs. With no wind a Fuel Model 6 is resistant to burning because of the absence of grasses, forbs and other fuels. This Model produces a very hot fire when winds are blowing.

If the photographs seem ambiguous than read the description for each Fuel Model that appears directly under the title for each Fuel Model. Practitioners, including fire scientists, firefighters, fire behavior officers, prescribed fire managers and fuel management officers can readily and easily identify the various Fuel Models in the field.

In the following tables there is a reference to Chains/Hour. A chain is a unit of measurement used by land surveyors, engineers and adopted by foresters. One chain equals 66 feet. A rate of spread of 80 chains per hour is 66 feet/chain X 80 chains/hour or 5,280 feet/hour or one mile/hour.

2.7.3 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:

2.7.3.1 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 a 1-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
	<i>Chains/Hour*</i>	<i>Feet/Minute</i>	<i>BTU/ft2</i>	<i>Feet</i>
1	81	89	92	4
2	31	34	491	6

*Chains per hour defined on p. 2-50.

2.7.3.2 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft2</i>	<i>Feet</i>
4	112	123	2712	24
5	42	46	659	6
6	33	36	499	6

2.7.3.3 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft2</i>	<i>Feet</i>
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.

2.7.3.4 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:

2.7.3.5 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft2</i>	<i>Feet</i>
1	272	299	92	8
2	90	99	491	10

2.7.3.6 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft2</i>	<i>Feet</i>
4	274	301	2712	36
5	50	55	659	9
6	73	80	499	9

2.7.3.7 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft²</i>	<i>Feet</i>
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 2 -2 in Section 2.7.4.

2.7.3.8 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:

2.7.3.9 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft²</i>	<i>Feet</i>
1	666	732.6	1,415	12.7
2	968	1,065	10,808	32.3

2.7.3.10 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft2</i>	<i>Feet</i>
4	2,104	22,154	130,077	101.3
5	367	402.7	5,437	22.5
6	398	438	4,493	21.5

2.7.3.11 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
	<i>Chains/Hour</i>	<i>Feet/Minute</i>	<i>BTU/ft2</i>	<i>Feet</i>
9	180	198	1,615	12.5

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

CAUTION: *The following Table 2-2 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 2-2 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 2-2

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 2.2 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 Reserve 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.