EAST BAY HILLS
VEGETATION MANAGEMENT CONSORTIUM

Fire Hazard Mitigation Program

&

Fuel Management Plan

for the

East Bay Hills

May 1995

View of the East Bay Hills: Berkeley-Kensington border south to Oakland-San Leandro border

Photos continue on back cover

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East Bay Hills

May 1995

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Project Background & Overview

Framework for Project

Fire is an acknowledged risk in the East Bay Hills. Over the years urban development has expanded into wildlands increasing the density of homes and plants that fuel wildland fires. The East Bay Hills are considered one of the most desirable places to live in the San Francisco Bay Area, with their spectacular views, proximity to surrounding city services and public open space, and an image of "country living". The hazards of wildland fire are usually far from a homeowner's mind. However, areas of extremely high fire hazard are created by the combination of steep slopes, dry summer months with hot fall "Diablo" winds, wood structures and dense vegetation that contribute to heavy fuel loads.

In order to address fire hazards of the future, nine public agencies have come together to form the Vegetation Management Consortium (VMC). This group works to reduce the common danger of fire by mitigating hazards in areas where urban development mixes with wildlands. Traditionally, fire safety issues have been left to individual special districts and cities. A regional approach allows consortium members to pool ideas and resources in an organized and planned response effort to reduce the potential of future fires turning into conflagrations.

Funded 50% by local agencies with matching dollars from the Federal Emergency Management Agency (FEMA) and California State Office of Emergency Services (OES), the program developed by the VMC is expected to become a model for similar high fire risk areas

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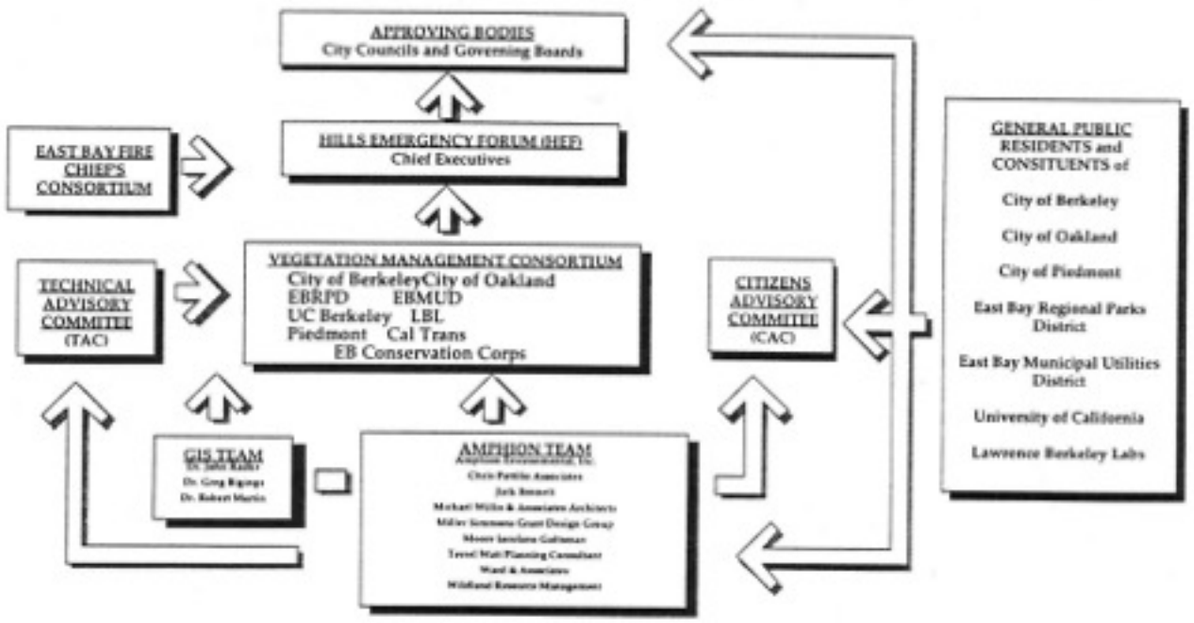
Fire Hazard Mitigation Program & Vegetation Management Plan
Organizational Chart



nationwide. This document summarizes VMC activities over the past 2 years. The Fire Hazard Mitigation Program and Fuel Management Plan offers an overview of the technical documents, policies and hazard reduction strategies developed through the VMC.

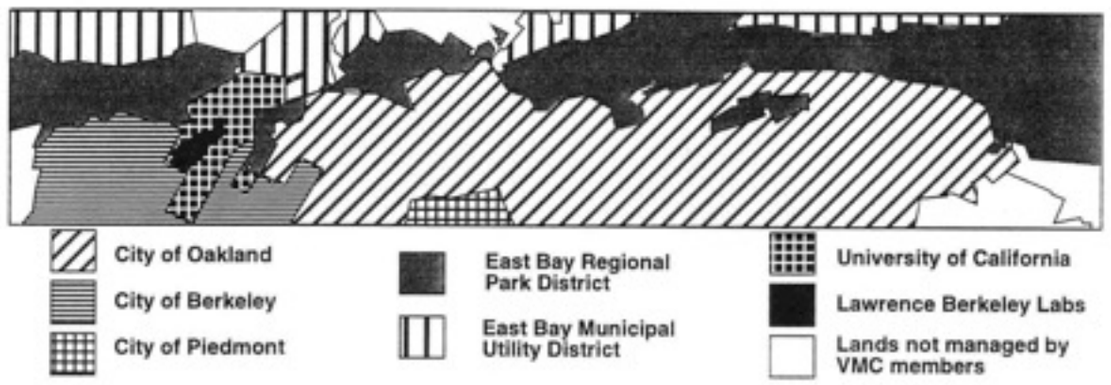
The VMC is an active part of an overall regional approach to mitigating the wildland fire hazards in the East Bay Hills. The Hills Emergency Forum (HEF) was formed in October 1992 with a letter of intent signed by the mayors and chief executive officers of the City of Berkeley, Oakland, East Bay Municipal Utility District (EBMUD), East Bay Regional Park District, (EBRPD) Lawrence Berkeley Labs (LBL) and the University of California, Berkeley (UCB). Goals of the organization were established in a recent mission statement:

> "The Hills Emergency Forum acts as the coordinator for information collection and assessment related to hill-area fire hazards. It provides a forum for building inter-agency consensus of the development of fire related standards, codes, ordinances, management priorities, equipment needs, fire training and inter-agency exercises."

Four standing committees support the HEF: the East Bay Fire Chiefs Consortium(EBFCC) made up of 17 Fire Chiefs from throughout the region, the VMC, the Media Support & Disaster Communications and an Executive Staff Liaison Group.

Study Area

The VMC identified a study area of approximately 37,000 acres spanning from the northern city limits of Berkeley to the southern boundary of Oakland. The area covers roughly 58 square miles and includes over 28,000 homes, public and private institutions, major regional watersheds and open space resources. It encompasses 16,170 acres of residential development and 18,482 acres of "wildlands." The study area was defined by the participating members' jurisdictions and not by any type of natural fire boundaries. It provides a representation of the wide variation of conditions found throughout the East Bay Hills from Richmond to Fremont.



Role of Vegetation Management Consortium & Project Goals

The Vegetation Management Consortium (VMC) plays a highly visible role in hazard mitigation. It is made up of representatives from the cities, special districts, state and federal agencies that manage public lands and regulate private lands in the East Bay hills. The VMC provides a forum for regional coordination of funding and work programs, exchange of

information, sharing of equipment and staff, and problem solving. The development of this plan was funded and sponsored through the VMC to provide baseline identification of the urban wildland intermix fire hazard, mitigation programs and to recommend on-going operations procedures based upon successful and unsuccessful projects conducted by VMC participants. The overall goal of the project was to reduce fire hazard in the East Bay Hills in the urban wildland intermix to an acceptable level of risk

The VMC does not exist in a political vacuum. Through an established network of groups, the Vegetation Management Consortium has the tools to impact a wide range of factors that influence fire in the hills and are managed by a variety of departments including:

City Manager's Office,
Emergency Services
Environmental Compliance
Grounds services
Fire Department
Parks and Recreation
Planning
Public Works
Risk Management

The VMC does not have a formal organizational structure. The group operates under the current HEF letter of intent, providing staffing and funding on a voluntary basis. Several members participated financially in funding the development of this plan, but there currently are no funding requirements for membership. It is recommended that the group remain an informal organization, with a set of by-laws that define the group's mission, organization and membership.

Decision making and consensus building on a regional level are perhaps the most critical roles of the VMC. Common standards and procedures, and communication regarding hazard abatement programs have been recommended as a product of the Fire Hazard Mitigation Program & Fuel Management Plan for the East Bay Hills. The VMC will need to continue the dialogue among its members to keep the program active and provide the region with the coordination required to mitigate fire hazards that do not stop at jurisdictional boundaries.

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Goals & Objectives for the East Bay Hills Fuel Management Plan

Goal

To reduce fire hazard in the East Bay Hills
in the urban wildland intermix to an acceptable level of risk.

Objectives

- ❑ Reduce potential for loss of human life or structures.
- ❑ Reduce potential for damage to structures and public improvements.
- ❑ Reduce potential for loss of sensitive natural, aesthetic or recreational resources.
- ❑ Increase ability to suppress fire and protect structures and public improvements..
- ❑ Increase ability to evacuate people and access for fire suppression activities.
- ❑ Work with neighbors to reduce potential for fires from moving off of publicly owned lands onto adjacent private property or threatening structures.
- ❑ Balance hazard reduction measures in relation to social, environmental and economic impacts.
- ❑ Manage public lands to promote more naturally fire safe environments.

What This Plan Is -- and What This Plan Is Not

The Fire Hazard Mitigation Program & Fuel Management Plan for the East Bay Hills contributes to an evolutionary process. The plan builds upon the 1982 Blue Ribbon Report and other studies to guide public policy and focus on implementation. A regional overview has been provided that addressees both public and private lands. It also creates a model for others dealing with similar fire hazard issues at the local, state or federal level.

- ❖The plan documents existing conditions in a geographic information system (GIS) that is utilized to assess hazards. This information serves as base data for the region.
- ❖The plan has developed unified management prescriptions and treatment standards, as well as coordinated methodologies to be used throughout the region. These methodologies include hazard assessment in the wildlands and in the urban wildland intermix; a site priority ranking method; a site refinement process and a cooperative interagency network.
- ❖The plan identifies applicable regulations such as the requirements established by AB 337 (Bates), the California Environmental Quality Act (CEQA) and Government Code requirements for a Safety Element as a part of the mandated General Plan.
- ❖ The plan provides an Initial Study that identifies the issues that may be relevant for fuel modification projects. It identifies regional impacts and mitigation measures on a programmatic level.
- ❖The plan recognizes that analysis of fire hazards and vegetation is an ongoing dynamic process. While the planning process has reviewed much of the current scientific research, the plan focuses on policy implications. As new research into fire hazards and mitigation techniques is completed, the standards and practices used throughout the region will need to be continually refined.
- ❖ The plan is **not** a definitive analysis of existing conditions. The regional perspective has not provided a detailed view of every parcel in the study area. The VMC members will continue to update the GIS data base as fuel changes, more research is completed and additional information is collected for specific projects.
- ❖The plan does **not** represent a comprehensive vegetation management plan that balances all management or ecosystem issues -- it focuses on fire management issues.
- ❖The plan is **not** a detailed action plan that dictates to each private or public property manager what to do on each parcel of land. The plan provides a series of tools and methods regarding how to reduce fire hazards. Each agency or owner retains the responsibility and right to make management decisions regarding fire safety and how to balance these requirements with other missions or mandates.
- ❖The plan does **not** fulfill the CEQA process. Environmental follow-up may be needed to address project or site specific issues that are not covered by previous CEQA documents.

Current Policies & Programs

The October 1991 Tunnel fire in the Oakland-Berkeley Hills changed many of the standard operating procedures throughout the region. After the fire, the regional outlook on preparedness, response, recovery and mitigation has been reviewed and many recommendations for improvements instituted. The Cities of Berkeley and Oakland have enacted new ordinances and special tax assessment districts that fund a variety of programs aimed at mitigating the hazards of fires in the urban wildland intermix. The special districts and public agencies have increased fuel management activities on the lands they manage and expanded their policies to incorporate regional cooperation. State representatives have also

responded in the wake of the 1991 disaster and similar fires in Southern California in the Fall of 1993. Several pieces of legislation have become State law that strengthen the requirements of cities and counties for emergency preparedness, high hazard identification and mitigation. Additional Senate and Assembly Bills are under consideration that address fire related issues relative to General Plan preparation, roofing standards, California Environmental Quality Act compliance and other pertinent topics.

Plan Development Process

In August 1993, the Consortium selected a consultant team led by Amphion Environmental, Inc. of Oakland to focus on the development of the East Bay Hills Fire Hazard Mitigation Program and Fuel Management Plan. The program has three primary types of tasks:

1. Identification and mapping of high fire hazard areas.
2. Coordinated management and treatment prescriptions for vegetation fuel loads on public lands to reduce fire hazard.
3. Development of prescriptions for private residences and landscapes to reduce fuel loads and the risk of wildland fire.

The planning process was divided into three subject tracks that related to the fire hazard in the East Bay Hills: private landscapes, private structures and public wildlands. These three subjects have been brought together through the Fire Hazard Mitigation Program and Fuel Management Plan.

The overall program emphasizes long-term, interagency coordination, cooperation and

High fire hazard areas occur on both private and public lands throughout the East Bay Hills

planning. The process used to develop the Plan was as important as the strategies formulated and products created. The formation of the VMC, establishment of regular meetings and identification of problems for specific work sessions are a few of the techniques utilized to encourage member participation and build a regional consensus. The focus of the Plan is to find "real world" solutions that meet the specific needs and peculiarities of each participating community. By having an informal, multi-jurisdictional network that operates outside the confines of any one agency's organizational structure, the process was able to encourage not only dialogue among regional counterparts, but also enhance interdepartmental communication. The past year has solidified a system for sharing information, experiences and expertise, as well as providing mutual support, improved regional coordination and friendly competition. A variety of planning tools were utilized - field trips, workshops, interaction with the GIS computer, negotiation strategy sessions such as the formation of the "Goat Cartel", and joint-agency prescribed burns and training exercises.

Providing input at various points during the process were two advisory committees, one of local citizens and another comprised of professionals with expertise in fire management, vegetation management, fuel dynamics, fire ecology and behavior, economics, slope stability, wildlife biology, native plant ecology and emergency services. These advisory committees represented a wide range of expertise and added many viewpoints to the program. Additionally, a series of community workshops were held during the planning process to gain wider public input. Other outreach activities gathered input through presentations to the Board Planning Committees of the EBMUD and EBRPD, Fire Assessment District Commissions of the Cities of Berkeley and Oakland, and special interest groups. Portions of the plan have been presented at a number of professional conferences for peer review. These have included the national annual meetings of the National Fire Prevention Association (NFPA), the American Planning Association (APA), and the FEMA Conference in Response to the 1993 Southern California Fires, as well as programs sponsored by the local chapters of the American Institute of Architects (AIA), American Society of Landscape Architects (ASLA), and Society of American Foresters (SAF). VMC activities have also received local newspaper, television, and radio coverage, as well as having been the subject of articles in professional journals and conference proceedings.

The Plan was prepared with the assistance of an interdisciplinary consultant team consisting of nine local firms that offered the VMC a wide range of expertise. Amphion provided both the VMC and team with overall project management and planning. The Oakland firms of Chris Pattillo Associates and Michael Willis & Associates provided expertise on residential landscape and building construction. Terrell Watt, AICP and Miller Simmons Grant Design Group focused on case law, plan implementation and public policy planning. Jack A. Bennett and Wildland Resource Management brought to the team the science and art of fire suppression and wildland fires. Ward and Associates provided environmental review with Moore Iacofano Goltsman supporting the team with their public facilitation and education expertise. In addition, the University of California, Berkeley researchers developed a state-of-the-art Geographic

Information System(GIS). Led by Dr. John Radke, Dr. Greg Biging and Dr. Robert Martin, the system components identify the vegetation types of the East Bay Hills, model structural and vegetation fuel hazards and predict fire behavior in the study area.

Plan Products

The Plan provides an overview and summary of the multitude of products that were developed during the year long process. These products include technical reports, discussion papers, meeting and working session materials, community workshop summaries, presentation materials and the interactive computer data prepared by UC Berkeley. The products can be grouped into 4 areas and are available for review by contacting VMC members:

- Background Information
- GIS Products and Derivatives
- Private Landscape and Structures
- Public Wildlands

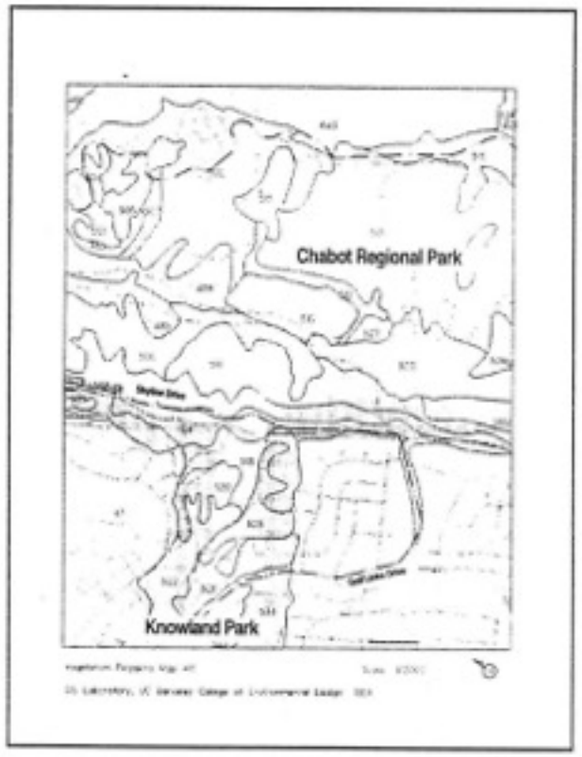
Background Information

As an orientation to both the VMC members and policy makers, research was done on the existing science and common practices. The results of this review include a *Literature and Management Summary* that summarizes relevant codes and standards, reviews the CEQA process, provides an overview of inspection programs throughout the country, identifies VMC member existing mitigation/ treatment methods, summarizes current thinking regarding fire resistant landscapes and provides definitions of technical terms. A *Case Law Review* has been tracking the evolving legal climate on relevant issues. In addition a bibliography was prepared of materials reviewed and a reference library begun that is available to VMC members (See Appendix 5).

GIS Products and Derivatives

The GIS is an interactive computer program that is currently housed at EBRPD and the UC Berkeley lab where it was developed. This program includes the factors used in the hazard assessments for both wildlands and private structures and landscapes. The system is composed of a number of layers of information displayed in map form with relevant data attributes spatially attached. This permits the operator to call up a variety of information regarding the conditions of any point in the study area.

A variety of reports have been prepared to document the development of the GIS and its findings. A technical chart titled *Master List of Vegetation Polygon Attributes* provides an 8 1/2 x 11 format print-out that identifies all of the vegetation polygons, with a chart of attributes such as vegetation type, acres, fuel model, development stage, crowning potential, slope class, flame lengths, rate of spread, heat per area



GIS products include maps identifying vegetation polygons for the Study Area wildlands

Low Development Stage | Moderate Development Stage | High Development Stage | Extreme Development Stage

Study area wildland vegetation is classified into NFFL fuel models and development stages used to model fire behavior. This series of photos depict the four development stages of NFFL Fuel Model #10 - Timber Litter Understory.

and ignition potential rating. A chart has also been created that identifies the characteristic of each polygon that fit the high hazard criteria for wildlands in the Study Area The high hazard chart also provides ownership and resource management unit identification. (See Appendix 3 Key to High Hazard Vegetation Polygons & Maps of Study Area Wildlands.

Private Landscapes and Structures

Four types of products are associated with private property within the study area. The *Model Ordinance* and its *Informational Booklet* outline the recommended regulatory measures for reducing hazards associated with private landscapes and structures. The model is designed to fulfill the requirements of Assembly Bill 337 and develop a regional standard building upon the best parts of existing ordinances. *Retrofit Standards* provide background information on fire preparedness and pre-suppression protection. This technical paper covers many items that are not suitable as a part of City regulations, but that provide additional hazard mitigation measures. These could form the basis of future education programs for homeowners interested in improving the fire safety of their property. The third product is the *Model General Plan Sub-element: Urban-Wildland Intermix Fire Safety*. This potentially powerful planning document contributes to fulfilling the State mandate to local city and counties to provide a Safety Element as one of the components of the General Plan. It also provides the necessary legal nexus for all codes and ordinances dealing with fire safety in the urban wildland intermix. The model offers a comprehensive look at potential issues of concern, responding policies and mitigation or implementation programs. The final type of products relate to public education and outreach. An *Education Program Overview* has been prepared establishing goals for a comprehensive program, documenting the existing education programs in the region, as well as identifying gaps and potential outreach activities. Presentation materials were prepared as communication tools used throughout the planning process. These slide shows, wall graphics, maps and illustrations are available for future programs sponsored by VMC members.

Public Wildlands

There were many working papers, technical summaries and charts prepared for the portion of the plan that deals with fire hazard mitigation in the public wildlands. The fuel management plan portion of this process addresses in detail the mitigation prescriptions, regional resources and existing work programs of the VMC member agencies.

The *Methodology for Development of a Regional Work Plan* provides a process to reach consensus on establishing the regional work program for mitigating identified highest risk areas. This technical paper is supported by the several other

technical products that are available for review through VMC members:

Fuel Models & Development Stage Descriptions. Description of fuel types in the region to provide fire behavior modeling of areas not included in the GIS.

Consortium Owned Parks, Open Spaces and Wildlands in Resource Management Units Maps and attribute tables identifying lands managed by VMC members

Key to High Hazard Vegetation Polygons. Maps and attribute tables describing vegetation areas that meet any of the specific high hazard criteria and potentially require priority action.

Treatment Prescription Descriptions by Vegetation Types. Detailed description of vegetation types in study area, primary fuel characteristics, recommended treatments, special considerations/ mitigation , and performance standards.

Available Techniques for Vegetation Management on Public Wildlands. Detailed descriptions of available techniques, their application, timing considerations, treatment life-cycle, relative cost, limiting factors, advantages and disadvantages.

Site Specific Hazard Mitigation Worksheets Worksheets utilized for site specific hazard assessment, treatment priority ranking and prescription refinement.

In addition, VMC members received other background papers and inventories that document:

Fire Trails in the Study Area. Tables identifying fire trails in each Resource Management Unit, including their managing jurisdiction, length, function, clearance/access, maintenance or operation concerns and status for public use.

Treatment Methods Utilized- Consortium Members Hazard Mitigation Programs. Table identifying each member's policy on use of various treatment methods.

Existing Resources for Management of Public Lands. Table identifying each members available expertise, personnel and equipment as they apply to management and treatment techniques.

Vegetation Types Managed and Methods Utilized. Table identifying type of vegetation each member manages and their policies on treatment techniques in those communities.

Fuelbreaks, Greenbelts and Fire Trails. Technical paper describing the state-of-the-art of fuelbreaks, greenbelts and fire trails and identifying the standards and location in the study area.

Interim Work Plan. Table summarizing VMC members proposed actions for 1994-1995 season.

Problem Statement

The modern "wildland fire" - Fire in the Urban-Wildland Intermix

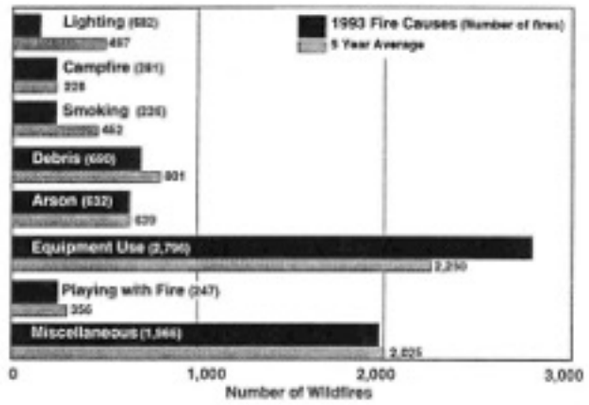
The October 1991 Tunnel fire provided the impetus for the development of the East Bay Hills Fire Hazard Mitigation Plan; however, it was not the first major urban-wildland intermix fire in this region. Historically the East Bay has proven prone to wildland fire with 14 major fires since the turn of the century. The 1923 fire in Berkeley resulted in losses that even today rank it as the 4th largest loss of structures from a wildfire. The 1970 fire destroyed 37 residences, damaged an additional 21 residences and involved 204 acres. The 1980 fire in Berkeley's Wildcat Canyon caused considerably less damage involving 5 houses and 2 acres. However this 1980 fire played a large role in the region in increasing public and agency awareness and led to the "1982 Report of the Blue Ribbon Urban Interface Fire Prevention Committee."

In the East Bay Hills the vegetation that contribute to wildfires are not part of remote wildlands. Most of the fires start adjacent to areas of urban and suburban development, along roadways or in regional recreation areas. While one could argue that these are not true wildland fires since they are not in "wild lands", there is no better recognized term available to describe the fires that often involve vegetation and multiple structures in the East Bay Hills. These fires can vary dramatically in size from portions of an acre to several thousand acres. These fires have the ability to spread rapidly through flame fronts and long range spotting that may create multiple fire fronts. Structures and their surrounding landscapes often intensify fire behavior, adding fuel and contributing to spotting with highly flammable materials and construction that easily succumbs to fire. The urban-wildland intermix demands that firefighters adopt new suppression tactics, training and equipment as the fires present the challenge of both structure fires and wildland fires. These fires have also demonstrated that under certain conditions additional water and fire suppression forces have minor impacts -- once underway major wildland fires can only be controlled by changes in fuel and environmental conditions.

Causes of ignition of fires in the East Bay Hills are varied: accidents with automobiles or equipment with hot engines and catalytic converters in dry grasses, arson, children

Overview of the changes in vegetation and structures in the East Bay Hills: 1934 Berkeley - Kensington

1994 Berkeley - Kensington



Wildfires by Cause
From: CDF 1993 Wildfire Activity Statistics

playing with matches or fireworks, sparks from chimneys, hot charcoals from barbecues, downed powerlines and cigarettes to name a few. Ignition reduction programs must target all of these potential causes.

Fires in the urban-wildland intermix will continue to be more common place as urban areas expand into adjacent wildlands. This expansion has dramatically altered the distribution of fuel types in the East Bay Hills and added ornamental landscaping and structures. The "natural" landscape has changed during the 19th and 20th centuries from grass covered hillsides that created relatively benign fires, to a mix of structures and vegetation that can produce catastrophic events. These fires are not unique to the East Bay Hills or even California. We continue to learn from each of the major fires that occur in areas of urban wildland intermix in portions of Australia, countries surrounding the Mediterranean and throughout the United States. Research and analyses of recent urban wildfires have provided new insight into structure survivability, fire behavior and other contributing factors.

Natural systems - Climatic conditions and California ecosystems

Fire is a natural part of the California ecosystem. The climate of the East Bay Hills is similar to that throughout the Mediterranean with cool, winter rainfall and warm, dry summers. The close proximity of the Pacific ocean provides a strong maritime influence that includes prevailing moisture laden west winds and fog.

Periodically the predominant weather patterns are reversed due to changes in the Pacific high pressure system. During these periods Foehn winds come across the continental United States and predominate for relatively short periods of time (1 to several days). These hot, dry winds create the worst of our "fire weather" and are locally called "Diablo winds," taking their name from Mount

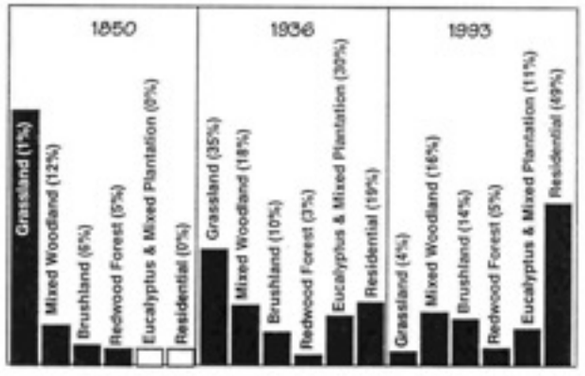
Overview of the changes in vegetation and structures in the East Bay Hills: 1886 Strawberry Canyon

1994 Strawberry Canyon

Diablo located in the east. The strong, hot, dry offshore winds increase the chance of ignition and rapid spread of fire by drying out vegetation and other fuels. The gusting winds result in erratic fire behavior and increase suppression difficulties. This change in the normal weather pattern is also referred to as "red flag weather" after the State program to identify periods of high fire potential.

Several California ecosystems are adapted to frequent fire occurring on a 10 to 15 year frequency. The life cycles of many plant species in brush and grassland communities depend upon fire to remove dead materials, prepare seed beds, stimulate growth diminish competition and provide lush forage for wildlife.

Natural changes in the fire regime are exemplified in a typical unmanaged succession from perennial grasslands to brush lands to oak woodland. Perennial grasslands accumulate relatively little fuel volume and will typically burn frequently, with fast, cool fires. Without regular disturbance, such as grazing or fire, most grasslands will be encroached by brush communities. The brush communities have a lower frequency of fire, accumulate higher volume of fuel and include species with volatile oils that can create spectacular fire behavior. In many areas the brush communities finally gave way to a climax oak-bay woodland. Once these oaks matured and their canopy shaded out much of the understory, the woodland burns infrequently. While the community may produce more tons of fuel per acre than the grassland or brush, the size and arrangement of the fuel makes it difficult to ignite. Over 4,500 acres within the study area have changed from grassland to brush resulting in a change in the overall fuel class distribution throughout the East Bay Hills and the capacity for high flame lengths and heat output.



From: A History of the Vegetation Changes in the East Bay Hills 1850 - 1993

The most dramatic change both visually and in the region's fire regimes relates to the increase in the human populations and associated expansion of non-native plant materials including annual grasses, exotic shrubs and introduced trees. These vegetation & fire

Overview of the changes in vegetation and structures in the East Bay Hills: 1934 Park Boulevard, Oakland

1994 Park Boulevard, Oakland

ecology comparisons focus on 19th & 20th century changes, as floristic conditions prior to European settlement and livestock grazing practices are not well documented. Several of these species were intentionally planted for their economic, erosion control or aesthetic value, such as eucalyptus and monterey pine, while other opportunistic species were brought in unwittingly with livestock and imported goods such as the annual grasses, french broom and pampas grass. The non-native species throughout the East Bay have successfully competed with native species to dramatically alter what appears as the "natural" landscape. Many of these species have characteristics that make them highly flammable and more hazardous than the native species they replaced. Several are more susceptible to freeze, drought, disease and insect damage that increase the amount of dead material present in the region increasing fire potential.

Early human use of the landscape recognized fire as a tool to manage vegetation for seed production and for hunting. It was only as settlement expanded that the predominant view of fire changed from a useful natural element to that of a damaging factor that should be excluded and eliminated.

Development patterns

Development of the East Bay urban landscape followed predictable patterns moving from early settlement near the Bay, east into the surrounding hillsides. Settlement of the hills continued at a rapid rate as the population grew, construction techniques made housing more affordable, and transportation improvements made the hillsides more accessible.

Developers at the turn of the century subdivided "range" land, platted out building lots and established road networks throughout the hills. The East Bay Hills rapidly attracted home buyers and became a premier residential area. Spectacular views of the bay and "rural" quality of the setting continues even today to attract new residents to the hills. Urban-scale 1/8 to 1/4 acre lots were established with little regard to the steep hillside's topography or for fire safety.

The homes in the hills are predominantly of wood construction -- the least expensive and fastest construction material available. The East Bay Hills is internationally renown for its architecture with many notable examples by famous architects. Brown Shingle, Craftsman Bungalow and Stick Style houses glorify wood construction with shake roofs and shingle siding. Before long, residents changed the landscape surrounding their homes by

Overview of the changes in vegetation and structures in the East Bay Hills: 1934 Leona Heights, Oakland

1994 Leona Heights, Oakland

introducing non-native plant materials that reflected East Coast or European lifestyles familiar to these new homeowners.

The major tree plantations visible today were also established in the early 1900s. Groves of *Eucalyptus globulus*, blue gum, were planted for hardwood timber production. Mass plantings of *Pinus radiata*, monterey pine, were added by land speculators to enhance property sales, and by local beautification groups concerned with the appearance of their environment. As development continued and the trees grew, the turn of the century appearance of the East Bay hills changed from being predominantly grasslands with clusters of native oak and bay trees in natural swales, to residences intermixed with introduced forests. From a fire ecology viewpoint both houses and the introduced plant materials increased the fuel volume far above that of the vegetation native to the hills.

Development patterns, structure building materials, design and construction techniques, and landscapes play a large role in the potential fire behavior and resultant damage. Analysis from recent fires in the urban-wildland intermix have focused on isolating the factors that increase survival of one structure over another. The Defensible Factor Study sponsored by the University of California, Berkeley has identified roof materials and clearance of vegetation away from structures as the two top factors, after accounting for people taking defensive actions to suppress fires around structures. Flammable roofing materials, such as shake roofs, are especially hazardous in that they not only decrease the chance of survival of the individual structure, but also can become airborne firebrands that contribute to the rapid spread of the fire through spotting. Vegetation clearance relates directly to lot size and set backs determined by development patterns. It is influenced by homeowners' need for privacy and desire to live in a "natural setting."

Ingredients for catastrophe

The East Bay Hills are a perfect setting for catastrophic fires with the key environmental factors, a history of fire in the area and a variety of challenges to fire suppression tactics. Key environmental factors include a combination of fire weather, steep topography and dense accumulation of fuel in vegetation and houses.

Hot, dry weather, with high winds and low humidity reduce the moisture level in fuel making it easier to ignite.

Overview of the changes in vegetation and structures in the East Bay Hills: 1934 Lake Chabot

1994 Lake Chabot

Weather influences wildland fires by affecting both the fuels and the fire's behavior.

Wind affects the fire behavior by increasing rate of combustion, bending flames closer to fuels, preheating fuel and carrying burning embers that can ignite additional fuels in advance of ground flame fronts.

Fire has the ability to create its own weather, modifying wind intensity and direction, increasing temperature and decreasing moisture in the air and surrounding fuels.

Topography affects ignition potential, rate of spread, and fire behavior.

Fires spread more rapidly uphill with flames pre-heating fuel to make it easier to ignite. (Under high wind conditions fires also will move downslope rapidly.) In the East Bay the topography is extremely steep with slopes exceeding 40% in many places.

Western and southern slopes tend to be the warmest and driest and influence how easily fuel can ignite.

Narrow canyons or saddles can act as natural chimneys intensifying fires by trapping heat, influencing wind patterns and fire spread. Fire behavior in these areas is difficult to predict.

Fuel includes anything that can burn -- grass, shrubs, trees, houses and personal possessions. In the East Bay Hills dense plantings and inadequate maintenance of vegetation has increased the fuel loads.

Characteristics of the fuel determine how it will burn -- size, moisture level, amount of fuel, ratio of dead-live materials, presence of volatile chemicals, continuity and arrangement.

These characteristics influence how easily the fuel ignites, how rapidly the fire can spread and its duration, amount of heat generated, flame lengths as well as how the fuel responds to changes in weather and moisture.

Two of the factors influencing fire behavior are beyond human control. We can do little to manipulate the weather patterns or topography associated with the study area. There will always be periods of "fire weather" especially in the spring and fall, though the number and severity of these "high hazard days" may vary from year to year. We can promote public awareness and appropriate behavior during these times of high fire hazard, but this does not eliminate the hazard. Improved building standards can require new urban or suburban developments be more responsive to topographic conditions and its role in fire hazards. However, there is little way to change the overall topography of the existing urban-wildland intermix areas. Fuel load is the one factor that mitigation programs can target to reduce fire hazards in the intermix zone.

The area's recorded fire history shows 14 major fires since the first fire documented in 1923. When mapped it becomes apparent that the fires often reoccur in the same general areas and show similar environmental conditions.

September 1923 - Berkeley / North of UC Berkeley campus. 584 homes destroyed and 130 acres. Diablo wind. Ignition: smoker.

November 1931 - Leona. 5 homes destroyed and 1800 acres burned. Diablo wind. Ignition: unknown.

November 1933 - Redwood / Joaquin Miller. 1 life, 5 homes and 1000 acres. Diablo wind. Ignition: smoker.

September 1937 - Broadway Terrace. 4 homes, 700 acres. West wind. Ignition: Backyard fire.

September 1940 - Broadway Terrace. 30 acres. West wind. Ignition: unknown.

September 1946 - Buckingham/ Norfolk. 1,000 acres. Diablo wind. Ignition: arson & rekindle.

November 1955 - Montclair. 10 acres. West wind. Ignition: unknown.

October 1960 - Leona. 2 homes, 1200 acres. Diablo wind. Ignition: unknown.

November 1961 - Tilden, Briones, Roberts & Chabot. 4 fires, 400 acres. South-west wind. Ignition: arson.

October 1968 - Oak knoll. 204 acres. West wind. Ignition: unknown.

September 1970 - Buckingham/Norfolk. 37 homes destroyed, 21 homes damaged, 204 acres. Diablo wind. Ignition: arson.

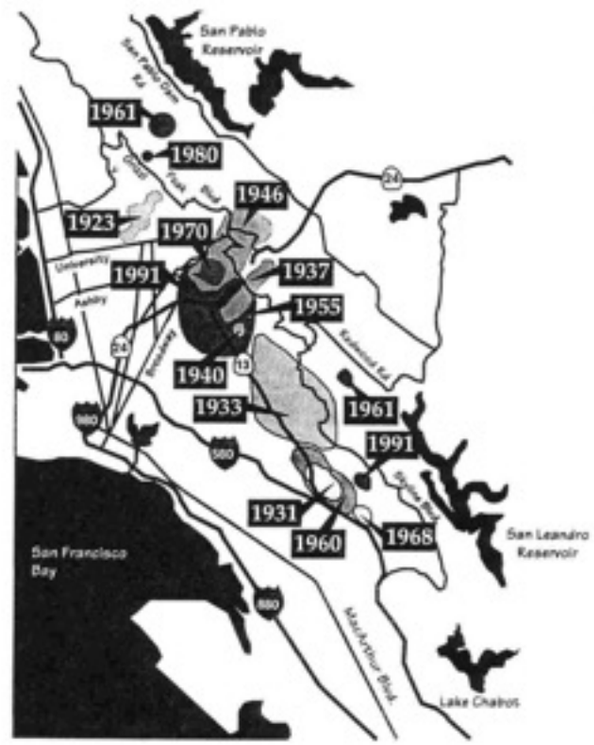
December 1980 - Berkeley/ Wildcat. 5 homes, 2 acres. Diablo wind. Ignition: power line.

October 1990 - Leona. 200 acres. West wind. Ignition: vehicle accident.

1970 fire at Buckingham/Norfolk, Oakland

October 1991 - Buckingham/Norfolk (Tunnel Fire). 25 lives. 3354 homes 456 apartments 1600 acres, estimated $1.5 billion damages. Diablo wind. Ignition: rekindle.

The fire cycles of the area were dramatically altered with tax payer support of effective fire departments. Since the departments' instigation fires have been aggressively suppressed, with many modern fire fighting techniques introduced. Fire stations were built throughout the hills to provide better access to fires. As available forces, equipment and personnel increased, effectiveness of suppression also rose. Ironically, this effectiveness has contributed to the build-up of fuel in the East Bay Hills by putting out fires that would have reduced vegetation fuel buildup. As the fuel has continued to build up, and more people have moved into the hills, the potential for catastrophic wildland fires has increased.



Location of Major Historic Fires in the Study Area

The road patterns dictated by the steep terrain, and added fuel of houses and domestic landscapes present critical challenges to suppression tactics. Perhaps the greatest challenge relates to the presence of people and their possessions which complicate suppression activities. Wildland fire fighting techniques focus on containment and control of the fire since typically there are relatively few dwellings or inhabitants in wildland areas. However, in

areas where the wildlands mix with urban development, the response must focus on safety of a larger number of people and protection of many properties, while also simultaneously trying to keeping the fire from spreading. This dilemma touches at the immensely challenging decisions that are inherent in dealing with the issue of fire in the urban-wildland intermix.

Public opinion and actions:
Role of private citizens, government, public resource managers

Following any major wildland fire there exists a small window of opportunity to instill public awareness of the dangers presented by wildland fire. History has proven that the memories of both policy makers and citizens are short, and that even after a major event the majority are unlikely to support the dramatic changes needed to significantly increase safety. It is rare that the rebuilding process after a fire modifies land development patterns, access routes, road alignment and widths. This phenomenon is as much due to ownership, property rights and the cost of improvements, as to civic will. Smaller incremental changes have historically been more acceptable to the general public.

Following the 1991 Tunnel Fire, the cities of Berkeley and Oakland adopted new ordinances and established tax assessment districts to support enforcement. These programs are having a tremendous impact in reducing the fuel loads in the East Bay Hills, but require a continued effort to maintain a high level of public awareness, support and compliance. The true test will come in future years when these special assessment districts return to the policy makers and citizens for renewal. It only took a few years after the 1923 Berkeley fire before the progressive fire safety ordinances were rescinded.

Perhaps the most difficult challenge to face is overcoming the lack of public perception of risk. The public attitude toward wildland fire is not unique, but rather shared with other environmental hazards, such as earthquakes, landslides or floods. Most hill residence will conclude that their chances of being personally involved in a wildfire are remote. Statistically the risk to an individual is low, in spite of the fact that the potential losses can be high.

The complexity of the issue makes it difficult to convince the public to take action to reduce their exposure to wildfires. There are a multitude of potential wildfire scenarios and highly technical information involved in risk assessment making it confusing for an individual to ascertain the best course of action. To further complicate an individual's decision there is often conflicting information presented or situations described that do not closely replicate the East Bay Hills. In addition many of the recommendations appear to directly conflict with other values such privacy, aesthetics, environmental concerns, slope stability, or economic considerations.

Fuel reduction around homes and in the wildlands can be tedious, physically demanding and expensive work that must be done on an annual basis for vegetation and can result in major changes to structures and the living environment. It is easy to understand the public's avoidance of acknowledgment of the threat of wildfires. Policy-makers are often influenced by the popularity of a position. Highly controversial programs are difficult to establish in public policy and procedures.

However, given the extreme consequence of risking life, home and personal possessions public awareness of hazards must be understood. Wildfire is the one of the few environmental hazards where individual decisions affect not only the individual and immediate family, but also neighbors and emergency personnel. One poorly maintained home and garden can serve as the entry for fire into a whole neighborhood. Addition of fuel through shake roofs, wood decks, fences, landscape plantings and vulnerable design and construction techniques endangers not only an individual residence, but can increase erratic fire behavior, contribute to the fire front and long range spotting involving many other properties. The liability of an individual homeowner for fires that move off of their private property and damage other properties has a clear legal tradition of being upheld in California courts. The costs in terms of economics, disruption of services, environment, aesthetics, public confidence in leadership and a myriad of other viewpoints have been well documented from the experiences of the October 1991 Tunnel fire and its predecessors.

Acceptable level of risk & Potential liability

The human response after a major fire is to declare "never again." While public land managers, policy-makers and homeowners can take actions to reduce the impact of wildfire, the risk can not be eliminated. There will always be wildfires and the potential for catastrophes involving homes. However, destructiveness of those fires can be lessened by institutionalizing safety precautions during high risk periods, reducing the fuel loads of vegetation and retrofitting structures to decrease their risk of ignition and improve survivability.

The concept of "acceptable losses" is fluid and difficult to measure. It is a helpful concept to identify the relative merits of various hazard reduction programs. Acceptable losses or level of risk may be measured in terms of threat to loss of life, structures, landscapes, species and environment, or the cost of post-fire restoration and recovery. It also can be related to our legal system, landowner liability and potential exposure to law suit and restitution for damages.

Unfortunately at the present the courts do not offer definitive guidelines for negligence in maintaining private or public lands to prevent fire from spreading. There are several relevant cases that address the liability associated with fire spreading from privately owned property. On-going litigation is addressing other issues dealing with public agency liability relating to wildland fire management. As fire in the urban-wildland intermix continues to become a more common occurrence, it is anticipated that society and the Courts will refine the concept of acceptable losses and the associated liability that may more clearly define "the problem."

1991 fire (Tunnel Fire) at Buckingham/Norfolk, Oakland

Hazard Analysis

Mandate for Hazard Identification - AB 337

In 1992, AB 337 (Bates) was adopted into the State Civil Code which requires each jurisdiction to identify very high fire hazard zones and pass ordinances equivalent to or more restrictive than the state standards. The bill requires that the zones be based on fuel types, slope, fire weather and other relevant factors. The California Department of Forestry and Fire Prevention were required to identify areas in the Counties of Alameda and Contra Costa on or before January 1, 1995. Within 120 days of these recommendations the local jurisdictions must respond adopting standards and high hazard areas equivalent to or more restrictive than those imposed by the Bill. Within the study area the Cities of Berkeley and Oakland currently have high hazard areas identified and local ordinances that address the legislation's major components. The Hazard Assessment in the Geographic Information System (GIS) and the Model Ordinance for private structures and landscapes prepared in conjunction with this plan provides a regionally coordinated response that can be adopted by the individual jurisdictions to fulfill the hazard identification requirements of AB 337.

Interrelationships of urban development and wildland areas.

It is important to understand the relationship between urban development and wildland areas to appreciate the overall regional hazard and bring together the two different approaches used to assess hazards in the study area. The study area can be divided into four broad classifications:

1. Urban Wildland Intermix
2. Classic Urban Wildland Interface
3. Development in Wildlands
4. Occluded Wildlands

Urban - Wildland Intermix is the most common in the study area and characterized by a dense mix of structures, wildlands and domestic landscapes.

These classifications provide not only a useful relative hazard assessment, but also a basis for development of pre-suppression treatment and suppression strategies.

Urban-Wildland Intermix

Almost one-half of the study area (16,170 acres) falls into this category with a dense mix of structures, wildland and domestic landscapes. The densely built urban or suburban development pose the possibility of major fire with high loss of life and property. There is a high potential for involvement of multiple structures as well as domestic vegetation or wildlands. Fuel build-up is usually throughout the area, but often especially concentrated in places with steep terrain or limited access. Fires in these areas require both structural and wildland fire protection strategies, with the

added challenge of large numbers of civilians that must be protected and evacuated. Fires can originate in these areas and spread to either private properties or the adjacent wildlands.

Classic Urban Wildland Interface

At the edge of the urban development there is often a well defined line where the wildlands form a broad front. Wildland vegetation immediately adjacent to urban development can promote wide flame fronts that can threaten numerous houses with a single fire. Should a wildland fire burn into an adjacent urban area there is a high potential for great loss of life and property. Similar to the urban intermix, there is often a false sense of security, since within the neighborhood an urban environment predominates. In the study area the edge of development often is demarcated by steep change in topography that can further intensify potential fire behavior.

Classic Urban Wildland Interface occurs most often at the ridgeline representing the edge of the study area's urban development.

Development in Wildlands

This third type is often called an "wildland-urban intermix", but reflects the low density end of the development spectrum. Structures are scattered throughout relatively natural setting on larger lots (5 acres or more). This type of structure development is not very

Development in Wildlands, characterized by low density development, occurs in isolated portions of the study area.

common in the study area, but do occur such as along Skyline Drive. Individual homes are difficult to protect because of large areas, poor access and signage, and often water supply and delivery systems that are not adequate for fighting wildland fires. In the United States fires in this type of wildlands traditionally threatened relatively few structures. As the high density urban development has expanded into the adjacent wildland, the more common type of intermix is that described in the first category above.

Occluded Wildlands

Isolated areas of wildlands larger than 5 acres occur within an urban setting throughout the study area and are both public and privately owned. The many homes that typcially surround these wildlands are potentially at risk from a single fire (with less overall acreage involved). These occluded wildland areas often are located in canyons or areas with difficult access and often have no developed water supply. In the study area they are typically the left over sites that could not be developed with structures or roadways. Some of these areas have been designated as parks or open space, but many are privately owned and are part of several properties or a condition of development to be maintained as private open space in perpetuity.

Occluded pockets of wildland surrounded by urban development are scattered throughout the study area often in areas with difficult access

Hazard Analysis using the Geographic Information System (GIS)

The term "hazard analysis" refers to a specific assessment in wildland fire planning that identifies areas where similar fire behavior can be anticipated. Fire behavior is affected by weather, topography and fuel loading. The hazard analysis for the study area assessed the topography and fuel loading and modeled under fire weather conditions (as they occur 85% of the time) how intensely a hypothetical fire could burn and its rate of spread, which in turn relates to the fire's resistance to control.

To develop the hazard analysis of the study area, a computerized Geographic Information System (GIS) was developed that identified the vegetation types of the East Bay Hills, categorized fuel hazard to provided baseline information for hazard assessment and modeled fire behavior. The GIS includes 8 different types of data:

1. Topography
2. Slope
3. Aspect
4. Geology
5. Soils

6a. Vegetation Types
6b. Vegetation Fuel Interpretation

7. Human Use of Land (population)
8. Infrastructure

The information in this system was compiled through a variety of existing data sources, photo interpretation, as well as field work.

Potential fire behavior was modeled by completing a fuel appraisal for the study area and utilizing information developed for the GIS. There is tremendous variation in structural development type and density, as well as vegetation composition, age and condition throughout the study area.

Two different systems were used to assess hazard. Fire behavior was used in assessing wildland fires involving vegetation, because they have been modeled and validated nationally over many years resulting in two widely recognized prediction or danger rating systems. Unfortunately, there is less information available on predicting fire behavior when structures are involved in wildland fires. Predictive models are under development, but until they are available a "proxy" approach must be utilized to identify fire hazard in the urban-wildland intermix. A method was developed for use in the urbanized portions of the study area that evaluated neighborhoods based on factors that relate to fire behavior, structural survivability and the ability to suppress a fire. These factors include structural materials, vegetation characteristics, neighborhood roads/ infrastructure and topography.

Impact of Changes in the Hazards over Time

The information produced by the hazard assessment using the Geographic Information System provides a snap-shot of the area at a given point in time. The GIS was designed to be an interactive system to accommodate periodic update of changes in the study area. It is helpful to anticipate the types and rates of changes in the hazards on a regional basis to plan for the timing of these updates.

Fuel changes over time as structures age, houses are remodeled, new housing developments are built, and as vegetation ages or receives vegetation treatment. By understanding natural growth, aging and succession patterns of vegetation, as well as the influence of cycles of drought, freeze, wet winters, damaging wind storms, floods and pest or disease infestations, relative changes in the overall regional hazards can be approximated. Tracking the actions made by private citizens complying with local structure and landscape ordinances also provide valuable information that can be used to adjust hazard assessment on a periodic basis.

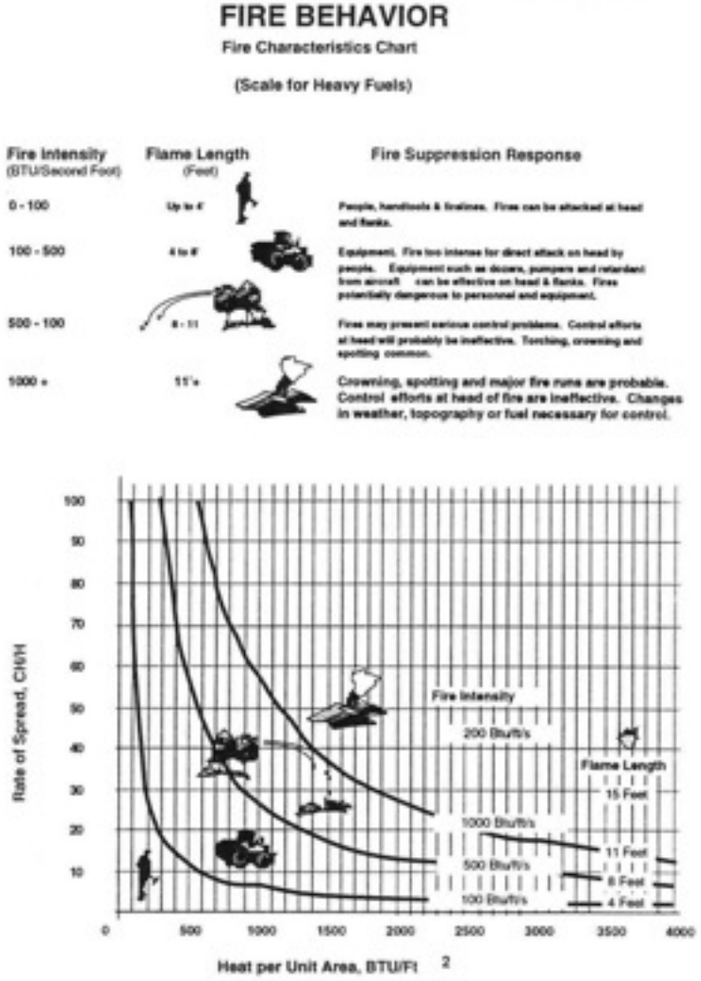
It is anticipated that the hazard assessment data in the GIS will need to be updated on approximately a five year cycle. The hazards in both the wildland and urban-wildland intermix will be reduced through the proposed mitigation programs. However, additional hazard areas will continue to develop in areas that were not identified now as targets for priority treatment.

Approximately 10,500 acres of the wildlands in the Study Area have been identified as being hazardous, with roughly 17% targeted for priority treatment. This assessment represents the hazards at the time of the field analysis in the Fall of 1993. It is expected that some vegetation in the study area will change at a fairly rapid rate. Areas fitting the following characteristics should be reviewed in the field on at least a three year interval to reassess their relative hazard and perhaps change their priority for treatment.

- Brush land encroachment in grasslands. The initial encroachment of Dry North Coastal Scrub into adjacent grasslands can rapidly change the anticipated fire hazards. Once brush has taken over the grasslands the relative change in development stages takes place over a longer time frame.
- Build up of leaf litter, pine needles and other organic duff in Eucalyptus and Pine Stands. Density, age and environmental conditions of the forest stands in the Study Area increase the likelihood of rapid build-up of fine surface fuels and ladder fuels that increase ignition potential and crowning potential.
- Invasion of exotic species such as french broom, pampas grass, blackberry or thistle. Grasslands and areas that have been recently disturbed, such as those receiving mitigation treatment, are prime candidates for rapid invasions of exotic weed species. Once established these species are very difficult to eliminate or even to slow their spread.
- Grasslands that are not actively managed should be reviewed on an bi-annual basis due to the potential for rapid vegetative growth, high ignition potential and natural succession.
- After winters with exceptionally heavy wind storms, floods or freeze, highly susceptible vegetation types such as Eucalyptus and Monterey Pines should be assessed for damage that increases ground fuel, fuel ladders or the overall fuel load of the area.

Wildland Hazards Assessment

There are two widely accepted wildland fire behavior prediction systems: The National Fire Danger Rating System (NFDRS) and the Fire Behavior Prediction System (FBPS) that uses the computer modeling program BEHAVE. NFDRS typically evaluates the approximate upper limit or most extreme wildfire behavior for a 24-hour period and is used as a guide for pre-suppression action in large areas. A system based on NFDRS was utilized in the 1982 Report of the Blue Ribbon Urban Interface Fire Prevention Committee that ranked hazard severity by vegetation type, slope and aspect. In contrast, BEHAVE predicts probable fire behavior and was designed to be used in directing suppression activities. Because of the finer resolution available, the FBPS and BEHAVE modeling were utilized to evaluate the wildland hazards in the study area.



The Hauling Chart provides a nationally recognized standard for mobilizing fire suppression forces. It has been used to establish an 8 foot flame length as hazardous conditions.

The BEHAVE modeling program considers the fuel available, topography and fire weather. Fuel in the study area was classified first by vegetation type through photo-interpretation and field verification. This allowed the study area to be categorized into one of the standard fuel models that were further customized through field analysis into development stages. This customization permitted the modeling of fire behavior in vegetation such as North Coastal Scrub and Eucalyptus where no standard models apply. It also provides the opportunity to predict the positive impacts prescribed vegetation treatments can have on anticipated fire behavior.

The fuel interpretation layer of the GIS documents the results of the BEHAVE modeling. The interactive system is currently "on-line" at the East Bay Regional Park District, but is available to all consortium members who have computer systems that can support ARCINFO GIS data. Potential fire behavior attributes are displayed by polygons of similar vegetation, fuel characteristics, and slope throughout the study area. Fire behavior attributes include flame length, rate of spread, heat per area and crowning potential. These attributes are used to prioritize hazard areas

for mitigation through the regional work program.

Wildland fires are a natural part of our ecosystems. Over half of the wildlands in the study area or approximately 10,500 acres (as shown on the following map *"High Hazard Areas in Study Area Wildlands"*) have the ability to produce dramatic fire behavior. Production of flame lengths over 8 foot and high crowning potential were identified as two critical components of fire behavior. The 8 foot flame length represents a nationally recognized standard over which erratic behavior and difficulty in control and suppression is anticipated. The VMC considered utilizing a 4 foot flame length as the hazard criteria which would have permitted hand crews to work fire suppression lines and further reduced the potential for crown fires. However at this time; due to the large amount of acres that meet that criteria, a 4 foot flame length would not help prioritize hazard areas.

High crowning potential refers to the probability of fire reaching the crown of much of the entire stand of trees or shrubs. Crown fires can lead to long distance spotting where burning materials become airborne and ignite additional fires well ahead of the main flame front. In the study area, all vegetation types except Mixed Hardwood Forest and Redwood Forests were capable of producing 8 foot flame lengths or greater. The actual flame lengths depended upon condition of the fuel type, development stage and slope. The primary vegetation types with high crowning potential included mature Pine Forests, Acacia and Eucalyptus that are either 20 years old or mature. High potential for crowning relates to specific stands, their fuel conditions and surrounding topography.

As a part of the ignition reduction program, the vegetation types also were evaluated for ignition potential and assigned a rating. The highest ignition potential in the study area is associated with many of the Grasslands, Monterey Pine Forests and all ages of Eucalyptus Forest. These are vegetation types that often have a high percentage of dry fine ground fuels present either as "flashy" grasses, natural duff or leaf/needle litter.

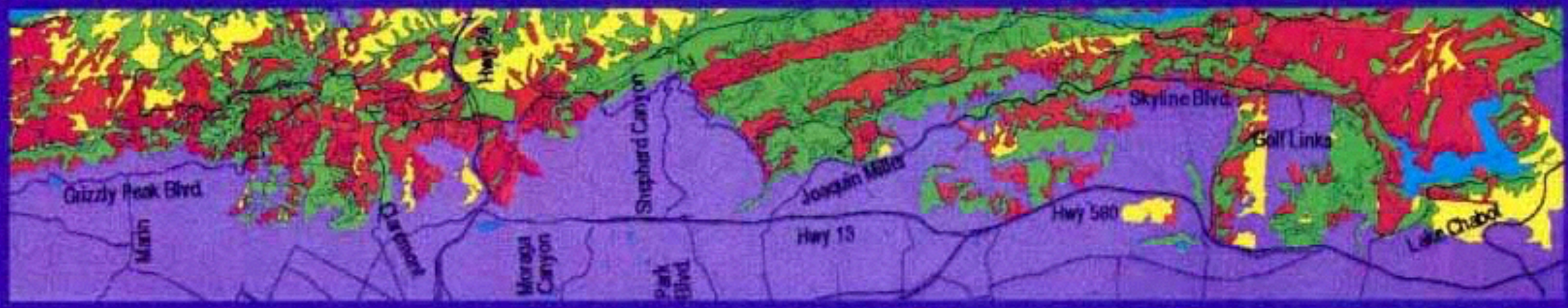
Wildland Vegetation Management

Approximately one-half of the study area can be categorized as wildlands. Over 1,000 acres of these lands are private property and will be mitigated through enforcement of local hazard abatement ordinances, such as the Model Ordinance. These properties must be managed to the same standards as the public wildlands. Local agencies undoubtedly will be requested to assist private land owners with large parcels to prioritize and plan mitigation and long term management strategies. The management of public lands offer a prototype for the privately owned wildlands.

Management of Public Lands

Wildland fuel hazard mitigation is an ongoing commitment. The regional work program promotes management of existing vegetation types. Conversion to alternative vegetation types is recommended only where repetitive treatment is unacceptable or where stand conversion is recommended in conjunction with other resource management goals. Continued

High Hazard Areas in Study Area Wildlands



Data from: GIS Laboratory UC Berkeley College of Environmental Design, 1994

- Trees with Flame Length >8' or High Crowning Potential
- Vegetation with Flame Length <8' or No Crowning Potential
- Shrubs with Flame Length >8'
- Urban Wildland Intermix - See "Hazards Rating in the Urban-Wildland Intermix" for Assessment
- Grasslands with Flame Length >8'
- Major Roads
- Streams or Lakes

management of the ridge top fuel break begun in 1973 with Federal Funding and addressed in the 1982 Blue Ribbon Report is recommended. Additional fuel modification areas are identified through the Methodology for Development of a Regional Work Program. The regional work program provides an area wide "measuring stick" to document and prioritize hazard areas, refine treatment prescriptions to protect site specific and natural and cultural resources, and monitor treatment goals, methods and results.

The top priority for treatment is given to high wildland fuel hazards located in a 500 foot wide buffer zone located immediately adjacent to urban development and to areas that could produce long distance spotting through crown fires. By focusing work adjacent to the area with the highest "Values at risk" the mitigation work can have the greatest impact on increasing safety to human life and property as described in the following sections. This buffer concept does not mean that hazards do not exist in other portions of the study area. It does serve to focus the available funds into areas where fuel modification can have the greatest impact.

Prioritizing Areas for Hazard Mitigation Treatment

The GIS has modeled fire behavior in the Study Area wildlands and a hazard criteria has been applied that identifies approximately 10,500 acres as high hazard. Realistically, it is not socially, environmentally, nor economically feasible to "treat" all of the wildlands in the East Bay Hills to mitigate the wildfire hazard. It is therefore necessary to prioritize those areas that can be treated effectively and that will provide the greatest reduction of risk in the most important areas defined as "values at risk." Values at risk" is a term used in the fire industry to identify those things or areas society values: homes or other structures, communication facilities, recreation areas, infrastructure improvements. "Values at risk" are commonly physical improvements with high economic value, but they can also include natural aspects that can be damaged or destroyed by wildfires.

A four part sequential process has been developed for prioritizing and assigning appropriate treatment prescriptions:

1. Identification of high hazard wildland areas.
2. Priority ranking for actions.
3. Refinement of the standard prescriptions for mitigation treatment.
4. Selection of preferred treatments.

It is not possible to eliminate the threat of wildfires by fuel mitigation treatments. By targeting for treatment those areas with fuels that can produce erratic fire behavior with tall flame lengths, a high potential for crowning and spotting, or a high ignition potential we can target the most hazardous conditions, increasing the ability to suppress and reduce the impact of wildfire. By focusing in the areas in a 500 foot buffer adjacent to "values at risk" and along regional evacuation routes we can further prioritize management actions to where they can have the greatest impact on protecting human life and property. Approximately 3,200 acres (17%) of the study area's 18,500 acres of wildland (as shown on the following map *"High Hazard Areas in Study Area Buffer"*) were identified to receive priority mitigation treatment consideration.

High Hazard Areas in Study Area Buffer

Data from: GIS Laboratory UC Berkeley College of Environmental Design, 1994

Trees with Flame Length >8' or High Crowning Potential

Shrubs with Flame Length >8'

Grasslands with Flame Length >8'

Vegetation with Flame Length <8' or No Crowning Potential

Urban Wildland Intermix - See "Hazards Rating in the Urban-Wildland Intermix" for Assessment

Major Roads

Streams or Lakes

AMPHION ENVIRONMENTAL INC.

EAST BAY HILL VEGETATION MANAGEMENT CONSORTIUM

Six criteria are used to evaluate hazardous areas and prioritize treatment.

1. Proximity to values at risk - priority is given to a 500 foot buffer established throughout the region.
2. Neighborhood hazard ranking
3. Predicted fire behavior - Flame lengths greater than 8 feet are given priority.
4. Crowning potential
5. Ignition potential
6. Proximity to regional emergency routes

This evaluation system assigns numerical ratings to establish a priority ranking for the vegetation polygons reviewed. This system provides a regional measuring stick to help prioritize actions. Where mitigation action is recommended, the system uses site specific hazard mitigation worksheets for each GIS vegetation polygon to serve as both a planning and tracking tool. These worksheets will be completed and updated over time as each year's action plan is formalized.

Prescriptions by Vegetation Type

Treatment prescriptions are identified by vegetation type. The treatment prescriptions developed for the region are grouped under eight major vegetation types -- listed from the most easily ignited and hazardous to the least. Each treatment prescription describes the vegetation type in general terms including species typically associated with the vegetation type. The primary fuel characteristics section of the prescriptions discuss the fire behavior and responsiveness to suppression, ignition potential, common characteristics and desired fire hazard reduction results. The treatments discuss special considerations such as anticipated environmental concerns and proposed mitigation, and review the potential treatment methods and limitations. Treatment performance standards are also established for each vegetation type that discuss the desirable actions and appropriate width of treatment areas. Treatment recommendations must be refined to be site specific and relate to not only the fuel load, but also to other factors such as local slope, proximity to residences, and road/ trail locations.

A buffer is established to give priority to mitigation of wildlands closest to the "values at risk" -- such as homes, public facilites, & emergency routes.

Grasslands

Grasslands cover approximately 20% of the wildlands in the study area with 601 acres identified for priority treatment. The tall, ungrazed grasslands were modeled as producing flame lengths ranging from 12 to 38 feet that could overwhelm suppression forces. The critical concern in this vegetation type is the rate of spread and ease of ignition with grasslands acting as a vector to ignite other vegetation types. This is one of the most dangerous wildfire types for fire fighter safety due to its rapid frontal spread.

Fortunately grasslands are very responsive to suppression activities and mitigation. Management of relatively narrow strips of grassland 30 to 100 feet wide by cutting grasses to a maximum of 4 to 6 inches will result in the "laying down" of the fire as it reaches the

Grasslands are easily ignited resutling in fires that can spread rapidly. Fortunately fire in grasslands respond to treatment of relatively narrow strips

treated areas. Production of airborne embers ahead of the flame front is not typical due to the rapid rate of spread. It is also important to maintain grasslands to keep brush encroachment to less than 30% cover. After treatment the grass areas should display fuel characteristics of either Fuel Model #1 Short Grass (low) or Model #3 Tall Grass (low) with either short grass heights or patchy continuity of taller grasses with minimal dead stem wood.

A number of the grassland types in the study area contain species of special concern such as perennial grasslands or serpentine grasslands.. Treatment methods will need to be modified where these species are identified. This modification may include delaying cutting until after the seeds have set. Potential treatment methods include hand labor (weed whipping), grazing, prescribed fire, mechanical mowing and roadside chemical treatments. Each of these treatments have limitations and restrictions on where they can be used effectively.

Brush & Scrub Dominant Communities

Four vegetation types are recognized in this category that occur in the study area and together account for approximately 24% of the wildlands.

North Mixed Chaparral while the most hazardous from a fire behavior standpoint, occurs in very small quantities throughout the hills (approximately 0.3% of total wildland vegetation with 43 acres identified for priority treatment).

North Coastal Scrub consists of both communities found on dry site, common throughout the hills comprising of 18% of vegetation, and less common mesic or wet sites (2%). 740 acres of Dry North Coastal Scrub and 162 acres of Wet North Coastal Scrub were identified for priority treatment.

Successional Scrub describes the stage of natural succession between scrub land and one of the woodland vegetation types. Successional Scrub accounts for approximately 5% of the study area wildlands with 304 acres identified for priority treatment.

Exotic shrubs and perennials are found intermixed with many of the vegetation types. Relatively pure stands of Acacia and French Broom were found in 2 locations in the study area (comprising less than 0.1%, but all 12 acres are identified for priority treatment).

All of the brush communities have fire behavior with flame lengths over 14 feet, with the high development stages of North Mixed Chaparral and Dry North Coastal Scrub having the potential for flames reaching 69 feet. Many of these species are difficult to

Dry north coastal scrub is the most common brush commnity in the study area and can produce drammatic fire behavior.

ignite. However, once ignited fire in these communities is difficult to suppress due to the dense stands and presence volatile oils that make them burn faster and hotter.

There is a high occurrence of species of special concern in these vegetation types. While many populations have been located, it is unlikely that all populations in the study are have been identified. Treatment recommendations take into account the environmental considerations and place limitation on the recommended methods to protect the specimens yet remove dead fuel. Hand labor, grazing, prescribed burns and mechanical methods as well as the performance standards emphasize reducing the fuel volume without removal of entire specimens. Recommendations encourage the limitation of brush encroachment into other vegetation types by more aggressive treatments, that still protect desirable specimens such as young oaks, to maintain open grasslands or speed succession into the woodland communities.

In shrub areas that do **not** contain species of special concern, the treatment recommendations focus on removing dead materials and litter and crushing the brush to maintain a maximum standing height of 3 feet. If taller shrub height is desirable, the area should be broken into islands that are separated by either crushed brush or mulch. The width of the treatment area varies from 100 to 500 feet wide depending upon slope conditions and fuel characteristics and includes a transition area where the amount of treatment is feathered from fully treated to no treatment. Where species of special concern exist, such as the rare Alameda manzanita, the treatment recommends careful removal by hand of dead materials. In areas of exotic species the entire shrub polygon will need to be maintained aggressively in order to control the spread of invasive specie. It is anticipated that a treatment cycle of 3 to 5 years will be required to maintain the brush and scrub dominant vegetation types to meet the classification of Fuel Model #4 Chaparral (low).

Eucalyptus Forests

Large plantations of Eucalyptus occur in the study area and represent approximately 12% of the wildland vegetation. These dense stands have been managed over the year to result in three distinct vegetation types.

Mature Eucalyptus forests are the stands that have never been cut and account for 36% of the Eucalyptus. They have a poorly developed understory consisting mainly of young Eucalyptus with annual grasses and other introduced species such as Acacia and Monterey Pine at the edges. 162 acres have been identified for priority treatment representing about 20% of the total mature Eucalyptus in the study area.

Second Growth:

20 year Eucalyptus. Approximately 60% of the Eucalyptus in the study area were cut in the last 20 years for fire wood production or removal of freeze damage. Subsequently these trees have resprouted or "coppiced" and now appear as mature trees with multiple stems from a single specimen and form a major fire concern.. 950 acres have been identified for priority treatment representing about 69% of the total 20 year Eucalyptus in the study area.

Pampas grass and broom, common exotic shrubs, are invasive especially in disturbed sites. Treatments must include subsequent control of these species.

1-5 year Eucalyptus. More recent treatment of the Eucalyptus account for the last 4% of the Eucalyptus in the Study Area. These are trees that were cut in the last 1 to 5 years and have resprouted. These trees also have multiple stems from a single specimen as well as a larger amount of leaves and suckers at lower levels. 95 acres have been identified for priority treatment representing about 51% of the total 1 to 5 year Eucalyptus in the study area.

Fire behavior in the Eucalyptus varies from relatively low flame lengths of 6 feet up to 21 feet depending upon depth of litter in and below trees, amount of dead materials within tree, stand density and understory mix. The ignition potential of all of these forests is very high and directly related to the depth of litter and dead materials on the ground. **A continuity of fuel from the ground to the crown of the forest presents the greatest hazard** with approximately 900 acres in the study area with high crowning potential.

These forests are non-native and support a low diversity of species. Long term replacement by native hardwood forest or other less flammable vegetation community is generally desirable, though the transition is recognized as disruptive. Prescriptions include removal of ground fuels to reduce crown fires, thinning, and removal of high hazard specimens. Specific planning and mitigation measures have been identified to address the special environmental considerations relating to raptors, especially nesting birds, and potential for wintering Monarch Butterflies.

Treatment methods, limitations and standards emphasize removal of leaf litter, dead materials, fuel ladders, stand density reduction, as well as follow-up treatment to ensure trees are monitored to eliminate stump sprouts. Hand labor, prescribed burns, mechanical cutting and chemical follow-up treatment of stumps are discussed as potential treatments. It is critical that any conversion process attempts to maintain needed nursery trees to encourage the succession of native oak woodlands in ravines and on north slopes where it already is in progress. Conversion to grasslands with scattered oaks on southern or western facing slopes and ridge tops may also be possible where it is part of eco-system rehabilitation project.

Where high crowning potential exists, the entire forest will need to be treated to reduce the spread of fire to the tops of trees by removal of fuels on the ground, young trees less than 12 inch diameter and fuels in the lower ten feet of the trees. It is important to maintain canopy closure to reduce invasion of weedy species after treatment. In some locations there may be a rich understory of native species that

Mature Eucalyptus forests with widely spaced single trunks and little ground litter (left) represent a lower fire hazard than the multiple stem second growth.

Second growth Eucalyptus forests characterized by multiple trunks, ladder fuels and large quantities of fine materials present high risks of ignition, fire spread and spotting.

may serve as a basis for conversion to an alternative fuel type. A choice must be made to manage for either the emerging forest or the existing canopy of eucalyptus. Young eucalyptus (1-5 year) should be removed while it is still relatively small and easy to remove. It is anticipated that eucalyptus forest will need treatment ever 2 to 3 years (perhaps even annual treatment in the dense, productive stands) to maintain them as either fuel Model #8 Closed Timber Litter, Model #9 Hardwood Litter (High) or Model #10 Timber Litter Understory (Low).

Monterey Pine Forest

Monterey Pines were introduced to the study area in the 1900s and occur as mature groves, in dense plantations and mixed with Eucalyptus. Open stands often have a well developed understory of Oaks, Bays, Poison Oak and Blackberry.

This vegetation type accounts for approximately 6% of the study area wildland vegetation. A relatively small amount of the mature Pine Forest and mixed mature Pine and Eucalyptus are targeted for priority mitigation (total of 18 acres). None of the pine forest plantations currently represent a hazard as far as flame lengths and crowning are concerned. However, all of this vegetation type has a high potential for ignition if the needles and surface fuels are not removed on a regular basis.

Monterey Pines in the Study Area vary in age, but many are old and diseased (left) increasing fire hazards.

Much of the species' population is aged and showing signs of decline. Many of the individual trees are approaching the end of their natural life cycle and should be replaced with other species as they are removed. It is likely that a larger proportion of this vegetation type will need to be managed in the near future for both structural and fire hazards. Public agencies and private land owners who manage a large number of aged pines will need to decide if these trees should be removed while structurally sound with wood that has commercial value that can offset the cost of removal, or if they prefer to wait until the individual trees begin to decline when the owners will end up paying significant cost for removal. In many locations as the trees age, there are serious liability issues related to trees falling on adjacent houses, cars, people or powerlines.

The fire behavior modeled varies from flame lengths of 2 feet to 16 feet depending upon understory conditions, development stage and slope. **These vegetation types have the highest ignition potential due to the presence of needles, hazardous understory and dead wood on the ground and lower portions of trees.**

Monterey Pine Forests in the study area are not essential for any known species of special concern that would suggest special management requirements. Aesthetically however, these forests are dominant in the landscape, with strong community support. Recommended treatment methods include grazing or prescribed burn to remove understory materials. Hand labor or mechanical cutting can be used to remove dead materials, selectively thin or remove hazardous aged stands. Treatment performance standards include reducing the overall stand density, removing dead materials, creating 10 feet vertical clearance between live needles and understory fuels and where appropriate encouraging succession of

native oak woodlands to replace the Monterey Pines. It is important to maintain canopy closure where possible to reduce invasive species after treatment. It is anticipated that treatment may occur on a 3 to 5 year basis to maintain stands as a fuel Model #2 Timber Grass (Low), Model #8 Closed Timber Litter, Model #9 Hardwood Litter (High),or Model #10 Timber Litter Understory (Low).

Mixed Hardwood Woodlands & Forests

These woodlands and forests are the most common vegetation type in the study area covering 27% of the study area wildlands. This vegetation type includes a mix of tree species such as Coast Live Oak, California Bay, Buckeye, Black Oak and Madrone. Woodlands have from 30 to 70% shrub understory and include many of the species categorized as Successional Scrub. Forests include little understory and have a greater than 70% canopy closure. The modeled flame lengths vary from 1 foot to 34 feet depending upon the understory vegetation. The forests with closed canopies and relatively little surface fuels represent very low hazards. Ignition potential is moderate due to the effects of canopy cover. Fire behavior in this vegetation type is depending on the build-up of surface fuels and dead materials within the tree that can carry fire to the crown.

Mixed hardwood woodlands typically include a dense brush layer that should be reduced to improve fire safety.

Approximately 116 acres of Mixed Hardwood Woodland (13%) have been identified for priority mitigation treatment. A number of species of special concern occur in Mixed Hardwood Woodlands and Forests often at the edges bordering brush and grasslands. The mitigation and monitoring recommendations outlined in those communities also apply to the treatments in the woodlands and forest. Hand labor, grazing and prescribed burns are recommended with special protection measures in order to reduce the build up of understory fuels. Mechanical equipment may be suitable to reduce adjacent brush encroachment but was not viewed as a common technique in this vegetation type. The performance standards highlight the need to maintain canopy cover and encourage species diversity of tree and understory while reducing the overall fuel load. The identified hazards should continue to reduce as the surface and ladder fuels are removed and the woodlands succeed into Mixed Hardwood Forests. It is anticipated that treatment will be required on a 5 to 7 year cycle and begin to taper off as the woodlands succeed into a closed canopy forest that meet the characteristics of Fuel Model #8 Closed Timber Litter. Until that time they should be maintained as Fuel Model #4 Chaparral (low), Model #2 Timber Grass (Low), Model #9 Hardwood Litter (High) or Model #10 Timber Litter Understory (Low).

Redwood Forest and Riparian Forest

The last two vegetation types in the study area represent relatively low fire hazards. Redwood Forests comprise approximately 9% of the wildlands in the Study Area, with Riparian Forests accounting for less than 0.4%. Both communities were modeled with fairly benign flame height varying from 2 feet up to 7 feet in the most extreme development stage on steep slopes and with a large build up of ground fuels.

Neither of these communities are recommended for treatment as both represent low fire hazards and often occur in environmentally sensitive settings. Hand labor was the only recommended technique should site specific areas of fuel buildup require mitigation. Prescribed burns may be utilized in redwood forests with a low intensity fire to remove litter build-up especially in open stands.

Redwood Forests and Riparian Forest represent relatively low fire hazards in the Study Area.

Urban-Wildland Intermix Hazard Assessment

There is no existing modeling program to predict fire behavior where urban development is predominant or intermixed with relatively few areas of wildlands. The computer modeling program BEHAVE was not utilized since its supporting fuel models do not recognize structures nor differentiate between vegetation common to our domestic landscapes. In these areas a proxy approach was used to identify the factors that relate to fire behavior, house survivability, and the ability to suppress a fire. Two categories were used to identify widely recognized contributing factors:

1. Structural Materials: Investigators classified the percentage of wood roofs and wood siding/decking materials.
2. Vegetation: The amount of "defensible space" clearance was identified as well as 5 critical components. Investigators classified the general surface fuel density, aerial fuel density (canopy cover), vertical continuity/ ladder fuel density, tree height and dominant vegetation fuel species flammability index.

Relative hazard was established by field investigation that evaluated the developed portions of the study area based not on the conditions of an individual property or structure, but on the characteristics of "neighborhoods." The investigating team evaluated groups of structures to establish "neighborhoods" of similar physical attributes. These neighborhoods generally do not correlate to the socially recognized neighborhoods except where the structures and landscapes were developed and maintained with similar features. In most cases the "neighborhoods" represent a cluster of structures and landscapes with similar fire hazard characteristics.

The rating system includes a weighted ranking to provide appropriate emphasis on the most critical factors based on fire behavior and structure survival. The relative weighting assigned to each factor is:

Roofs	75%
Siding & Decking	25%
Subtotal Structure Components	**100%**
Overall Defensible Space	25%
Surface Fuel Density	25%
Aerial Fuel Density	10%
Vertical Continuity	20%
Tree Canopy Height	10%
Dominant Species Flammability	10%
Subtotal Landscape Components	**100%**

The rating system results in three categories of relative hazard that combine to assess the neighborhood's potential role in fire: moderate

Structural hazards are evaluated based on the amount of wood roofs & wood siding/ decking in neighborhoods.

The urban wildland intermix is evaluated for structural & landscape hazards to allow each "neighborhood" a unique mitigation response.

hazard, high hazard and extreme hazard. These classifications are shown on the following two maps *"Structure Hazards Rating in the Urban - Wildland Intermix"* and *"Vegetation Haards Rating in the Urban - Wildland Intermix."*

The hazard classification system developed for the urban portions of the urban-wildland intermix provides the ability to identify the specific factors contributing to the overall hazard levels. The mitigation response in each neighborhood can be unique based on its conditions. The assessment system can be further refined to be utilized by individual property owners. Actions can target the most threatening situations in each neighborhood to reduce the overall fuel contribution, slow the spread of fire by eliminating flammable wood roof shingles and other materials with a high

Landscape hazards are evaluated based on such components as density of surface fuel, defensible space and aerial fuel.

spotting potential, as well as increase the potential for survival of an individual structure. The classification system can be further utilized to target life safety issues in densely populated areas to develop appropriate fire tactics response plans.

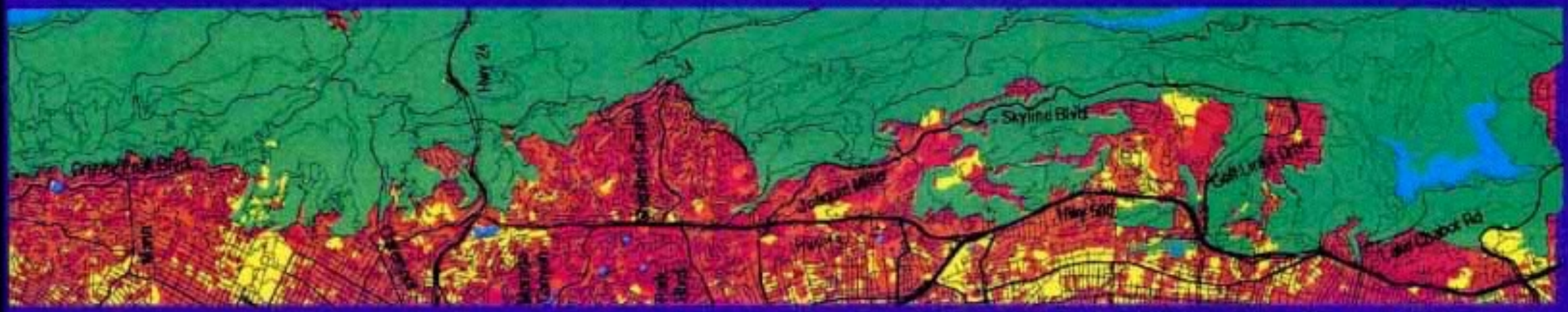
Mitigation of Hazards Related to Private Structures and Landscapes

Approximately two-thirds of the study area is privately owned. Most of this area has been urbanized and includes private residences and landscapes. Pockets of commercial/ retail and private institutions are scattered through the region. **It is apparent by their sheer numbers that private homeowners, business owners and directors of private schools, churches and other institutions must play an active role in hazard mitigation.** The mitigation programs for private lands balance private property rights with the social and legal responsibilities for all owners to maintain their lands reasonably free of dangerous conditions.

Two mitigation programs are aimed at private property: a model ordinance and retrofit standards. The model ordinance will need to be adopted by each agency to modify their existing codes as required. The incentives and enforcement that are recommended must also be modified to conform with each jurisdiction's powers. The retrofit standards provide additional recommendations for individual homeowners interested in mitigating specific structural or landscape hazards identified in their "neighborhoods." Many of these retrofit elements are important components of education programs, but are not suitable for inclusion in the ordinance or other regulations.

During the development of these programs public input was gathered through a series of 5 widely publicized community workshops. The participants were asked for their input on the model code topics, as well as to discuss potential triggers when each standard would apply. This input was factored into the development of the ordinance. However, the VMC will need to continue to coordinate with local civic leaders, politicians and individual city departments to develop public acceptance and compliance with these mitigation strategies.

Structure Hazards Rating in the Urban -Wildland Intermix



Data from: GIS Laboratory UC Berkeley College of Environmental Design, 1994

Extreme Hazard

High Hazard

Moderate Hazard

Study Area Wildlands - See High Hazard Areas in Study Area Wildlands for Rating

AMPHION ENVIRONMENTAL INC.

EAST BAY HILLS VEGETATION MANAGEMENT CONSORTIUM

Vegetation Hazards Rating in the Urban -Wildland Intermix

Data from: GIS Laboratory UC Berkeley College of Environmental Design, 1994

Extreme Hazard

High Hazard

Moderate Hazard

Study Area Wildlands - See High Hazard Areas in Study Area Wildlands for Rating

AMPHION ENVIRONMENTAL INC.

EAST BAY HILLS VEGETATION MANAGEMENT CONSORTIUM

Model Ordinance

As a part of the preparation of the model the VMC reviewed the various existing ordinances in the region as well as throughout the United States. The model incorporates many of the findings from that review and develops an integrated approach to addressing hazards related to both landscapes and structures.

The model ordinance consists of four major sections *(see Appendix 2 for complete ordinance)*:

1.00 General Provisions
2.00 Special Provisions for Landscapes
3.00 Special Provisions for Structures
4.00 Special Provisions for Compliance

The special provisions for landscapes include the requirements and standards for establishment of defensible space, storage of flammable and combustible materials and garden structures. These requirements apply to the entire parcel regardless of lot size or land use.

The special provisions for structures includes a requirement for removal of combustible roofing within 7 years of adoption of the ordinance provided the recommended incentive programs are in place. Additional standards for structures include requirements for roofing, re-roofing, spark arrestors, roof overhangs, exterior siding materials, projections, windows, smoke detectors, and interior fire sprinklers.

The Special Provisions for Compliance address the determination and notification process, inspection and compliance processes as well as actions taken for non-complying sites. **Each jurisdictions will need to work with property owners to develop strategies for reducing their fire hazards that fit their community's needs.**

Retrofit Standards

Retrofit standards were established for the major components of both structures and landscapes in the urban-wildland intermix. These standards provide technical background information for the model ordinance and discuss future technology, strategies and techniques for mitigating the hazards in the study area.

The model ordinance recommendations for the creation of defensible space can be aesthetically pleasing

Each component identified appropriate hazard reduction goals and reviewed the current state of the art such as applicable codes and standards, testing criteria, effectiveness and acceptance. The development of these standards looked at the types of materials, methods or techniques, optimum applications or relevant circumstances as well as the potential for future technological advances. Finally the standards reviewed the relative costs and benefits assessing priority, costs , both initial and life cycle, as well as the pros and cons of implementation and environmental considerations.

The retrofit standards were reviewed for the following components:

Landscape Measures
Defensible Space
Plant Materials
Garden Structures & Other Elements
Irrigation
Garden Maintenance

Exterior Structure Measures
Roofing
Exterior Finish Materials
Projections
Roof Overhangs
Windows
Vents
Spark Arrestors
Exterior sprinklers
Technological Fire Barriers and Suppression Systems

Interior Structure Measures
Smoke Detectors
Interior Fire Sprinklers

Model Ordinance recommendations are proposed to apply to both private and public properties

Other Hazard Mitigation Programs

Public Policy & Administrative Programs

There has been increasing evidence of the heightened awareness among civic leaders since the October 1991 Tunnel fire and those that blazed through Southern California in the Fall of 1993. A wide variety of public policies, ordinances and State legislation have been successful enacted and more are in the "pipeline." It is critical that public programs continue to provide the institutional memory regarding fire hazard and mitigation. Public leaders must maximize windows of opportunity as they arise, spin off of other projects and search out shared goals to promote education and mitigation programs regarding fire in the urban-wildland intermix. Several grass roots programs have developed in the East Bay Hills through individuals and community groups. It is important that hazard reduction programs pursue multiple tracks and that they include changes in public policy and activities.

Coordination with Fire Safety Elements

The Plan's response to the fire hazard in the Urban Wildland Intermix has a multitude of components. The variety of fire safety elements require a concerted coordination effort to understand how these components interact. Continued intra and inter-departmental communication within the VMC members' organizations is critical to coordinate the programs managed by Fire, Parks, Planning, City Manager Office, Emergency Services, Operations and others. Fire Safety programs in the region include:

Red Flag Weather warning system using the local Remote Area Weather Stations (RAWS) that are managed by the East Bay Regional Parks District.

Mutual Response Areas and mutual aid agreements through local fire departments, State Office of Emergency Services and the California Department of Forestry and Fire Protection.

Emergency response/evacuation programs such as in Berkeley, Oakland and El Cerrito that train citizens for emergency response.

Fire Assessment District Programs in Berkeley and Oakland that encompass fire hazard inspections, education programs, fire watch patrols during extreme weather and vegetation/fuel reduction programs.

Use of prescribed fire as a mitigation method provides the opportunity for shared equipment and expertise among VMC members

A variety of planning groups are active in the East Bay Hills and surrounding region. The VMC has made connections with the following groups and should continue to coordinate with :

East Bay Fire Chiefs Consortium. Representatives of 17 fire districts from Richmond to Fremont.

Alameda County Emergency Managers Association.

Coastal Region of the State Office of Emergency Services.

State mandated requirements provide two major allies for coordinating local hazard mitigation programs -- the General Plan and Subdivision Map Act requirements set out in the Government Code, and the Standardized Emergency Management System (SEMS) required by Senate Bill 1841. Both of these laws apply to all California Counties and Cities.

The VMC provides a vehicle for coordinated contracting and use of specialized equipment.

State law requires that the General Plan include a Safety Element for the protection of the community from any unreasonable risks associated with wildland and urban fires among other hazards. Recent court decisions have strengthened the authority of this planning document. A model sub-element addressing issues of concern in the East Bay Hills and recommending potential policies and implementation measures was prepared as a part of this plan. This model also addresses the requirements of SB 1841 which calls forinteragency coordination when multiple agencies respond to and manage emergencies and disasters that involve several jurisdictions. In order to be eligible for reimbursements of response related personnel costs under disaster assistance programs, each local jurisdiction must follow SEMS by December 1996. The fire hazard in the urban-wildland intermix is clearly one of the hazards that must be addressed in this planning/response effort.

Ignition Reduction Program

Fire mitigation planning needs to not only understand the hazards related to potential fire behavior, but also the risk and potential sources of ignition. The ignition reduction program for the East Bay Hills identifies the high risk associated with human activities and uses, as well as the region's fire history. It targets campgrounds, barbecue and picnic areas, rifle ranges, schools sites, power distribution lines, roadways, trails and parking areas as potential ignition sites. It also looks at special events or seasonal activities, such as fireworks or event parking, that increase the risks.

Fuel reduction along roadsides, trailheads, parking lots and other areas with high levels public activity is recommended to reduce ignition potential

Ignition reduction treatments are proposed to match both the surrounding vegetation and the ignition history of the area. Vegetation treatments are only one part of the mitigation and must work in conjunction with other policy or physical changes and public education. Changes to policies and practices may include park closures, no barbecue days and increased patrols during red flag days (periods of high risk of ignition). Programs to education the public about the potential causes of fire in the urban-wildland intermix need to include both information on preventing ignition and on early

detection. These educational programs should target not only home owners, but special event organizers, park visitors, equipment operators, volunteers and schools. They should be increased during high hazard conditions, but should also be part of an ongoing comprehensive program.

Public Education and Involvement

It is clear that to effectively mitigate the fire hazards in the region a partnership will need to be forged by public agencies, cities and special districts with the individual homeowners, local businesses and professionals. Many VMC members and associates are involved in public education. During the preparation of this plan, a network was formed to provide on-going coordination for outreach programs in the region. The universal challenge faced by these education efforts is the ability to capture public interest and develop and maintain public involvement and support.

An overview of a comprehensive regional education program was prepared as a part of the plan. It identified that the program must be regional in nature, communicate the principals of fire safety and proposed ordinance requirements, and compel its audience to adopt appropriate actions. The primary objectives of the program are to:

1) Inform or raise general awareness.
2) Gain political, intellectual, emotional and fiscal support.
3) Answer questions and disseminate knowledge.
4) Provide skills transfer by demonstrating important techniques.
5) Influence behavior and cause audience to modify their actions.

Adoption of any new idea can be broken into 4 major steps as developed from the work by Ron Hodgson at California State University at Chico. The education program recommends components that continually address each step since at any moment in time audience members may be at any one of the stages of adopting the information. These steps include:

1) Awareness - The first step captures an individuals attention and tells them the about the program.
2) Attitude Formation - Once aware of the issue, it is important to show how it applies to each individual.
3) Decision making - Now its time to get commitment -- to show that it is beneficial to take action.
4) Implementation and Confirmation -- Finally its critical to address specific problems faced by the audience and provide confirmation for actions taken.

The education program overview identifies the educational activities in the region and categorizes them by sponsoring agency, communication methods, target audience and a number of other factors, as well as matching them to the four adoption stages. Potential programs to fill several information gaps in the existing programs are also recommended. VMC members continue to be involved in the development of curriculum and content of many of the programs.

Fuel Modification Zones, Fuel breaks, Greenbelts and Fire trails

Both public and private areas identified to receive fire hazard mitigation treatments join to form a system of fuel modification zones, fuel breaks, green belts and fire trails that protect

the region from fire in the urban wildland intermix. The greatest protection possible is gained by focusing these treatments on areas adjacent to neighborhoods, critical facilities and emergency routes, and providing areas of reduced fuel as a buffer for suppression actions as outlined in the sections addressing mitigation in Wildlands and the Urban Wildland Intermix.

Fuel Modification Zones

Fuel modification zones are those areas that are managed to reduce the overall level of fire hazard by manipulating the existing vegetation. Treatment focuses on removing the build up of dead fuels, thinning dense stands of trees and removing understory materials that create fire ladders (continuity from ground fuels into tree crowns). The mitigation is aimed at reducing the potential flame lengths to under 8 feet and eliminating crowning potential. While fire may still occur in these treated areas, it should be easier to suppress and produce less damage.

Throughout the East Bay Hills 500 foot wide buffers have been identified as priority fuel modification zones or mitigation treatments areas in the wildland portions of the study area. The final size of the treatment areas within these buffer will vary depend upon surrounding development, vegetation type, development stage and slope. Fuel modification zones are usually wider than fuel breaks in order to achieve the required effectiveness. However, they are often more acceptable to the public as they are more natural in appearance and incorporate other concerns, such as aesthetics and biodiversity.

Fuel Breaks

Fuel breaks are mosaics of grasslands, shrubs and trees and are from 100 to 300 feet in width depending upon the surrounding terrain and vegetation. Narrower fuel breaks have more limited effectiveness even if located on ridge tops or other strategic positions. Fuel breaks must be strategically located to provide their full effectiveness in slowing the advance of wildland fires by reducing fire intensity and resistance to control. Thevegetation is modified to reduce the overall amount of fuel by modifying the type and arrangement. Fuel breaks concentrate on the rearrangement of existing vegetation. Selective removal creates "islands" of taller shrubs and trees. Removal of the most hazardous specimens is balanced with the goal of maintaining the overall diversity of vegetation types and habitat value.

The Blue Ribbon Report from 1982 created 25.5 miles of ridge top fuel breaks including 13.8 miles that are managed by EBMUD, EBRPD, UC Berkeley and the City of Oakland. An additional 6.8 miles of these ridge top fuel breaks include private property (the remaining 4.9 miles were considered low hazard areas). Much of the identified fuel break had been constructed in 1973/ 1974 after the winter freeze of 1972 that damaged ridge top eucalyptus. Most of the 25.5 mile Blue Ribbon fuel breaks also fall within the 500 foot buffer identified in this study as priority wildland treatment areas.

The Blue Ribbon Report recommendations were based on the assumption of a wildland fire

Manual labor is the most selective of mitigation treatment techniques and is appropriate for many locations within the fuel modification zones.

starting in park or public open lands east of the major ridge line and moving west towards the urbanized areas. The proposed locations are effective for this fire scenario and should continue to be maintained. However, the existing system of fuel breaks does not address fires spotting into the urban areas or those fires that start in the wildlands east of the ridge. The current priorities focus on the areas adjacent to urban development, as well as reducing the fuel loads within the residential areas related to structures and landscapes.

Green Belts and Fire Compatible Land Use

Green belts include areas used for recreation and other activities and generally receive a higher level of maintenance and irrigation. These may include golf courses, cemeteries, school yards, and recreation areas where fire hazards are reduced due to vegetation management, construction type or design to accommodate these other uses. Privately owned greenbelts may be a compatible land use depending upon their design and maintenance. This open space is often established for recreation or aesthetic purposes and may not consider fire hazard in the original design. Greenbelts are often heavily landscaped with ornamental or native plants and may not be interconnected or strategically located for fire safety.

The plan recognizes the existing greenbelts and encourages more. However, the plan does not recommend any specific locations for additional greenbelts since these features are usually a part of larger overall development project for recreation or residential purposes. Future proposals for projects should address fire hazards and may incorporate greenbelts as appropriate mitigation measures for changes in existing land uses.

Fire Trails

The VMC members currently maintain over 125 miles of fire trails that form an interconnected system of roads that provide access through the wildland areas. These trails have been categorized by the multiple uses of observation, fire suppression activities, emergency access, or recreation. The placement and location of a few of these trails serve as a narrow firebreak, as well as access route. Adjacent vegetation must be managed to provide an access corridor with both horizontal and vertical clearance. Removable barriers restrict unauthorized vehicular access.

Not all trails through open space can be used during fire suppression efforts -- location, vertical and horizontal alignment, vegetation clearance, surface maintenance (erosion, drainage, edge treatment etc.), length, width, turnouts, position on slope were considered prior to the designation of a trail as a fire trail rather than one suitable for patrol or observation.

Regional Work Program

The Plan has focused on laying the groundwork for the development of a **regional work program** and divided the study area into Resource Management Units (RMU) that encompass watersheds rather than following jurisdictional boundaries. Most of the high hazard polygons identified by the GIS clearly fall on lands owned by a single public agency, city or on private lands. However, there are several areas in the East Bay Hills where a multi-jurisdiction approach is the best solution to hazard mitigation since the high hazard areas overlap ownership boundaries or the sensitivity of the resource is best dealt with in a coordinated process. Two such areas are:

Portions of the Strawberry Canyon, Claremont Canyon, Siesta Valley and Tunnel Canyon resource management units are managed by EBMUD, EBRPD, UC Berkeley and City of Oakland. This area historically has a high frequency of fire and includes the environmentally sensitive Caldecott Tunnel Wildlife Corridor.

The ridge line above Shepherd Canyon and near Pinehurst Road includes property managed by EBMUD, EBRPD, City of Oakland and PG&E.

There are also many cases of high hazard areas overlapping 2 jurisdictions such as Joaquin Miller and Redwood Regional Park; Tilden and San Pablo Watershed; Moraga Canyon; Davies Stadium; Knowland Zoo and Chabot Regional Park; Oakland Municipal Golf Course and Chabot Regional Park. These areas offer the opportunity for specific cooperation between VMC members to address the hazards in portions of the study area.

The plan has identified common mitigation practices and established standards for their use. The resources available in the region have also been identified and categorized in terms of expertise, personnel and specialized equipment. These resource inventories establish the foundation for allocation to a regional work program. The funding and detailed definition of each years program will need to be resolved as the VMC continues to refine future work.

An interim work program was established for 1994- 1995 during the development of the plan. Joint negotiations with the sole source goat herder for the region proved successful. Discussions among VMC members will continue to resolve outstanding details, such as wintering of the herd, to improve the effectiveness of that mitigation technique. Joint inter-agency prescribed burns were also planned and completed. Other opportunities exist for interagency cooperatives for negotiation with contractors who operate specialized equipment to spread the expense of mobilization to the region over a broader job base.

Funding & Implementation

Identification and development of regional support for implementation is a primary role for the VMC. The network established among the VMC members offer a superior clearing house to target funding sources and be able to capture grants and other sources of matching funds. It is anticipated that the application of those funds to regionally focused programs may be the deciding factor for support from many of the funding agencies.

Federal Support & Involvement

The Federal Emergency Management Agency has been supportive in funding the development of the regional plan and have made offers of financial support for mitigation programs. The funding application procedures should be pursued on a regional basis by the VMC. The emergency services organizations are beginning a trend in both government and private sectors, such as the American Red Cross, to provide

Selective cutting to remove hazardous trees is recommended throughout the study area.

Prescribed fire has the potential for understory fuel reduction in some Study Area locations

funds for preparedness and mitigation of hazards and not just the traditional response and recovery.

The Federally funded 1990 US Farm Bill provides for a State run program called Stewardship Incentive Program aimed at private landowners. In California this program is managed by the Forestry Assistance Program of CDF. The program encourages active management of all forest land for multiple resource benefits and can be used for fire mitigation programs that also enhance wildlife habitat, or provide soil and water protection and improvement. The minimum land size is 20 acre minimum plan size with 10 acre minimum per landowner which can include groups, associations or corporations. This cost share is a reimbursement rate of 75% maximum with a $10,000 cap per owner per year. The program requires a ten year land use agreement.

State Support & Involvement

The State of California has also been supportive in funding the development of the plan through their Office of Emergency Service.

At the state level there are also several new pieces of legislation under review that will provide support for the East Bay Hills plan.

AB 3819 (Willie Brown) - This new Bill was passed in Fall of 1994 and requires Class A roofs in all very high hazard areas. It strengthens two pieces of existing legislation that were passed 1992 and are currently in effect:

The existing AB 2131 only requires a minimum class C roof for all new and reroofing throughout California and must be met by July 1, 1995.

The existing AB 337 (Bates) currently only requires a minimum class B roof in all very high hazard areas.

AB 3819 also requires that by July 1, 1996 the State Fire Marshall adopt a model ordinance that provides for "comprehensive space and structure defensibility. This defensibility extends beyond the vegetation management practices currently required and includes but is not limited to measures that increase the likelihood of a structure to withstand intrusion by fire." The model ordinance will likely address "building design and construction requirements that use fire resistant building materials and provide protection of structure projections, including porches, decks, balconies and eaves and structure opening including attic and eave vents and windows."

AB 3812 - (Valerie Brown & Woodruff) This new Bill proposes to amend several sections of Public Resource code relating to:

County General Plan development & review (PRC Section 4128.5)

The Bill proposes to clarify the existing PRC 4291 so that actions required by this code for fire mitigation will not constitute a taking of endangered species

The Bill also proposes to amend the existing PRC 4466 by requiring that CDF prepare model plans for prescribed burns and complete CEQA review on those plans.

The VMC proposes approaching the local representatives with requests for additional programs that include incentives for

homeowners to comply with the model ordinance and replace existing flammable roofs with Class A roofs. These incentives may be similar to solar energy credit or tax rebates. While legislative analysis will be required, the issue is clearly of statewide concern.

The VMC is proposing to also request state support from the University of California system to establish a research directive addressing the fire hazards associated with domestic landscapes. A small scale program had been undertaken by the UC Botanical garden to test flammabilty of 20 common plants in both field and laboratory conditions, but was canceled last year. This is another area of statewide interest that needs a broader solution.

Local Jurisdictions

The members of the VMC will be the primary funding and implementation source. The Cities of Oakland and Berkeley currently have Fire Assessment Districts that provide a tax base for mitigation programs. Maintenance and operations budgets annually fund fuel management including roadside clearance, and fuel break maintenance in each of the cities and special districts.

Public education & outreach programs are currently funded through fire prevention, the special assessment districts and local offices of emergencies services. Local philanthropic organizations, such as the San Francisco Foundation and East Bay Community Foundation, have participated in funding education programs in the past and may be approached for future regional needs

The Model Ordinance recommends actions to reduce hazards associated with gardens & structures

CEQA Compliance

The California Environmental Quality Act (CEQA) was enacted in 1970 and requires environmental review and assessment be undertaken for all projects. The CEQA requirements as they apply to the East Bay Hills Fire Hazard Mitigation Program and Fuel Management Plan will vary depending upon actions and location. The local jurisdiction's response to these requirements may also vary. Some of the responsible jurisdictions have existing certified environmental documents that address long term goals, policies and actions that are recommended in this plan. There are also categorical exemptions specified in Guidelines Sections 15301-15329 that address specific actions such as:

Operation, repair, maintenance or minor alterations of existing structures or facilities not expanding existing uses (15301).

Certain minor alterations of land, water or vegetation (15304)

Basic data collection, research, experimental management and resource evaluation activities (1506)

Certain actions taken by regulatory agencies to maintain, restore, or enhance the environment (15308).

However, there are also exceptions to Categorical Exemptions if a reasonable possibility exists that the activity may have a significant environmental impact because of unusual circumstances, cumulative impacts, or affect locations within specified sensitive environments. Because of the potential for all of these three exceptions to occur within the study area, the exercise of a Notice of Exemption is not recommended for new areas receiving fuel modification treatments.

The members of the VMC have a choice among three main approaches for complying with the requirements of CEQA.

1. Each jurisdiction may act separately as individual lead agencies and respond to CEQA as it deems approriate. This may be to the advantage of some jurisdictions who have either limited hazards to mitigate or who already have certified CEQA documents that cover their actions.

2. The VMC members may select a lead agency and jointly prepare a regional response to CEQA requirements for the programs identified in the plan. The advantages are a coordinated document with the costs of preparation spread across the region.

3. The VMC with support of the HEF may seek state level legislative relief recognizing the planning process and development of the regional fuel management plan as fulfilling CEQA. This is a long term commitment though there has been State precedent for such actions.

The Fire Hazard Mitigation Program and Vegetation Management Plan is designed to be a self-mitigating program. Throughout the plan, environmental issues are identified and mitigation and monitoring measures designed to reduced the impact of actions to not significant. The proposed actions are required to be modified should other significant impacts be recognized in the future.

Initial Study

An Initial Study was completed as a part of the preparation of the Plan to provide a preliminary analysis of potentially significant impacts. The plan has been designed as a self-

mitigating program incorporating mitigation and monitoring measures. The initial study reviewed the following Environmental Factors and identified the following potentially significant impacts with recommendations for mitigation and monitoring.

The fuel management plan recognizes several potentially significant impacts and incorporates measures to mitigate and reduce these potential impacts. The plan requires that site specific treatment actions be evaluated and recorded using a work sheet. This work sheet requires the land manager to evaluate the fuel condition and potential fire behavior, priority ranking as well as the environmental conditions that will need to be factored into the fuel treatment actions to reduce potential impacts.

Where feasible, the plan recommends avoiding significant impacts on a site specific basis by treating alternative areas to achieve fuel reduction goals and protect adjacent homes, populations concentrations and evacuation/emergency access routes. Where alternate treatment is not viable or does not reduce the potential for extreme fire behavior, the plan incorporates measures to alter the season or timing of treatment, as well as method or techniques to protect resources or reduce potential impacts to a level of "not significant."

Geology - Erosion and Slope Stability

- <u>Surface erosion:</u>
  Several of the proposed fuel management actions will increase the temporary exposure of bare soil by removal of natural leaf litter, duff and small twigs, and other above ground materials that shelter the soil. The proposed mitigation includes restricting removal to the "dry" season when the erosion potential is reduced. The plan also recommends that existing fuel be crushed or that removed material be processed into mulch and redistributed on the site.

  Where removal of hazardous trees is recommended, felling and disposal operations must include specific mitigation for potential surface erosion or soil disturbance caused by equipment and actions of cutting, or hauling the trees. Haul routes shall be planned to minimize disturbance and work restricted on steep slopes and wet ground.

  Operation of machinery also will be restricted to slopes of less than 30% and not be permitted on wet soils. Equipment that uses articulated arms, separate rollers or other devices while the main weight of the machinery remains on adjacent paved roads or flatter slopes may be utilized on steep slopes or under wet soil conditions.

  Where prescribed fire is utilized, a pre-burn plan shall be prepared and implemented for the specific site to reduce the chance for escape fires and to keep fire intensity and duration within safe limits. The burn plan will directly affect the residual matter that remains after the prescribe fire to reduce the potential for surface erosion. The prescribed fire will impact only the surface fuels and not be hot enough to destroy the roots of existing plant materials that help bind the soils until the plants resprout. As necessary depending on the seasonal timing, burn plans shall include site specific emergency erosion control measures that may incorporate mechanical or biological methods as well as conditions for its use. These measures may include natural wattles, biodegradable erosion control blankets or sediment catchments .

- Slope stability:
  The proposed fuel reduction actions focus on removal of surface and aerial fuels without disturbing the root system or surrounding soils. Where trees are proposed for removal, such as Eucalyptus 1-5 years, the stump and root system will remain, if required the trunk will be treated to remove resprouts.

  Much of the study area is within areas of active or potential land sliding. In areas where the terrain exceeds 30% a geologist or geotechnical engineer will evaluate any potential stability hazards and recommend site specific mitigation prior to treatment. All areas of potential instability shall be monitored during and after fuel reduction treatment and appropriate necessary measures incorporated to reduce potential impacts on a site by site basis.

Water Quality

- Sediment control:
  Many of the mitigation measures for erosion control also serve as control of sediment into adjacent streams and watersheds.

- Water quality:
  Use of chemicals to prevent resprout are required to comply with all Federal, State and Local laws for safe handling, mixing and application to prevent these materials from entering water bodies or ground waters.

  All management actions shall incorporate "best practices" to avoid non-point source pollution that could impact local watersheds. This will include operation and refueling of hand held power tools, machinery, grazing practices, and prescribed fire control.

Air Quality

- Violation of any air quality standard
  Pre-burn plans for prescribed fires require that a burn permit be obtained from the Bay Area Air Quality Management District. All prescribed fires would be conducted in accordance with this permit to meet regional air quality goals and to assist in dispersal of smoke and particulate.

  Equipment utilized for fuel management operations shall be equipped with emissions control devices as required by Federal, State and local regulations to reduce potential impacts from vehicles, machinery and hand held equipment.
- Exposure of sensitive receptors to pollutants or objectionable odors
  Prescribed fires could emit oxides of carbon dioxide, nitrogen, particulates or volatile oils from eucalyptus, poison oak or other plants. The pre-burn plans required by the fuel management plan will include notification of potentially sensitive receptors including schools, medical facilities. The pre-burn plan will also specify environmental conditions to optimize dispersal of smoke, odors and particulate pollutants.

Biological Resources

- Endangered, threatened or rare species or their habitats
  Four rare and endangered plant species and four wildlife species are known to exist within the study area. Where feasible, alternative treatment areas will be managed in order to avoid endangered, threatened or rare species or their habitat. It is anticipated that not all populations of these species have been located within the proposed treatment areas. Therefore, the plan specifies surveying and monitoring requirements to inventory a site prior to treatment of vegetation types where these species are likely to occur. The monitoring shall continue during and after treatment, and for any subsequent treatment.

Treatment actions and restrictions are also specified to reduce potential impacts, such as only removing dead fuels by hand within populations of Alameda manzanita, and prohibiting any activity within 1/8 mile of active nesting sites of golden eagle, Cooper's hawk or sharp-shinned hawk until the young are fledged.

- Locally designated species - heritage trees
  There is the potential for impacting specimens eligible as heritage trees by local ordinances. The survey requirements prior to treatment specify that any trees eligible for heritage status be identified and protective measures taken to avoid adversely impacting them. Protective measures will include field identification and protection from machinery, damage by browsing animals, hand clearing of understory or excessive ground litter, or removal of dead limbs.

- Locally designated natural communities
  Three locally significant natural communities are included in the project for fuel management actions: North Maritime Chaparral, Serpentine Grasslands and Valley Needlegrass Grassland. Where feasible, these communities will be avoided. Where management actions cannot avoid these areas the plan restricts the method and season when fuel management can be undertaken in these communities in order to reduce potential impacts. All management in the North Maritime Chaparral that contains Alameda manzanita must be by hand and remove only dead materials. Serpentine grasslands can be managed by prescribed fire or mowing, but the native plant species must have matured prior to treatment. Valley Needle Grassland is less susceptible to damage from hoof action and may be grazed except during late winter and early summer growing periods. Mowing and prescribed fire may also be utilized in the Valley Needle Grassland provided the native plant species of concern have matured.

  Because the long term ecological effects of fuel management are not well known for vegetation and wildlife, the plan proposes on-going monitoring and quantitative documentation of treatments and their affects.

- Wetland habitat
  No known wetlands, marshes, riparian habitat or vernal pools are identified for fuel management treatment. Should any of these habitats be identified during pre-treatment surveys these areas will be avoided and protected from adverse impacts of adjacent treatment. A buffer zone of 100 feet will be maintained around these resources to avoid erosion and sedimentation into these habitats.

- Wildlife dispersal or migration corridors
  A wildlife corridor located in the Caldecott Tunnel area is of locally concern. The plan focuses fuel management actions in the buffer within 500 feet of homes, and in the existing ridge top fuel break. These fuel management zones are predominantly on the western side of the ridge line in the area where urban development and the 1991 Tunnel Fire have dramatically altered the vegetation. The plan does not identify any areas for treatment on eastern side of the ridge line where the existing habitat is the most diverse.

Hazards

- Health Hazards:
  Prescribed fires could emit oxides of carbon dioxide, nitrogen, particulates or volatile oils from eucalyptus, poison oak or other plants exposing both neighbors and fire personnel to potential health hazards.

Appendices

Fire Hazard Program
&
Fuel Management Plan
for the
East Bay Hills

The pre-burn plans required by the fuel management plan will include notification of potentially sensitive receptors including schools, medical facilities. The pre-burn plan will also specify environmental conditions to optimize dispersal of smoke, odors and particulate pollutants and mitigate potentially significant health impacts.

Improper use of chemicals to prevent resprout could also endanger worker or neighbor safety. All storage, mixing or application of chemicals will comply with Federal, State and Local regulations to reduce the potential for significant health impacts.

- Increased Fire Hazards
  Prescribed fires present the potential for increased risk of escaped fires. The pre-burn plan required by the fuel management plan will specify both weather and fuel characteristics to reduce the change of escape. Pre burn fuel treatment, adequate suppression forces and prescribed weather conditions are proposed as potential mitigation measures.

CEQA Compliance Options

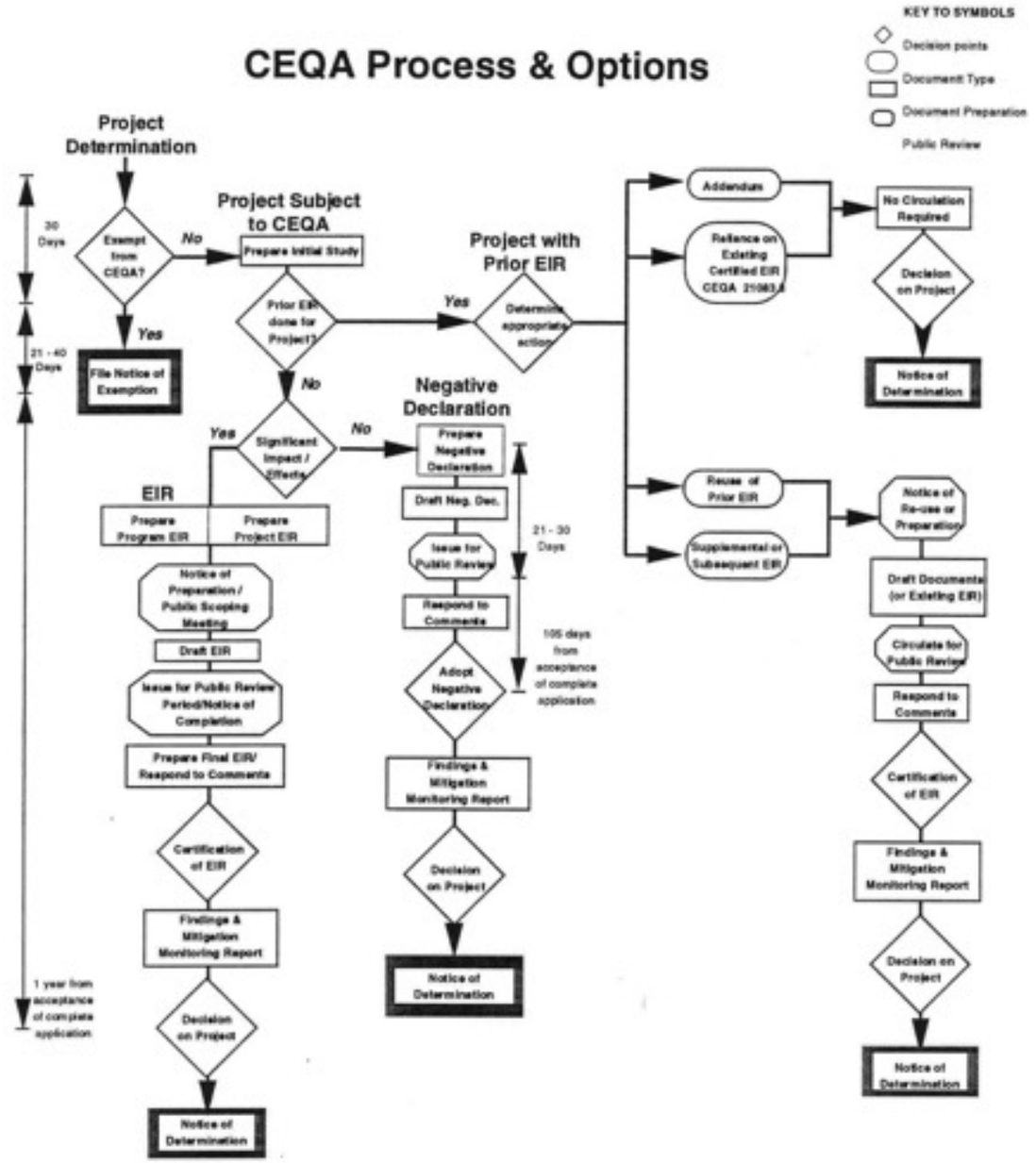
By incorporating mitigation and monitoring programs into the regional standards, operations and procedures the plan has been designed to be a self-mitigation program that may qualify for a Negative Declaration.

Individual Members may choose to complete additional CEQA documentation for their specific activities they propose for their jurisdiction. If specific action proposed on a given agencies lands that may be "fairly argued based on substantial evidence that a significant effect may occur" and it can not been mitigated to an insignificant level of impact, an Environmental Impact Report (EIR) must be prepared. Several options are available for compliance depending upon the program or project under consideration. These options include:

Reuse of a prior EIR
Subsequent or Supplemental EIR
Focused EIR
Program or Project EIR

The chart following provides and overview of the CEQA process, required actions and time frames.

CEQA Process & Options



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Model Ordinance for Landscapes & Structures in the High Hazard Areas of the Urban Wildland Intermix

SECTION 1.00 GENERAL PROVISIONS

Section 1.01 Findings

A. Human settlement adjacent to wildlands and associated development patterns including housing density, infrastructure (roadways water delivery systems) and landscaping, have increased the risk of fire and potential loss of property and human life.

B. Private residential landscapes and structures in hazardous fire areas can greatly increase the damage from a fire, by providing fuel and restricting safe access by firefighters.

C. Homeowner actions related to their landscape and structures can increase the chances for human life safety and property survival during the event of a fire in the urban-wildland interface.

D. Climatic, geologic, geographic and topographical conditions that exist in hazardous fire areas make it desirable for reasons of public health, safety and welfare to adopt certain standards and requirements relating to fire safety that are more stringent than existing standards.

Section 1.02 Intent

It is the intent of this ordinance to provide necessary safeguards to maximize fire-protection areas for firefighters, to reduce the intensity of fires in this area, to reduce the potential loss of property and human life resulting from fires in the hazardous fire areas.

This ordinance will not eliminate the threat of fire in the urban-wildland intermix. Actions mandated by this ordinance will increase the odds of human life safety and structure survivability in the event of fire. These actions will increase the ability of trained firefighters to suppress these fires by reducing fire control problems including flame lengths greater than 8 feet, the generation of crown fires and the associated long distance spotting that can rapidly spread wildfires. The ordinance also targets potential ignition sites, including undeveloped privately owned parcels.

By targeting these ordinances at private properties the safety zones created are closest to those factors most valued including people, property and public improvements.

Section 1.03 Definitions

A. **Defensible Space**: A safety zone established throughout a privately owned parcel. The vegetation and landscape in this zone shall meet the requirements as outlined in Section 2.03 Requirements and Standards for Establishment of Defensible Space. All structures in this zone must meet the requirements and standards specified in Section 3.02 Requirements and Standards for Removal of Combustible Roofing.

B. **Combustible Materials**: Any element in the landscape which is easily ignited and capable of burning rapidly. Combustible materials include but are not limited to the following: waste paper, hay, grass or weeds more than 4 inches tall, flammable waste material, petroleum products, dead vegetation, dead branches on living plants, firewood, and loose papery bark on trees.

C. **Managed Domestic Landscape:** Privately owned parcels that receive regular maintenance and are kept free of flammable vegetation.. These landscapes may include structures or be essentially undeveloped.

E. **Fire Hazard:** Any thing or act which increases or may cause an increase of the fire hazard or menace of fire to a greater degree than that customarily recognized as normal. Any thing or act which may obstruct, delay, hinder, or interfere with the operations of the Fire District or the egress of occupants in the event of fire.

F. **Flammable Materials**: Any liquid or gas that is easily ignited and capable of burning rapidly.

G. **Flammable Vegetation:** Plants with one or all of these characteristics: accumulation of dead vegetation, high volume growth, or low fuel moistures. These plants may ignite easily, burn rapidly or produce high heat output and are capable of transmitting fire.

H. **Fuel Load**: The quantity of fuel expressed in terms of weight per unit area of land (typically tons per acre or TPA).

I. **Horizontal Separation**: Spacing between plants designed to minimize the spread of fire from plant to plant. The minimum distance between shrub islands is the height of the tallest plant.

J. **Ornamental Plant**: Any plants growing in a garden situation, undergoing regular watering and/or maintenance. Exceptions include hazardous species, poorly maintained or aged specimens that meet the definition of flammable vegetation.

K. **Parcel**: a portion of land of any size, the area of which is determined by assessor's maps and records and identified by an assessor's parcel number. Each parcel has a zoning designation that identifies it permissible use and requirements for any development.

L. **Phyrophyte** (Phyrophytic plant)**:** Highly flammable plant materials that are high in flammable oils or resins, produce large quantities of dead materials, litter or commonly have very low fuel moistures. (see also flammable vegetation).

M. **Unmaintained Landscape:** Privately owned parcels with flammable vegetation that do not receive regular treatment to reduce fire hazard. These landscapes may include structures or be essentially undeveloped.

N. **Shrub Islands**: Distinct groupings of shrubs designed to help control the spread of fire. Islands should be small enough to provide adequate horizontal separation between groupings. These groupings may be established during initial planting or created by removing and maintaining existing shrubs.

O. **Vertical Separation**: The distance from the top of shrubs or groundcover to adjacent trees, designed to minimize the spread of fire to the crown of trees or structure roofs. The minimum distance is two times the height of the shrub to the leaves or needles of adjacent overstory trees.

P. **Wildland**: An area in which development is essentially non-existent, except for roads, railroads, powerlines and similar transportation facilities. Structures, if any, are widely scattered are primarily for recreation purposes or management support.

SECTION 2.00 SPECIFIC PROVISIONS FOR RESIDENTIAL LANDSCAPES

Section 2.01 Applicability

A. Requirements in this ordinance shall apply to all residential, commercial, retail, institution and governmental property in the High Fire Hazard Area, including undeveloped parcels. The requirements shall be the responsibility of the owner of the lot.

B. Requirements shall apply to the entire parcel regardless of size. For parcels containing wildland areas larger than 5 acres in size, hazard mitigation requirements and standards may be modified on a site specific basis at the discretion of the Fire Marshall to meet the standards established regionally for fuel management of wildland vegetation.

Section 2.02 Exemptions

The Property Owner is responsible for all documentation of existing site conditions required for exemptions from the requirements of this ordinance. Existing data and information developed by the city shall be made available to the public.

A. Any parcel where slope stability will be threatened by removal of plants may be exempt from treatment requirements or subject to alternate treatments. Property Owner must submit a report documenting the probability of failure due to vegetation removal, prepared by a licensed civil, geotechnical or soils engineer. The report shall propose alternative treatment methods to address fire hazard. Report will be reviewed by city staff. Review and acceptance of alternative treatment will supersede the requirements outlined below.

B. Any parcel or lot that includes plant or animal species that are rare, endangered or of special concern may qualify for alternative plant treatment and spacing requirements. Property Owner must submit a report from a qualified resource biologist or landscape architect describing the species, actions required to preserve its environmental value, as well as proposed alternative measures to address fire hazards. Report will be reviewed by a designated city staff person. Review and acceptance of alternative treatment will supersede the requirements outlined below for those specified plants or plant groupings.

Section 2.03 Requirements and Standards for Establishment of Defensible Space

A. Removal of Dead Materials: Remove all dead plants and combustible materials to establish and maintain a defensible space, this includes private property adjacent to roads, driveways and along fence lines. Removal of combustible material includes but is not limited to the following:

1. Cut grass and weeds to less than 4 inches. Cutting of native grass and wildflowers may be delayed until after seed set provided they do not form a means of rapidly transmitting fire to any structures.

2. Keep the ground, roofs, decking or balconies free of dead leaves, needles or other plant debris.

3. Remove all dead plant material from the site. Any dead materials to remain on site shall meet the requirements of C. Disposal of Materials.

4. Remove from trees all vines, loose papery bark, dead branches, and live branches smaller than 3 inches in diameter, to 8 feet above ground.

5. Remove all dead branches from within live ground covers, vines and shrubs.

B. Reduction of Fuel Load: Reduce the fuel load on the lot as needed to slow the spread of fire and reduce its intensity. Reduction of the fuel load includes but is not limited to the following:

1. Thin individual plants or shrub masses as necessary to create "shrub islands" with adequate horizontal spacing. Islands should be small enough to ensure proper maintenance, and no greater than 8 feet across. Ornamental plants are exempt provided they do not form a means of rapid transmission of fire.

2. Remove plants as necessary to create adequate vertical spacing between shrubs or ground covers and trees, decks or overhangs on buildings. Vertical spacing shall be a minimum of eight feet or two times the height of the understory plant to the leaves or needles of adjacent overstory trees, decks or overhangs, which ever provides greater separation. For overstory trees under 24 feet in height the minimum clearance of 8 feet can be reduced to 1/3 of the overall height of the overstory tree provided this reduced clearance does not form a means of rapid transmission of fire.

3. Remove all branches within 10 feet of any chimney or stovepipe, including chimneys on adjacent properties.

4. Maintain adequate root systems and vegetative cover to reduce the potential for soil erosion and increased run-off or sedimentation. Requirements and standards for the estabishment of defensible space do **not** require complete removal of all vegetative matter to bare earth. The Property Owner shall be responsible any erosion and sediment control measures such as ground cover plantings, jute netting, erosion control blankets, etc. required in order to reduce geologic or hydrologic impacts downstream or on adjacent lands.

C. Disposal of Materials:

1. Properly and legally dispose of all flammable materials removed from the safety zone. Legal methods include using a legal landfill or dump, bagging or stacking material to be picked up in a city-sponsored program, or delivering cuttings to a mulching service.

2. Chip materials may remain on site. Size of chips to be spread on ground shall be no greater than 4 to 6". Duff, finely shredded matter, bark or other fibrous material easily ignited shall not be permitted in mulch layer. Mulch layer shall be no greater than 2 inches in depth.

3. Compost piles: Compost or manure piles shall be located and maintained so that they do not represent a fire hazard.

2.04 Requirements and Standards for Storing Flammable and Combustible Materials

A. Store flammable and combustible materials in such a way to reduce the spread of fire.

1. Store all flammable materials in their original containers, away from sources of ignition.

2. Do not store any flammable or combustible material where it will help ignite a building, decks, large trees or shrubs, or fencing. If possible, store in an enclosure.

3. Stack firewood away from structures or fences and from shrub islands, brush or trees, or store in non-combustible enclosure. Store all kindling and small diameter materials separately from stacked firewood. Keep area surrounding firewood clear of all fine fuels, dead materials brush or other flammable materials.

4. Store matches, lighters and other types of ignitors out of children's reach or in locked cupboard.

2.05 Garden Structures

A. New garden structures such as freestanding decks, gazebos, hot tubs or outbuildings shall meet minimum standards for materials, timber size, and other requirements as described in Structures ordinance.

B. Built-in-place barbecue areas shall be no farther than 15 feet from a water source, or be equipped with a fire extinguisher. Barbecues must be surrounded by at least 10 square feet of non-flammable materials and be 10' clear of all overhanging structures or trees. All associated chimneys shall be fitted with a spark arrester.

C. Fencing: Maintain a defensible space along wood fences to reduce possibility of fire spreading from vegetation to fence. Timber size for new wood fences shall be minimum 1" nominal thickness.

SECTION 3.0 SPECIAL PROVISIONS FOR RESIDENTIAL STRUCTURES

Section 3.01: Applicability:
The requirements, standards and provisions of this Ordinance shall apply to all buildings and structures located in the designated very high fire hazard severity zone.

Section 3.02: Requirements and Standards for Removal of Combustible Roofing:

A. Applicability: Regardless of any other provisions of this Code every building or structure which has a combustible roof covering as determined by the Building Official shall replace such combustible roof covering with fire retardent "Class A" roofing in accordance with UBC Standard 32-7 and as defined in the applicable roofing provisions of Section 3204 of the latest version of the Uniform Building Code as adopted and amended by the city.

B. Notification: Identification and Notification: No later than 2 years after the effective date of this ordinance the Building Official shall notify in writing by certified mail the owner of each building or structure within the scope of this section. The notice shall contain a copy of this ordinance, a commentary on it and a Notice of Intent form. The Notice of Intent shall include a request for a schedule for replacing the combustible roofing. If a building or structure within the scope of this ordinance is not discovered by the Building Official until after the deadline for notification the building or structure owner shall be notified within 30 days of such discovery. Failure to receive notification does not exempt a building owner from the requirements of this ordinance.

C. Implementation:

1. The owner shall submit a properly completed Notice of Intent form to the Building Official no later than 3 years after the effective date of this ordinance. Such notice shall state the date by which the building owner shall comply with the requirements of this ordinance.
   EXCEPTION: No Notice of Intent is required if an approved roof is installed prior to the deadline above.

2. The requirements stated in Section 2 above shall be accomplished no later than 7 years after the effective date of this ordinance. Failure to comply within the required time frame is a violation of this code and the Building Official shall have the power to abate the building or structure in accordance with Section 203 of this Code.

3. Authority of Building Official. For the purposes of applying the provisions of this ordinance the Building Official shall have the authority to be flexible in the event of extenuating circumstances that may exist in an individual case and to do the following:

   a. Waive these requirements for specific individual buildings or structures if it can be demonstrated that such requirements are not physically possible, or pose an undue hardship with little increase in fire safety and that a physical alternative cannot be provided. Alternative defensible space landscaping provisions may be considered by the Building Official as alternate methods for these requirements for specific individual buildings or structures under Section 105 of this Code, and:

   b. Grant necessary extensions of time when it can be shown that the specified time periods are not physically practical or pose an undue hardship. The granting of an extension of time for compliance shall be based on the showing of good cause and subject to the filing of an acceptable schedule for correction with the Building Official.

4. Appeal: Decisions of the Building Officials may be appealed under Section 4.3 of this Code.

Section 3.03: Requirements and Standards for Residential Structures:

Except as expressly limited herein, the following requirements, standards and provisions shall apply to the construction, re-construction, alteration, re-roofing and/or repair of any building and/or structure located in the designated very high hazard severity zone. These requirements are to be implemented in concert with defensible space criteria described in Section 2.00. Historic structures shall be reviewed on a case-by-case basis to meet the intent of this ordinance.

A. Roofing: Roof coverings shall be fire retardent "Class A" in accordance with UBC Standard 32-7 and as defined in the applicable roofing provisions of Section 3204 of the latest version of the Uniform Building Code as adopted and amended by the city.

B. Reroofing:

1. All re-roofing shall conform to the applicable roofing provisions of the latest version of the Uniform Building Code as adopted and amended by the city. All re-roofing valued in excess of $100.00 shall require a building permit. The roofing material for any building and/or structure which has more than 50% of the original roof area re-roofed within a one year period after the issuance of a building permit shall conform to the requirements for a fire retardent "Class A" roof as defined in Section 1.

2. New roof covering shall not be applied over an existing wood shingle or wood shake roof.

C. Spark Arresters:
All chimneys or stovepipes attached to any appliance or fireplace that burns solid fuel shall be provided with an approved spark arrester in accordance with the General Chimney requirements of Section 3703 (h.1 in the latest version of the California State Building Standards Code.

D. Vent Coverings:
All vent openings into under-floor areas, enclosed attics and enclosed rafter spaces shall be covered with a non-combustible, corrosion resistant metal mesh with mesh openings not exceeding 1/4 inch in dimension. Ventilation shall be provided in conformance with the requirements of the Uniform Building Code as adopted and amended by the city. Vents shall be located as far as practicable from the outer face of the outside wall to minimize updraft fire pathways into combustible attic spaces.

E. Roof overhangs:
Roof overhangs constructed of non-combustible materials need not be protected. Combustible roof overhangs projecting less than 10 inches from the exterior face of the exterior wall may be unprotected. Overhangs extending more than 10 inches shall be protected by one of the following:

1. One hour fire resistive materials with a non-combustible surface on the underside and exposed edges

2. "Heavy timber" construction as defined in Section 2106 of the Uniform Building Code.

3. Any other non-combustible material with the approval of the Building Official.

F. Exterior Siding Materials: Exterior finishes shall be one of the following:

1. 7/8" minimum thickness three coat exterior cement plaster ("stucco")

2. Any exterior one hour rated wall assembly with a non-combustible surface in accordance with the latest version of the Uniform Building Code as adopted and amended by the city.

3. Any other non-combustible material with the approval of the Building Official. 1" nominal minimum dimension trim may be applied on walls constructed as noted above. Untreated wood shingles and wood shakes of any kind are prohibited.

G. Projections: For the purposes of this section projections shall include decks, exterior balconies, porches and exterior stairs. Projections shall be of non-combustible materials or combustible projections shall be protected as follows in accordance with the applicable provisions of the latest version of the Uniform Building Code as adopted and amended by the city:

1. One hour fire resistive materials with non-combustible surfaces applied on the underside and all exposed edges.

2. "Heavy timber" construction as defined in Section 2106 modified to allow the following member sizes:
   a. 6" nominal minimum dimension columns

b. 6" x 8" nominal minimum dimension horizontal supports
c. 2" nominal minimum dimension spaced decking

3. A "skirt" wall extending down from the projection surface to the adjacent grade completely enclosing the projection with a one hour fire resistive assembly in accordance with UBC Chapter 43 with a non-combustible surface.

4. Projections whose outer edge is greater than 15 feet above adjacent grade are exempt if there is a residential vegetation management plan in effect for the property.

H. Windows: Notwithstanding any provisions or exemptions of the energy requirements of California Code of Regulations, Title 24, all new windows shall be of minimum double glazed construction.

I. Smoke Detectors: All residential occupancy structures shall be provided with smoke detectors installed in accordance with Section 1210 of the Uniform Building Code. In existing structures the requirements for detectors in each sleeping room shall not apply. All other requirements of Section 1210 shall apply to all new and existing residential occupancies. Smoke detectors shall be installed within one year of the adoption date of this ordinance. Failure to install an approved smoke detector shall subject the owner of the structure to a fine of not less than $50 dollars.

J. Interior Fire Sprinklers: Interior fire sprinklers conforming to the requirements of NFPA 13D shall be installed in newly constructed buildings and/or structures and in remodeled buildings and/or structures where the value of the new work exceeds 50% of the value of the existing building, under any one of the following conditions:

1. The residence has a response time from the nearest fire station of greater than 5 minutes as determined by the Fire Marshal.
2. The residence is located on a street with a width of less than 20 feet.
3. The residence has a private driveway over 300 feet in length, or a width of less than 12 feet over a distance greater than 50 feet.
4. The residence is located on a street or driveway with a gradient of more than 15%.
5. Any portion of the building is located at a distance greater than 600 feet from a fire hydrant with a capacity of less than 1,000 gm at a residual pressure of 20 psi for 2 hours.
6. The residence floor area is in excess of 3,600 square feet.

Installation of fire sprinklers in remodeled buildings and/or structures shall meet all service requirements of local water districts and may include water meter and service line upgrades at the owner's expense.

K. Future Ordinance Elements; There is insufficient background data for the following elements to allow preparation of ordinance language. These items should be the subject of further research. These issues should be considered as potential items to be included in educational programs about fire safety and private fire response, but they should not be supported at this time by ordinances.

1. Exterior Fire Sprinklers

2. Technological Barriers

3. Technological Fire Suppression Systems

SECTION 4.0 SPECIAL PROVISIONS FOR COMPLIANCE

Section 4.1 Determination and Notification

A. Determination of Hazards: The Fire Department of each jurisdiction shall determine what constitutes a hazard.

B. Notice to Public: The Fire Chief of the jurisdiction shall send, by certified mail or courier, a notice describing to the property owner or persons in control of the property the inspection process.

Section 4.2 Inspection

A. Inspection Forms: The inspection form utilized during the inspection process shall record the existing conditions on the properties and indicate areas of non-compliance.

B. Entry onto Private Property: The officer, board or commission and designated assistants, deputies, employees or contracting agents or other representatives may enter upon private property for the purpose of inspecting for or abating hazardous fire conditions.

C. Access Procedures: Whenever necessary to make an inspection to enforce any of the provisions of this code, or whenever the chief has reasonable cause to believe that there exists in any building or upon any premises any condition which makes such building or premises unsafe, the chief may enter at all reasonable times to inspect or to perform any authorized duty, provided that such property is occupied. The Chief shall first present proper credentials and demand entry. If the property is unoccupied, the chief shall first make a reasonable effort to locate the owner or other persons having charge or control of the building or premises and demand entry. If such entry is refused the Chief shall have recourse to every remedy provided by law to secure entry.

D. Inspection Warrants: If the owner or occupant denies entry, the Chief is authorized to obtain a proper inspection warrant or other remedy provided by law to secure entry. Owners or occupants or other persons have charge, care or control of any property shall, after proper request is made, promptly permit entry for the purpose of inspection.

Section 4.3 Compliance

A. Notice of Inspections. The Fire Chief of the jurisdiction shall send, by certified mail or courier, a notice describing to the property owner or persons in control of the property fire hazards present on their land. The letter shall advise them of potential hazards to be abated, the time allowed for the work, and the abatement procedures for non-complying sites. If no address for an owner or tenant can be found, a notice will be posted on the property itself.

B. Hearing Process. At the time stated in the notices, the Board shall hear and consider all objections or protests, if any, the proposed compliance to the ordinance, and may continue the hearing from time to time.

1. Action of the Board on objections shall allow or overrule any or all objections and the decision of the Board on the matter is final.
2. Seasonal and recurrent nuisance. If the non-complying parcel is seasonal and recurrent, the Board shall so declare. Thereafter, such seasonal and recurring conditions shall be abated

every year without the necessity of any further hearing.

C. Subsequent Inspections: An inspection shall be performed after delivery of the notice, to determine if the abatement work is complete.

Section 4.4 Non-Complying Sites

A. Notice to perform abatement work on non-complying sites: An inspection shall be performed after delivery of the notice, to determine if the abatement work is complete. If work has not begun, a notice to perform abatement work will be sent to property owner or posted on property. The notice shall state the length of the compliance period. At the end of this period, the Fire Chief may order the premises cleaned in accordance with procedures set forth below.

B. Collection of cost of abatement: After performing the abatement work, the Fire Chief shall record with the County Recorder a "prospective notice of special assessment lien." Such notice shall summarize the work performed, the cost and date of completion.

C. Notice of hearing on lien: Upon receipt of the notice to record a lien, a copy of the notice shall be served on the owner of the property. The notice shall include a hearing date to give the property owner a chance to discuss the case before City Council.

Key to High Hazard Vegetation Polygons in Study Area Buffer

Vegetation Polygons with Portions within 500 ft of Values at Risk and Flame Length > 8ft or with High Crowning Potential

Sorted by Vegetation Type

Key to Symbols	
Polygons with Flame Length >8 ft & High Crown Potential	0
Polygons with High Crown Potential	0

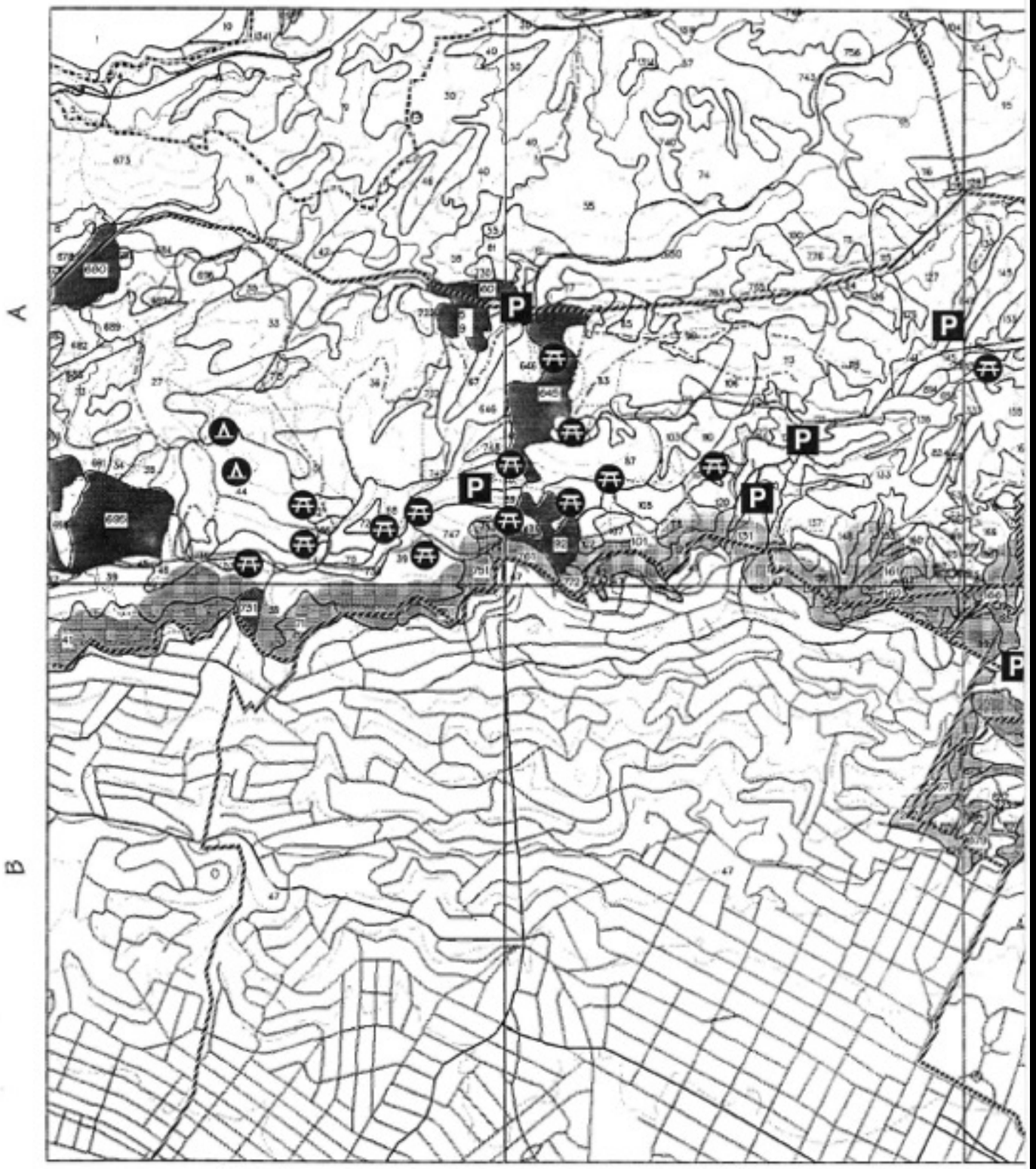
Polygon Id #	RMU Identity Number	Managing Agency	Vegetation type	Total Acres	Approx Acres in Buffer	Position on Slope	Relation to Structures	Fuel Model	Development Stage	Slope	Flame Length	Rate of Spread	Heat per Area	Ignition Potential Rating
Grassland Communities														
247	CC4	UCB	Grassland	8	8	Mid to top slope	LBL/ UCB above & below	Tall Grass	High Dev Stage-wild	40	29	590	902	1
342	ERS2	EBRPD	Grassland	15	0.10	Top	Roundtop?	Tall Grass	High Dev Stage-wild	20	29	560	902	1
437	DR2	EBRPD	Grassland	13	13	Ridge top	Houses below	Tall Grass	High Dev Stage-wild	10	28	547	902	1
456	SR1	EBRPD	Grassland	13	13	Midslope	Houses above	Tall Grass	High Dev Stage-wild	20	29	560	902	1
462	SR1	EBRPD	Grassland	28	28	Midslope	Campus adj	Tall Grass	High Dev Stage-wild	40	29	590	902	1
509	ER3	Oakland	Grassland	73	73	Top to Bottom slope	Houses adj & above	Tall Grass	High Dev Stage-wild	20	29	560	902	1
520	AVC1	Oakland	Grassland	13	7	Mid to top	Houses adj & above	Tall Grass	High Dev Stage-wild	20	29	560	902	1
525	AVC1	Oakland	Grassland	20	10	Top	Houses adj	Tall Grass	Extreme Dev Stg-wld	20	37	1,244	700	1
533	AVC1	Oakland	Grassland	118	79	Mid to top	Houses adj & above	Tall Grass	High Dev Stage-wild	20	29	560	902	1
543	AVC1	Oakland	Grassland	24	24	Midslope	Houses adj	Tall Grass	High Dev Stage-wild	20	29	560	902	1
558	DR6	Oakland	Grassland	6	6	Top	Houses adj.	Tall Grass	Extreme Dev Stg-wld	20	37	1,244	700	1
622	DR2	EBRPD & Private	Grassland	432	202	Mid to top	Houses adj below & above	Tall Grass	High Dev Stage-wild	20	29	560	902	1
626	DR2	EBRPD	Grassland	17	0.20	Top	Houses adj	Tall Grass	High Dev Stage-wild	10	28	547	902	1
633	DR2	EBRPD	Grassland	69	32	Top	Houses adj & below	Tall Grass	High Dev Stage-wild	20	29	560	902	1
802		Private	Grassland	33	5	Midslope	Houses below	Tall Grass	High Dev Stage-wild	20	29	590	902	1
857	ERN1	EBMUD & Private	Grassland	181	5	Top	Houses above	Tall Grass	Moderate Dev Stg-wld	12	12	365	189	1
867	CC7	LBL & UCB	Grassland	10	10	Mid to Top	Houses & lab adj	Tall Grass	High Dev Stage-wild	20	29	590	902	1
934	ERN1	EBMUD	Grassland	61	2	Ridgetop	House adj	Tall Grass	High Dev Stage-wild	20	29	590	902	1
966	CC2	EBRPD	Grassland	7	4	Midslope	House below	Tall Grass	High Dev Stage-wild	20	29	590	902	1
979		Private	Grassland	33	33	Top	House adj & below	Tall Grass	Extreme Dev Stg-wld	40	38	1,299	700	1
997		Private	Grassland	26	26	Top	Houses above	Tall Grass	Extreme Dev Stg-wld	40	38	1,299	700	1
1010		Private	Grassland	12	12	Top	Houses above	Tall Grass	Extreme Dev Stg-wld	40	38	1,299	700	1
1239		Private	Grassland	8	2	Midslope	House below	Tall Grass	High Dev Stage-wild	20	29	560	902	1
1262		Private	Grassland	7	1	Midslope	Houses below	Tall Grass	High Dev Stage-wild	20	29	560	902	1
1327		Private	Grassland	3	1	Midslope	Houses adj	Tall Grass	High Dev Stage-wild	20	29	590	902	1
1335		Private	Grassland	1	1	Midslope	Houses adj	Tall Grass	High Dev Stage-wild	20	29	560	902	1
1336		Private	Grassland	1	1	Midslope	Houses adj	Tall Grass	High Dev Stage-wild	20	29	560	902	1
			Subtotal Grassland Communities					**599**	*Total Grassland in Study Area*			*3,679*	*Treated*	*16%*
Shrub Communities														
41	ERN3	EBRPD	Successional Scrub	35	35	Top	Houses above	Brush	Moderate Dev Stg-wld	20	14	139	760	4
71	ERN3	EBRPD	Wet N Coastal Scrub	11	11	Top	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	8

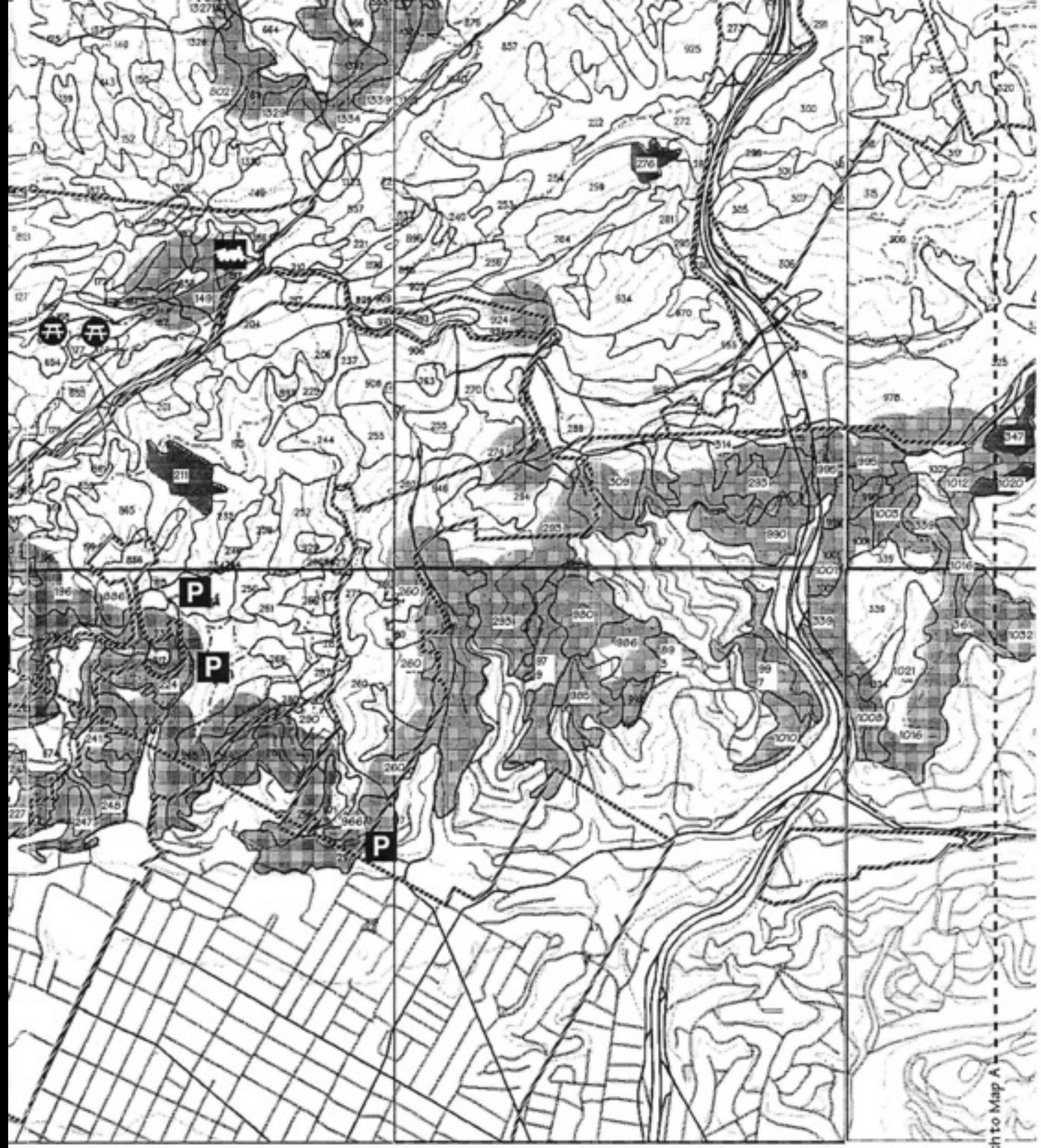
101	ERN3	EBRPD	Dry N Coastal Scrub	12	6	mid slope	Houses upslope	Brush	High Dev Stage-wild	20	18	142	1230	4
160	ERN1	EBRPD	Dry N Coastal Scrub	5	1	Midslope	Golfcourse?	Brush	Moderate Dev Stg-wld	20	14	139	760	4
162	ERN3	EBRPD	Dry N Coastal Scrub	6	6	Top	Houses upslope	Brush	Moderate Dev Stg-wld	20	14	139	760	4
196	CC4	UCB	Successional Scrub	23	12	Top - mid	UC adj, LBL below	Brush	High Dev Stage-wild	20	18	142	1230	4
224	CC7	UCB/LBL	Dry N Coastal Scrub	23	23	Mid to Top	LBL above	Brush	High Dev Stage-wild	20	18	142	1230	4
241	CC7	UCB/LBL	Dry N Coastal Scrub	11	11	mid slope	LBL above.	Brush	High Dev Stage-wild	40	18	150	1230	4
260	CC4/ CC2	UCB/ EBRPD	Dry N Coastal Scrub	107	1	Lower slope	Houses below	Brush	High Dev Stage-wild	40	18	150	1230	4
274	CCR	UCB	Successional Scrub	54	1	Top	House adj	Chaparral	High Dev Stage-wild	20	45	435	3114	4
290		Private	Successional Scrub	4	1	Top	Houss below	Brush	High Dev Stage-wild	40	18	150	1230	4
293	CCT10	EBRPD & Private	Dry N Coastal Scrub	124	93	Top	Houses below	Brush	Moderate Dev Stg-wld	40	14	146	760	4
309	CCT10	Oakland?	Dry N Coastal Scrub	15	10	Top	Houses below	Brush	Moderate Dev Stg-wld	40	14	146	760	4
314	CCT10	Oakland?	Successional Scrub	21	1	Top	Houses below	Chaparral	High Dev Stage-wild	40	46	458	3114	4
325			Successional Scrub	93	93	Top	Houses below	Closed Timber Litter	High Dev Stage-wild	20	2	9	226	4
362	TC4	EBRPD	Dry N Coastal Scrub	15	4	Ridgetop	Houses below	Brush	Extreme Dev Stg-wld	40	32	423	1490	4
364		Private	Successional Scrub	35	18	Top	Houses below	Brush	High Dev Stage-wild	40	18	150	1230	4
385	ERS4	EBRPD	Successional Scrub	19	10	Top	Houses below	Brush	High Dev Stage-wild	20	18	142	1230	4
395	ERS4/ PSC2	EBRPD/ Oakland	Successional Scrub	49	24	Top	Houses below	Brush	High Dev Stage-wild	20	18	142	1230	4
399	PSC2	Oakland	Successional Scrub	5	1	Ridgetop	? redwood	Brush	Moderate Dev Stg-wld	20	14	139	760	4
401	PSC2	Oakland	Successional Scrub	7	7	Ridgetop	? redwood	Brush	High Dev Stage-wild	10	17	139	1230	4
403	PSC2	Oakland	Successional Scrub	19	10	Midslope	Houses adj & below	Brush	Extreme Dev Stg-wld	40	32	423	1490	4
417	ERS4	EBRPD	Successional Scrub	14	0.10	Top	Rec area above	Brush	High Dev Stage-wild	40	18	150	1230	4
421	ERS4	EBRPD	Dry N Coastal Scrub	33	6	Ridgetop	Houses below	Brush	High Dev Stage-wild	20	18	142	1230	4
433		Private	Dry N Coastal Scrub	9	9	Midslope	Houses above	Brush	High Dev Stage-wild	40	18	150	1230	4
441	DR2	EBRPD	Dry N Coastal Scrub	8	8	Top	Houses adj	Brush	High Dev Stage-wild	40	18	150	1230	4
444	DR2	EBRPD	Dry N Coastal Scrub	22	22	Top to midslope	Houses above & adj	Brush	High Dev Stage-wild	20	18	142	1230	4
446	DR2	EBRPD	Dry N Coastal Scrub	60	10	Top to midslope	Houses above & adj	Brush	Extreme Dev Stg-wld		31	403	1490	4
448	LR3	Oakland	French Broom	6	6	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	6
451	LR3	Oakland	Dry N Coastal Scrub	30	30	Top to midslope	Houses above & adj	Brush	High Dev Stage-wild	40	18	150	1230	4
454	SR1	EBRPD	Wet N Coastal Scrub	147	110	Midslope	Houses above	Brush	High Dev Stage-wild	40	18	150	1230	8
455		Private	Wet N Coastal Scrub	3	3	Top	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	8
459	SR1	EBRPD	Successional Scrub	20	20	Midslope	Houses adj & below	Brush	High Dev Stage-wild	20	18	142	1230	4
464	DR2	EBRPD	Dry N Coastal Scrub	88	22	Top	Houses adj	Chaparral	Moderate Dev Stg-wld	20	24	208	1609	4
466		Private	N Mixed Chaparral	9	9	Midslope	Houses above	Chaparral	High Dev Stage-wild	40	46	458	3114	6
468		Private	Dry N Coastal Scrub	24	24	midslope	& adj	Brush	High Dev Stage-wild	20	18	142	1230	4
473		Private	Dry N Coastal Scrub	10	10	midslope	& adj	Brush	Moderate Dev Stg-wld	40	14	146	760	4
474		Private	Successional Scrub	14	14	Midslope	below	Brush	Moderate Dev Stg-wld	20	14	146	760	4
479		Private	N Mixed Chaparral	8	8	Midslope	Houses above	Chaparral	High Dev Stage-wild	40	46	458	3114	6
483		Private	Dry N Coastal Scrub	33	33	Top to midslope	Houses above & adj	Brush	High Dev Stage-wild	40	18	150	1230	4
485	DR1	San Leandro	Dry N Coastal Scrub	155	19	Top to midslope	Houses above & adj	Brush	Extreme Dev Stg-wld	20	31	403	1490	4

486	DR2	EBRPD	Dry N Coastal Scrub	52	52	Top to midslope	Houses above & below	Brush	High Dev Stage-wild	20	18	142	1230	4
490	SR1	EBRPD	Dry N Coastal Scrub	13	13	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	4
494		Private	N Mixed Chaparral	12	12	Midslope	Houses above	Chaparral	Moderate Dev Stg-wld	40	24	219	1609	6
498	DR2	EBRPD	Dry N Coastal Scrub	5	5	Top	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	4
508	D2/AVC1	EBRPD/Oak	Dry N Coastal Scrub	66	33	Ridgetop	Houses below	Brush	Moderate Dev Stg-wld	20	14	139	760	4
538	AVC2	EBMUD	N Mixed Chaparral	14	14	Ridgetop	Zoo adj	Chaparral	High Dev Stage-wild	20	45	435	3114	6
514	DR2	EBRPD	Dry N Coastal Scrub	71	16	Top	Houses below	Chaparral	Extreme Dev Stg-wld	20	68	924	3529	4
518	AVC1	Oakland	Dry N Coastal Scrub	26	13	Midslope	Houses adj.	Brush	High Dev Stage-wild	20	18	142	1230	4
521	ER3	Oakland	Dry N Coastal Scrub	16	16	Top	Houses adj & above	Brush	High Dev Stage-wild	20	18	142	1230	4
528	AVC1	Oakland	Dry N Coastal Scrub	21	7	Top	Houses adj. & above	Brush	High Dev Stage-wild	20	18	142	1230	4
530	AVC1	Oakland	Dry N Coastal Scrub	47	1	Midslope	Houses adj.	Brush	High Dev Stage-wild	20	18	142	1230	4
545		Private	Dry N Coastal Scrub	18	18	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	4
559		Private	Successional Scrub	12	12	Top slope	Houses above	Brush	High Dev Stage-wild	40	18	150	1230	4
570	DR2	EBRPD	Dry N Coastal Scrub	6	3	Midslope	Houses adj.	Brush	Extreme Dev Stg-wld	20	31	403	1490	4
588	DR2	EBRPD	Dry N Coastal Scrub	227	14	Top	EBRPD Ofc	Chaparral	High Dev Stage-wild	20	45	435	3114	4
623	DR2	EBRPD & private	Dry N Coastal Scrub	5	4	Midslope	Houses adj.	Brush	Extreme Dev Stg-wld	20	31	395	1490	4
624	DR2	EBRPD	Successional Scrub	24	24	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	4
751	ERN3	EBRPD	Wet N Coastal Scrub	12	12	Top	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	8
761	ERN3	EBRPD	Successional Scrub	7	7	Top	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	4
986		Private	Dry N Coastal Scrub	19	17	Midslope	Houses adj & below	Brush	Low Dev Stage-wild	40	10	89	576	4
990		Private	Dry N Coastal Scrub	27	27	Midslope	Houses adj & below	Brush	Low Dev Stage-wild	40	10	89	576	4
993		Private	Dry N Coastal Scrub	5	5	Top	Houses above, adj & below	Brush	Low Dev Stage-wild	40	10	89	576	4
1001	CTC8	Oakland	Wet N Coastal Scrub	15	15	Bottom	Freeway below	Brush	High Dev Stage-wild	40	18	150	1230	8
1008	CTC8	CALTRANS	Wet N Coastal Scrub	10	10	Bottom	Freeway below	Brush	Moderate Dev Stg-wld	20	14	146	760	8
1012		Private	Dry N Coastal Scrub	27	24	Top	Houses below & above	Brush	High Dev Stage-wild	40	18	150	1230	4
1016		Private	Dry N Coastal Scrub	47	47	Top	Houses below	Brush	Moderate Dev Stg-wld	40	14	146	760	4
1116	ERN5	EBRPD	Successional Scrub	7	7	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	4
1198	AVC1 & AVC2	Oakland &EBMUD	Successional Scrub	8	8	Bottom of slope	Houses adj & above	Timber/Grass	High Dev Stage-wild	20	16	259	553	4
1329		Private	Dry N Coastal Scrub	11	5	Midslope	Houses below	Brush	High Dev Stage-wild	40	18	150	1230	4
1334	ERN1	EBMUD	Dry N Coastal Scrub	28	21	Midslope	Houses below	Brush	High Dev Stage-wild	20	18	142	1230	4
1339	ERN1	EBMUD	Successional Scrub	11	1	Mid sloe	Houses below	Brush	Moderate Dev Stg-wld	20	14	146	760	4
			Subtotal Shrub Communities					**1,201**	*Total Shrub Communities in Study Area*			*3,349*	*Treated*	*36%*
Tree Dominated Communities														
408	PRC2	Oakland	Acacia	6	6	midslope	upslope	Hardwood Litter	Extreme Dev Stg-wld	40	15	135	848	6
			Subtotal Acacia					**6**	*Total Acacia in Study Area*			*6*	*Treated*	*100%*
92	ERN3	EBRPD	Eucalyptus-mature	14	14	Mid to bottom	Houses above	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
203	CC7	UCB	Eucalyptus-mature	9	9	Mid slope	Structures above below & adj	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	1
227	CC&	UCB	Eucalyptus-mature	13	13	Mid slope	Structures above below & adj	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1

248	CC4	UCB	Eucalyptus-mature	5	5	Mid slope	Structures above below & adj	Brush	High Dev Stage-wild	20	18	142	1230	1
339		Private	Eucalyptus-mature	54	54	Top	Houses above & below	Timbr Littr/Undrstry	Moderate Dev Stg-wld	40	9	32	1197	1
481	LR3	Oakland	Eucalyptus-mature	8	8	Lower slope	Houses adj & above	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
534	AVC2	EBMUD	Eucalyptus-mature	20	20	Bottom	Houses adj & above	Timber/Grass	Extreme Dev Stg-wld	10	20	229	938	1
537	AVC1	Oakland	Eucalyptus-mature	14	14	Bottom	Houses adj & above	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	1
547	DR2	EBRPD	Eucalyptus-mature	10	10	Midslope	Houses above	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
562	DR2	EBRPD	Eucalyptus-mature	6	6	Midslope	Houses distant	Closed Timber Litter	Extreme Dev Stg-wld	40	6	36	526	1
568	DR2	EBRPD	Eucalyptus-mature	5	5	Top of slope	Houses above	Hardwood Litter	Extreme Dev Stg-wld	20	14	129	848	1
640	DR1/DR2	EBRPD/San Leandro	Eucalyptus-mature	80	10	Bottom	Houses below	Hardwood Litter	Extreme Dev Stg-wld	20	14	129	848	1
747	ERN3	EBRPD	Eucalyptus-mature	19	5	Mid slope	Houses above	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	1
886	CC7	LBL & UCB	Eucalyptus-mature	19	2	Top	LBL below	Hardwood Litter	Extreme Dev Stg-wld	20	14	129	848	1
			Subtotal Eucalyptus Mature					**175**	*Total Eucalyptus - mature in Study Area*			*804*	*Treated*	*22%*
120	ERN3	EBRPD	Eucalyptus-20 yr	7	0.10	Midslope	Houses above	Hardwood Litter	Extreme Dev Stg-wld	20	14	129	848	1
161	ERN1	EBRPD	Eucalyptus-20 yr	6	6	Midslope	Houses above	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	1
166	CC4	UCB	Eucalyptus-20 yr	14	7	Top	below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
211	CC4	UC Berkeley	Eucalyptus-20 yr	15	15	Midslope	UC/ LBL below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
227	CC4	UCB	Eucalyptus-20 yr	13	13	Midslope	UC/ LBL below & above	Timbr Littr/Undrstry	Moderate Dev Stg-wld	40	9	32	1197	1
270	CCR	UCB	Eucalyptus-20 yr	15	1	Ridgetop	Houses adj	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	1
276	ERN1	EBMUD	Eucalyptus-20 yr	6	6	Ridgetop	Houses below (Distant)	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
337	ERS2	EBRPD	Eucalyptus-20 yr	8	8	Top - Midslope	House below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
347	TC4	EBRPD	Eucalyptus-20 yr	14	14	Top	Houses below	Timbr Littr/Undrstry	High Dev Stage-wild	40	12	50	1511	1
350	ERS2	EBRPD	Eucalyptus-20 yr	29	29	Ridgetop	Houses below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
361		Private	Eucalyptus-1 to 5 yr	6	6	Top	Houses above & below	Southern Rough	High Dev Stage-wild	40	13	149	596	2
368		Private	Eucalyptus-20 yr	11	7	Midslope	Houses below	Hardwood Litter	Extreme Dev Stg-wld	40	15	135	848	1
370	ERS3	Private & EBRPD	Eucalyptus-20 yr	8	8	Midslope	Houses below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
382	ERS4	EBRPD	Eucalyptus-1 to 5 yr	8	4	Top	Houses below	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	2
391	ERS4	EBRPD	Eucalyptus-20 yr	23	23	Top to bottom slope	Houses distant	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
397	ERS4 / PSC2	EBRPD & Oakland	Eucalyptus-20 yr	13	13	Ridgetop	Houses below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	10	20	117	1906	1
402	PSC2	Oakland	Eucalyptus-20 yr	10	7	Ridgetop	Houses below	Timbr Littr/Undrstry	High Dev Stage-wild	40	12	50	1511	1
493		Private	Eucalyptus-20 yr	19	19	Lower slope	Houses adj & above	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	1
503	AVC1	Oakland	Eucalyptus-20 yr	24	21	Ridgetop	Houses below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
513	DR2	EBRPD	Eucalyptus-20 yr	608	608	Top to bottom	Houses below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
515	DR2	EBRPD	Eucalyptus-20 yr	30	30	Top to bottom	Houses below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
576	DR2	EBRPD	Eucalyptus-20 yr	7	7	Bottom	Houses distant	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1

645	ERN3	EBRPD	Eucalyptus-20 yr	33	33	Ridgetop	Houses distant	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
680	ERN3	EBRPD	Eucalyptus-20 yr	19	19	Ridgetop	Houses distant	Timbr Littr/Undrstry	Extreme Dev Stg-wld	10	20	117	1906	1
695	ERN3	EBRPD	Eucalyptus-20 yr	45	45	Bottom	Houses below (distant)	Timbr Littr/Undrstry	Extreme Dev Stg-wld	20	20	120	1906	1
731	ERN3	EBRPD	Eucalyptus-20 yr	5	5	Top	Houses above	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
924	CC4 & ERN1	UCB & EBRPD	Eucalyptus-20 yr	34	1	Ridgetop	Transmission above	Hardwood Litter	Extreme Dev Stg-wld	40	15	135	848	1
980		Private	Eucalyptus-1 to 5 yr	22	22	Top - mid	Houses above & below	Hardwood Litter	Moderate Dev Stg-wld	40	14	127	848	2
985		Private	Eucalyptus-1 to 5 yr	21	21	Lower slope	Houses below	Hardwood Litter	Moderate Dev Stg-wld	40	14	127	848	2
989	CCT10	Oakland	Eucalyptus-1 to 5 yr	8	4	Top	Houses below	Hardwood Litter	Moderate Dev Stg-wld	40	14	127	848	2
995		Private	Eucalyptus-1 to 5 yr	20	20	Top	Houses below & adj.	Southern Rough	High Dev Stage-wild	40	22	165	1681	2
1003		Private	Eucalyptus-1 to 5 yr	18	13	Top	Houses below & adj.	Southern Rough	High Dev Stage-wild	40	22	165	1681	2
1020	TC4/ PG&E	EBRPD, Private & PG&E	Eucalyptus-20 yr	6	6	Top	Houses below	Timbr Littr/Undrstry	Extreme Dev Stg-wld	40	21	127	1906	1
1032	CTC8	Private	Eucalyptus-1 to 5 yr	20	3	Top	Houses above & below	Southern Rough	High Dev Stage-wild	40	22	165	1681	2
			Subtotal Second Growth Eucalyptus					**1,045**	*Total Eucalyptus - 20 yr in Study Area*			*1,379*	*Treated*	*76%*
131	ERN3	EBRPD	Mixed Hardwood Wdlnd	10	6	Midslope	Houses above	Brush	Moderate Dev Stg-wld	20	14	139	760	6
138	ERN3	EBRPD	Mixed Hardwood Wdlnd	17	17	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	6
351	TC4	EBRPD	Mixed Hardwood Wdlnd	18	5	Top	Houses below	Timbr Littr/Undrstry	High Dev Stage-wild	40	12	50	1511	6
428	DR2	EBRPD	Mixed Hardwood Wdlnd	23	3	Midslope	Houses above	Brush	High Dev Stage-wild	40	18	150	1230	6
442	DR2	EBRPD	Mixed Hardwood Wdlnd	16	16	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	6
458	DR2	EBRPD	Mixed Hardwood Wdlnd	23	15	Midslope	Houses above	Brush	High Dev Stage-wild	40	18	150	1230	6
482		Private	Oak Savannah	10	10	Midslope	Houses above & adj	Timber/Grass	High Dev Stage-wild	40	16	266	553	1
491	SR1	EBRPD	Mixed Hardwood Wdlnd	30	30	Midslope	Houses above	Brush	High Dev Stage-wild	20	18	142	1230	6
583	DR2	EBRPD	Mixed Hardwood Wdlnd	23	20	Midslope	Houses below	Brush	High Dev Stage-wild	40	18	150	1230	6
652	ERS2	EBRPD	Mixed Hardwood Wdlnd	9	1	Ridgetop	?	Brush	Extreme Dev Stg-wld	40	32	423	1490	6
1021		PG&E & Private	Mixed Hardwood Wdlnd	21	4	Mid - Bottom	Houses below	Brush	High Dev Stage-wild	40	18	150	1230	6
			Subtotal Mixed Hardwood Wdlnd					**126**	*Total Mixed Hdwd Wdlnd in Study Area*			*889*	*Treated*	*14%*
59	ERN3	EBRPD	Pine Forest-mature	12	12	Ridgetop	Houses distant	Hardwood Litter	High Dev Stage-wild	20	7	56	448	2
60	ERN3	EBRPD	Pine Forest-mature	5	5	Ridgetop	Houses distant	Hardwood Litter	High Dev Stage-wild	20	7	56	448	2
130	ERN3	EBRPD	Mature Pine/Euc Mix	7	0.10	Mid to bottom	Houses above	Timbr Littr/Undrstry	High Dev Stage-wild	10	12	46	1511	6
380	ERS4	EBRPD	Mature Pine/Euc Mix	62	1	Ridgetop	Houses below	Timbr Littr/Undrstry	High Dev Stage-wild	20	12	47	1511	6
			Subtotal Pine Forest Mature					**19**	*Total Pine Forest Mature in Study Area*			*865*	*Treated*	*2%*
			Total High Hazard Polygons for Treatment					**3,171**	**acres**			**Total Acres Treated**		**17%**
			Total in Acres in Wildland					**18,482**	**acres**					
					5,198									


A
B
Map 1
Map 2
500 foot wide Buffer
Jurisdiction Boundaries
Fire Roads
Parking
Picnicking
Camping
Activity Areas Targeted for Ignition Reduction Program
148
Vegetation Polygon & Identification Number
148
Polygon Identified for Priority Treatment & Identification Number



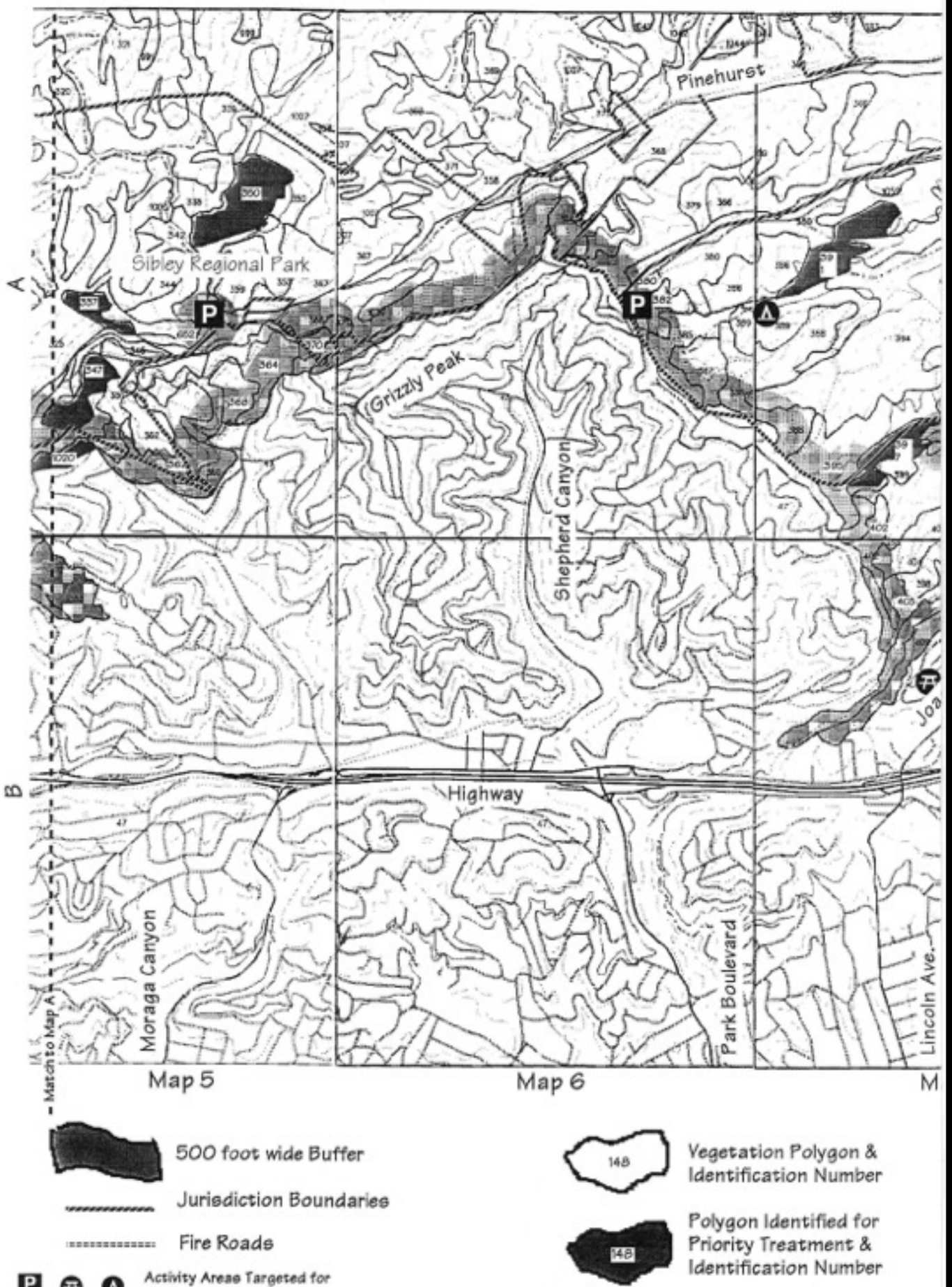
Scale

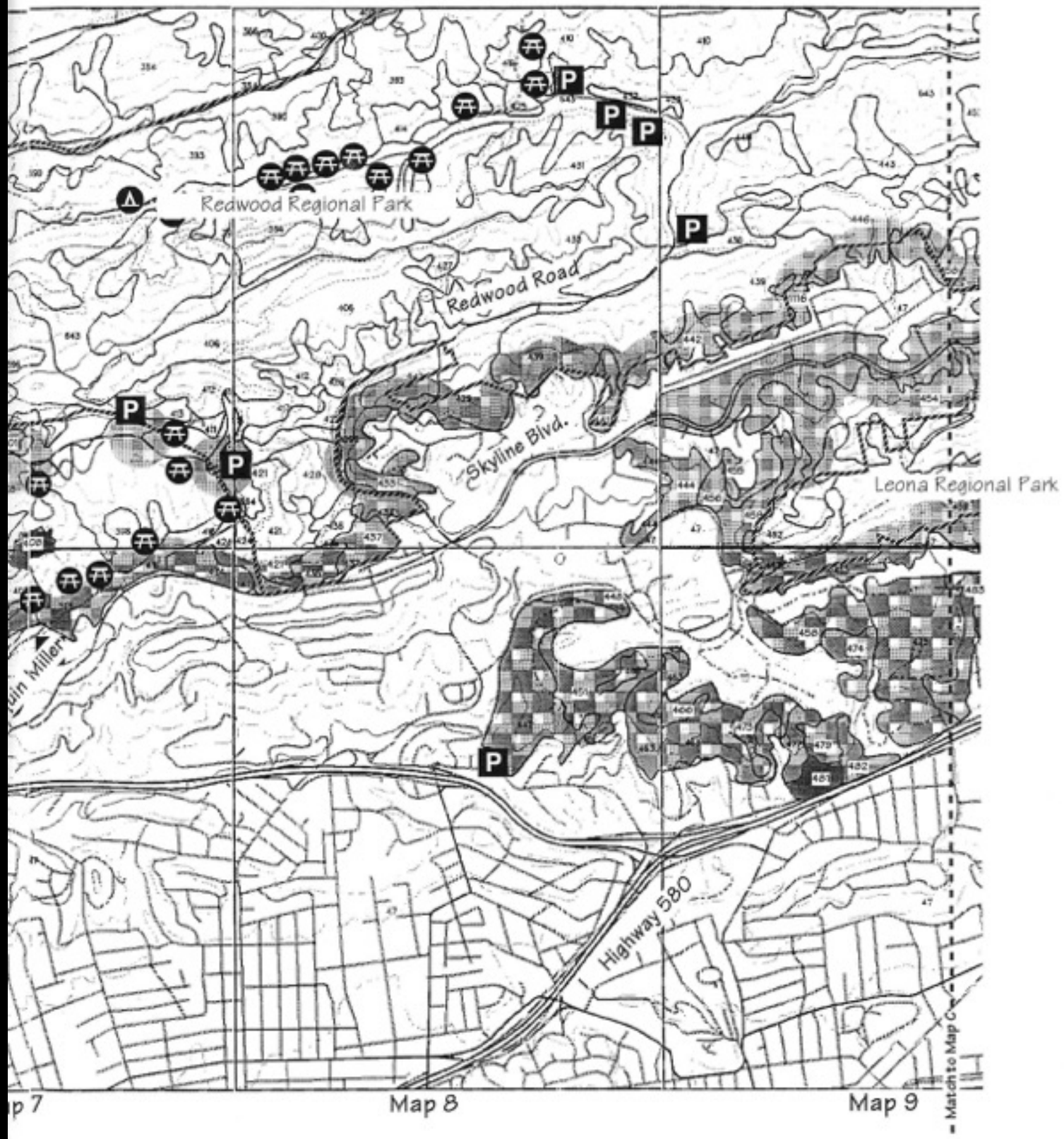
0 1000 3000

North

Vegetation Polygons in Study Area Wildlands

Map A

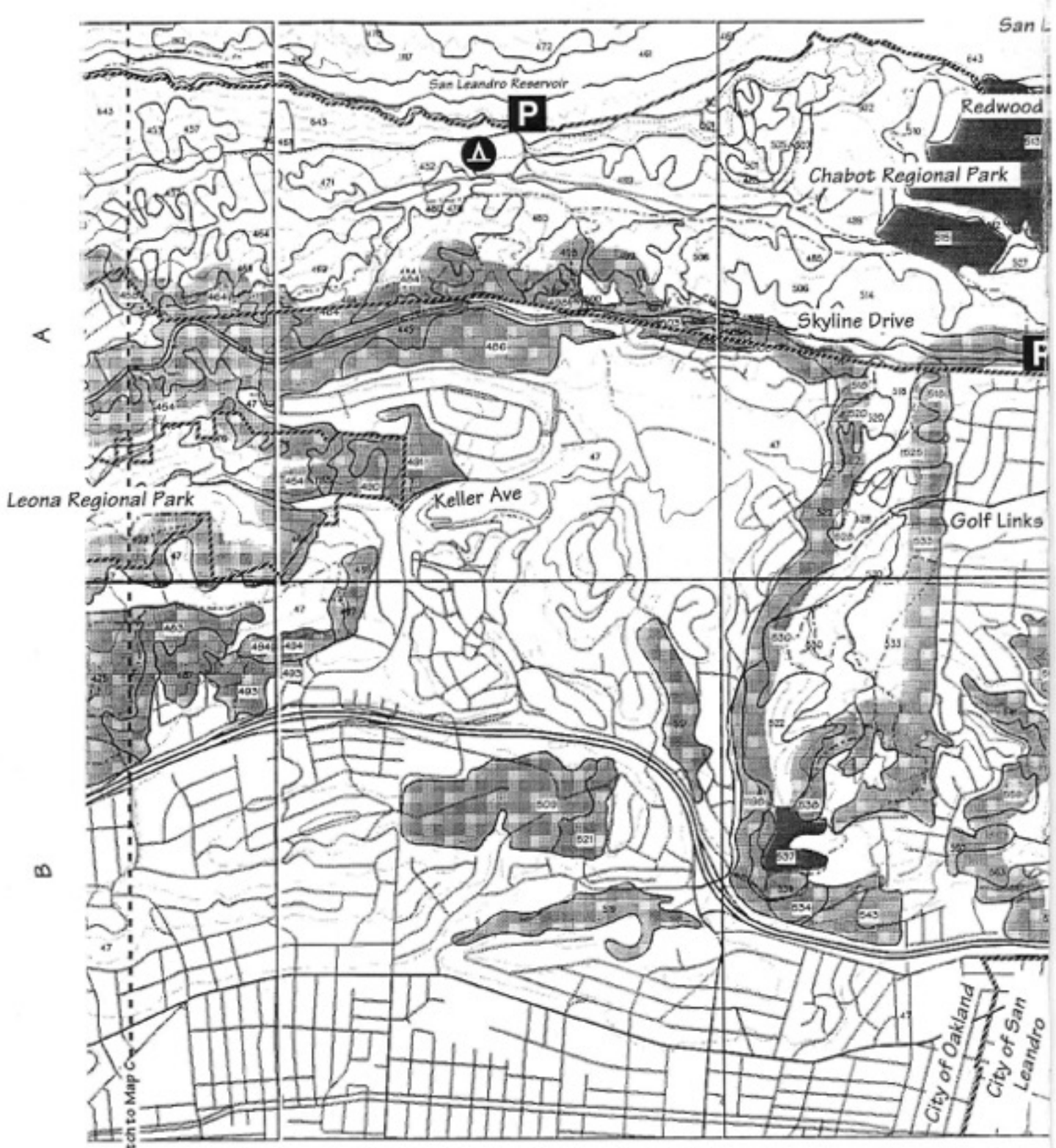

Pinehurst
Sibley Regional Park
Grizzly Peak
Shepherd Canyon
Highway
Moraga Canyon
Park Boulevard
Lincoln Ave.
A
B
Match to Map A
Map 5
Map 6
M
500 foot wide Buffer
Jurisdiction Boundaries
Fire Roads
Activity Areas Targeted for Ignition Reduction Program
Parking
Picnicking
Camping
148
Vegetation Polygon & Identification Number
148
Polygon Identified for Priority Treatment & Identification Number

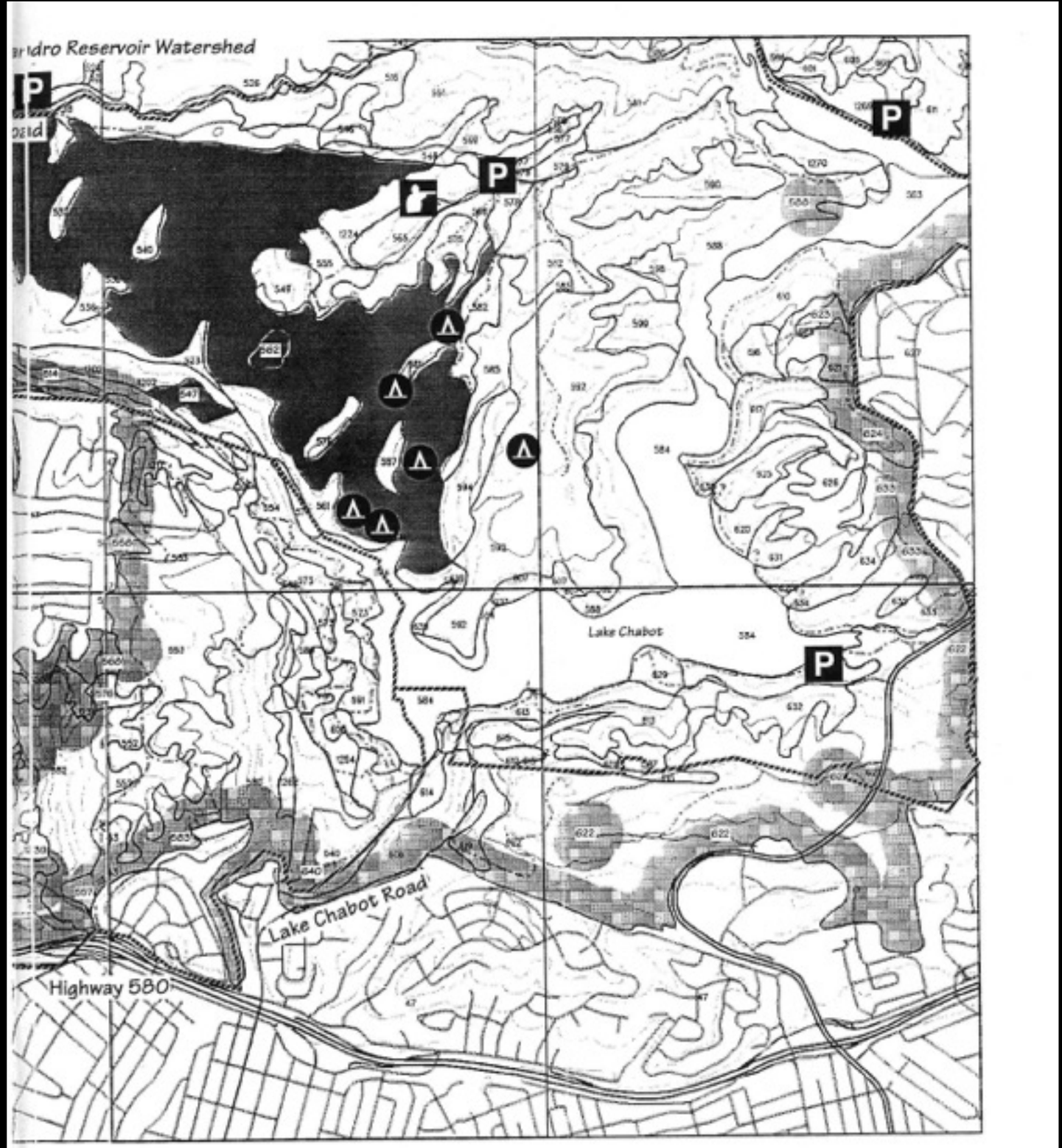


Scale
0 1000 3000
North

Vegetation Polygons in Study Area Wildlands

Map B


San Leandro Reservoir
Redwood
Chabot Regional Park
Skyline Drive
Leona Regional Park
Keller Ave
Golf Links
City of Oakland
City of San Leandro
A
B
Match to Map C
Map 9
Map 10
Map 11
500 foot wide Buffer
Jurisdiction Boundaries
Fire Roads
Parking
Picnicking
Camping
Activity Areas Targeted for Ignition Reduction Program
148
Vegetation Polygon & Identification Number
148
Polygon Identified for Priority Treatment & Identification Number



Map 12 Map 13

Scale
0 1000 3000
North

Vegetation Polygons in Study Area Wildlands

Map C

Glossary of Terms

Acronyms

AIA	American Institute of Architects
APA	American Planning Association
ASLA	American Institute of Landscape Architects
BFD	Berkeley Fire Department
CDF	California Department of Forestry & Fire Protection
EBH FCC	East Bay Hills Fire Chief Consortium
EBRPD	East Bay Regional Parks District
EBMUD	East Bay Municipal Utilities District
GIS	Geographic Information System
HEF	Hills Emergency Forum
FEMA	Federal Emergency Management Agency
LBL	Lawrence Berkeley Laboratory
LRA	Local Responsibility Area
NFPA	National Fire Prevention Association
OES	Office of Emergency Services
OFD	Oakland Fire Department
SAF	Society of American Foresters
SRA	State Responsibility Area
UCB	University of California Berkeley
VMC	Vegetation Management Consortium

Definitions

Accessory Building: Any building used as an accessory to residential, commercial, recreational, industrial or education purposes. California Building Code, 1989 Amendments Chapter 11, Group M Division 1 Occupancy.

Aerial Fuels: Standing and supported live and dead combustibles not in direct contact with he ground and consisting mainly of twigs, branches, stems, cones, bark and vines.

Aspect: Direction towards which the slope faces.

Brush: Shrubs and scrub vegetation or other growth heavier than grass, but not tree size.

Combustible Materials: Any element in the landscape which is easily ignited and capable of burning rapidly. Combustible materials include but are not limited to the following: waste paper, hay, grass or weeds more than 4 inches tall, flammable waste material, petroleum products, dead vegetation, dead branches on living plants, firewood, and loose papery bark on trees.

Crowing Potential The ability for fire to move from ground level into the upper branches & foliage of shrubs or trees.

Dead End Road: A road that provides only one point of ingress and egress.

Defensible Space: The area within the perimeter of a parcel, neighborhood or community where basic wildland fire protection practices and measures are implemented. Providing the key point of defense from an approaching wildland fire or defense against encroaching wildfires or escaping structure fires. The perimeter as used in this regulation is the area encompassing the parcel excluding the physical structure itself. The area is characterized by the establishment and maintenance of emergency vehicle access, emergency water reserves, street names and building identification and fuel modification measures.

Fire Brands: Small piece of burning materials. Materials such as shake roof shingles and tree bark or branches commonly break apart into brands and can become airborne during a fire.

Fire Hazard: Any thing or act which increases or may cause an increase of the potential for or menace of fire to a greater degree than that customarily recognized as normal. Any thing or act which may obstruct, delay, hinder, or interfere with the operations of the Fire District or the egress of occupants in the event of fire.

Flammable Materials: Any liquid or gas that is easily ignited and capable of burning rapidly.

Flammable Vegetation: Plants with one or all of these characteristics: accumulation of dead vegetation, high volume growth, or low fuel moistures. These plants may ignite easily, burn rapidly or produce high heat output and are capable of transmitting fire.

Foehn Winds: A dry warm wind that blows from the continental land mass; locally known as "Diablo Winds" or Easterlies.

Fuels: All Class a fuels within the wildland urban interface or wildland/urban intermix, including vegetation and structures.

Fuel Break: An area, usually a long strip strategically locate, wherein vegetative fuels are reduced in volume and maintained to cause a reduction of fire intensity if ignited by a wildland fire.

Fuel Load: the quantity of fuel expressed in terms of weight per unit area of land, generally expressed in tons per acre (TPA).

Fuel Mosaic: removal of vegetation to create distinct and separate groups of plants with the goal of breaking up fuel continuity.

Fuel Modification area: An area where the overall volume of flammable vegetation has been reduced, providing reduced fire spread, intensity and duration. Modification actions include the removal of fuels, conversion of vegetation with low volume or less ignitable fuel characteristics, increased spacing of individual plants, or lowering of age class within a given area.

Greenbelts: A facility or land-use, designed for a use other than fire protection, which will slow or resist the spread of a wildland fire. Includes parking lots, irrigated or landscaped areas, golf courses, parks, playgrounds, maintained vineyards, orchards or annual crops that do not cure in the field.

Ground Fuels: Any native or landscape vegetation not considered a tree and generally in contact with the ground.

Hammerhead/T: a road that provides a "T": shaped, three-point turn-around for emergency equipment, being no narrower than the road that it serves, with the top of the "T" being a minimum of 40 foot long.

Hazardous Vegetation (called Flammable Vegetation in State Fire Code): any vegetation, including ornamental, that either by its intrinsic species characteristics, spacing, placement or lack of care is easy to ignite, spreads fire rapidly, produces high heat or creates fires that are difficult to suppress.

Horizontal Separation: Spacing between plants designed to minimize the spread of fire from plant to plant.

Listed: Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with the produce evaluation that maintains periodic inspection of production of listed equipment or materials. Listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner. Typically listed equipment is also labeled with listing agency.

Local Responsibility Area (LRA): Area or district under the jurisdiction of a local fire department. (see also State Responsibility Area)

Managed Domestic Landscape: Privately owned parcels that receive regular maintenance and are kept free of flammable vegetation.. These landscapes may include structures or be essentially undeveloped.

Nexus: a connected group or series of actions (or case law) that provides a supporting legal framework linking one finding to the next.

Ornamental: any vegetation or group of native or introduced plants that have been located and are maintained for a functional or aesthetic purposes.

Parcel: a portion of land of any size, the area of which is determined by assessor's maps and records and identified by an assessor's parcel number. Each parcel has a zoning designation that identifies it permissible use and requirements for any development.

Phyrophyte (Phyrophytic plant)**:** Highly flammable plant materials that are high in flammable oils or resins, produce large quantities of dead materials, litter or commonly have very low fuel moistures.

Prescribed Fire: the knowledgeable application of fire to a specific land area to accomplish predetermined land management objectives.

Rated Roof: A roof constructed of materials that are listed as meeting the requirements for Class A, B or C roofing materials.

Shrub Islands: Distinct groupings of shrubs designed to help control the spread of fire. Islands should be small enough to provide adequate horizontal separation between groupings. These groupings may be established during initial planting or created by removing and maintaining existing shrubs.

Slope: Upward or downward incline or slant, usually calculated as a percentage of slope (rise or fall per 100 feet of horizontal distance).

Spotting: The phenomena of fire brands or live embers being carried by wind to ignite new fires ahead of the main fire front.

State Responsibility Area (SRA): Area or district under the jurisdiction of the State of California and State Fire Marshall's Office. Fire protection is provided by CDF. (see also Local Responsibility Area)

Unmaintained Landscape: Privately owned parcels with flammable vegetation that do not receive regular treatment to reduce fire hazard. These landscapes may include structures or be essentially undeveloped.

Urban/ Wildland Interface: An area where built development and wildland fuels meet at a well defined boundary.

Urban/ Wildland Intermix: An area where built development and wildland fuels mix with no clearly defined boundary.

Vertical Separation: The distance from the top of shrubs or groundcover to adjacent trees, designed to minimize the spread of fire to the crown of trees or structure roofs. The minimum distance is two times the height of the shrub to the leaves or needles of adjacent overstory trees.

Wildland: An area in which development is essentially non-existent, except for roads, railroads, powerlines and similar transportation facilities. Structures, if any, are widely scattered are primarily for recreation purposes or management support.

Wildland Fire: An unplanned and unwanted fire requiring suppression action. An uncontrolled fire, usually spreading through vegetative fuels, but often threatening and involving structures. Wildland fires are not restricted to undeveloped areas but may also occur in the Urban Wildland Intermix

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Note: This 331 page Technical Appendix is not included here, and covers the material listed below in a separate document.

EAST BAY HILLS
VEGETATION MANAGEMENT CONSORTIUM

Technical Appendices

Fire Hazard Program
&
Fuel Management Plan
for the
East Bay Hills

May 1995

Hazard Assessment

Wildland Mitigation

Urban-Wildland Intermix Mitigation

Policy Programs

Background Materials