

4 | FIRE HAZARDS

4.1 | OVERVIEW

Characteristics Fire is a unique hazard in that it can result both from natural processes and from the intentional or accidental actions of people. There are three main types of fire hazards: wildfires, which affect open space and development on the urban fringe; structural fires, which occur in buildings; and industrial fires, which result from the ignition of hazardous materials. While fires are not entirely preventable, it is possible to create conditions that reduce the chances of fire and that facilitate efficient response in case fire breaks out. When a fire does ignite, quick response from firefighters and an adequate supply of water are essential in minimizing damage.

Key vulnerability factors General factors that affect an area's risk from fire hazards include its location, land uses, distance from fire stations, ease of accessibility by fire-fighting equipment, and adequacy of water supply. More specifically, the extent, severity and damage of fires are determined by several key factors affecting vulnerability. For the three types of fire examined in the safety element, these vulnerabilities include:

- Wildfires: steep and rugged topography, dense and unmanaged vegetation (especially woods and brush), accessibility to human activities, exposure to wind and sun,



drought conditions, and the presence of above-ground utility lines. The wild-land/urban interface is an especially hazardous area because it combines a resident population with large areas of combustible material (including structures), and is often characterized by sub-standard water supplies and a distant location from fire stations. The time of the year of high wildfire danger is from May to October, when temperatures are higher and humidity is lower. The closer to the end of this “fire season,” the more critical the danger is, as vegetation becomes increasingly dry.

- Structural fires (excluding industrial buildings, which are discussed below): Especially vulnerable building and land-use types include high-rise buildings, multi-family dwellings, and high-density residential neighborhoods; places of mass assembly, such as schools, stadiums, auditoriums and shopping centers; structures constructed before current fire and building codes; institutions such as hospitals and jails that house people of limited mobility; and downtowns and other high-density commercial districts.
- Industrial fires: Especially vulnerable facilities include large industrial complexes, including seaports and airports, and businesses and other “target hazards” with substantial concentrations of highly combustible and toxic materials. Because of their nature, industrial fires are covered in the “Hazardous Materials” chapter rather than in this chapter.

Relationship to earthquakes While fires usually happen as stand-alone events, the threat of extensive fire damage is greatest following a major earthquake. Strong earthquakes can rupture gas lines and down electric lines, which can, in turn, spark fires. The severity of fires occurring under those circumstances would likely be compounded by the accompanying failure of water mains (which would hamper fire-suppression efforts) and damage to roads and overpasses (which would restrict the evacuation of people and access by emergency vehicles). In the past, strong earthquakes in the Bay Area have been followed by fires requiring the extensive involvement of professional firefighters, a relationship that is likely to continue.

The 1991 Oakland/Berkeley Hills Fire A substantial fire occurred in the North Oakland hills in 1970 that consumed 200 acres and destroyed 37 homes. Regarding this fire, the city’s original safety element prophetically stated that “fortunately [a] disaster has not occurred but the potential for such a disaster is still real.” In the morning of Sunday, October 20, 1991, flames broke out in a residential canyon west of Grizzly Peak Boulevard and the Caldecott Tunnel. The flames—fueled by record-high temperatures, five years of drought conditions, freeze-damaged groves of trees, and strong, hot, dry



winds—leapt quickly and easily across parcels. In little more than 15 minutes, the fire had gone out of control. It is said that during its first three hours, the fire consumed one house every 11 seconds. It took more than 1,800 fire personnel using over 400 pieces of equipment, including 20 helicopters and airplanes, to subdue the fire. The conflagration—which became known as the Oakland/Berkeley Hills firestorm, or the Tunnel fire—was not officially declared under control until 8 am on Wednesday, October 23; by then, it had become the costliest wildfire in U.S. history, causing 25 deaths, 150 injuries, the destruction of more than 3,000 homes, and approximately \$1.5 billion in property damage.

This disaster led to numerous new regulations at the state and local levels. As a result of the fire, real-estate sellers statewide, for example, are now required to inform prospective buyers if a residential property lies within a zone of very high fire-hazard severity. The fire also prompted the state to create the Standardized Emergency Management System (SEMS; see chapter 2, “Emergency Management”), a framework for standardizing emergency-response procedures throughout California and facilitating the flow of information and resources among agencies. At the local level, Oakland and many neighboring jurisdictions strengthened their building and fire-prevention codes by placing new or additional regulations on the separation of buildings, ventilation criteria, roof materials, landscaping, building access, and the installation of automatic fire-extinguishing systems in public buildings.

4.2 | INSTITUTIONAL FRAMEWORK

Oakland Fire Department (OFD) OFD is the agency with primary responsibility for preventing and suppressing fires in Oakland. Besides fighting accidental fires and arson, OFD conducts fire-safety inspections and plan checks of buildings and businesses; provides fire-danger patrols and issues public warnings during times of high fire danger; conducts vegetation-management inspections; responds to hazardous-materials spills; oversees the Oakland Office of Emergency Services; issues permits for fairs, carnivals, pyrotechnic displays and other special events; offers classes to the public on first aid and cardio-pulmonary resuscitation; provides on-site training to local



businesses on basic emergency response; and teaches basic personal fire-safety and fire-prevention practices to school children.

OFD is often the first agency called in the event of medical and other emergencies. Through its emergency medical services (EMS) division, OFD has been providing round-the-clock paramedic service to Oakland residents since 2000. (Ambulance service is provided by private companies under contract with Alameda County). Every fire-station engine in Oakland has at least one paramedic on staff to provide advanced medical care; in addition, all firefighters are certified emergency medical technicians, able to provide basic care. The EMS division also distributes equipment and supplies for life-support services, and provides training and continuing education to ensure that certification and licensing requirements are current for all OFD personnel. Finally, OFD sponsors California Task Force 4 (CATF-4), a team of firefighters, doctors, paramedics, search-dog handlers, structural engineers and other specialists trained in “urban search and rescue” (US&R). The task force possesses a high level of expertise in medical, rescue and technical skills, and the specialized equipment needed to rescue victims trapped in building collapses, industrial accidents, transportation disasters and other complex situations. CATF-4 is one of eight US&R teams in California and 28 nationwide that may be mobilized within hours to respond to emergencies anywhere in the country.

Local amendments to the California (or Uniform) Fire Code are found in chapter 15.12 of the Oakland Municipal Code. The amendment to the California Building Code regarding special fire-related construction requirements is found in section 15.04.785 of the municipal code.

Regulations pertaining to land subdivisions related to fire safety and ingress/egress are found in chapters or sections 16.16, 16.20.030, 16.24.040, 16.28.040 and 16.32 of the Oakland Municipal Code; regulations pertaining to secondary units are found in sections 17.102.360; regulations concerning building numbers are found in chapter 15.40; regulations regarding bedroom security bars are found in chapter 15.64; and the Oakland Housing Code is found in chapter 15.08.

Local regulations Oakland’s fire-protection standards for construction are based on Title 24 of the California Code of Regulations (see above), specifically on the California Building Code (CBC) and the California Fire Code (CFC). Oakland, like many other localities in California, has amended these codes to reflect local conditions. A noteworthy local fire-related amendment to the CBC is the addition of a chapter providing for special construction requirements in fire-hazard areas, in the area damaged by the 1991 Oakland hills fire, and in areas covered by the North Oakland Hill Area Specific Plan. This amendment discusses fire-resistive walls and roofs, the separation of buildings to minimize potential fire spread, and automatic fire-extinguishing systems.

Additionally, the city has enacted a number of provisions pertaining to land subdivisions and secondary units that relate to fire safety and ingress/egress, including the width and grade of streets, minimum street-curvature radii, installation of fire hydrants and street design in hillside subdivisions. Also, the city’s municipal code has chapters regulating the location, design and assignment of building numbers, and also the use and design of bedrooms that have windows or doors with security bars. Finally, various sections of

the housing code call for the use of fire-resistant construction and the provision of smoke detectors and adequate fire-extinguishing systems or equipment. The Building Services Division of the city's Community and Economic Development Agency (CEDA) is responsible for enforcing the city's various codes when reviewing construction projects submitted for official approval.

Inter-agency cooperation In addition to general mutual-aid agreements (see the “Emergency Management” chapter), Oakland has entered into agreements with adjoining jurisdictions for cooperative response to fires. These agreements help protect Oakland residents and business situated nearer the fire stations of adjoining jurisdictions and also from fires originating outside city boundaries. Oakland has mutual-response agreements for fire protection with Alameda and Contra Costa counties, the East Bay Regional Park District (EBRPD) and the cities of Alameda, Berkeley, Emeryville, Piedmont and San Leandro. (EBRPD has its own fire department, with staff and equipment distributed among five park units, of which Tilden is the closest to Oakland.) In addition, the OFD is a member of the Hills Emergency Forum (HEF) and Diablo FireSafe Council (DFC). HEF is a coalition of government agencies and special districts that coordinate the collection and assessment of information related to fire hazards in the East Bay hills, and develops fire-safety standards and codes, incident-response and management protocols, and fuel-reduction strategies. DFC is a partnership among government and private-sector organizations working to prevention wildfires in Alameda and Contra Costa counties.



California Department of Forestry and Fire Protection (CDF) The CDF has primary responsibility for preventing and suppressing fires on more than 31 million acres of non-federal wildlands in California. The department also responds to thousands of non-wildfire emergencies annually, including car crashes, hazardous-materials spills and medical calls. Among CDF's several divisions is the Office of the State Fire Marshal (OSFM), the duties of which include regulating flammable substances and consumer products; providing statewide guidance on fire prevention in wildland areas; providing plan review and construction inspections for all state-owned and state-occupied facilities in California; and regulating intrastate hazardous-liquid pipelines. CDF, including SFM, enforces most of the state's fire-related laws (see below).

State regulations pertaining to wildfire prevention are found primarily in sections 4251-4290, 4291-4299 and 4421-4446 of the California Public Resources Code. Regulations concerning structural-fire prevention are found primarily in the California Health and Safety Code, mostly under division 2, chapter 3, and under division 12, part 2.

Part 8 of Title 24 is found on the website of the California Building Standards Commission (BSC). Parts 2, 3, 4 and 9 are published by non-governmental organizations with sole publication and distribution rights, and are not yet available on the Internet; however, they may be examined free of charge at one of many "depository libraries" throughout the state (listed on the BSC's website).

State laws and regulations The State of California has passed numerous laws to address both wildland and structural fires. Wildfire-prevention laws regulate activities in areas deemed by the state to be "hazardous fire areas;" the maintenance of buildings and other structures in areas covered by forest, brush or other flammable materials; and the setting and burning of fires on open land. Specific issues addressed include the building of campfires, smoking, the use of fireworks, the provision of firebreaks, the design and maintenance of roofs and chimney outlets, permits for burning and blasting, and the use of spark-emitting devices. Laws aimed at preventing structural fires establish fire-safety standards for high-rise structures, public-assembly buildings, hotels and motels, and institutional facilities such as hospitals, convalescent homes, child day-care centers, foster homes, group homes, temporary shelters, and prisons and jails. Laws also address the provision of smoke detectors, portable fire extinguishers, and fire sprinklers and other automatic fire-extinguishing systems. In addition, owners must disclose to prospective buyers of real-estate property the existence of any hazards, including location in a fire-hazard severity zone.

California Code of Regulations (CCR) Title 24 Title 24 of the CCR ("California Building Standards Code") sets forth the fire, life-safety and other building-related regulations applicable to any structure fit for occupancy statewide for which a building permit is sought. The 2001 triennial edition of Title 24 contains 11 parts, including (with brief descriptions):

- Part 2, California Building Code: general standards for the design and construction of buildings, including provisions related to fire, life safety and structural safety.
- Part 3, California Electrical Code: electrical building standards.
- Part 4, California Mechanical Code: mechanical standards related to the design, construction, installation, and maintenance of heating, ventilating, cooling, and refrigeration systems and of heat-producing appliances.
- Part 9, California Fire Code (CFC): building standards related to fire safety that are referenced in other parts of Title 24. Topics addressed in the code include automatic sprinkler systems, fire-alarm systems, access by fire-fighting equipment, fire hydrants, explosion-hazards safety, hazardous-materials storage and use, protection for first responders, industrial processes, and many other general and specialized fire-safety requirements for new and existing buildings and premises. The CFC is based on the Uniform Fire Code (UFC), a "model" code adopted through national-level consensus and which does not carry the weight of law (unlike the CFC). The CFC incorporates by reference the text of the latest published UFC, and reflects additions and deletions made to the UFC by the state.

California Environmental Quality Act (CEQA) The state’s CEQA guidelines propose a wide range of environmental impacts that public agencies should consider in their evaluation of development proposals. Considerations related to fire hazards include the potential for a project to:

- expose people or structures to a significant risk of loss, injury or death involving wildland fires.

4.3 | ANALYSIS

Fire-fighting response As mentioned above, OFD is the agency with primary responsibility for preventing and suppressing fires in Oakland. OFD employs approximately 500 sworn full-time equivalents (FTE’s) and 70 civilian FTE’s. Combined daily staffing at all the city’s fire stations totals three battalion chiefs, 32 officers, 25 fire engineers and 75 firefighters over three daily shifts. OFD operates 25 fire stations throughout the city, including one at Oakland International Airport and a fire station in the North Hills, dedicated in 1999 (see Figure 4.1). OFD’s fleet of equipment includes 25 type-1 engines, four type-3 engines, seven aerial ladders, eight brush patrols, a fireboat, a heavy-rescue vehicle, two foam units, six airport rescue rigs, and four hose tenders.

The department receives in the range of 50,000-70,000 emergency and non-emergency calls a year. Of the emergency calls, approximately three-fourths are for emergency medical services, with the rest related to utilities, commercial alarms, structural fires (mostly residential), vehicle and “outside” fires, grass/wild-land fires and other emergencies. In 2002, fires caused three confirmed deaths in the city and an estimated \$8.75 million in property damage. (In recent years, on average, there have been five fire-related fatalities annually.) Because fast response is critical in preventing widespread damage from fires and other emergencies, OFD aims to provide emergency service within seven minutes of notification 90 percent of the time. Generally, service can be provided in that time-frame to areas located within 1.5 miles of a fire station. Figure 4.1 shows the 1.5-mile response radii for Oakland’s 25 fire stations; as shown, the vast majority of the city is covered by these response radii, with the main exceptions being



distant corners of the airport and seaport, the Bay Bridge approach, and an area in the South Hills between Skyline Boulevard and Keller Avenue. (A small area around San Pablo Avenue and 66th Street is covered by an Emeryville fire station—not shown—at Hollis and 63rd streets.) The opening of the North Hills fire station in 1999 has significantly improved the department's average response time in an area of the city that is particularly susceptible to wildfires.

Water supply Oakland obtains most of its water supply from the East Bay Municipal Utility District (EBMUD). Water flows into Oakland primarily through the Claremont tunnel from the Orinda water treatment plant, then through several aqueducts and large transmission mains into smaller distribution mains supplying the entire city; at the same time, water is stored at various reservoirs located throughout the city.

The adequacy of water supply for firefighting purposes is judged by the fire flow, or the rate of water flow needed, which is measured in gallons per minute (gpm). The desired fire flow in an area depends on the area's land use, degree of fire hazard, exposure of neighboring buildings, and the size, construction and occupancy of buildings in the area. Water supply should not be confused with water pressure, which measures the *strength* of water flow, in pounds per square inch (psi). To provide more uniform water pressure regardless of elevation, the distribution of water in Oakland is divided into pressure zones, each covering a 200-foot elevation range, approximately. Water pressure in a zone ranges from approximately 40 pounds per square inch (psi) at the top of the zone to 130 psi at the bottom of the zone. In order to maintain minimum residual pressure in the system while water is flowing, water mains must be adequately sized and fire hydrants must be adequately spaced. Most water transmission mains in Oakland are at least 20" in diameter, with a grid of smaller distribution mains serving individual blocks and hydrants. There are approximately 6,500 fire hydrants in the city, the distribution and spacing of which are generally governed by fire-code requirements. With a few exceptions, fire hydrants in Oakland are owned and maintained by EBMUD.

For the 1991 Oakland Hills fire, firefighters used water from many reservoirs in several pressure zones. However, the water supply from several reservoirs became exhausted after several hours, and responding fire units experienced difficulty in locating and maintaining an adequate supply of water. Illustrating the compounding effect of disasters, power failures shut down water-pumping stations that supplied reservoirs, and reservoirs were further drained as water lines at hundreds of burned-out homes burst and poured water into the streets. On a separate note, fire companies from other

jurisdictions experienced difficulty connecting to Oakland hydrants, and operations were delayed as adapters were distributed. (At the time, Oakland hydrants had three-inch outlets while most other jurisdictions use two-and-a-half-inch connections and hose couplings.)

EBMUD periodically conducts hydrant-flow tests in the city to determine the available water flow and pressure in hydrants and water mains. Contrary to misconceptions arising from the 1991 fire, water pressure is generally adequate throughout the city. However, the ability to feed water within certain zones and to certain hydrants is restricted by older water mains that are not sized for current standards or that have lost capacity due to deterioration. In addition, optimal “gridding” of water mains is not possible in the Oakland Hills due to the area’s topography and street layout. Moreover, enlarging water mains to improve fireflows in low-density areas (such as the hills) is not always desirable since it could lead to poor water turnover and a resulting deterioration in water quality.

Since the 1991 firestorm, the city and EBMUD have undertaken several projects to improve the performance of the water-distribution system for purposes of fighting fires. For example, Oakland’s hydrants have been retrofitted with universal hose couplings (or replaced altogether), and OFD has developed a portable water-delivery system—consisting of large-diameter hose, connections and pumps for drafting water from the bay, lakes, creeks, reservoirs and even storm-drain sewers—in the event of failure of EBMUD’s water supply. At the same time, the city and EBMUD have improved fire flows in the Rockridge neighborhood, a project funded through a special assessment district of area homeowners.

Structural fires The primary factors affecting the risk of structural fire are the age and condition of the building or structure, its proximity to other structures, and the methods and materials used in its construction. Generally, older buildings are at higher risk because they were constructed prior to the adoption of current building standards; with the few exceptions of buildings that have been extensively remodeled recently, older buildings do not meet current construction codes. Higher-density development presents an increased fire risk due to the greater intensity of use and higher chance of fire spreading from one building to another. Finally, particularly susceptible to fire are wood-framed buildings, especially those with wood-shingle roofs, methods and materials that apply predominantly to small, detached single-family homes.



The City of Oakland is at higher risk for structural fire than most other jurisdictions in California because of its relatively old and dense development pattern. The geographic area of greatest concern is downtown, due to its high land-use densities and concentration of older, multi-story buildings. (This is, of course, the area from which development radiated as the city grew.) Because of its high density, downtown is the area at greatest risk of suffering harm from structural fires, in terms of both human life and property damage. On the other hand, accessibility by fire-fighting equipment is excellent, and the area has the most extensive fire-protection coverage, with seven of the city's 26 fire stations located within 1.5 miles of the corner of 14th Street and Broadway (arguably the city's development center). Elsewhere in the city, there is generally enough clearance between buildings that structural fires can usually be contained to the structure of origin. This is especially true in districts of single-family homes.

Two building-occupancy types present special fire hazards: public-assembly buildings such as schools, stadiums and auditoriums (because of the concentrations of people found at times in such buildings), and high-rise buildings. High-rise buildings pose particular access and evacuation challenges: moving firefighters and equipment up stairways lengthens response time, and chances are higher that occupants could become trapped. Current statewide fire-safety standards for high-rise structures and public-assembly buildings require built-in protection such as automatic smoke-detection, fire-detection and fire-extinguishing systems; fire-resistive methods and materials; and internal-communication systems. (With certain exceptions, standards for high-rises apply to buildings constructed after July 1, 1974 "having floors used for human occupancy located more than 75 feet above the lowest floor level having building access.") It should be noted that suppressing fires in older high-rise buildings, especially because they lack automatic fire-protection systems, could prove difficult. However, OFD has recently expanded its arsenal of fire-fighting equipment for high-rise buildings to include improved large-diameter-hose nozzles and updated its trainings and drills.

The city has in place a number of strategies to prevent structural fires. OFD's Fire Prevention Bureau reviews proposed development projects to ensure that appropriate fire-mitigation measures are taken. Projects are reviewed for such design, construction and operational features as adequate water supply and access by firefighting equipment, adequate emergency exits, sufficient clearance between structures, the use of noncombustible materials (especially for roofs and exterior walls), the provision of smoke detectors and fire extinguishers, and compliance with other building code requirements. The Fire Prevention Bureau also conducts regular inspections of

commercial and multi-dwelling buildings and residential care facilities to determine if corrective measures are necessary to protect occupants from fire. On a different note, OFD has in the last several years given away thousands of smoke detectors and replacement batteries to the public through its “fire-safe city” initiative.

Structural fires have always been, and will always be, an urban hazard in cities around the world; Oakland is no exception. However, structural fires are relatively easy to contain, certainly compared to wildfires, and especially given the city’s fire-suppressing capabilities. It is unusual for a structural fire to spread to other than immediately adjacent buildings, and it is extremely unlikely that a structural fire could not be contained within the city block in which it originated (expect, perhaps, following a major earthquake). While structural fires cause localized damage in Oakland almost daily, they are highly unlikely to result in widespread damage—again, compared to wildfires. At the same time, stricter construction codes and other fire-prevention strategies have, over time, significantly reduced the aggregate structural-fire hazard.

Wildland fires Wildfires are the most severe fire hazard in Oakland, especially in the hills, above the Warren Freeway. Because the Oakland hills are a fire-dependent ecosystem, wildfires occur there every year, especially in late summer and early fall when the area’s natural vegetation is dry and extremely flammable. While small fires occur every year, large fires should be anticipated every 10-20 years. The vegetation of the hills ranges from densely wooded forests to open grasslands, making virtually the entire area vulnerable to fire; the wooded areas pose risks due to the supply of fuel from trees and the possibility of crown, or tree-top, fires, while the grass- and brush-covered areas are highly flammable. Adding to the fire risk are the area’s steep and rugged terrain, and the abundance of non-native vegetation, especially Monterey pine and eucalyptus, which are not fire-resistant. Most of the wildfires in the hills are minor, and OFD is usually able to control them easily. Nevertheless, aggravating circumstances can turn even small fires into disastrous events with breathtaking speed. In the case of the 1991 fire, for example, the combination of abundant dead vegetation, hot and dry weather, strong winds and, in some areas, poor accessibility and insufficient water pressure created an uncontrollable firestorm in much less than an hour.

Most of the severity of Oakland’s wildfire hazard stems from the presence of residential neighborhoods amidst the large vegetated areas—a condition known as the “urban/wildland interface.” Contributing to the hazard are the many wooden structures in the area and, in places, the lack of adequate evacuation routes and access routes for



emergency vehicles. Also, as shown on Figure 3.1, the hills are traversed by the Hayward fault; a significant fault movement could result in the breakage of natural-gas pipelines, setting off area-wide fires, and could also block roads and damage water lines, delaying OFD’s response and compromising their fire-suppressing abilities. Finally, immediately adjacent to the city, to the northeast, are large areas of combustible material in the form of open spaces in unincorporated Contra Costa County (Orinda Canyon, primarily) and of the densely vegetated parklands owned by EBRPD: Charles Lee Tilden, Redwood and Anthony Chabot regional parks; Claremont Canyon, Robert Sibley Volcanic, Huckleberry Volcanic and Leona Heights Open Space regional preserves; and Roberts Regional Recreation Area. CDF has developed a rating of wildland fire threat for the entire state based on the combination of potential fire behavior (derived from weather, terrain and vegetative-fuel data) and expected fire frequency (derived from 50 years of fire-history data). Under this rating system, areas are assigned one of four fire-threat ratings: moderate, high, very high and extreme. While most of Oakland is rated “moderate” for fire threat, scattered parts of the Oakland Hills and most of the area adjacent to the city to the northeast (mentioned in the paragraph above) have ratings of “high” or “very high” (see Figure 4.1). Moreover, because the CDF rating does not take into account the presence of houses and other flammable structures, it most likely underestimates the fire threat in Oakland (and other urban areas).



Following the 1991 firestorm, the mayors of Oakland and Berkeley convened a series of meetings of a task force on “emergency preparedness and community restoration.” The task force produced a list of nearly 100 recommended actions to mitigate wildfire hazards, covering four broad areas: emergency preparedness; communications; forestry and vegetation; and planning, zoning and design. The city Manager’s office prepared a detailed response to the task force’s report, describing the status or analyzing the feasibility of each recommendation. Also, the task force’s report became part of a plan submitted by the city—as required of recipients of federal disaster aid—to FEMA (and also to the California OES) in 1992. The plan evaluated the natural hazards of the disaster area, reviewed past mitigation measures and recommended mitigation actions for the future. The plan identified several priority projects including implementation of a vegetation-management program, development of a portable water-supply system, implementation of a variety of fire-safety improvements at critical city-owned facilities.

In response to the 1991 firestorm, the city enacted special development requirements, described earlier in this chapter, for new construction in the wildfire-hazard areas. Also, in 1993, the city established a fire-prevention and suppression assessment district to

fund fuel-reduction, vegetation-management, fire suppression and public education programs in the Oakland Hills. The assessment district was terminated in 1997. However, mindful of the continued hazard presented by wildfires, the city council in late 2003 organized a vote among Oakland Hills dwellers for the formation of a new wildfire-prevention assessment district. The new assessment district was ratified in January 2004 after a majority of Hills voters approved its formation (see Figure 4.1 for the boundaries of the new district). The new assessment district will continue work funded by the previous district, paying for fire-safety inspections of private properties, vegetation management, roving firefighter patrols on high fire-hazard days, public education, goat grazing and other services.

OFD's vegetation-management program requires that owners of both vacant and developed lots in the area comply with fire-hazard-abatement requirements. Requirements include the removal of overgrown grass, brush and weeds; the removal of low-hanging tree branches, and of dead and dying vegetation; and street-address numbers visible from the road. Most importantly, residents must maintain firebreaks—a discontinuity of fire fuels—around buildings, structures, right-of-ways and property lines. (The purposes of a firebreak, or “defensible space,” are to slow the advance of fire, give structures an opportunity to remain undamaged, and provide a clear path for firefighting personnel.) Properties found to be out of compliance with the requirements may have a tax lien placed against them. By 1999, OFD had conducted 21,000 vegetation-management inspections.

Despite the city's efforts, continued work is needed to mitigate the hazard from wildfires in the hills. Specifically, progress still needs to be made in maintaining an effective fire break along the urban-wildland interface and defensible space around residential structures, reducing the build-up of dead vegetation, re-vegetating the area with native plants resistant to fire and drought, educating area residents about wildfire mitigation, and providing adequate evacuation routes and procedures (see below). At the same time, the rebuilding of homes destroyed by the fire means that the number of people and homes in harm's way is roughly the same as it was before the fire.

Roadway standards and emergency routes Roadway standards—for such criteria as width, grades, overhead clearance and turning radii—are necessary to provide for adequate access by fire and emergency vehicles and evacuation of residents. As mentioned earlier, chapter 16.16 of the Oakland municipal code (“Design Standards”) establishes regulations related to the design of streets, including alignment, width, grade, intersection, visibility, curvature radii and tangents; the chapter also includes regulations

related to the design of blocks, lots, alleys and pedestrian ways; in addition, section 16.24.040 contains lot-design standards, and chapter 16.32 covers design standards for private-access easements. Section 16.28.040 requires that in hillside subdivisions, the dedicated widths of all streets (other than arterial and collector streets) shall be at least 40 feet; and that the paved roadway widths shall be at least 30 feet if there is lot frontage on both sides the street, or 24 feet if there is lot frontage on one side of the street only. Finally, section 17.102.360 stipulates that secondary units may be permitted only if all streets connecting the lot to the nearest arterial street have a minimum pavement width of at least twenty feet.

Emergency-access and evacuation routes are a concern associated primarily with wildfires, since these tend to cover much greater areas than structural fires. Limited accessibility in the hills complicated emergency response and evacuation during the 1991 fire. Many streets in the area are narrow, winding or indirect. During the fire, many roads in the immediate and surrounding areas became clogged with residents trying to get out as emergency personnel were trying to get in; congestion was worsened by “rubberneckers,” parked cars, vehicles abandoned by fleeing residents, fallen power poles and high-voltage lines, and debris falling from higher elevations. The long-range planning efforts following the 1991 fire resulted in two main recommendations related to emergency access and evacuation: to set and enforce minimum unobstructed street widths (to be implemented by street widenings and parking restrictions, accompanied by new off-street parking); and to designate and sign evacuation and emergency-response routes. Neither recommendation has been implemented to any significant extent—other than the designation of evacuation routes—and residents in the hills remain highly vulnerable to future disasters. Ingress and egress in the Oakland Hills could be compromised further, and severely, if the fire is the result of a strong earthquake (from ruptured gas mains or downed power lines), since such an earthquake would likely damage roads, bridges and overpasses.

It should be mentioned that off-street walkways provide important alternate routes for emergency evacuation, particularly in hilly areas where street access may be limited or indirect. According to the city’s pedestrian master plan, there are approximately 200 walkways in the city. They are most common in older neighborhoods with hilly terrain and long street blocks; the highest concentrations of walkways are found in the neighborhoods of Upper Rockridge, Montclair, Trestle Glen, San Antonio, Fruitvale and Eastmont, and along Glen Echo Creek. The pedestrian master plan also mentions that there are at least 200 undeveloped rights-of-way that are potential sites for additional

walkways. Among the recommendations emerging after the 1991 fire were the provision of additional pathways and the provision and maintenance of pathway lighting. However, both recommendations remain largely unimplemented.

4.4 | POLICY STATEMENTS

POLICY FI-1

Maintain and enhance the city's capacity for emergency response, fire prevention and fire-fighting.

- ACTION FI-1.1: Periodically assess the need for new or relocated fire stations and other facilities, changes in staffing levels, and additional or updated supplies, equipment, technologies and in-service training classes.
 - ▶ **OFD TECHNICAL SERVICES DIVISION**
- ACTION FI-1.2: Strive to meet a goal of responding to fires and other emergencies within seven minutes of notification 90 percent of the time.
 - ▶ **OFD FIELD OPERATIONS DIVISION**
- ACTION FI-1.3: Continue to offer fire-prevention and fire-safety presentations and training to the public.
 - ▶ **OFD FIELD OPERATIONS DIVISION**
 - ▶ **OFD SUPPORT SERVICES DIVISION**
 - ▶ **OFD OFFICE OF EMERGENCY SERVICES**
- ACTION FI-1.4: Continue to sponsor the formation and training of CORE teams.
 - ▶ **OFD OFFICE OF EMERGENCY SERVICES**
- ACTION FI-1.5: Continue to participate not only in general mutual-aid agreements but also in agreements with adjoining jurisdictions for cooperative response to fires.
 - ▶ **OFD FIELD OPERATIONS DIVISION**
- ACTION FI-1.6: Continue to conduct monthly tests of the alerting and warning system's outdoor sirens, coordinating them to the extent possible with those of neighboring jurisdictions.

CORE: Citizens of Oakland Respond to Emergencies

► OFD OFFICE OF EMERGENCY SERVICES

- ACTION FI-1.7: Along with the East Bay Municipal Utility District, review the extent to which recommendations from the district's 1994 infrastructure policy study on needed improvements to the water distribution system were implemented.

► OFD FIELD OPERATIONS DIVISION

POLICY FI-2

Continue, enhance or implement programs that seek to reduce the risk of structural fires.

- ACTION FI-2.1: Adopt and amend as needed updated versions of the California building and fire codes so that optimal fire-protection standards are used in construction and renovation projects.

► CEDA BUILDING SERVICES DIVISION

► OFD SUPPORT SERVICES DIVISION

- ACTION FI-2.2: Continue to enforce provisions under the local housing code requiring the use of fire-resistant construction and the provision of smoke detectors and fire-extinguishing systems.

► CEDA BUILDING SERVICES DIVISION

► OFD SUPPORT SERVICES DIVISION

- ACTION FI-2.3: Continue to review development proposals to ensure that they incorporate required and appropriate fire-mitigation measures, including adequate provisions for occupant evacuation and access by fire-fighting personnel and equipment.

► OFD SUPPORT SERVICES DIVISION

- ACTION FI-2.4: Compile a list of high-rise and high-occupancy buildings which are deemed due to their age or construction materials to be particularly susceptible to fire hazards, and determine an expeditious timeline for the fire-safety inspection of all such structures.

► OFD SUPPORT SERVICES DIVISION

- ACTION FI-2.5: Continue to conduct periodic fire-safety inspections of commercial, multi-family and institutional buildings.

► OFD SUPPORT SERVICES DIVISION

- ACTION FI-2.6: Enforce the chapter of the municipal code regulating the location and design of street-address numbers on buildings.

► **CEDA BUILDING SERVICES DIVISION**

POLICY FI-3

Prioritize the reduction of the wildfire hazard, with an emphasis on prevention.

- ACTION FI-3.1: Implement and administer the 2004 wildfire-prevention assessment district for the Oakland Hills, and carry out the programs funded by the district, including fire-safety inspections of private properties, vegetation management practices, roving firefighter patrols on high fire-hazard days, and public education efforts.

► **OFD SUPPORT SERVICES DIVISION**

► **OFD FIELD OPERATIONS DIVISION**

► **PWA TRANSPORTATION SERVICES DIVISION**

- ACTION FI-3.2: Consistent with the city's pedestrian master plan, develop unused pedestrian rights-of-way in the Oakland Hills as walkways to serve as additional evacuation routes, and provide and maintain lighting facilities for new and existing walkways.

► **PWA TRANSPORTATION SERVICES DIVISION**

► **PWA ENGINEERING DESIGN DIVISION**

► **PWA ELECTRICAL SERVICES DIVISION**

- ACTION FI-3.3: Continue to participate in multi-jurisdictional programs and task forces, such as the Hills Emergency Forum and Diablo FireSafe Council, that work to reduce the threat of wildfires.

► **OFD SUPPORT SERVICES DIVISION**

- ACTION FI-3.4: Along with EBMUD, review the extent to which recommendations from the utility's district's 1993 study on its preparation and response to the 1991 firestorm were implemented.

► **OFD FIELD OPERATIONS DIVISION**

4.5 | RESOURCES

Agencies consulted

- California Department of Forestry and Fire Protection (www.fire.ca.gov)
- Office of the State Fire Marshal (osfm.fire.ca.gov)
- California Building Standards Commission (www.bsc.ca.gov)
- East Bay Municipal Utility District (www.ebmud.com)
- East Bay Regional Park District Fire Department (www.ebparks.org/fire/firewx.htm)
- Oakland Fire Department (www.oaklandnet.com/oakweb/fire/index.html)
- Diablo FireSafe Council (www.diablofiresafe.org)
- The Hills Emergency Forum (www.lbl.gov/ehs/hef)

Documents consulted

- “Fire Hazard Mitigation Plan for the City of Oakland—Oakland Hills ‘Tunnel Fire’ Disaster Declaration,” Oakland Emergency Services Division, April 1992.
- “East Bay Hills Firestorm Response Assessment, Phase I,” East Bay Municipal Utility District, January 1992.
- “East Bay Hills Firestorm Response Assessment, Phase II,” East Bay Municipal Utility District, July 1992.
- “Water Supply Reference Course,” Oakland Fire Services Agency, revised March 1997.
- “Resource Management Plan for the Caldecott Wildlife Corridor; Alameda-Contra Costa Biodiversity Working Group,” Caldecott Corridor Committee, September 2001.
- “The Tunnel Incident, Oakland 1991—Ten Years After,” The Hills Emergency Forum, October 2001 (<http://www.lbl.gov/ehs/hef/10yrsAfter.pdf>).
- “Annual Report 2000,” Oakland Fire Department, undated.
- “The Oakland Hills Fire Storm: After-Action Report,” Oakland Office of the city Manager, Emergency Services Division, undated.

Other resources

- Oakland Wildfire Prevention Assessment District (www.oaklandnet.com/government/cmo/wildfireprevention.htm)
- “The Oakland/Berkeley Hills Fire” (www.firewise.org/pubs/theOaklandBerkeleyHillsFire)