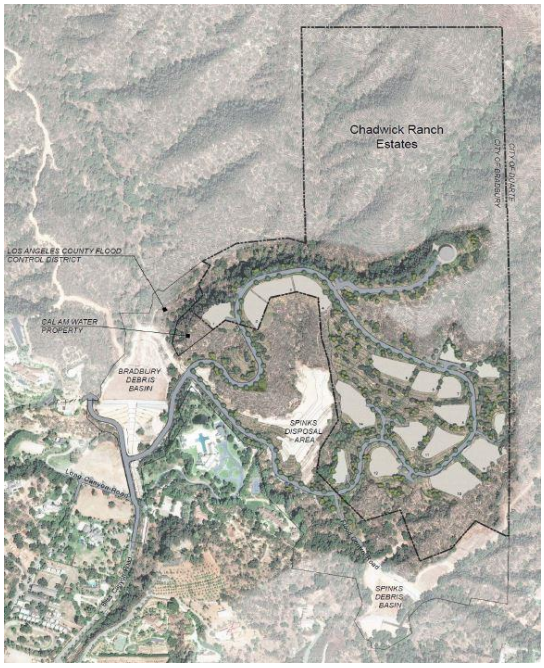
APPENDIX J

FIRE PROTECTION PLAN

CONCEPTUAL FIRE PROTECTION PLAN
CHADWICK RANCH ESTATES



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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
CAL FIRE	California Department of Forestry and Fire Protection
CBC	California Building Code
CFC	California Fire Code
CRE	Chadwick Ranch Estates
FMZ	Fuel Modification Zone
FPP	Fire Protection Plan
HOA	Homeowner's Association
LACFCD	Los Angeles County Flood Control District
LACoFD	Los Angeles County Fire Department
NFPA	National Fire Protection Association
WUI	Wildland Urban Interface

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Executive Summary

This Fire Protection Plan (FPP) has been prepared for the proposed Chadwick Ranch Estates single-family residential estates Project (Project) that incorporates land uses for residential and agriculture purposes. The Chadwick Ranch Estates Project is currently zoned as "Agriculture/Estates Residential," which would allow for the construction of five-acre minimum single-family lots. The Project proposes 14 single-family estate homes on approximately 111.8 acres located near the northeastern edge of the incorporated City of Bradbury in the County of Los Angeles, California. The Project site is currently undeveloped and is located along the northern fringe of the urbanized portion of the Los Angeles basin at the base of the San Gabriel Mountains in the Angeles National Forest. Bordering the southern boundary of the Project site is the Spinks Debris Basin, Spinks Debris Disposal Area, and the Bradbury Debris Basin, all of them flood control facilities owned and operated by the Los Angeles County Flood Control District (LACFCD). The western property boundary is adjacent to naturally vegetated open space areas and a proposed residential community; open space (Duarte Wilderness Preserve) and existing single-family residences border the eastern property boundary; and naturally vegetated open space lands within the Angeles National Forest border the northern property boundary. The proposed development will be situated on three parcels intended for the construction of residential estates comprised of the following Assessor Parcel Numbers (APN's): APN's 8527-005-001, 8527-005-004, and 8527-001-010. Thirteen additional parcels would be committed to non-residential uses including open space, backbone circulation system, requisite infrastructure, as well as a water tank, a booster station, debris and water basins. Primary access to the site will be via the Bliss Canyon Road/Long Canyon Road intersection, located within the Bradbury Estates Community, requiring travel through the LACFCD property holdings to an entrance at the westernmost extension of the Project site.

The Chadwick Ranch Estates Project site lies within an area considered a Very High Fire Hazard Severity Zone (VHFHSZ), as designated by the Los Angeles County Fire Department (LACoFD) and California Department of Forestry and Fire Protection (CAL FIRE). Fire hazard designations are based on topography, vegetation, and weather, amongst other factors. VHFHSZ designation does not indicate that an area is not safe for development. It does indicate that specific fire protection features that minimize structure vulnerability will be required, including Chapter 7A of the California Building Code (CBC) and provisions for maintained fuel modification zones, amongst others described in this FPP.

The Project site is currently undeveloped and vacant, and is vegetated primarily by mixed chaparral and coastal sage scrub (CCS) habitats and scattered individual oak and sycamore tree stands within the and more concentrated trees throughout the property (riparian habitat). The terrain on, and within the vicinity of the project, is characterized by having very steep slopes, with gradients exceeding 50% in some areas. The Project site area, like all of Southern California and Los Angeles County, is subject to seasonal weather conditions that can heighten the likelihood of fire ignition and spread, and, considering the site's terrain and vegetation, may result in a fast moving and intense wildfire.

This FPP evaluates and identifies the potential fire risk associated with the Project's land uses and identifies requirements for water supply, fuel modification and defensible space, access, building ignition and fire resistance, and fire protection systems, among other pertinent fire protection criteria. The purpose of this plan is to generate and memorialize the fire safety requirements and standards of the LACoFD along with project-specific measures based on the site, its intended use, and its fire environment.

Fire service would be provided by the LACoFD. The Project population and number of calculated emergency calls was evaluated for its potential to impact LACoFD's response capabilities from its nearest existing stations. The addition

of fewer than 5 calls per year to Engine companies' 44 and 244 call volume is considered insignificant. The closest existing LACoFD fire stations' response times conforms to internal response time standards.

As determined during the analysis of this site and its fire environment, the Project site, in its current condition, may include characteristics that, under favorable weather conditions, could have the potential to facilitate fire spread. Under extreme conditions, wind-driven wildfires from the east/northeast are likely to cast embers onto the property. Once the Project community is built, the Chadwick Ranch Estates on-site fire potential will be lower than its current condition due to fire safety requirements that will be implemented on this site. The proposed residential structures would be built using ignition-resistant materials pursuant to the most recent County Fire and Building Codes (Chapter 7-A – focusing on structure ignition resistance from flame impingement and flying embers in areas designated as high fire hazard areas), which are the amended 2019 California Fire Code and 2019 California Building Code. This would be complemented by:

- site-wide, ignition resistant landscapes,
- perimeter fuel modification zone,
- improved water availability, capacity, and delivery system,
- Project Area firefighting resources,
- fire department access throughout the developed areas,
- monitored defensible space/fuel modification,
- interior, automatic fire sprinkler systems in all structures,
- monitored interior sprinklers in applicable structures,
- fire response travel times based on County response guideline, and
- other components that would provide properly equipped and maintained structures with a high level of fire ignition resistance.

Post wildfire save and loss assessments have revealed specifics of how structures and landscapes can be constructed and maintained to minimize their vulnerability to wildfire. Among the findings were: how construction materials and methods protect homes, how fire and embers contributed to ignition of structures, what effects fuel modification had on structure ignition, the benefits of fast firefighter response, and how much (and how reliable) water was available, were critically important to structure survivability. Following these findings over the last 20 years and continuing on an ongoing basis, the Fire and Building codes are revised, appropriately. Los Angeles County now boast some of the most restrictive codes for building within Wildland Urban Interface (WUI) areas that focus on preventing structure ignition from heat, flame, and burning embers.

Fire risk analysis conducted for this Project resulted in the determination that wildfire has occurred and will likely occur near the Project Area again, but the proposed Project would provide ignition-resistant landscapes (drought-tolerant and low-fuel-volume plants) and ignition-resistant structures, and defensible space with implementation of specified fire safety measures. Based on modeling and analysis of the Project area to assess its unique fire risk and fire behavior, it was determined that the Los Angeles County standard of 100-foot-wide fuel modification zones (FMZs) would help considerably to set the site's structures back from off-site fuels, but based on site specific findings and as part of this FPP's conservative approach, was extended to provide additional defensible space buffering. A code-exceeding fuel modification zone of 200 feet will be implemented around Lots 1 through 8 and Lots 10 through 14; due to property boundary restraints, Lot 9 is will include a 100-foot wide fuel modification zone along the eastern side of the side of the lot. Furthermore, a portion of the 200-fot wide fuel modification zone extends beyond the property boundary around Lots 1 through 4 and 14. As part of the Project's Conditions of Approval by the Board of Supervisors, the Project would be required to meet the following site access and fuel modification easements from the Los Angeles County Flood Control; 1.) LA County Flood Control

site access easement into the proposed development, and 2.) a Los Angeles County Flood Control fuel modification zone easement, which would allow the Project to provide fuel modification outside of the Project's boundary adjacent to Lots 1, 2, 3, 4, and 14. If the easements are obtained and the Project is able to provide a full 200 feet of fuel modification around Lots 1 through 4 and 14, then no additional mitigation is required for these lots. However, if the Board of Supervisors does not approve the Project to obtain an offsite fuel modification easement, allowing the Project to provide the remaining offsite fuel modification, then additional Project construction mitigations will be implemented for Lots 1 through 4, 9, and 14. The 200-foot-wide FMZ, when properly maintained, will effectively minimize the potential for structure ignition from direct flame impingement or radiant heat. The FMZs for Chadwick Ranch Estates Project would be maintained in perpetuity by a funded Homeowner's Association (HOA), or similarly funded entity[1].

This FPP provides a detailed analysis of the Project, the potential risk from wildfire, and potential impacts on the LACoFD, as well as an analysis on meeting or exceeding the requirements of Los Angeles County. Further, this FPP provides requirements, recommendations, and measures to reduce the risk and potential impacts to acceptable levels, as determined by the LACoFD.

[1] In accordance with section 325.2.2 of the Los Angeles County Fire Code, Clearance of Brush and Vegetation Growth "Extra Hazard", it may be determined by the fire official that some sites pose an extra hazard. In such cases Fuel Modification may exceed 100 feet but not exceed 200 from structures. Based on modeled fire behavior, it was determined that a code-exceeding 200-foot FMZ would provide adequate defensible space for the Chadwick Ranch Estates Project.

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1 Introduction

This Fire Protection Plan (FPP) has been prepared for the proposed Chadwick Ranch Estates Project (Project) in Bradbury, California, an incorporated city in Los Angeles County. The purpose of the FPP is to evaluate the potential impacts resulting from wildland fire hazards and identify the measures necessary to adequately mitigate those risks to a level consistent with County of Los Angeles (County) thresholds. Additionally, the purpose of this plan is to generate and memorialize the fire safety requirements of the Fire Authority Having Jurisdiction (FAHJ), which is the Los Angeles County Fire Department (LACoFD). Requirements and recommendations detailed in this FPP are based on site-specific characteristics, applicable code requirements, and input from the Project's applicant (City of Bradbury), project planners, engineers, and architects, as well as the fire authority having jurisdiction.

As part of the assessment, this FPP has considered the fire risk presented by the site including the property location and its topography, geology, surrounding combustible vegetation (fuel types), climatic conditions, fire history and the proposed land use. This FPP addresses water supply, access, structural ignitability and ignition resistive building features, fire protection systems and equipment, impacts to existing emergency services, defensible space, and vegetation management. The FPP also identifies fuel modification zones and recommends the types and methods of treatment that, when implemented and maintained, are designed to protect this project's assets. This FPP also recommends measures that developer/builders, property owners, and the Homeowner's Association (HOA) will take to reduce the probability of structural and vegetation ignition.

The Project is located within the boundaries of the LACoFD and thus this FPP addresses LACoFD's response capabilities and response travel time within the Project Area, along with projected funding for facility improvements and fire service maintenance.

The following tasks were performed toward completion of this FPP:

- Gather site specific climate, terrain, and fuel data,
- Collect site photographs and map fuel conditions using 200-scale aerial images. Field observations were used to augment existing digital site data in generating the fire behavior models and formulating the recommendations presented in this FPP. Refer to Appendix A, *Representative Site Photographs,* for site photographs of existing site conditions,
- Process and analyze the data using the latest geographic information system (GIS) technology,
- Predict fire behavior using scientifically based fire behavior models, comparisons with actual wildfires in similar terrain and fuels, and experienced judgment,
- Analyze and guide design of proposed infrastructure,
- Analyze the existing emergency response capabilities,
- Assess the risk associated with the Project site,
- Evaluate nearby firefighting and emergency medical response resources, and
- Prepare this FPP detailing how fire risk will be mitigated through a system of fuel modification, structural ignition resistance enhancements, and fire protection delivery system upgrades.

1.1 Intent

The intent of this FPP is to provide fire planning guidance and requirements for reducing fire risk and demand for fire protection services associated with the Project. To that end, the fire protection "system" detailed in this FPP includes redundant layering of measures, including pre-planning, fire prevention, fire protection, passive and active suppression, and related measures proven to reduce fire hazards and overall risk. The fire protection system planned for the Project has proven, through real-life wildfire encroachment examples throughout Southern California, to reduce the fire risk associated with this type of residential community.

1.2 Applicable Codes/Existing Regulations

This FPP demonstrates that the Project would comply with applicable portions of Title 32 of the Los Angeles County Code, as amended, and adopting by reference the 2019 edition of the California Fire Code (CFC) . Title 32 is hereafter referred to as the Los Angeles County Fire Code (2020 or current edition) or "Fire Code". The Project also complies with Chapter 7A of the 2019 California Building Code (CBC); the 2019 California Residential Code, Section 237; and 2018 Edition of the International Fire Code as adopted by the County. The Project would also be subject to the provisions of section 4291 of the Public Resources Code regarding brush clearance standards around structures and the Los Angeles County Fire Department guidelines for Fuel Modification Plans.

Chapter 7A of the CBC addresses reducing ember penetration into homes, a leading cause of structure loss from wildfires (California Building Standards Commission 2019). Thus, code compliance is an important component of the requirements of this FPP, given the Project's wildland-urban interface (WUI) location that is within an area statutorily designated as a Very High Fire Hazard Severity Zone (VHFHSZ) by California Department of Forestry and Fire Protection (CAL FIRE) (FRAP 2007). Fire hazard designations are based on topography, vegetation, and weather, among other factors with more hazardous sites, including steep terrain, unmaintained fuels/vegetation, and WUI locations. Projects situated in VHFHSZ require fire hazard analysis and application of fire protection measures to create ignition resistant structures and defensible communities within these WUI locations. VHFHSZ designations do not, in and of themselves, indicate that it is unsafe to build in these areas. As described in this FPP, the Project would meet applicable code requirements for building in these higher fire hazard areas. These codes have been developed through decades of wildfire structure save and loss evaluations to determine the causes of building losses and saves during wildfires. The resulting fire codes now focus on mitigating former structural vulnerabilities through construction techniques and materials so that the buildings are resistant to ignitions from direct flames, heat, and embers, as indicated in the 2019 California Building Code (Chapter 7-A, Section 701A Scope, Purpose, and Application) (California Building Standards Commission 2019).

1.3 Chadwick Ranch Estates Project Summary

1.3.1 Location

The Project is located within the north-northeast portion of the incorporated City of Bradbury. The City of Bradbury is located in Los Angeles County along the northern fringe of the urbanized portion of the Los Angeles basin at the base of the San Gabriel Mountains in the Angeles National Forest. The City is bordered by the City of Monrovia to the west and north and the City of Duarte to the south and east. Bordering the Project site's southern boundary are the Spinks Debris Basin, Spinks Debris Disposal Area, and Bradbury Debris Basin, all of them flood control

facilities owned and operated by the LACFCD. Royal Oaks Drive serves as the southern boundary of the City's corporate limits. Royal Oaks Drive parallels the I-210 Freeway, located approximately one mile south of the City; access to this major regional transportation corridor is available through Duarte via Buena Vista Street and Mountain Avenue. More specifically, the Chadwick Ranch Estates Project site is situated in Section 19 of Township 1 North, Range 10 West on the U.S. Geological Survey (USGS) 7.5 minute Bradbury, California quadrangle map (Figure 1, *Project Site Regional Map* and Figure 2, *Project Site Vicinity Map*).

The 111.8-acre project site is irregularly shaped, and currently undeveloped. Site topography is comprised of canyons and slopes with elevations that range from 700 feet above mean sea level (AMSL) at the lower, southern portion of the site to 1,800 feet AMSL at the highest point to the north. There are no existing buildings on site; native vegetation, including sage scrub and chaparral vegetation, coast live oak and sycamore trees and scrub oak, occur throughout a majority of the site. The entirety of the proposed property lies within the local responsibility area (LRA) VHFHSZ, as statutorily designated by CAL FIRE (2007) and the LACoFD (Figure 3, *Chadwick Ranch Estates Fire Hazard Severity Zone Map*).

1.3.2 Project Description

The Project will utilize a variety of grading techniques aimed at blending buildable areas with the natural terrain, minimizing abrupt elevation and slope transitions, and softening the slopes between building pads, and will consist of 14 single-family estate homes. The residential estates would allow for a primary home, a guest home, and other ancillary structures including, but not limited to, garages and stables. The Project's Conceptual Site Plan depicts the arrangement of the developable areas within each of the 14 residential estates lots and the spatial relationships between each residential developable area and the Project's circulation system. Lot areas vary from approximately 26,000 square feet (0.6 acre) to nearly 91,500 square feet (2.1 acres). Site grading will create developable portions in each lot that range in size from 20,000 square feet to 49,000 square feet (Figure 4, *Proposed Site Plan)*.

Development is estimated to disturb approximately 49 percent of the Project site. Currently, it is the applicant's intention ultimately to dedicate the remaining undisturbed acreage, about 51 percent of the site, to a conservancy yet to be named. By doing so, the preservation of open space in this portion of the project will be assured in perpetuity. While a conservancy will administer the aforementioned open space preservation area, the common areas in the remaining portion of the project site, including perimeter fuel modification zones, would be maintained by the Project's HOA.

Although the number of homes ultimately to be constructed on the Project site is relatively small, supporting public facilities and infrastructure is still a necessity. Included among these improvement plans are roadways, drainage facilities, water and sewer systems, including an on-site 1,000,000-gallon water tank, and dry utilities such as electrical, natural gas, and fiber optics for cable television and communications. Project-related infrastructure is discussed in greater detail in the following subsections.

In addition to the 14 proposed single-family estate lots, the Project will include lots dedicated to fuel modification zones (FMZ) to be managed by the property owners and the HOA. Landscaped areas may incorporate horticultural plantings. The Chadwick Ranch Estates Project would include 200 feet of fuel modification around Lots 1 through 8 and Lots 10 through 14, consisting of three zones, a minimum 30-foot setback Zone A, a 70-foot irrigated Zone B, and a 100-foot thinning Zone C. Due to property boundary restraints, Lot 9 will include 100 feet of irrigated fuel modification, consisting of a minimum 30-foot setback Zone A and a 70-foot irrigated Zone B. Additionally, a portion of the 200-fot wide fuel modification zone extends beyond the property boundary around Lots 1 through 4

and 14, which will require a Los Angeles County Flood Control fuel modification zone easement, which would allow the Project to provide fuel modification outside of the Project's boundary adjacent to Lots 1, 2, 3, 4, and 14.

Primary vehicular access to the Project site begins offsite at the intersection of Long Canyon Road and Bliss Canyon Road. From there the project access road traverses LACFCD property and utilizes a portion of the Flood Control District road system using existing easements until it reaches the project site boundary. A large portion of the existing LACFCD road system would be improved for the safety of current and future residents, as well as for ongoing LACFCD operations. From the point that the offsite roadway enters the Project site, the onsite roadway climbs until it reaches its high point at the water tank access. From there it proceeds downhill to provide access to the remaining residential lots and debris basins. The access road continues to the southerly portion of the site and connects to the Flood Control Road creating a single looped road throughout the Project.

1.1.3 Current Land Use

The Chadwick Ranch Estates Project site is currently undeveloped and vacant, consisting of naturally vegetated slopes and disturbed land. The terrain on, and within the vicinity of the project, is characterized by having very steep slopes, with gradients exceeding 50% in some areas. Elevations within the Project site range from 700 feet AMSL at the lower, southern portion of the site to 1,800 feet AMSL at the highest point to the north. The Project site is heavily vegetated with trees and shrubs. The majority of the property supports mixed chaparral with inclusions of coastal sage scrub. The dominant plant species include laurel sumac (*Malosma laurina*), scrub oak (*Quercus berberidifolia*), chamise (*Adenostoma fasciculatum*), spiny redberry (*Rhamnus crocea*), toyon (*Heteromeles arbutifolia*), coastal sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), white sage (*Salvia apiana*), and deerweed (*Acmispon glaber*) (Chadwick Ranch Estates Specific Plan, 2019).

The Project site also exhibits a primarily native scrub oak woodland setting, with non-native trees and scattered large oaks on the canyon floor areas of the property. Of the 2,287 trees inventoried there are 928 protected trees located throughout the project site, 811 of which are native (35.46%) and 67 of which are non-native significant trees (2.93%). There were 50 (2.19%) dead or critical health hazard trees observed. Additionally, 1,359 (59.42%) undersized trees may have the potential to exceed the standards within the City's Municipal Code. Based on species type, site climatic conditions, and hydrology of the site, these undersized trees are not likely to exceed the standards within the lifetime of this project. Of the 928 protected trees on site, 428 are expected to be impacted by the proposed project and associated infrastructure improvements (Chadwick Ranch Tree Preservation and Protection Plan, 2021).

There are eight native tree species that meet the City's definition of a native tree: western sycamore (*Platanus racemosa*), coast live oak (*Quercus agrifolia*), California scrub oak (Quercus berberidifolia), Engelmann oak (*Quercus engelmannii*), western cottonwood (*Populus fremontii*), toyon (*Heteromeles arbutifolia*), arroyo willow (*Salix lasiolepis*), and Mexican elderberry (*Sambucus mexicana*). Of the eight native species found on site, coast live oak and California scrub oak are the most prominent. Non-native trees found on site include Italian cypress (*Cupressus sempervirens*), red river gum (*Eucalyptus camaldulensis*), ash tree (*Fraxinus* species), silkoak (*Grevillea robusta*), American sweetgum (*Liquidambar styraciflua*), Canary Island pine (*Pinus canariensis*), Afghan pine (*Pinus eldarica*), Aleppo pine (*Pinus halepensis*), pittosporum (*Pittosporum* spp.), Santa Rosa plum (*Prunus salicina*), southern live oak (*Quercus virginiana*), Peruvian pepper (*Schinus molle*), Chinese elm (*Ulmus parvifolia*), and California fan palm (*Washingtonia filifera*) (Chadwick Ranch Estates Specific Plan, 2019). In 1958 and 1980, fires burned through the Project site and these plant communities, but they have since grown back in similar proportions, because these communities are comprised of species largely adapted to periodic fires.

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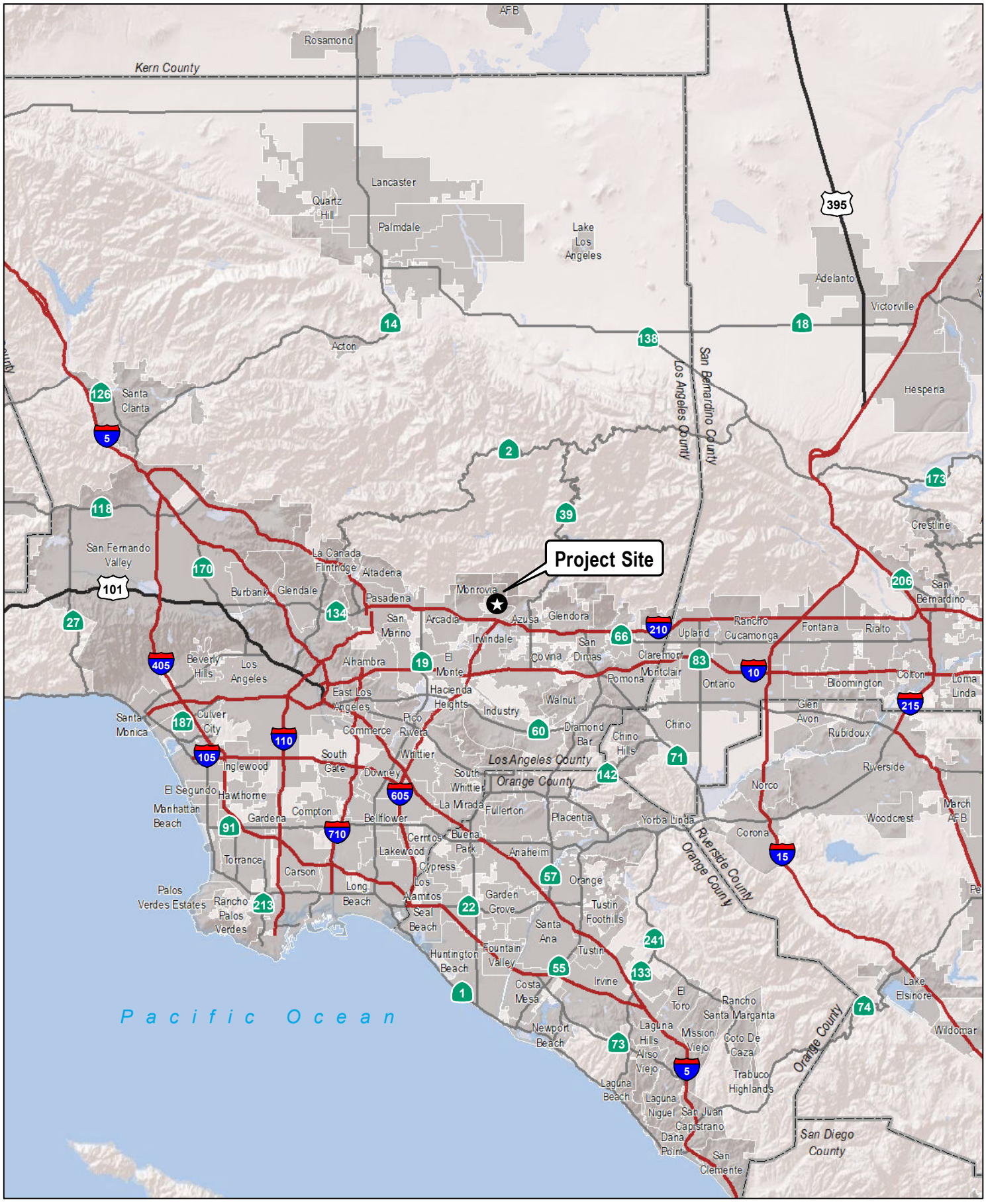

SOURCE: ESRI

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FIGURE 1

Project Site Regional Map

Chadwick Ranch Estates Fire Protection Plan

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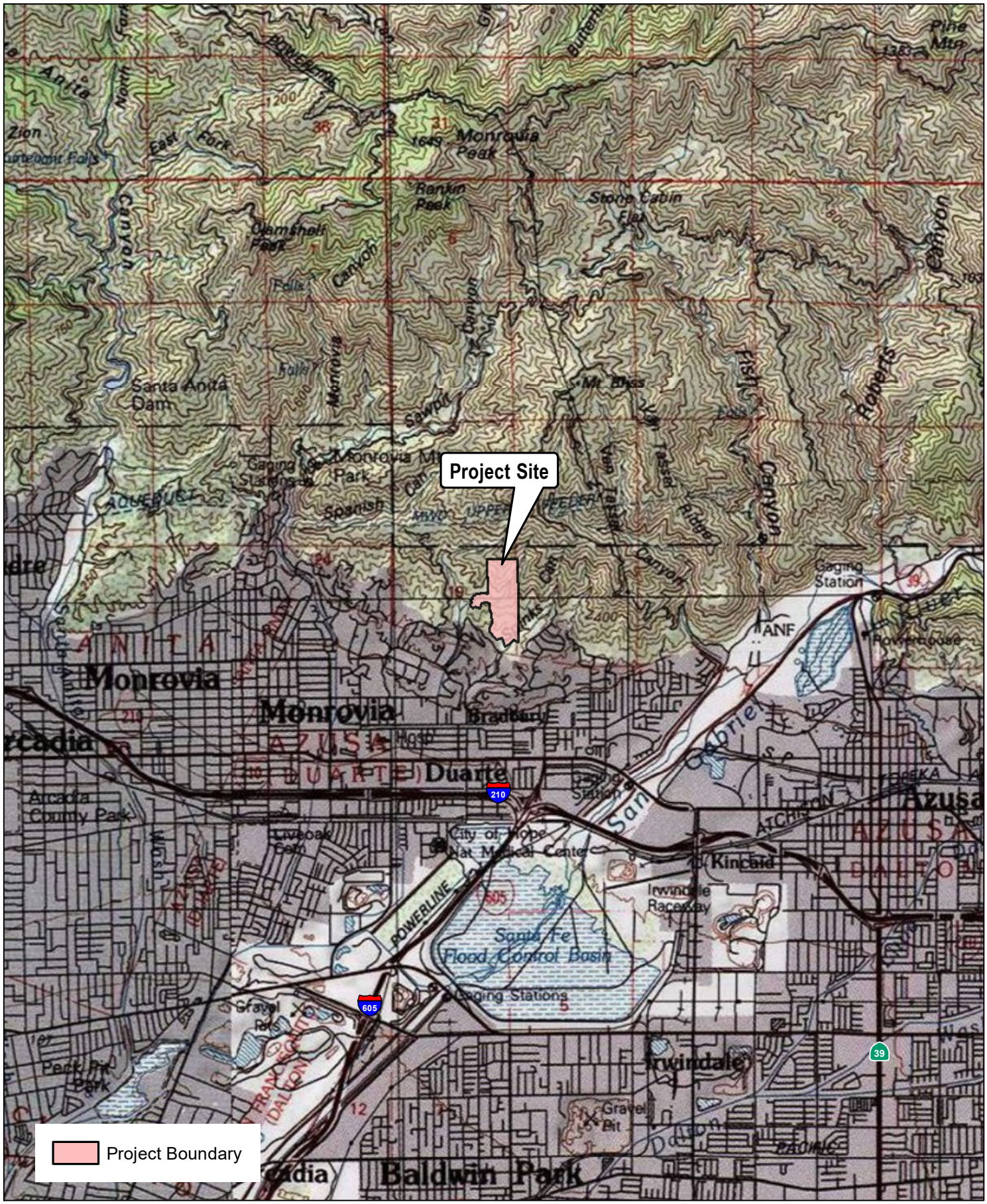

Document Path: Z:\Projects\j1123970\1\MAPDOC\MAPS\Fire Protection Plan\Fig 2 Vicinity.mxd

SOURCE: USGS 7.5 Minute Series, Azusa Quadrangle

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FIGURE 2

Vicinity Map

Chadwick Ranch Estates Fire Protection Plan

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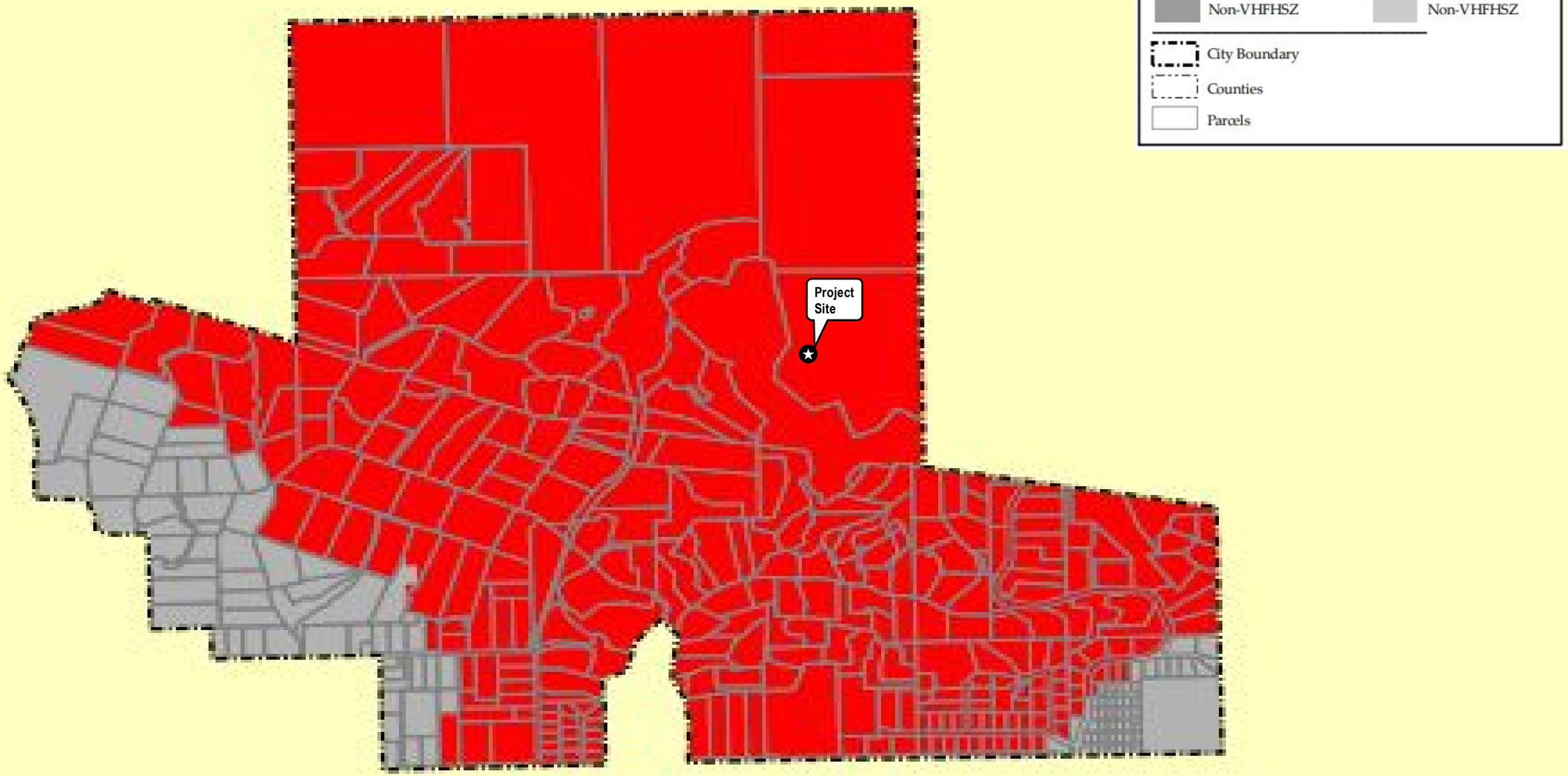

SOURCE: CAL FIRE, 2019

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FIGURE 3

Chadwick Ranch Fire Hazard Severity Zone Map

CHADWICK RANCH ESTATES FIRE PROTECTION PLAN

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SOURCE: Nevis Capital LLC, 2019

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FIGURE 4
Proposed Site Plan
Chadwick Ranch Estates Fire Protection Plan

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2 Chadwick Ranch Estates Site Risk Analysis

2.1 Environmental Setting and Field Assessment

After review of available digital Study Area information, including topography, vegetation types, fire history, and the Project's development footprint, a Dudek Fire Protection Planner conducted a site evaluation on December 6, 2019, in order to confirm/acquire site information, document existing site conditions, and to determine potential actions for addressing the protection of the Project's structures. While on site, Dudek's Fire Planners assessed the area's topography, natural vegetation and fuel loading, surrounding land use and general susceptibility to wildfire. Among the field tasks that were completed included:

- Topography evaluation
- Vegetation/fuel assessments
- Photograph documentation of the existing condition
- Confirmation/verification of hazard assumptions
- Off-site, adjacent property fuel and topography conditions
- Surrounding land use confirmations
- Necessary fire behavior modeling data collection
- Ingress/egress documentation
- Nearby Fire Station reconnaissance.

Study Area photographs were collected (refer to Appendix A, *Representative Site Photographs*), and fuel conditions were mapped using aerial images. Field observations were utilized to augment existing site data in generating the fire behavior models and formulating the requirements and recommendations detailed in this FPP.

2.2 Site Characteristics and Fire Environment

Fire environments are dynamic systems and include many types of environmental factors and site characteristics. Fires can occur in any environment where conditions are conducive to ignition and fire movement. Areas of naturally vegetated open space are typically comprised of conditions that may be favorable to wildfire spread. The three major components of fire environment are topography, vegetation (fuels), and climate. The state of each of these components and their interactions with each other determines the potential characteristics and behavior of a fire at any given moment. It is important to note that wildland fire may transition to urban fire if structures are receptive to ignition. Structure ignition depends on a variety of factors and can be prevented through a layered system of protective features including fire resistive landscapes directly adjacent the structure(s), application of known ignition resistive materials and methods, and suitable infrastructure for firefighting purposes. Understanding the existing wildland vegetation and urban fuel conditions on and adjacent the site is necessary to understand the potential for fire within and around the Project site. The following sections discuss the characteristics of the Project Area at a regional scale. Evaluating conditions at this macro-scale provides a better understanding of the regional fire environment, which represents the fuel bed for wildfires that may

ignite in the vicinity of, and burn toward, the Project's planned and maintained fire buffers, landscapes, and ignition-resistant structures.

2.2.1 Topography

Topography influences fire risk by affecting fire spread rates. Typically, steep terrain results in faster fire spread up-slope and slower spread down-slope. Terrain that forms a funneling effect, such as chimneys, chutes, or saddles on the landscape can result in especially intense fire behavior. Conversely, flat terrain tends to have little effect on fire spread, resulting in fires that are driven by vegetation and wind.

The Project site is located at the base of the San Gabriel Mountains in the Angeles National Forest. The northern portion of the Project site is very steep, sloping from the northeast to the southwest. The southern portion of the Project site is fairly steep with rolling terrain sloping towards the south. Elevation at the site ranges from approximately 700 feet AMSL at the lower, southern portion of the site to 1,800 feet AMSL at the highest point to the north. The site has been previously disturbed by several fires in recent years.

Topographic features that may present a fire spread facilitator are the slope and canyon alignments, which may serve to funnel or channel winds, thus increasing their velocity and potential for influencing wildfire behavior. From a regional perspective, the alignment of tributary canyons and dominant ridges are conducive to channeling and funneling wind, thereby increasing the potential for more extreme wildfire behavior in the region.

2.2.2 Climate

The Project site, like much of Southern California, is influenced by the Pacific Ocean and a seasonal, migratory subtropical high pressure cell known as the "Pacific High." Wet winters and dry summers with mild seasonal changes characterize the Southern California climate. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, easterly Santa Ana winds. The average high temperature for the project area is approximately 74°F, with daily highs in the summer and early fall months (July–October) exceeding 95°F. Precipitation typically occurs between December and March with average rainfall of 18 inches (Western Regional Climate Center, 2019).

From a regional perspective, the fire risk in southern California can be divided into three distinct "seasons" (Nichols et al. 2011, Baltar et al 2014). The first season, the most active season and covering the summer months, extends from late May to late September. This is followed by an intense fall season characterized by fewer but larger fires. This season begins late September and continues until early November. The remaining months, November to late May cover the mostly dormant, winter season. Mensing et al. (1999) and Keeley and Zedler (2009) found that large fires in the region consistently occur at the end of wet periods and the beginning of droughts. Typically, the highest fire danger in southern California coincides with Santa Ana winds. The Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis near the end of fire season during late summer and early fall. They are dry, warm winds that flow from the higher desert elevations in the east through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors. Localized wind patterns on the Project Sites are strongly affected by both regional and local topography.

The prevailing wind pattern is from the west (on-shore), but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are from the west–southwest (sea) and at night

winds are from the northeast (land), averaging 2 miles per hour (mph). During the summer season, the diurnal winds may average slightly higher (approximately 19 mph) than the winds during the winter season due to greater pressure gradient forces. Surface winds can also be influenced locally by topography and slope variations. The highest wind velocities are associated with downslope, canyon, and Santa Ana winds. The Chadwick Ranch Estates Project site includes topography that would create unusual weather conditions, thus the site is subject to periodic extreme fire weather conditions that occur throughout foothill portions of Los Angeles County.

2.2.3 Vegetation (Fuels)

Extensive vegetation type mapping is useful for fire planning, because it enables each vegetation community to be assigned a fuel model, which is used in a software program to predict fire behavior characteristics, as discussed in Section 3.1, Fire Behavior Modeling. Vegetative fuels on site are characteristic of the area and are primarily mixed chaparral and coastal sage scrub (CCS) habitats and scattered individual oak and sycamore tree stands and more concentrated trees throughout the property (riparian habitat). Man-made land cover types, such as disturbed land were also observed. The area proposed for development and within the project grading limits will be converted to roads, structures, and landscaped vegetation following project completion. Vegetative fuels within proposed fuel modification zones consist primarily of mixed chaparral and coastal sage scrub (CCS) and scattered oak and sycamore stands, although these fuels will be modified as a result of development, altering their current structure and species composition and resulting vulnerability to wildfire.

The Project site is heavily vegetated with trees and shrubs. The majority of the property supports mixed chaparral with inclusions of coastal sage scrub. The dominant plant species include laurel sumac (*Malosma laurina*), scrub oak (*Quercus berberidifolia*), chamise (*Adenostoma fasciculatum*), spiny redberry (*Rhamnus crocea*), toyon (*Heteromeles arbutifolia*), coastal sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), white sage (*Salvia apiana*), and deerweed (*Acmispon glaber*) (Chadwick Ranch Estates Specific Plan, 2019).

The Project site also exhibits a primarily native scrub oak woodland setting, with non-native trees and scattered large oaks on the canyon floor areas of the property. Of the 2,020 trees inventoried there are 711 protected trees located throughout the project site, 644 of which are native (30.4%) and 67 of which are non-native significant trees (3.2%). There were 50 (2.4%) dead or critical health hazard trees observed. Additionally, 1,359 (64.1%) undersized trees may have the potential to exceed the standards within the City's Municipal Code. Based on species type, site climatic conditions, and hydrology of the site, these undersized trees are not likely to exceed the standards within the lifetime of this project. Of the 711 protected trees on site, 679 are expected to be impacted by the proposed project and associated infrastructure improvements (Chadwick Ranch Estates Specific Plan, 2019).

There are eight native tree species that meet the City's definition of a native tree: western sycamore (*Platanus racemosa*), coast live oak (*Quercus agrifolia*), California scrub oak (Quercus berberidifolia), Engelmann oak (*Quercus engelmannii*), western cottonwood (*Populus fremontii*), toyon (*Heteromeles arbutifolia*), arroyo willow (*Salix lasiolepis*), and Mexican elderberry (*Sambucus mexicana*). Of the eight native species found on site, coast live oak and California scrub oak are the most prominent. Non-native trees found on site include Italian cypress (*Cupressus sempervirens*), red river gum (*Eucalyptus camaldulensis*), ash tree (*Fraxinus* species), silkoak (*Grevillea robusta*), American sweetgum (*Liquidambar styraciflua*), Canary Island pine (*Pinus canariensis*), Afghan pine (*Pinus eldarica*), Aleppo pine (*Pinus halepensis*), pittosporum (*Pittosporum* spp.), Santa Rosa plum (*Prunus salicina*), southern live oak (*Quercus virginiana*), Peruvian pepper (*Schinus molle*), Chinese elm (*Ulmus parvifolia*), and California fan palm (*Washingtonia filifera*) (Chadwick Ranch Estates Specific Plan, 2019). In 1958 and 1980,

fires burned through the Project site and these plant communities, but they have since grown back in similar proportions, because these communities are comprised of species largely adapted to periodic fires.

Post-development vegetation composition proximate to the Chadwick Ranch Estates footprint is expected to be significantly different than current conditions. Following build-out, irrigated and thinned landscape vegetation associated with fuel modification zones (FMZ) A, B, and C would be located in the immediate area surrounding the Project site, extending 200 horizontal feet from each of the structures. Consistent with requirements, native and naturalized vegetation occurring within FMZ Zone C is not expected to be irrigated, although overall fuel volumes will be reduced by removing dead and dying plants, non-natives, highly flammable species, and thinning the remaining plants so they would not readily facilitate the spread of fire on an ongoing basis. The provided FMZ areas will be maintained on an ongoing basis in order to comply with LACoFD's Fuel Modification Plan guidelines.

2.2.4 Vegetation Dynamics (Fuel Loads)

The vegetation described above translates to fuel models used for fire behavior modeling, discussed in Chapter 3 of this FPP. Variations in vegetative cover type and species composition have a direct effect on fire behavior. Some plant communities and their associated plant species have increased flammability based on plant physiology (resin content), biological function (flowering, retention of dead plant material), physical structure (bark thickness, leaf size, branching patterns), and overall fuel loading. For example, the native shrublands that compose the coastal scrub community throughout the Project site are a high potential hazard based on such criteria. California sagebrush scrub can produce higher heat intensity and higher flame lengths under strong, dry wind patterns, but does not typically ignite or spread as quickly as light, flashy grass fuels. The corresponding fuel models for each of these vegetation types are designed to capture these differences.

Vegetation distribution throughout the Project site varies by location and topography. Areas where the Project development is located are primarily disturbed or support coastal sage scrub cover. The importance of vegetative cover on fire suppression efforts is its role in affecting fire behavior. For example, fire burning in grasslands may have shorter flame lengths than those burning in coastal scrub; however, fire in grasslands, due to its flashy (easily ignited when dry) nature, often spreads more rapidly than fire in other vegetation types.

As described, vegetation plays a significant role in fire behavior, and is an important component to the fire behavior models discussed in this report. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes disrupts plant succession, setting plant communities to an earlier state where less fuel is present for a period of time as the plant community begins its succession again. In summary, high-frequency fires tend to convert shrublands to grasslands or maintain grasslands, and fire exclusion tends to convert grasslands to shrublands over time as shrubs sprout back or establish and are not disturbed by repeated fires. In general, biomass and associated fuel loading will increase over time, assuming that disturbance (e.g., fire) or fuel reduction efforts are not diligently implemented. It is possible to alter successional pathways for varying plant communities through manual alteration. This concept is a key component in the overall establishment and maintenance of the proposed FMZs for the project site. The FMZs will consist of irrigated and maintained landscapes that will be subject to regular "disturbance" in the form of maintenance and will not be allowed to accumulate excessive biomass over time, which results in reduced fire ignition, spread rates, and intensity.

2.2.5 Fire History

Fire history is an important component of a site-specific FPP. Fire History data provides valuable information regarding fire spread, fire frequency, ignition sources, and vegetation/fuel mosaics across a given landscape. One

important use for this information is as a tool for pre-planning. It is advantageous to know which areas may have burned recently and therefore may provide a tactical defense position, what type of fire burned on the site, and how a fire may spread. Fire history represented in this FPP uses the California Department of Forestry and Fire Protection (CAL FIRE) Fire and Resource Assessment Program (FRAP) database. FRAP summarizes fire perimeter data dating to the late 1800s, but which is incomplete due to the fact that it only includes fires over 10 acres in size and has incomplete perimeter data, especially for the first half of the 20th century (Syphard and Keeley 2016). However, the data does provide a summary of recorded fires and can be used to show whether large fires have occurred in the Project area, which indicates whether they may be possible in the future.

According to available data from the CAL FIRE in the FRAP database[2], ninety-three (93) fires have burned within 5 miles of the Project site since the beginning of the historical fire data record. Recorded wildfires within 5 miles range from 10.1 acres to 43,049.9 acres (1924 San Gabriel Fire) and the average fire size is approximately 1,546 acres (not including the 1924 San Gabriel Fire or fires smaller than 10 acres). The 2016 San Gabriel Complex Fire (also known as the Fish Fire) (approximately 4,246 acres) is the most recent fire, which occurred approximately 1-mile northeast of the Project Site. Two fires have burned on the project site. LACoFD may have data regarding smaller fires (less than 10 acres) that have occurred on the site that have not been included herein. Fire history for the general vicinity of the project site is illustrated in the map in Appendix B, *Fire History Map*.

Based on an analysis of this fire history data set, specifically the years in which the fires burned, the average interval between wildfires within 5 miles of the Project site was calculated to be one year with intervals ranging between 0 (multiple fires in the same year) to 9 years. Based on this analysis, it is expected that there will be wildland fires within 5 miles of the Project site at least every nine (9) years and on average, every 1.25 years, as observed in the fire history record. Based on fire history, wildfire risk for the Project site is associated primarily with a Santa Ana wind-driven wildfire burning or spotting onto the site from the north or east, although a fire approaching from the south during more typical on-shore weather patterns is possible. The proximity of the Project to large expanses of open space to the north, northwest, and northeast and the terrain within the San Gabriel Mountains, including multiple sub-drainages and canyons, has the potential to funnel Santa Ana winds, thereby increasing local wind speeds and increasing wildfire hazard in the Project vicinity.

[2] Based on polygon GIS data from CAL FIRE's FRAP, which includes data from CAL FIRE, USDA Forest Service Region 5, BLM, NPS, Contract Counties and other agencies. The data set is a comprehensive fire perimeter GIS layer for public and private lands throughout the state and covers fires 10 acres and greater between 1878–2018.

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3 Anticipated Fire Behavior

3.1 Fire Behavior Modeling

Following field data collection efforts and available data analysis, fire behavior modeling was conducted to document the type and intensity of fire that would be expected on and adjacent to the Chadwick Ranch Estates Project site given characteristic site features such as topography, vegetation, and weather. Dudek utilized the BehavePlus software package (Andrews, Bevins, and Seli 2008) to analyze potential fire behavior for the northern, southern, eastern, and western edges appropriate to the site. As is customary for this type of analysis, four fire scenarios were evaluated, including two summer, onshore weather condition (west and south of the project site) and two extreme fall, offshore weather condition (north and east/northeast of the project site), with assumptions made for the pre- and post-project slope and fuel conditions. Results are provided below and a more detailed presentation of the modeling inputs and results is provided in Appendix C, *Fire Behavior Modeling Summary*.

3.1.1 Fire Behavior Modeling Analysis

An analysis utilizing the BehavePlus software package was conducted to evaluate fire behavior variables and to objectively predict flame lengths, intensities, and spread rates for four modeling scenarios for the Chadwick Ranch Estates Project. These fire scenarios incorporated observed fuel types representing the dominant on-site and off-site vegetation on vacant land adjacent to the proposed developments, in addition to measured slope gradients, and wind and fuel moisture values derived from Remote Automated Weather Stations (RAWs) weather data sets (Henninger Flats Station) for both the 50th percentile weather (on-shore winds) and the 97th percentile weather (off-shore winds). Modeling scenario locations were selected to better understand different fire behavior that may be experienced on or adjacent the site.

Vegetation types, which were derived from the field assessment of the Project site, were classified into a fuel model. Fuel Models are simply tools to help fire experts realistically estimate fire behavior for a vegetation type. Fuel models are selected by their vegetation type; fuel stratum most likely to carry the fire; and depth and compactness of the fuels. Fire behavior modeling was conducted for vegetative types that surround the proposed developments. Fuel models were selected from *Standard Fire Behavior Fuel Models: a Comprehensive Set for Use with Rothermel's Surface Fire Spread Model* (Scott and Burgan 2005). Fuel models were also assigned to the perimeter fuel management areas to illustrate post-project fire behavior changes. Based on the anticipated pre- and post-project vegetation conditions, six different fuel models were used in the fire behavior modeling effort presented herein. Fuel model attributes are summarized in Table 1.

Table 1: Existing Fuel Model Characteristics

Fuel Model	Description	Location	Fuel Bed Depth (Feet)
Sh4	Riparian Habitat (Timber Shrub)	Riverbed that runs below the northern and western boundaries, as well as along below the debris disposal area along the southern portion of the site.	>8.0 ft.
Sh5	High Load, Dry Climate Shrub	Adjoining, single-family properties without maintenance.	>4.0 ft.
Gs1	Low Load, Dry Climate Grass-Shrub	Fuel type will occur post development within Zone B - Irrigated zone.	1.0 ft.
Gs2	Moderate load, Dry Climate Grass-Shrub	Fuel type will occur post development within 50% thinning zone.	<3.0 ft.
FM8	Irrigated Landscape	Fuel type will occur post development within Zone A - setback irrigated zone.	<1.0 ft.

3.1.2 Fuel Model Output Results

The results from the BehavePlus fire behavior modeling analysis for pre- and post-project conditions are presented in Tables 2 and 3, respectively, and in Figure 5, *BehavePlus Fire Behavior Analysis Map*. As presented, wildfire behavior on the Chadwick Ranch Estates Project site is expected to be primarily of moderate to high intensity throughout the non-maintained coastal sage scrub and chaparral dominated fuels north, south, west, and east of the Project site.

Table 2: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

Fire Scenario	Flame Length[1] (feet)	Spread Rate[1] (mph[5])	Fireline Intensity[1] (Btu/ft/s)	Spot Fire[6] (miles)	Surface Fire to Tree Crown Fire	Tree Crown Fire Rate of Spread (mph)	Crown Fire Flame Length (feet)
Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub[2,3] (Sh4)	10.9’	0.9	1,013	0.5	Crowning [4]	0.8	110.8’
Sagebrush scrub (Sh5)	19.5’	1.5	3,599	0.7	No	N/A	N/A
Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	12.8’ (23.5’)[6]	1.1 (4.2)	1,453 (5,471)	0.5 (1.5)	Crowning	1.0 (4.1)	133.1’
Sagebrush scrub (Sh5)	25.0’ (41.8’)	2.1 (6.4)	6,184 (18,966)	0.8 (2.3)	No	N/A	N/A
Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)							
Sagebrush scrub (Sh5)	24.0’ (41.3’)	1.9 (6.2)	5,697 (18,499)	0.8 (2.3)	No	N/A	N/A
Scenario 4: 18% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	10.5’	0.8	933	0.4	Crowning	0.8	110.8’
Sagebrush scrub (Sh5)	18.8’	1.4	3,328	0.6	No	N/A	N/A

Note:

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.

3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph.

Table 3: RAWS BehavePlus Fire Behavior Model Results – Post Project Conditions

Fire Scenario	Flame Length (feet)	Spread Rate (mph)[1]	Fireline Intensity (Btu/ft./sec)	Spot Fire (Miles)[2]
Scenario 1: 38% slope, Summer, On-shore Winds (Post Development)				
FMZ Zone A (FM8)	1.6'	0.1	16	0.1
FMZ Zone B (Gs1)	5.4'	0.5	221	0.3
FMZ Zone C (Gs2)	7.8'	0.7	500	0.4
Scenario 2: 43% slope, Fall, Offshore, Extreme Winds (Post Development)				
FMZ Zone A (FM8)	2.0' (2.6')	0.1 (0.1)	25 (46)	0.1 (0.3)
FMZ Zone B (Gs1)	7.0' (12.1')	0.7 (2.4)	387 (1,283)	0.3 (1.0)
FMZ Zone C (Gs2)	10.1' (19.1')	1.0 (3.9)	870 (3,450)	0.4 (1.4)
Scenario 3: 20% slope, Fall, Offshore, Extreme Winds (Post Development)				
FMZ Zone A (FM8)	1.9' (2.6')	0.1 (0.1)	23 (46)	0.1 (0.3)
FMZ Zone B (Gs1)	6.7' (12.1')	0.7 (2.4)	355 (1,283)	0.3 (1.0)
FMZ Zone C (Gs2)	9.7' (18.9')	0.9 (3.8)	797 (3,380)	0.4 (1.3)
Scenario 4b: 18% slope, Summer, On-shore Winds (Post Development)				
FMZ Zone A (FM8)	1.6'	0.1	18	0.1
FMZ Zone B (Gs1)	5.2'	0.5	202	0.2
FMZ Zone C (Gs2)	7.5'	0.6	455	0.3

Note:

1. mph = miles per hour
2. Spotting distance from a wind driven surface fire.
3. It should be noted that the wind mph in parenthesis represent peak gusts of 50 mph.

The results presented in Tables 2 and 3 depict values based on inputs to the BehavePlus software and are not intended to capture changing fire behavior as it moves across a landscape. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. For planning purposes, the averaged worst-case fire behavior is the most useful information for conservative fuel modification design. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

Based on the BehavePlus analysis, the maximum flame lengths anticipated in untreated, surface fuels, including Coastal sage scrub, could reach 41.8 feet in height with rates of spread between 1.1 mph and 6.4 mph under extreme weather conditions, represented by Santa Ana winds blowing at gusts of 50 mph. Should ignition in the riparian understory occur, fire would be expected to burn aggressively due to the presence of large amounts of biomass from dense stands of shrubby willows. Modeling outputs indicate a transition to crown fire is expected from a fire burning in the riparian understory, since the canopy heights to lowest branch are roughly 3 feet above ground and in most situations the canopies touch the ground. Under such conditions, expected surface flame lengths in peripheral riparian surface fuels could reach up to 23.5 feet and ignite the tree canopies with flame lengths potentially in excess of 100 feet. Embers could be generated from both surface and crown fires resulting in ignition of receptive fuel beds 0.8 to 2.3 miles downwind.

Fires burning from the west and pushed by ocean breezes typically exhibit less severe fire behavior due to lower wind speeds and higher humidity. Under typical onshore weather conditions, a sagebrush scrub fire could have flame lengths of 19.5 feet in height and spread rates of 1.5 mph. Modeling outputs indicate flame lengths. Spotting distances, where airborne embers can ignite new fires downwind of the initial fire, range from 0.4 to 0.7 mile.

As previously mentioned, Dudek conducted modeling of the site for post-fuel modification zones. Typical fuel modification includes establishment of minimum 100-foot wide irrigated zone (Zones A and B) and a 100-foot wide thinning zone (Zone C) on the periphery of the project site, beginning at the structure. For modeling the post-FMZ treatment condition, the fuel model assignment for non-native grasslands was re-classified according to the specific fuels management (e.g., irrigated, fire resistive landscaping and 50% thinning) treatment.

Based on the BeahvePlus analysis, post development fire behavior is expected in irrigated and replanted with plants that are acceptable with LACoFD (Zones A and B - FM8), as well in an area with 50% thinning of the existing shrubs (Gs2) under peak weather conditions (represented by Fall Weather, Scenario 2). Under such conditions, expected surface flame length is expected to be significantly lower, with flames lengths reaching approximately 19 feet with wind speeds of 50+ mph. Under this scenario, fire line intensities reach 3,450 BTU/feet/second with relatively slow spread rates of 3.9 mph and could have a spotting distance up to 1.4 miles away.

3.2 Chadwick Ranch Estates Area Fire Risk Assessment

Given the climatic, vegetative, topographic characteristics, and local fire history of the area, the Project site, once developed, is determined to be subject to periodic wildfires that may start on, burn onto, or spot into the site. The most common type of fire anticipated in the vicinity of the Project Area is a wind-driven fire from the north/northeast during the fall. Potential for off-site wildfire encroaching on, or showering embers on the site is considered moderate, but risk of ignition from such encroachments or ember showers is considered low based on the type of construction and fire protection features that will be provided for the structures.

Wildland fires are a common natural hazard in most of southern California with a long and extensive history. Southern California landscapes include a diverse range of plant communities, including vast tracts of tracts of grasslands and shrublands, like those found adjacent to the Chadwick Ranch Estates Project site. Wildfire in this Mediterranean-type ecosystem ultimately affects the structure and functions of vegetation communities (Keeley 1984) and will continue to have a substantial and recurring role (Keeley and Fotheringham 2003). Supporting this are the facts that 1) native landscapes, from forest to grasslands, become highly flammable each fall and 2) the climate of southern California has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with high winds (Santa Ana) occurring during autumn after a six-month drought period each year.

Based on this research, the anticipated growing population of Los Angeles County WUI areas, including in the City of Bradbury, and the regions fire history, it can be anticipated that periodic wildfires will occur in the open space areas of Los Angeles County, with the natural open spaces north, northwest, and east of the Chadwick Ranch Estates Project site being no exception. With conversion of the landscape to ignition resistant development, wildfires may still encroach upon and drop embers on the site, but would not be expected to burn through the site due to the lack of available fuels. Studies indicate that even with older developments that lacked the fire protections provided the Project, wildfires declined steadily over time (Syphard, et. al., 2007 and 2013) and further, the acreage burned

remained relatively constant, even though the number of ignitions temporarily increased. This is due to the conversion of landscapes to ignition resistant, maintained areas, more humans monitoring areas resulting in early fire detection and discouragement of arson, and fast response from the fire suppression resources that are located within these developing areas. While it is true that humans are the cause of most fires in California, there is no data available that links increases in wildfires with the development of ignition resistant communities. The Project will include a robust fire protection system, as detailed in the Project's FPP. This same robust fire protection system provides protections from on-site fire spreading to off-site vegetation. Accidental fires within the landscape or structures in the Project will have limited ability to spread. The landscape throughout the Project and on its perimeter will be highly maintained and much of it irrigated, which further reduces its ignition potential. Structures will be highly ignition resistant on the exterior and the interiors will be protected with automatic sprinkler systems, which have a very high success rate for confining fires or extinguishing them. The project will be a fire-adapted community with a strong resident outreach program that raises fire awareness among its residents. Therefore, potential impacts to special status species would be reasonably anticipated to be negligible.

Therefore, it will be critical that the latest fire protection technologies, developed through intensive research and real world wildfire observations and findings by fire professionals, for both ignition resistant construction and for creating defensible space in the ever-expanding WUI areas, are implemented and enforced. The Project will implement the latest fire protection measures, including fuel modification along the perimeter edges of the development. The Project, once developed, would not facilitate wildfire spread and would reduce projected flame lengths to levels that would be manageable by firefighting resources for protecting the site's structures, especially given the ignition resistance of the structures and the planned ongoing maintenance of the entire sites' landscapes, providing defensible space. In addition, the code-exceeding 200-foot FMZ widths for the Chadwick Ranch Estates site would be approximately four times as wide as the longest calculated flame lengths during offshore wind conditions for portions of the proposed developed area that abut Coastal sage scrub. Whereas, the 200-foot FMZ width would be approximately eight times wider than the calculated flame lengths for a fire during on-shore weather conditions.

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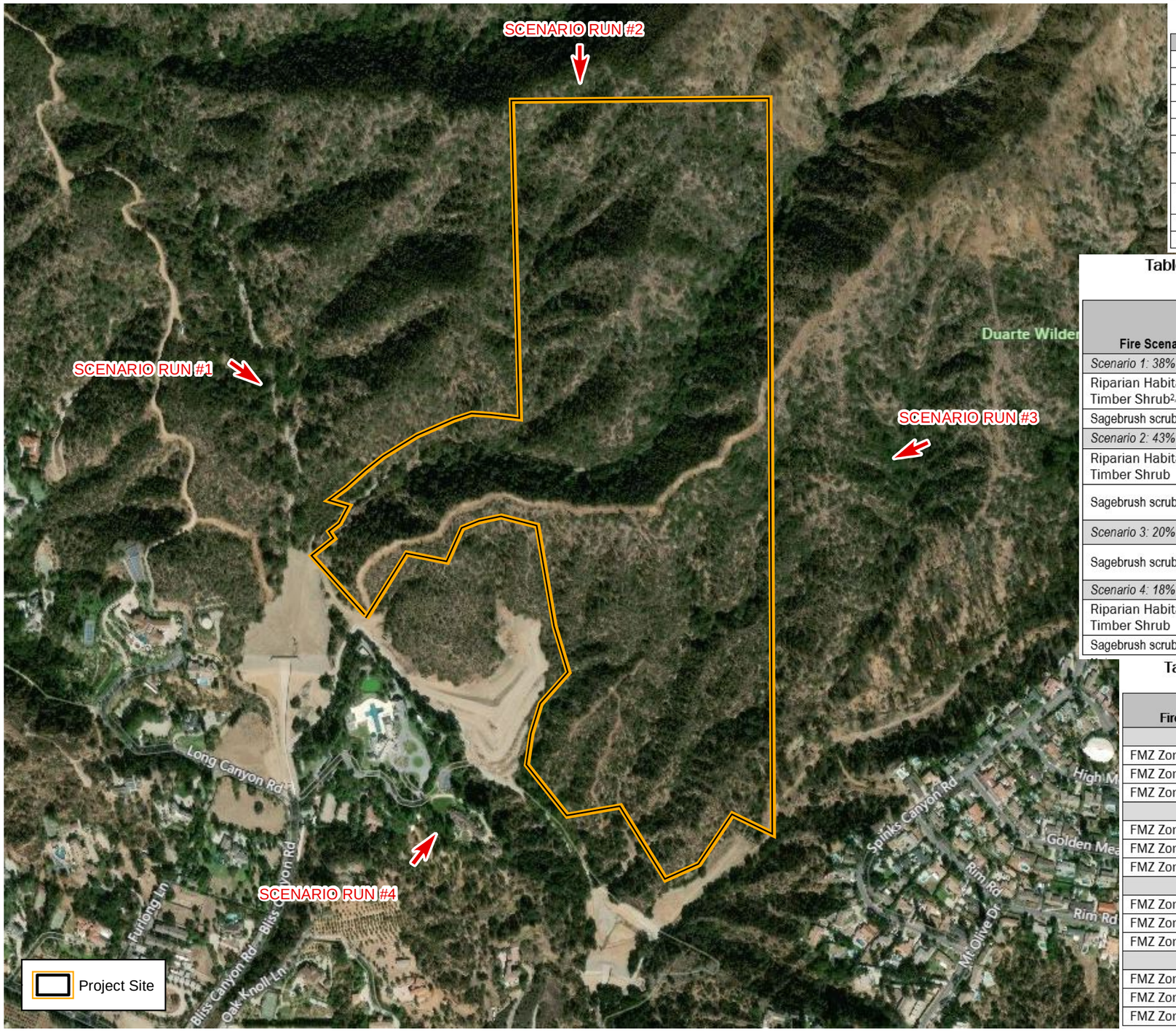

Table 1: Variables Used For Fire Behavior Modeling

Model Variable	Summer Weather (50th Percentile)	Peak Weather (97th Percentile)
Fuel Models	Sh4 and Sh5	FM4, Sh4, and Sh5
1 h fuel moisture	5%	2%
10 h fuel moisture	6%	3%
100 h fuel moisture	9%	5%
Live herbaceous moisture	39%	30%
Live woody moisture	78%	60%
20 ft. wind speed	19 mph (sustained winds)	18 mph (sustained winds); wind gusts of 50 mph
Wind Directions from north (degrees)	200 and 290	0 and 80
Wind adjustment factor	0.4	0.4
Slope (uphill)	18 to 38%	20 to 45%

Table 2: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

Fire Scenario	Flame Length[1] (feet)	Spread Rate[1] (mph[5])	Fireline Intensity[1] (Btu/ft/s)	Spot Fire[1] (miles)	Surface Fire to Tree Crown Fire	Tree Crown Fire Rate of Spread (mph)	Crown Fire Flame Length (feet)
Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub[2,3] (Sh4)	10.9'	0.9	1,013	0.5	Crowning [4]	0.8	110.8'
Sagebrush scrub (Sh5)	19.5'	1.5	3,599	0.7	No	N/A	N/A
Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	12.8' (23.5')[6]	1.1 (4.2)	1,453 (5,471)	0.5 (1.5)	Crowning	1.0 (4.1)	133.1'
Sagebrush scrub (Sh5)	25.0' (41.8')	2.1 (6.4)	6,184 (18,966)	0.8 (2.3)	No	N/A	N/A
Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)							
Sagebrush scrub (Sh5)	24.0' (41.3')	1.9 (6.2)	5,697 (18,499)	0.8 (2.3)	No	N/A	N/A
Scenario 4: 18% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	10.5'	0.8	933	0.4	Crowning	0.8	110.8'
Sagebrush scrub (Sh5)	18.8'	1.4	3,328	0.6	No	N/A	N/A

Table 3: RAWS BehavePlus Fire Behavior Model Results – Post Project Conditions

Fire Scenario	Flame Length (feet)	Spread Rate (mph)[5]	Fireline Intensity (Btu/ft./sec)	Spot Fire (Miles)[6]
Scenario 1: 38% slope, Summer, On-shore Winds (Post Development)				
FMZ Zone A (FM8)	1.6'	0.1	16	0.1
FMZ Zone B (Gs1)	5.4'	0.5	221	0.3
FMZ Zone C (Gs2)	7.8'	0.7	500	0.4
Scenario 2: 43% slope, Fall, Offshore, Extreme Winds (Post Development)				
FMZ Zone A (FM8)	2.0' (2.6')	0.1 (0.1)	25 (46)	0.1 (0.3)
FMZ Zone B (Gs1)	7.0' (12.1')	0.7 (2.4)	387 (1,283)	0.3 (1.0)
FMZ Zone C (Gs2)	10.1' (19.1')	1.0 (3.9)	870 (3,450)	0.4 (1.4)
Scenario 3: 20% slope, Fall, Offshore, Extreme Winds (Post Development)				
FMZ Zone A (FM8)	1.9' (2.6')	0.1 (0.1)	23 (46)	0.1 (0.3)
FMZ Zone B (Gs1)	6.7' (12.1')	0.7 (2.4)	355 (1,283)	0.3 (1.0)
FMZ Zone C (Gs2)	9.7' (18.9')	0.9 (3.8)	797 (3,380)	0.4 (1.3)
Scenario 4b: 18% slope, Summer, On-shore Winds (Post Development)				
FMZ Zone A (FM8)	1.6'	0.1	18	0.1
FMZ Zone B (Gs1)	5.2'	0.5	202	0.2
FMZ Zone C (Gs2)	7.5'	0.6	455	0.3

SOURCE: AERIAL-BING MAPPING SERVICE 2019

DUDEK

0 500 1000 2000 Feet

FIGURE **5**

BehavePlus Analysis Map

Chadwick Ranch Estates Fire Protection Plan

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4 Emergency Response and Service

The following sections analyze the Chadwick Ranch Estates Project in terms of current LACoFD Fire Service capabilities and resources to provide Fire Protection and Emergency Services. The analysis that follows examines the ability of the existing LACoFD fire stations to adequately serve the Project site. Response times were evaluated using Project build-out conditions. It was assumed that phased construction would include access roads to the newly constructed buildings and that the shortest access route to those structures would be utilized.

4.1 Fire Facilities

The Project is located within the LACoFD jurisdictional response area. Regionally, LACoFD provides fire, emergency medical, and rescue services from 173 stations. The Department serves over 4 million residents throughout 59 cities and all unincorporated portions of Los Angeles County. The Project site lies within the East Operations Bureau, Division 2. Fire Station 44 would provide initial response; however, Stations 29, 32, 48, and 169 within LACoFD's Division 2 are available to service the Projects, if needed. These five existing station were analyzed herein due to their proximity to either Project site. Figure 6 illustrates the station locations and Table 4 provides a summary of the LACoFD fire and medical delivery system for Fire Stations 29, 32, 44, 48, and 169.

Table 4. Closest Los Angeles County Fire Department Responding Stations Summary

Station	Location	Equipment	Staffing
Station 29	14334 Los Angeles Street, Baldwin Park, California, 91706	- (1) Paramedic Engine Company - (1) Paramedic Squad Truck - (1) Quint [1]	- 3-Person Engine company - 2-Person Paramedic Squad - 4-Person Quint
Station 32	605 North Angeleno Avenue, Azusa, California, 91702	- (1) Paramedic Engine Company - (1) Paramedic Squad Truck	- 4-Person Engine Company - 2 Person Paramedic Squad
Station 44	1105 Highland Avenue, Duarte, California, 91010	- (1) Paramedic Engine Company - (1) Assessment Engine Company	- 3-Person Engine Company - 4-Person Assessment Engine Company[2]
Station 48	15546 Arrow Highway, Irwindale, California, 91706	- (1) Engine Company	- 4-Person Engine Company
Station 169	5112 North Peck Road, El Monte, California, 91732	- (1) Engine Company	- 3-Person Engine Company

1. A quintuple combination pumper or "quint" is a fire-service apparatus that serves the dual purpose of an engine and a ladder truck.
2. An assessment engine company, is an engine company with some limited paramedic capabilities.

The closest existing fire station to the Chadwick Ranch Estates development is Station 44 located at 1105 Highland Avenue, Duarte, California, which includes a three (3)-person Engine Company staffed with a Captain, a Firefighter Specialist, and a Firefighter, and a four (4)-person Assessment Engine Company[3] with a Captain, a Firefighter Specialist, a Firefighter/Paramedic, and a Firefighter, 24-hours per day/seven days a week. Station 32, located at 605 North Angeleno Avenue, Azusa, California, is the next closest station, which includes a four (4)-person Paramedic Engine Company staffed with a Captain, a Firefighter Specialist, a Firefighter/Paramedic, and a Firefighter, and a two (2)-person Paramedic Squad truck with two (2) Firefighter/Paramedics, 24-hours per day/seven days per week

Additionally, Station 29 located at 14334 Los Angeles Street, Baldwin Park, California, Station 48 located at 15546 Arrow Highway, Irwindale, California, and Station 169 located at 5112 North Peck Road, El Monte, California could provide an effective firefighting force for the Chadwick Ranch Estates Project. Station 29 houses a three (3)-person Paramedic Engine Company, a four (4)-person Quint Company, and a tow (2)-person Paramedic Squad truck; Station 48 staffs a four (4)-person Engine Company; and Station 169 staffs a three (3)-person Engine Company.

4.2 Estimated Calls and Demand for Service from the Chadwick Ranch Estates Project

Emergency call volumes related to typical projects, such as new residential and commercial developments, can be reliably estimated based on the historical per-capita call volume from a particular fire jurisdiction. The LACoFD documented 403,615 total incidents for 2019[4] generated by a County-wide service area total population of approximately 4,250,000 persons in 58 cities and all unincorporated communities within Los Angeles County (revised from LACoFD 2017). The County's per capita annual call volume is approximately 95 calls per 1,000 persons. The resulting per capita call volume is 0.095. The City of Bradbury has a total population of 1,069 persons[5].

Based on the proposed development plans for the Chadwick Ranch Estates, the Project's estimated population of 44 is calculated to generate up to 4 calls per year (0.35 calls per month). The estimated incident call volume at buildout from the Chadwick Ranch Estates is based on a conservative estimate of the maximum potential number of persons on site at any given time (considered a "worst case" scenario). The Project includes 14 single-family estate lots with an average unit occupancy of 3.15 people per single-family dwelling unit, which calculates to a total population of approximately 44 people (3.15 x 14 DU = 44.1). Using Los Angeles County Fire agencies' estimate per capita call volume of 0.095 (95 annual calls per 1,000 population), the Chadwick Ranch Estates Project's estimated 44 people would generate up to 4 additional calls per year. The type of calls expected would primarily be medical-related.

[3] As Assessment Engine Company, is an engine company with some limited paramedic capabilities.
[4] https//www.fire.lacounty.gov/lacofd-releases-2019-statistics-for-incidents/
[5] https://www.scag.ca.gov/Documents/Bradbury.pdf

4.2.1 Response Capability Impact Assessment

As presented in Table 5, using 2019 call volume data (Bagwell, pers. Email comm. 2020a), Engines 29, 32, 48, 169, 244, and Assessment Engine 44, the six closest Engines[6], ran calls in 2019, averaging 11, 8, 3, 4, 6, 3, and 7 calls per day, respectively. Quint 29, and Squads 29 and 32 with larger response jurisdictions ran 5, 15, and 14 calls per day, respectively.

Table 5. LACoFD 2019 Call Volume Totals for Closest Fire Stations

Response Jurisdiction	*Engine 29*	*Quint 29*	*Squad 29*	*Engine 32*	*Squad 32*	*Assess. Engine 44*	*Engine 244*	*Engine 48*	*Engine 169*
Fire	180	214	74	140	58	103	129	131	149
Medical Aid (EMS)	3,442	1,094	5,316	2,670	5,088	2,099	546	1,146	1,750
Other	429	309	142	347	128	328	280	334	349
Annual Total Response	**4,051**	**1,617**	**5,532**	**3,157**	**5,274**	**2,530**	**955**	**1,611**	**2,248**
Total Calls Per Day	**11**	**5**	**15**	**8**	**14**	**7**	**3**	**4**	**6**

Source: LACoFD Planning Division

The available firefighting and emergency medical resources in the vicinity of the Project sites include an assortment of fire apparatus and equipment considered fully capable of responding to the type of fires and emergency medical calls potentially occurring within the Project site.

The Chadwick Ranch Estates Project includes 14 new single-family residential estate lots. The Chadwick Ranch Estates development is conservatively projected to add up to 4 calls per year (approximately 0.375 calls per month), mostly likely medical, initially within Station 44's first-in response jurisdiction. The addition of 4 call per year is not considered a significant impact. For perspective, Assessment Engine 44 and Engine 244 ran 7 and 3 calls per day (Refer to Table 5 above). A busy suburban fire station would run 10 or more calls per day. An average station runs about 5 calls per day.

The level of service demand for the Chadwick Ranch Estates Project site slightly raises overall call volume, but is not anticipated to impact the existing fire station to a point that they cannot meet the demand. For perspective, five calls per day are typical in an urban or suburban area. A busy fire station company would be one with 10 to 15 or more calls per day. Station 44 would respond to an additional 4 calls per year, although the number will likely be lower than that based on the conservative nature of the population and calls per capita data used in this estimate.

4.3 Emergency Response Travel Time Coverage

Land use in the City of Bradbury vicinity area varies greatly from urbanized and suburban clusters to vast rural areas. LACoFD's response time targets (Bagwell, pers. Email comm. 2020b) by land use type are:

[6] Engines 29, 32, and Assessment Engine are Paramedic Engines

- 5 minutes or less for urban areas
- 8 minutes or less for suburban areas
- 12 minutes or less for rural areas

In an effort to understand fire department response capabilities, Dudek conducted an analysis of the travel-time response coverage from the closest, existing station (Fire Station 44). This response time analysis was conducted using travel distances that were derived from Google road data and Project development plan data. Travel times were calculated applying the distance at speed limit formula[7] (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH) as well as the nationally recognized Insurance Services Office (ISO) Public Protection Classification Program's Response Time Standard formula (T=0.65 + 1.7 D, where T= time and D = distance) for comparison. The ISO response travel time formula discounts speed for intersections, vehicle deceleration and acceleration, and does not include turnout time. Tables 6 and 7 present tabular results of the emergency response time analysis using the distance at speed formula and the ISO formula, respectively.

Table 6. Chadwick Ranch Estates Emergency Response Analysis using Speed Limit Formula

LACoFD Station Nos.	Travel Distance to Project Entrance[1]	Travel Time to Project Entrance[1]	Maximum Travel Distance[2]	Maximum Travel Time[2]	Total Response Time[3]
29	6.9 miles	11 minutes 48 seconds	7.4 miles	12 minutes 40 seconds	14 minutes 40 seconds
32	6.5 miles	11 minutes 10 seconds	7.0 miles	12 minutes	14 minutes
44	2.8 miles	4 minutes 47 seconds	3.3 miles	5 minutes 36 seconds	7 minutes 36 seconds
48	6.8 miles	11 minutes 36 seconds	7.3 miles	12 minutes 30 seconds	14 minutes 30 seconds
169	6.0 miles	10 minutes 16 seconds	6.6 miles	11 minutes 19 seconds	13 minutes 19 seconds

Notes:

1. Assumes travel distance and time to the Project entrance off Bliss Canyon Road from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH), a 35 mph travel speed, and does not include turnout time.
2. Assumes travel distance and time to the furthest point within the Project site from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH), a 35 mph travel speed, and does not include turnout time.
3. Emergency response time target thresholds include travel time to furthest point within the Project site from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH) a 35 mph travel speed along with dispatch and turnout time, which can add an additional two minutes to travel time.

[7] Using the speed limit of 35 MPH.

Table 7. Chadwick Ranch Estates Emergency Response Analysis using ISO Formula

LACoFD Station Nos.	Travel Distance to Project Entrance[1]	Travel Time to Project Entrance[1]	Maximum Travel Distance[2]	Maximum Travel Time[2]	Total Response Time[3]
29	6.9 miles	12 minutes 23 seconds	7.4 miles	13 minutes 15 seconds	15 minutes 15 seconds
32	6.5 miles	11 minutes 42 seconds	7.0 miles	12 minutes 31 seconds	14 minutes 31 seconds
44	2.8 miles	5 minutes 25 seconds	3.3 miles	6 minutes 15 seconds	8 minutes 15 seconds
48	6.8 miles	12 minutes 13 seconds	7.3 miles	13 minutes 02 seconds	15 minutes 02 seconds
169	6.0 miles	10 minutes 48 seconds	6.6 miles	11 minutes 48 seconds	13 minutes 48 seconds

Notes:

1. Assumes travel distance and time to the Project entrance off Bliss Canyon Road from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed, and does not include turnout time.
2. Assumes travel distance and time to the furthest point within the Project site from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed, and does not include turnout time.
3. Emergency response time target thresholds include travel time to furthest point within the Project site from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed along with dispatch and turnout time, which can add an additional two minutes to travel time.

Emergency response time target thresholds include travel time along with dispatch and turnout time, which can add an additional two minutes to travel time. As indicated in Table 6, response to the Chadwick Ranch Estates Project site from the closest existing LACoFD fire station (Station 44) conforms to the response time standard of 8 minutes for suburban areas. Station 44 at 1105 Highland Avenue, Duarte, California, would provide initial response. Total response time from Station 44 is calculated at roughly 7 minutes 36 seconds or 8 minutes 15 seconds to the furthest lot within the proposed development, depending on the utilized travel time formula. The second engine to the site is estimated to arrive within approximately 13 minutes 19 seconds or 13 minutes 48 seconds. All response calculations are based on an average response speed of 35 mph, consistent with nationally recognized National Fire Protection Association (NFPA) 1710. Based on these calculations, the Project would meet or substantially confirm with the County's response time standard for suburban from existing fire stations.

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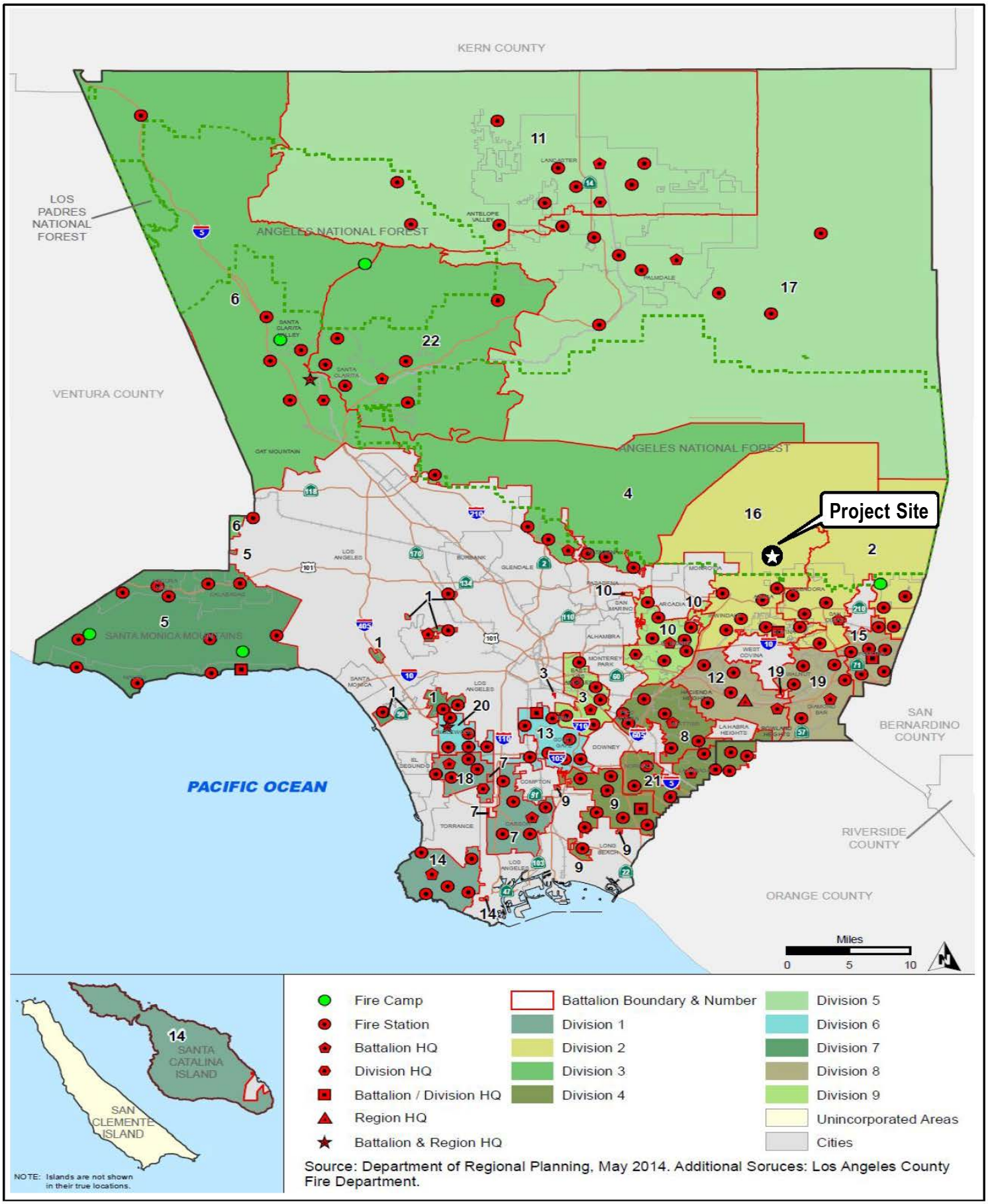

SOURCE: Los Angeles County Fire Department, 2019

DUDEK

Figure 6

Los Angeles County Fire Department Battalions and Stations Map

Chadwick Ranch Estates Fire Protection Plan

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5 Buildings, Infrastructure and Defensible Space

This FPP demonstrates that the Project would comply with applicable portions of 2020 Los Angeles Fire Code (Title 32), as amended, and adopting by reference the 2019 edition of the CFC. The Project also complies with Chapter 7A of the 2019 California Building Code (CBC); the 2019 California Residential Code, Section 237; and 2018 Edition of the International Fire Code as adopted by the County. The Project would also be subject to the provisions of section 4291 of the Public Resources Code regarding brush clearance standards around structures and the Los Angeles County Fire Department guidelines for Fuel Modification Plans. The project will meet or exceed applicable codes or will provide alternative materials and/or methods. While these standards will provide a high level of protection to structures for the Project, there is no guarantee that compliance with these standards will prevent damage or destruction of structures by fire in all cases. A response map update, including roads and fire hydrant locations, in a format compatible with current department mapping shall be provided to the LAcoFD.

The following summaries highlight important fire protection features. All underground utilities, hydrants, water mains, curbs, gutters, and sidewalks will be installed, and the drive surface shall be approved prior to combustibles being brought on site.

5.1 Fire Apparatus Access

5.1.1 Primary

The project would involve the construction of new structures, roadways, and would generate new trips to and from the project site. Project site access, including road widths and connectivity, will be consistent with the County's roadway standards (Title 21) and the 2016 CFC Section 503. Additionally, an adequate water supply and approved paved access roadways shall be installed prior to any combustibles being brought on site and will include:

- The Chadwick Ranch Estates Project site's primary access would be accessible through a series of internal neighborhood roadways within the Bradbury Estates gated community, including Deodar Lane and Bliss Canyon Road. Access to the Project site would be from a single entrance; access through the existing Los Angeles County Flood Control property using existing easements to allow access to the Project site from the intersection of Long Canyon Road and Bliss Canyon Road. A large portion of the existing Flood Control road system will be improved to be consistent with the County's roadway standards (Title 21) and the 2019 CFC, Section 503.
- The Primary access to the Project site begins offsite at the intersection of Bliss Canyon Road and Long Canyon Road. From there the Project access road traverses LACFCD property and utilizes a portion of the Flood Control District road system using existing easements until it reaches the Project site boundary. From the point that the offsite roadway enters the Project site, the onsite roadway climbs until it reaches its high point at the water reservoir access road. From there it proceeds downhill to provide access to the remaining residential lots and debris basins along the way. The access road continues to the southerly

portion of the site and connects the Flood Control Road creating a single looped road throughout the Project. According to Title 21, Chapter 21.24.020 – Restricted Residential Access, if a street or street system is restricted to a single route of access to a highway shown on a Highway plan, the street or street system shall not serve more than 150 dwelling units where the restriction is designed to be permanent and the street or street system does not traverse a wildland area which is subject to hazard from brush or forest fire. The Chadwick Ranch Estates Project will designed with a looped circulation road system which will provide access to less than the maximum 150 units allowed on a single point of access, which meets the requirement.

- Typical, interior Project roads will comply with all fire apparatus access road standards; all interior fire access roadways where a fire hydrant is located shall be constructed to a minimum unobstructed road width of 26 feet, exclusive of shoulders and shall be improved with aggregate cement or asphalt paving materials. Fire access roadways designed to allow parking shall provide a minimum clear width of not less than 34 feet for parking on one side and a clear width of not less than 42 feet for parking on both sides. The interior residential access roads will be designed to accommodate a minimum of a 75,000-pound (lb.) fire apparatus load.
- All interior circulation roads include all roadways that are considered common or primary roadways for traffic flow through the Project site and for fire department access serving all proposed residential lots. Any dead-end streets serving new residential structures that are longer than 150 feet shall have approved provisions for fire apparatus turnaround.
- Private and public streets for each phase shall meet all project approved fire code requirements and/or mitigated exceptions for maximum allowable dead-end distance, paving, and fuel management prior to combustibles being brought to the site.
- Fire apparatus roads shall have an unobstructed width of not less than 20 feet, exclusive of shoulders, except for approved security gates in accordance with Section 503.6, and an unobstructed vertical clearance clear to the sky to allow aerial ladder truck operation.
    - Exception: A minimum vertical clearance of 13 feet 6 inches may be allowed for protected tree species adjacent to access roads. Any applicable tree-trimming permit from the appropriate agency is required.
- Roads with a median or center divider will have a minimum 20 feet unobstructed width on both sides of the center median or divider.
- Three hammerhead turnarounds are provided along the primary site access roadway to facilitate fire engine access throughout the site. Fire apparatus turnaround have been designed along “A” Street every 1,000 feet. Fire apparatus turnarounds will meet requirements and LACoFD cul-de-sac length restrictions (County Code Section 21.24.190) as follows:
    - 500 feet on length, when serving land zones for industrial or commercial use.
    - 700 feet in length, when serving land zoned for residential uses having a density of more than four dwelling units per net acre.

- A turning area shall be provided at the end of cul-de-sac streets and dead-end alleys. The advisory agency may require turnarounds:
  - Upon the recommendation of the subdivision committee, at intermediate points on cul-de-sacs of more than 700 feet in length, and on other local streets where the distance between intersections exceeds 2,000 feet; and
  - At the end of stub or dead-end streets or more than 300 feet in length where the future extension of the street is remote.
- All such turnarounds shall conform to the specifications of the road commissioner

- Roadways and/or driveways will provide fire department access to within 150 feet of all portions of the exterior walls of the first floor of each structure.
- Access roads shall be completed and paved prior to issuance of building permits and prior to the occurrence of combustible construction.
- The developer will provide information illustrating the new roads, in a format acceptable to the LACoFD for updating of Fire Department response maps.

5.1.2 Gates

Gates on private roads are permitted, but subject to Fire Code requirements and standards, including:

- Gates shall be equipped with conforming sensors for detecting emergency vehicle "opticom" strobe lights from any direction of approach, if required.
- All entrance gates will be equipped with a key switch, which overrides all command functions and opens the gate.
- Gate activation devices will be equipped with a battery backup or manual mechanical disconnect in case of power failure.
- Further, gates will be:
  - Minimum 20 feet wide of clearance for one-way traffic when fully open at entrance.
  - Minimum of two feet wider than road width at exit.
  - Constructed from non-combustible or exterior fire-rated treated wood materials.
  - Inclusive of provisions for manual operation from both sides, if power fails. Gates will have the capability of manual activation from the development side or a vehicle (including a vehicle detection loop).

5.1.3 Road Width and Circulation

On-site roads will be constructed to current Los Angeles County Fire Apparatus Access Code standards and 2019 CFC, including all interior fire access roadways where a fire hydrant is located shall be constructed to a minimum unobstructed road width of 26 feet, exclusive of shoulders and shall be improved with aggregate cement or asphalt paving materials. Fire access roadways designed to allow parking shall provide a minimum clear width of not less than 34 feet for parking on one side and a clear width of not less than 42 feet for parking on both sides. The interior residential access roads will be designed to accommodate a minimum of a 75,000-pound (lb.) fire apparatus load.

5.1.4 Grade

The project complies with the Los Angeles County grade requirements. Fire apparatus access roads shall not exceed 15 percent in grade. Exception: For a fire access road serving no more than two single-family dwellings, grades shall not exceed 20 percent when approved by the fire code official (Section D103.4).

5.1.5 Surface

All fire apparatus access and vehicle roadways shall be asphalt or concrete and designed and constructed in accordance with County Public Works standards

5.1.6 Vertical Clearance

- Fire apparatus roads shall have an unobstructed width of not less than 26 feet, exclusive of shoulders, except for approved security gates in accordance with Section 503.6, and an unobstructed vertical clearance clear to the sky to allow aerial ladder truck operation.
    - Exception: A minimum vertical clearance of 13 feet 6 inches may be allowed for protected tree species adjacent to access roads. Any applicable tree-trimming permit from the appropriate agency is required.

5.1.7 Premise Identification

Identification of roads and structures will comply with Fire Code as follows:

- All commercial/industrial structures required to be identified by street address numbers at the structure. Numbers to be minimum 8 inches high with 1-inch stroke, visible from the street. Numbers will contrast with background and shall be electrically illuminated during the hours of darkness where building setbacks exceed 100 feet from the street or would otherwise be obstructed; numbers shall be displayed at the property entrance. Numbers will contrast with background.
- All residential structures shall be identified by street address. Numbers shall be 4 inches in height, 1/2 -inch stroke, and located 6 to 8 feet above grade. Addresses on multi-residential buildings shall be 6 inches high with 1/2-inch stroke. Numbers will contrast with background.
- Multiple structures located off common driveways or roadways will include posting addresses on structures and on the entrance to individual driveway/road or at the entrance to the common driveway/ road for faster emergency response.
- Streets will have street names posted on non-combustible street signposts. Letters/numbers will be per County standards.

5.2 Ignition Resistant Construction and Fire Protection Systems

The proposed structures will be built utilizing the most current construction methods intended to mitigate wildfire exposure, required by LACoFD, at the time of construction. Within the limits established by law, construction methods intended to mitigate wildfire exposure will comply with the wildfire protection building construction requirements contained in the Los Angeles County Building Code including the following:

1. Los Angeles County Building Code, Chapter 7A
2. Los Angeles County Residential Code, Section R327
3. Los Angeles County Referenced Standards Code, Chapter 12-7A

Construction practices respond to the requirements of the LACoFD Fire Code Title 32 and the Los Angeles County Building Code (Title 26, Chapter 7A), "Construction Methods for Exterior Wildfire Exposure" These requirements include the ignition resistant requirements found in Chapter 12-7A of the Los Angeles County Referenced Standards Code. While these standards will provide a high level of protection to structures in this development, and should reduce or eliminate the need to order evacuations, there is no guarantee of assurance that compliance with these standards will prevent damage or destruction of structures by fire in all cases.

There are two primary concerns for structure ignition: 1) radiant and/or convective heat and 2) burning embers (NFPA 1144 2008, Ventura County Fire Protection District 2011, IBHS 2008, and others). Burning embers have been a focus of building code updates for at least the last decade, and new structures in the Wildland Urban Interface[8] (WUI) built to these codes have proven to be very ignition resistant. Likewise, radiant and convective heat impacts on structures have been minimized through the Chapter 7A exterior fire ratings for walls, windows and doors. Additionally, provisions for modified fuel areas separating wildland fuels from structures have reduced the number of fuel-related structure losses. As such, most of the primary components of the layered fire protection system provided the project are required by the LACoFD, but are worth listing because they have been proven effective for minimizing structural vulnerability to wildfire and, with the inclusion of required interior sprinklers (required in the 2016 Building/Fire Code update), of extinguishing interior fires, should embers succeed in entering a structure. Even though these measures are now required by the latest Building and Fire Codes, at one time, they were used as mitigation measures for buildings in WUI areas, because they were known to reduce structure vulnerability to wildfire. These measures performed so well, they were adopted into the code. The following project features are required for new development in WUI areas and form the basis of the system of protection necessary to minimize structural ignitions as well as providing adequate access by emergency responders:

1. The 7A Materials and Construction Methods for Exterior Wildfire Exposure (CBC) chapter details the ignition resistant requirements for the following key components of building safely in wildland urban interface and fire hazard severity zones:
    a. Roofing Assemblies (covering, valleys and gutters)

[8] The Wildland-Urban interface is the area where urban and suburban development meets the undeveloped areas containing natural vegetation

b. Vents and Openings
c. Exterior wall covering
d. Open Roof Eaves
e. Closed Roof Eaves and Soffits
f. Exterior Porch Ceilings
g. Floor projections and underfloor protection
h. Underfloor appendices
i. Windows, Skylights and Doors
j. Decking
k. Accessory structures

2. New class-A fire rated roof and associated assembly. With the proposed class-A fire rated roof, areas where there will be attic or void spaces requiring ventilation to the outside environment, the attic spaces will require either ember-resistant roof vents or a minimum 1/16-inch mesh (smaller sizes restrict air flow) and shall not exceed 1/8-inch mesh for side ventilation (recommend BrandGuard, O'Hagin or similar vents). All vents used for this project will be approved by LACoFD.
3. Multi- pane glazing with a minimum of one tempered pane, fire-resistance rating of not less than 20 minutes when tested according to NFPA 257 (such as SaftiFirst, SuperLite 20-minute rated glass product), or be tested to meet the performance requirements of State Fire Marshal Standard 12-7A-2
4. Automatic, Interior Fire Sprinkler System to code by occupancy type for all habitable, multi-family residential dwellings.
5. Modern infrastructure, access roads, and water delivery system.

5.3 Infrastructure and Fire Protection Systems Requirements

The following infrastructure components are made in order to comply with the Los Angeles County requirements, the 2019 California Fire Code, LACoFD's Fire Code Standards, and nationally accepted fire protection standards, as well as additional requirements to assist in providing reasonable on-site fire protection.

5.3.1 Water

The Project will be consistent with County Title 20, Section 20.16.060 for fire flow and fire hydrant requirements within a VHFHSZ. Currently, domestic water lines exist in Bliss Canyon Road and Long Canyon Road. Water utilities will be connected prior to any construction. The Project will be served with a main line within Bliss Canyon Road. Water supply lines will provide the main water supply to domestic service to each structure and common landscape area. These internal waterlines will also supply sufficient fire flows and pressure to meet the demands for required onsite fire hydrants and interior fire sprinkler systems for all structures. Additionally, the Project proposes the construction of one (1) 1,000,000-gallon aboveground water tank and associated equipment above the Project site (at approximately 1,230 feet amsl), which will be accessed via a newly constructed, code compliant interior roadway. Water supply must meet a 2-hour fire flow requirement of 2,500 gpm with 20-psi residual pressure, which must be over and above the daily maximum water requirements for this development.

NOTE TO REVIEWER please provide details regarding water supply, storage, pressures and volumes (i.e., minimum residual pressure during peak hour demands and a minimum residual pressure during maximum day demands plus fire flow.

5.3.2 Fire Hydrants

Fire Hydrants shall be located along fire access roadways as determined by LACoFD Fire Chief or Fire Marshal and current fire code requirements to meet operational needs. The required fire hydrant spacing will be 600 feet apart for single-family residential.

Fire Hydrants will be consistent with applicable County Design Standards. Hydrants will have one 2.5-inch outlet and one 4- inch outlet and be of bronze construction per the LACoFD fire code. Reflective blue dot hydrant markers shall be installed in the street to indicate location of the hydrant. Crash posts will be provided where needed in on-site areas where vehicles could strike fire hydrants or fire department connections. Prior to issuance of building permits, the appropriate number of fire hydrants and their specific locations will be approved by LACoFD.

5.3.3 Automatic Fire Sprinkler Systems

All structures, of any occupancy type, will be protected by an automatic, interior fire sprinkler system. All structures Automatic internal fire sprinklers would be in accordance with National Fire Protection Association (NFPA) 13, 13D, or 13R and LACoFD installation requirements as required based on structure type, use and size. Actual system design is subject to final building design and the occupancy types in the structure. Fire sprinkler plans for each structure will be submitted and reviewed by LACoFD for compliance with the applicable fire and life safety regulations, codes, and ordinances.

5.3.4 Residential Hazard Detectors

All residences will be equipped with residential smoke detectors and carbon monoxide detectors and comply with current CBC, CFC, and California Residential Code standards.

5.4 Ongoing Building and Infrastructure Maintenance

The Chadwick Ranch Estates Project HOA shall be responsible for long term funding and maintenance of private roads and fire protection systems, including fire sprinklers and private fire hydrants.

5.5 Pre-Construction Requirements

Per Los Angeles County Fire Code, 4908.1, A fuel modification plan shall be submitted and have preliminary approval prior to any subdivision of land; or, have final approval prior to the issuance of a permit for any permanent structure used for habitation; where, such structure, or subdivision is located within areas designated as a Fire Hazard Severity Zone within State Responsibility Areas or Very High Fire Hazard Severity Zone within the Local Responsibility areas, applicable Fire Hazard Zone maps, and Appendix M of this code at the time of application. An on-site inspection must be conducted by the personnel of the Forestry Division of the Fire

Department and a final approval of the fuel modification plan issued by the Forestry Division prior to a certificate of occupancy being granted by the building code official.

As an additional consultant recommendation, prior to bringing lumber or combustible materials onto the Project Site, site improvements within the active development area shall be in place, including utilities, operable fire hydrants, an approved, temporary roadway surface, and fuel modification zones established.

5.6 Activities in a Hazardous Fire Area

The Project will comply with LACoFD requirements for activities in Hazardous Fire Areas. it is recommended that a construction fire prevention plan be prepared for the Project prior to commencement of construction activities that will designate fire safety measures to reduce the possibility of fires during the construction phase. The plan may include the following measures: fire watch/ fire guards during hot works and heavy machinery activities, hose lines attached to hydrants or a water tender, Red flag warning weather period restrictions, required on-site fire resources, and others as determined necessary.

5.7 Defensible Space and Vegetation Management

5.7.1 Fuel Modification Zones (FMZ)

An important component of a fire protection system for the Project is the provision for fire resistant landscapes and modified vegetation buffers. FMZs are designed to provide vegetation buffers that gradually reduce fire intensity and flame lengths from advancing fire by strategically placing thinning zones, restricted vegetation zones, and irrigated zones adjacent to each other on the perimeter of the WUI exposed structures.

The Project will be exposed to naturally-vegetated open space areas to the northern, western, and eastern portions of the site. The rest of the proposed development is adjacent to a residential community to the south, southeast, and southwest. Based on the modeled extreme weather flame lengths for the Project site, average wildfire flame lengths are projected to be approximately 40 to 45 feet high in areas of Development Footprint-adjacent coastal scrub and chaparral fuels. The fire behavior modeling system used to predict these flame lengths was not intended to determine sufficient FMZ widths, but it does provide the average predicted length of the flames, which is a key element for determining “defensible space” distances for providing firefighters with room to work and minimizing structure ignition. For the Chadwick Ranch Estates Project site, the FMZ widths between the naturally vegetated open space areas and the property lot lines are proposed to include 200 feet of fuel modification around Lots 1 through 8 and Lots 10 through 14, approximately 4 times the modeled flame lengths based on the existing fuel types represented adjacent to the Development footprint. Due to property boundary restraints, Lot 9 will include 100 feet of irrigated fuel modification, approximately 2.5 times the modeled flame lengths based on the existing fuel types represented adjacent to the Development footprint. The FMZs will be constructed from the structure outwards towards undeveloped areas. Figure 7 illustrates the LACoFD approved FMZ Plan for the Chadwick Ranch Estates Project Site, and includes a minimum 30-foot wide irrigated, setback area Zone A, a minimum 70-foot wide irrigated area Zone B, and a minimum 100-foot wide 50% thinning area Zone C. A 30-foot wide roadside FMZ along each side of the roads adjacent to the open space shall be required as well.

Although FMZs are very important for setting back structures from adjacent unmaintained fuels, the highest concern is considered to be from firebrands or embers as a principal ignition factor. To that end, this site, based on its location and ember potential, is required to include the latest ignition and ember resistant construction materials and methods for roof assemblies, walls, vents, windows, and appendages, as mandated by the LACoFD and County's Fire and Building Codes (e.g., Chapter 7A).

NOTE: Although portions of the Project site are adjacent to and require access that traverses LACFCD property, utilizing a portion of the Flood Control District road system via existing easements until it reaches the project site boundary, the LACoFD has approved the submitted FMZ Plan for the Chadwick Ranch Estates Project. To mitigate for the inability to achieve the full 200 feet of FMZ for Lot 9 of the Project site, a minimum 100-foot, fully irrigated fuel modification zone will be incorporated along the eastern side of Lot 9. Furthermore, a portion of the 200-fot wide fuel modification zone extends beyond the property boundary around Lots 1 through 4 and 14. As part of the Project's Conditions of Approval by the Board of Supervisors, the Project would be required to meet the following site access and fuel modification easements from the Los Angeles County Flood Control; 1.) LA County Flood Control site access easement into the proposed development, and 2.) a Los Angeles County Flood Control fuel modification zone easement, which would allow the Project to provide fuel modification outside of the Project's boundary adjacent to Lots 1, 2, 3, 4, and 14. If the easements are obtained and the Project is able to provide a full 200 feet of fuel modification around Lots 1 through 4 and 14, then no additional mitigation is required for these lots. However, if the Board of Supervisors does not approve the Project to obtain an offsite fuel modification easement, allowing the Project to provide the remaining offsite fuel modification, then additional Project construction mitigations will be implemented for Lots 1 through 4, 9, and 14. These additional mitigations are listed below in Section 6.

5.7.1.1 Los Angeles County Fuel Modification Zone Standards

A FMZ is a strip of land where combustible vegetation has been removed and/or modified and partially or totally replaced with more adequately spaced, drought-tolerant, fire resistant plants in order to provide a reasonable level of protection to structures from wildland fire. The purpose of this section is to document LACoFD's standards and make them available for reference. However, we are proposing a site-specific fuel modification zone program with additional measures that are consistent with the intent of the standards. Los Angeles County Fire Code (Title 32, Fire, Section 4908) is consistent with the 2019 California Fire Code (Section 4907 — Defensible Space), Government Code 51175 – 51189, and Public Resources Code 4291, which require that fuel modification zones be provided around every building that is designed primarily for human habitation or use within a VHFHSZ. Fuel modification consists of at least 100 feet, measured in a horizontal plane, from the exterior façade of all structures towards the undeveloped areas. A typical landscape/fuel modification installation per the County's Fire Code consists of a 30-foot-wide Zone A and a 70-foot wide Zone B for a total of 100[9] feet in width. An additional

[9] In accordance with section 325.2.2 of the Los Angeles County Fire Code, Clearance of Brush and Vegetation Growth "Extra Hazard", it may be determined by the fire official that some sites pose an extra hazard. In such cases, Fuel Modification Zones may exceed 100 feet but not exceed 200 feet from structures. Based on modeled fire behavior, it was determined that 200- feet FMZs would provide adequate defensible space for the Project.

100-foot wide Zone C may be required for the areas adjacent to natural-vegetated, open space areas. Lot 1 through 8 and Lots 10 through 14 of the Chadwick Ranch Estates Project will consist of a 30-foot wide Zone A and a 70-foot wide Zone B (both Zones A and B will be irrigated) and a 100-foot thinning Zone C. Due to property boundary restraints, Lot 9 will include 100 feet of irrigated fuel modification, consisting of a minimum 30-foot setback Zone A and a 70-foot irrigated Zone B. A Fuel Modification Plan has been reviewed and approved by the Forestry Division of the LACoFD, and is consistent with the defensible space and fire safety guidelines. As part of the Fuel Modification Plan's approval, a Los Angeles County Flood Control fuel modification zone easement is required, which would allow the Project to provide fuel modification outside of the Project's boundary adjacent to Lots 1, 2, 3, 4, and 14. If the easements are obtained and the Project is able to provide a full 200 feet of fuel modification around Lots 1 through 4 and 14, then no additional mitigation is required for these lots. However, if the Board of Supervisors does not approve the Project to obtain an offsite fuel modification easement, allowing the Project to provide the remaining offsite fuel modification, then additional Project construction mitigations will be implemented for Lots 1 through 4, 9, and 14. Figure 7 is a LACoFD approved FMZ Plan, that displays FMZ Zones A, B and C for the Project site.

To ensure long-term identification and maintenance, a fuel modification area shall be identified by a permanent zone marker meeting the approval of LACoFD. All markers will be located along the perimeter of the fuel modification area at a minimum of 500 feet apart or at any direction change of the fuel modification zone boundary. FMZs will be maintained on at least an annual basis or more often as needed to maintain the fuel modification buffer function.

An on-site inspection will be conducted by staff of the Forestry Division of the LACoFD upon completion of landscape install before a certificate of occupancy being granted by the County's building code official.

Zone A – From structure outward to minimum 30 feet

Zone A is an irrigated, limited planting area measured from the outermost edge of the structure or appendage outward to 30 feet (horizontal distance), or to the property line for perimeter lots adjacent to native vegetation.

1. Zone A should be planted with plants from Appendix D: Acceptable Plant List by Fuel Modification Zone. Plant selection for Zone A should consist of small herbaceous or succulent plants less than two to three feet in height or regularly irrigated and mowed lawns.

2. Plants identified as "Target" or undesirable plants (See Appendix E: Fuel Modification Zone Undesirable Plant List) by LACoFD shall not be planted within Zone A.

3. Trees should be spaced to allow a minimum 10-foot canopy clearance at full maturity to the structure.

4. Inorganic mulches, such as gravel, shall be used within 10 inches of the structure.

5. A 5-foot wide pathway shall be provided around and abutting any structures for firefighter access.

Zone B – From outer edge of Zone A to 100 feet from structure

Zone B is the area (may be irrigated or not irrigated) measured horizontally from the outer edge of Zone A to 100 feet from the structure or property line, whichever is first.

1. Zone B can be planted with slightly higher plant density than Zone A as long as landscape does not create any horizontal or vertical fuel ladders (e.g., fuel which can spread fire from ground to trees).
   Exception: Screen plantings are permissible if used to hide unsightly views.
2. Trees found in Appendix D can be planted, if they are Zone B appropriate and the tree canopies at maturity are not continuous.
3. Plants identified as "Target" or undesirable plants (See Appendix E) by LACoFD shall not be planted within Zone B.
4. Avoid planting woody plant species taller than 3 feet in height at maturity directly underneath any tree canopy.
5. Zone B may not be landscaped, but it is still subject to brush clearance standards (https://www.fire.lacounty.gov/forestry-division/fire-hazard-reduction-programs/)

Zone C – Thinning Zone (from outer edge of Zone B to 200 feet from structure)

Zone C is considered a thinning zone and is any FMZ greater than 100 feet from structures. When provided, either by conditions of development, voluntary by the property owner, or required by the LACoFD, this zone is more of a progressive thinning zone to lessen spread of fire as it approaches the primary FMZ adjacent to structures. The amount of fuel reduction and removal should take into consideration the type and density of fuels, aspect, topography, weather patterns, and fire history. For this Project, the thinning zone will include a minimum of 50 percent fuel reduction, on average, throughout the 100-foot-wide Zone C. In no case shall the Zone C be less than 100 feet wide. Thinning of less than 50 percent of the existing condition may be acceptable where erosion is of high concern, but the average cover throughout the Zone C will be reduced by 50 percent, resulting in approximately 50 percent ground cover by plant canopy.

5.7.1.2 Other Vegetation Management

Roadway-Adjacent Defensible Space

As required by the Los Angeles County Fire Department, fire engine apparatus roads will be maintained with a minimum 20-foot wide roadway that is clear to the sky. An exemption allows for a minimum vertical clearance of 13 feet 6 inches may be allowed for protected tree species adjacent to access roads. Any applicable tree-trimming permit from the appropriate agency is required. All flammable vegetation or other combustible growth shall be removed on each side of fire access roads and driveways for a minimum of 10 feet (Title 32 Section 325.10), however, the Proposed Chadwick Ranch Estates Project site will provide a code exceeding 30 feet roadside FMZ. The clearance of 30 feet does not apply to single specimen trees, ornamental shrubbery, or cultivated ground cover, such as grass, ivy, succulents, or similar plants used as ground cover, provided that they do not form a means of readily transmitting fire.

Roadside fuel modification for the Chadwick Ranch Estates consists of mowing grasses to less than four inches in height and/or maintaining ornamental landscapes, including trees, clear of dead and dying plant materials. Roadside fuel modification shall be maintained by the Project's HOA.

Special Fuel Management Issues

On the Project site, tree planting in the fuel modification zones and along roadways is acceptable, as long as they meet the following restrictions as described below and in the County's Fire Code and the LACoFD's Guide to Defensible Space and Fuel Modification Zones spacing requirements:

- For streetscape plantings, trees should be planted 10 feet from edge of curb to center of tree trunk. Care should be given to the type of tree selected, that it will not encroach into the roadway, or produce a closed canopy effect.
- Crowns of trees located within defensible space shall maintain a minimum horizontal clearance of 15 feet for a single tree. Mature trees shall be pruned to remove limbs one-third the height or six feet, whichever is less, above the ground surface adjacent to the trees.
- Dead wood and litter shall be regularly removed from trees.
- Ornamental trees shall be limited to groupings of 2–3 trees with canopies for each grouping separated horizontally.

Specific Landscaping Requirements

The following requirements are provided for HOA-maintained fuel modification zones. All landscaping shall be maintained by the HOA.

Plants used in the fuel modification areas or landscapes will include drought-tolerant, fire resistive trees, shrubs, and groundcovers. The planting list and spacing will be reviewed and approved by LACoFD, included on submitted landscape plans. The plantings will be consistent with LACoFD's Suggested Plant Reference Guide (refer to Appendix D). The intent of the suggested plant reference guide is to provide examples of plants that are less prone to ignite or spread flames to other vegetation and combustible structures during a wildfire. Additional Plants can be added to the landscape plant material palette with the approval from LACoFD.

Pre-Construction Requirements

- Perimeter fuel modification areas must be implemented and approved by the LACoFD prior to combustible materials being brought on site.
- Existing flammable vegetation shall be reduced by 50% on vacant lots upon commencement of construction.
- Dead fuel, ladder fuel (fuel which can spread fire from ground to trees), and downed fuel shall be removed and trees/shrubs shall be properly limbed, pruned, and spaced per this plan.

Undesirable Plants

Certain plants are considered to be undesirable in the landscape due to characteristics that make them highly flammable. These characteristics can be physical (structures promote ignition or combustible) or chemical (volatile chemicals increase flammability or combustion characteristics). The plants included in the FMZ

Undesirable Plan List (refer to Appendix E) are unacceptable from a fire safety standpoint, and shall not be planted or allowed to establish opportunistically within the FMZs or landscape areas.

5.7.2 Fuel Modification Area Vegetation Maintenance

All fuel modification area vegetation management within the FMZs shall be completed annually by May 1 of each year and more often as needed for fire safety, as determined by the LACoFD.

The individual homeowners shall be responsible for all fuel modification vegetation management on their lots in compliance with this plan and the LACoFD requirements. The Chadwick Ranch Estates Project HOA shall be responsible for all fuel modification vegetation management for all common areas of the Project site, including roadsides clearance and fuel modification zones. The Project HOA will assure private homeowner lots comply with this plan initially and on an ongoing basis. Chapter 7A requirements for ongoing maintenance of fire resistive building materials and fire sprinkler systems will be included in the C, C and R's and Deed encumbrances for each lot. Additionally, the Project HOA shall be responsible for ensuring long-term funding and ongoing compliance with all provisions of this FPP, including vegetation planting, fuel modification on the perimeter, and maintenance requirements on all common areas and roadsides.

Maintenance of FMZ's and Defensible Space is an important component for long term fire safety of the Project. Maintenance obligations will be as follows:

Chadwick Ranch Estates HOA:

- The Chadwick Ranch Estates HOA will maintain the access roads, including a minimum of 30 feet clearance on each side of road(s) within the Development Footprint adjacent to open space areas.
- The Chadwick Ranch Estates HOA will be required to annually maintain the FMZs (or as needed)
- The Chadwick Ranch Estates HOA will maintain all common areas, including trees planted along roadways and in other areas throughout project.

Resident/Homeowner:

- Maintenance of vegetation on individual property lots.

5.7.3 Annual Fuel Modification Zone Compliance Inspection

To confirm that the Project's FMZs and landscape areas are being maintained according to this FPPs and the LACoFD's fuel modification guidelines, the Project HOA would obtain an FMZ inspection and report from a qualified LACoFD-approved 3rd party inspector in May/June of each year certifying that vegetation management activities throughout the project site have been performed. If the FMZ areas are not compliant, the Chadwick Ranch Estates HOA will have a specified period to correct any noted issues so that a re-inspection can occur and certification can be achieved. Annual inspection fees are subject to the current Fire Department Fee Schedule.

5.7.4 Construction Phase Vegetation Management

Vegetation management requirements shall be implemented at commencement and throughout the construction phase. Vegetation management for the Project area shall be performed pursuant to this FPP and LACoFD

requirements on all building locations prior to the start of work and prior to any import of combustible construction materials. Adequate fuel breaks shall be created around all grading, site work, and other construction activities in areas where there is flammable vegetation. Combustible Materials will not be brought on site without prior fire department approval.

In addition to the requirements outlined above, the project will comply with the following important risk-reducing vegetation management guidelines:

- All new power lines shall be underground for fire safety during high wind conditions or during fires on a right-of-way that can expose aboveground power lines. Temporary construction power lines may be allowed in areas that have been cleared of combustible vegetation.
- Caution must be used not to cause erosion or ground (including slope) instability or water runoff due to vegetation removal, vegetation management, maintenance, landscaping, or irrigation.

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6 Alternative Materials and Methods for Non-Conforming Fuel Modification

As previously mentioned, due to site constraints, it is not feasible to achieve the standard FMZ width adjacent to Lot 9 of the development. Furthermore, a portion of the 200-fot wide fuel modification zone extends beyond the property boundary around Lots 1 through 4 and 14. As part of the Project's Conditions of Approval by the Board of Supervisors, the Project would be required to meet the following site access and fuel modification easements from the Los Angeles County Flood Control; 1.) LA County Flood Control site access easement into the proposed development, and 2.) a Los Angeles County Flood Control fuel modification zone easement, which would allow the Project to provide fuel modification outside of the Project's boundary adjacent to Lots 1, 2, 3, 4, and 14. If the easements are obtained and the Project is able to provide a full 200 feet of fuel modification around Lots 1 through 4 and 14, then no additional mitigation is required for these lots. However, if the Board of Supervisors does not approve the Project to obtain an offsite fuel modification easement, allowing the Project to provide the remaining offsite fuel modification, then additional Project construction mitigations will be implemented for Lots 1 through 4, 9, and 14. As such, this FPP describes additional measures that will be implemented to mitigate the non-conforming fire related threats and reduced fuel modification zones. These measures are customized for this site based on the analysis results and focus on providing functional equivalency as a County-defined, full fuel modification zone.

As experienced in numerous wildfires homes in the WUI are potential fuel. The distance between the wildland fire that is consuming wildland fuel and the home ("urban fuel") is the primary factor for structure ignition (not including burning embers). The closer a fire is to a structure, the higher the level of heat exposure (Cohen 2000). However, studies indicate that given certain assumptions (e.g., 10 meters (roughly 32 feet) of low fuel landscape, no open windows), wildfire does not spread to homes unless the fuel and heat requirements (of the home) are sufficient for ignition and continued combustion (Cohen 1995, Alexander et al. 1998). Construction materials and methods can prevent or minimize ignitions. Similar case studies indicate that with nonflammable roofs and vegetation modification from 10–18 meters (roughly 32–60 feet) in southern California fires, 85–95% of the homes survived (Howard et al. 1973, Foote and Gilless 1996). Similarly, San Diego County after fire assessments indicate strongly that the building codes are working in preventing home loss: of 15,000 structures within the 2003 fire perimeter, 17% (1,050) were damaged or destroyed. However, of the 400 structures built to the 2001 codes (the most recent at the time), only 4% (16) were damaged or destroyed. Further, of the 8,300 homes that were within the 2007 fire perimeter, 17% were damaged or destroyed. A much smaller percentage (3%) of the 789 homes that were built to 2001 codes were impacted and an even smaller percentage (2%) of the 1,218 structures built to the 2004 Codes were impacted (IBHS 2008). Damage to the structures built to the latest codes is likely from flammable landscape plantings or objects next to structures or open windows or doors (Hunter 2007).

These results support Cohen's (2000) findings that if a community's homes have a sufficiently low home ignitability, the community can survive exposure to wildfire without major fire destruction. This provides the option of mitigating the wildland fire threat to homes/structures at the residential location without extensive wildland fuel reduction. Cohen's (1995) studies suggest, as a rule-of-thumb, larger flame lengths and widths require wider fuel modification zones to reduce structure ignition. For example, valid SIAM results indicate that a 20-foot high flame has minimal radiant heat to ignite a structure (bare wood) beyond 33 feet (horizontal distance). Whereas, a 70-foot-high flame may require about 130 feet of clearance to prevent structure ignitions from radiant heat (Cohen and Butler 1996). This study utilized bare

wood, which is more combustible than the ignition resistant exterior walls for structures built today. Fire behavior modeling conducted for this project indicates that fires in the moderate to high load shrub and chaparral surrounding the Project Site would result in roughly 11 to 42-foot flame lengths under fall, extreme weather conditions. The proposed FMZ is twice the length of the predicted flame length.

As indicated in this report, the FMZs and additional fire protection measures proposed for Lot 9, as well as for Lots 1 through 4 and 14 if an offsite fuel modification zone easement is not obtained provide equivalent wildfire buffer, but are not standard zones. Rather, they are based on a variety of analysis criteria including predicted flame length, fire intensity (Btu), site topography and vegetation, extreme and typical weather, position of structures on pads, position of roadways, adjacent fuels, fire history, current vs. proposed land use, neighboring communities relative to the proposed project, and type of construction. The fire intensity research conducted by Cohen (1995), Cohen and Butler (1996), and Cohen and Saveland (1997) and Tran et al. (1992) supports the fuel modification alternatives proposed for this project.

6.1 Additional Structure Protection Measures

The following additional measures will be implemented to "mitigate" potential structure fire exposure related to Lot 9 of the development, as well as to Lots 1 through 4 and 14, if an offsite fuel modification easement is not obtained. These measures are customized for this site, its unique topographical and vegetative conditions, and focus on providing functional equivalency as a full fuel modification zone. In order to provide compensating structural protection in the absence of a 200-foot wide FMZ, and in addition to the residences being built to the latest ignition resistant codes, the residences on Lot 9, as well as to Lots 1 through 4 and 14 if an offsite easement is not obtained, will also include the following features for additional fire prevention, protection, and suppression:

1. Provide exterior glazing in windows (and sliding glass doors, garage doors, or decorative or leaded glass doors) facing the open space and naturally vegetated areas to be dual pane with both panes tempered glass. Dual pane, one pane tempered glass has been shown during testing and in after fire assessments to significantly decrease the risk of breakage and ember entry into structures. Therefore, requiring code-exceeding dual pane, both panes tempered is anticipated to be an important safety measure that provides enhanced structure protection and provides mitigation for reduced fuel modification zones and limited setbacks from adjacent structures. *The window upgrade also exceeds the requirements of Chapter 7A of the CBC and providing additional protection for the structure's most vulnerable, exterior side*;

2. Two (2) sheets 5/8-inch drywall or one (1) layer of 5/8-inch Type X gypsum sheathing applied behind the exterior covering or cladding (stucco or exterior siding) on the exterior side of the framing, from the foundation to the roof for a facade facing the open space and naturally vegetated areas;

3. Provide a noncombustible, 6-foot high concrete masonry unit (CMU) wall at the top of the manufactured slope behind the Lot(s). The proposed fire wall will be installed to function as heat-deflecting walls.

The information provided herein supports the ability of the proposed structure(s) located on the lot(s) unable to achieve a full 200-foot FMZ to withstand the predicted short duration, moderate to high intensity wildfire and ember shower that would be expected from wildfire burning in the vicinity of the site or within the site's landscape.

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7 Homeowner's Association Wildfire Education Program

Early evacuation for any type of wildfire emergency at the Project Site is the preferred method of providing for resident safety, consistent with the LACoFD's current approach within Los Angeles County. As such, the Project's Homeowner's Association (HOA) would formally adopt, practice, and implement a "Ready, Set, Go!" approach to evacuation[10]. The "Ready, Set, Go!" concept is widely known and encouraged by the State of California and most fire agencies. Pre-planning for emergencies, including wildfire emergencies, focuses on being prepared, having a well-defined plan, minimizing potential for errors, maintaining the Project Site's fire protection systems, and implementing a conservative (evacuate as early as possible) approach to evacuation and Project Area activities during periods of fire weather extremes.

Project residents and occupants would be provided ongoing education regarding wildfire and this FPP's requirements. This educational information must include maintaining the landscape and structural components according to the appropriate standards designed for this community. Informational handouts, community website page, mailers, fire safe council participation, inspections, and seasonal reminders are some methods that would be used to disseminate wildfire and relocation awareness information. LACoFD would review and approve all wildfire educational material/programs before printing and distribution.

[10] https://www.fire.lacounty.gov/rsg/

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8 Conclusion

The requirements and recommendations set forth in this FPP meet fire safety, building design elements, infrastructure, fuel management/modification, and landscaping recommendations of the applicable codes. The recommendations provided in this FPP also have been designed specifically for the proposed construction of structures within a VHFHSZ area. When properly implemented on an ongoing basis, the fire protection strategies proposed in this FPP should significantly reduce the potential fire threat to vegetation on the community and its structures, and should assist LACoFD in responding to emergencies within the Project Site. The fire protection system provided for the Project Site includes a redundant layering of code compliant, fire-resistant construction materials and methods that have been shown through post-fire damage assessments to reduce risk of structural ignition. Additionally, modern infrastructure would be provided. Further, all structures are required to include interior, automatic fire sprinklers consistent with the County's regulatory standards. Fuel modification also would occur on perimeter edges adjacent to the open space areas.

Note that this is a conceptual plan, which provides enough detail for LACoFD approval. Detailed plans, such as improvement plans and building permits, demonstrating compliance with the concepts in this FPP and with County Fire Code requirements, would be submitted to LACoFD at the time they are developed. When properly implemented on an ongoing basis, the fire protection strategies proposed in this FPP should significantly reduce the potential fire threat to vegetation on the community and its structures and should assist the fire authority in responding to emergencies within the Project Site. The Project Site includes a redundant layering of protection methods that have been shown through post-fire damage assessments to reduce risk of structural ignition. Modern infrastructure will be provided along with implementation of the latest ignition resistant construction methods and materials. Further, all structures are required to include interior, automatic fire sprinklers consistent with the fire codes. Fuel modification will occur on perimeter edges adjacent open space areas as well as throughout the interior of the Project Site.

Fire is a dynamic and somewhat unpredictable occurrence and as such, this plan does not guarantee that a fire will not occur or will not result in injury, loss of life or loss of property. There are no warranties, expressed or implied, regarding the suitability or effectiveness of the recommendations and requirements in this plan, under all circumstances.

The Project's developers, contractors, engineers, and architects are responsible for proper implementation of the concepts and requirements set forth in this FPP. Homeowners and property managers are also responsible for maintaining their structures and lots, including fuel modification and landscape, as required by this FPP, the Fire LACoFD, and as required by the County Fire Code. Alternative methods of compliance with this FPP can be submitted to the fire authority and for consideration.

It will be extremely important for all homeowners, property managers, and occupants to comply with the recommendations and requirements described and required by this FPP on their property. The responsibility to maintain the fuel modification and fire protection features required for the Project site lies with the homeowners. The HOA or similar entity would be responsible for ongoing education and maintenance of the common areas, and the LACoFD would enforce the vegetation management requirements detailed in this FPP. Such requirements would be made a part of deed encumbrances and CC&Rs for each lot, as appropriate. It is recommended that the homeowners or other occupants who may reside within the Chadwick Ranch Estates development adopt a conservative approach to fire safety. This approach must include maintaining the landscape and structural components according to the appropriate standards and embracing a "Ready, Set,

Go" stance on evacuation. This project is not to be considered a shelter-in-place development. However, the fire agencies and/or law enforcement officials may, during an emergency, as they would for any new development providing the layers of fire protection as Chadwick Ranch Estates development, determine that it is safer to temporarily refuge clients or visitors on the site. When an evacuation is ordered, it will occur according to pre-established evacuation decision points or as soon as notice to evacuate is received, which may vary depending on many environmental and other factors. Fire is a dynamic and somewhat unpredictable occurrence, and as such, this FPP does not guarantee that a fire will not occur or will not result in injury, loss of life, or loss of property. It is important for anyone living at the WUI to educate themselves on practices that will improve safety. There are no warranties, expressed or implied, regarding the suitability or effectiveness of the recommendations and requirements in this FPP, under all circumstances.

The goal of the fire protection features, both required and those offered above and beyond the Codes, provided for the Chadwick Ranch Estates Project is to provide the structures with the ability to survive a wildland fire with little intervention of firefighting forces. Preventing ignition to structures results in reduction of the exposure of firefighters and residents to hazards that threaten personal safety. It will also reduce property damage and losses. Mitigating ignition hazards and fire spread potential reduces the threat to structures and can help the fire department optimize the deployment of personnel and apparatus during a wildfire. The analysis in this FPP provides support and justifications for acceptance of the proposed fuel modification zones for the Chadwick Ranch Estates Proposed Development Footprint based on the site specific fire environment.

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Appendix A

Representative Site Photograph Log

Photograph log

Chadwick Ranch Estates Project Fire Protection Plan

Photograph 1. View of existing driveway entrance to the Project site. Driveway entrance is currently approximately 22 feet wide. Photograph taken facing south.

Photograph 2. View of existing Flood Control Road at the entrance of the Project site. Photograph taken facing north.

Photograph 3. View looking northeast towards the western portion of project site, standing above the Bradbury Debris Basin. Note the existing Flood Control Road to the east.

Photograph 4. Photograph of the existing Riparian habitat within Bliss Canyon and the Bradbury Debris Basin, below Proposed Lot 1. Photograph taken facing North.

Photograph 5. Photograph of the existing natural vegetation and terrain on the northwest side of the Project site, standing near the Proposed Lots 2 through 4. Photograph taken facing north. Note existing Riparian habitat at the base of the slope.

Photograph 6. Photograph of the existing natural vegetation and terrain on the northern side of the Project site. Photograph taken facing north.

Photograph 7. Photograph of the existing natural vegetation and terrain on the northwestern side of the Project site. Photograph taken facing northeast.

Photograph 8. Photograph of the existing natural vegetation and terrain above the existing Spinks Disposal Area, below Proposed Lots 2 through 4. Photograph taken facing south.

Photograph 9. Photograph of the existing natural vegetation and terrain above the existing Spinks Disposal Area, below Proposed Lots 2 through 4. Photograph taken facing southwest.

Photograph 10. Photograph of the existing natural vegetation and terrain below Proposed Lot 1. Photograph taken facing south.

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Photograph 11. Photograph of the existing natural vegetation and terrain below Proposed Lot 1. Photograph taken facing north.

Photograph 12. Photograph looking south towards the existing Flood Control Road and Bradbury Debris Basin at the entrance of the Project site. Note this is the location where the looped Flood Control Road will intersect.

Photograph 13. Photograph of the existing natural vegetation and terrain on the eastern side of the Project site, adjacent to Proposed Lots 5 through 14. Photograph taken facing northeast.

Photograph 14. Photograph of the existing natural vegetation and terrain below Lots 2 through 4, standing on the upper Spinks Disposal Area pad. Photograph taken facing north.

Photograph 15. Photograph of existing Flood Access Road above the Spinks Debris Basin. Photograph taken facing northwest back towards the Project site.

Photograph 16. Photograph of existing Flood Access Road adjacent to the Spinks Disposal Area, in the southwestern portion of the Project site. Photograph taken facing northwest.

Photograph 17. Photograph of existing Flood Access Road near the Project's entrance. Photograph taken facing southwest.

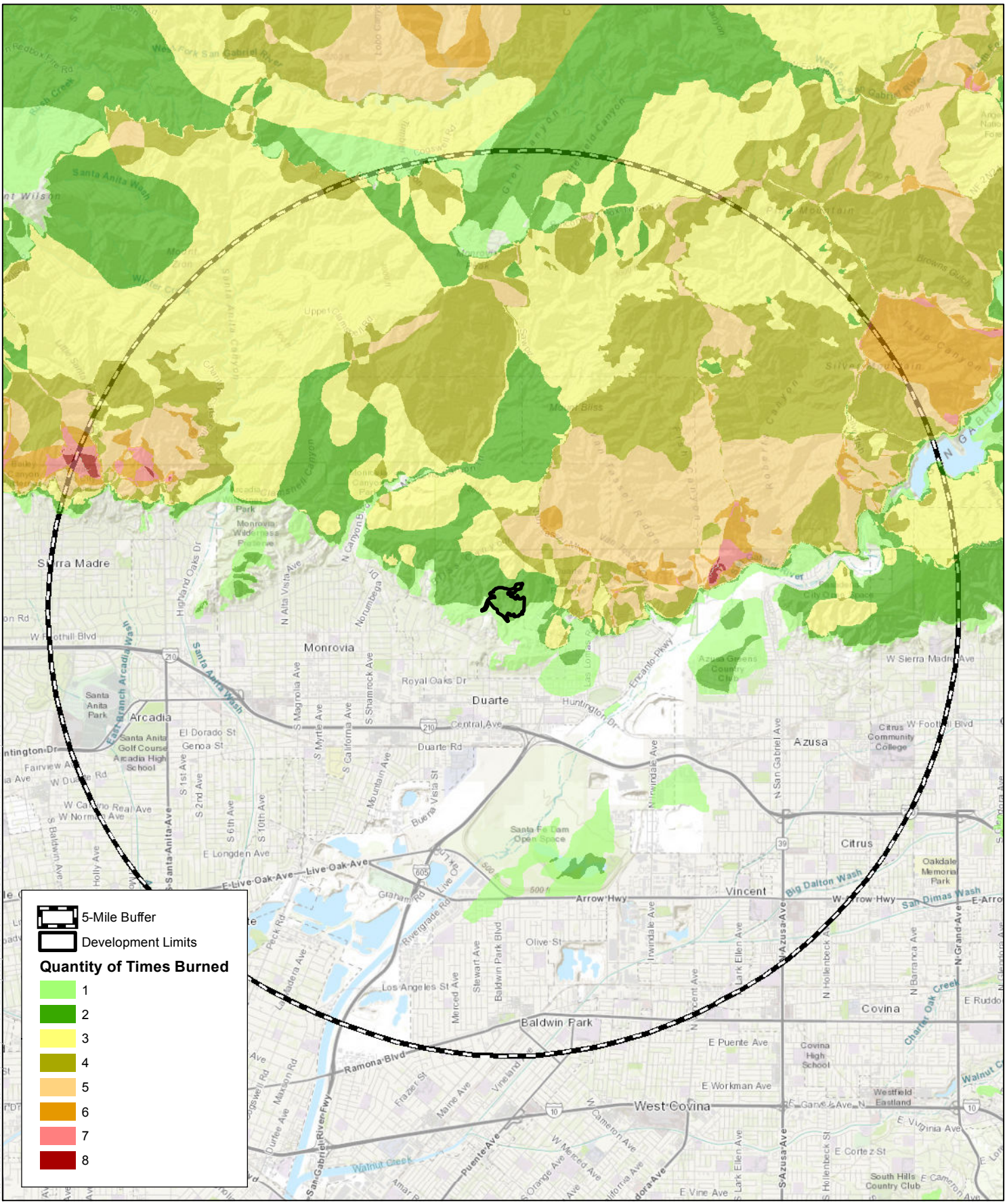
Photograph 18. Flood Control Road at the intersection of Bliss Canyon Road and Long Canyon Road, leading to the entrance of the Project site. Photograph taken facing north. Note the Project entrance will be constructed on western side of the Debris Channel.

Photograph 19. Photograph of Proposed entrance to the Project site at the intersection of Bliss Canyon Road and Long Canyon Road. Photograph taken facing southeast.

Photograph 20. Photograph of existing Bliss Canyon Road. Photograph facing south towards intersection with Deodar Lane.

Appendix B

Fire History Map



SOURCE: BASEL-ESRI; FIRE DATA-CALFIRE 2018

DUDEK

0 1 2 Miles

APPENDIX B

Fire History Map

Chadwick Ranch Estates Fire Protection Plan

Appendix C

BehavePlus Fire Behavior Analysis

Fire Behavior Modeling Summary
Chadwick Ranch Estates Project, Bradbury, California

BEHAVEPLUS FIRE BEHAVIOR MODELING HISTORY

Fire behavior modeling has been used by researchers for approximately 50+ years to predict how a fire will move through a given landscape (Linn 2003). The models have had varied complexities and applications throughout the years. One model has become the most widely used as the industry standard for predicting fire behavior on a given landscape. That model, known as "BEHAVE", was developed by the U. S. Government (USDA Forest Service, Rocky Mountain Research Station) and has been in use since 1984. Since that time, it has undergone continued research, improvements, and refinement. The current version, BehavePlus 6.0, includes the latest updates incorporating years of research and testing. Numerous studies have been completed testing the validity of the fire behavior models' ability to predict fire behavior given site specific inputs. One of the most successful ways the model has been improved has been through post-wildfire modeling (Brown 1972, Lawson 1972, Sneeuwjagt and Frandsen 1977, Andrews 1980, Brown 1982, Rothermel and Rinehart 1983, Bushey 1985, McAlpine and Xanthopoulos 1989, Grabner, et. al. 1994, Marsden-Smedley and Catchpole 1995, Grabner 1996, Alexander 1998, Grabner et al. 2001, Arca et al. 2005). In this type of study, Behave is used to model fire behavior based on pre-fire conditions in an area that recently burned. Real-world fire behavior, documented during the wildfire, can then be compared to the prediction results of Behave and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling conducted on this site includes a relatively high-level of detail and analysis which results in reasonably accurate representations of how wildfire may move through available fuels on and adjacent the property. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. To objectively predict flame lengths, spread rates, and fireline intensities, this analysis incorporated predominant fuel characteristics, slope percentages, and representative fuel models observed on site. The BehavePlus fire behavior modeling system was used to analyze anticipated fire behavior within and adjacent to key areas just outside of the proposed lots. Predicting wildland fire behavior is not an exact science. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather and the limits of weather forecasting. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire prevention planning information. To be used effectively, the basic assumptions and limitations of BehavePlus must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuels less than one-quarter inch in diameter. These are the fine fuels that carry fire. Fuels greater than one inch have little effect while fuels greater than three inches have no effect on fire behavior.

- Second, the model bases calculations and descriptions on a wildfire spreading through surface fuels that are within six feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.
- Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, the BehavePlus fire behavior computer modeling system was not intended for determining sufficient fuel modification zone/defensible space widths. However, it does provide the average length of the flames, which is a key element for determining "defensible space" distances for minimizing structure ignition.

Although BehavePlus has some limitations, it can still provide valuable fire behavior predictions which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven fuel characteristics help define the 13 standard fire behavior fuel models[1] and the five custom fuel models developed for Southern California[2]. According to the model classifications, fuel models used in BehavePlus have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Observation of the fuels in the field (on site) determines which fuel models should be applied in BehavePlus. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models and the custom Southern California fuel models:

- Grasses — Fuel Models 1 through 3
- Brush — Fuel Models 4 through 7, SCAL 14 through 18
- Timber — Fuel Models 8 through 10

[1] Anderson, Hal E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service Gen. Tech. Report INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT.

[2] Weise, D.R. and J. Regelbrugge. 1997. Recent chaparral fuel modeling efforts. Prescribed Fire and Effects Research Unit, Riverside Fire Laboratory, Pacific Southwest Research Station. 5p.

- Logging Slash Fuel Models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models[3] developed for use in BehavePlus modeling efforts. These new models attempt to improve the accuracy of the standard 13 fuel models outside of severe fire season conditions, and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the new 40 fuel models:

- Non-Burnable Models NB1, NB2, NB3, NB8, NB9
- Grass Models GR1 through GR9
- Grass-shrub Models GS1 through GS4
- Shrub Models SH1 through SH9
- Timber-understory Models TU1 through TU5
- Timber litter Models TL1 through TL9
- Slash blowdown Models SB1 through SB4

BehavePlus software was used in the development of this Chadwick Ranch Estates Project (Proposed Project) Fire Protection Plan (FPP) in order to evaluate potential fire behavior for the Project site. Existing site conditions were evaluated, and local weather data was incorporated into the BehavePlus modeling runs.

FUEL MODELS

Dudek utilized the BehavePlus software package to analyze fire behavior potential for the Chadwick Ranch Estates Project site in Bradbury, California. As is customary for this type of analysis, four fire scenarios were evaluated, including two summer, onshore weather condition (south and west from the Project Site) and two extreme fall, offshore weather condition (north and northeast of the Project Site). Fuels and terrain at and beyond this distance can produce flying embers that may affect the project, but defenses have been built into the structures to prevent ember penetration and to extinguish fires that may result from ember penetration. It is the fuels adjacent to and within fuel modification zones that would have the potential to affect the project's structures from a radiant and convective heat perspective as well as from direct flame impingement. BehavePlus software requires site-specific variables for surface fire spread analysis, including fuel type, fuel moisture, wind speed, and slope data. The output variables used in this analysis include flame length (feet), rate of spread (feet/minute), fireline intensity

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

(BTU/feet/second), and spotting distance (miles). The following provides a description of the input variables used in processing the BehavePlus models for the Proposed Project site. In addition, data sources are cited and any assumptions made during the modeling process are described.

Vegetation (Fuels)

To support the fire behavior modeling efforts conducted for this FPP, the different vegetation types observed adjacent to the site were classified into the aforementioned numeric fuel models. As is customary for this type of analysis, the terrain and fuels directly adjacent to the property are used for determining flame lengths and fire spread. It is these fuels that would have the potential to affect the project's structures from a radiant and convective heat perspective as well as from direct flame impingement.

Vegetation types were derived from a site visit that was conducted on December 5, 2019 by a Dudek Fire Protection Planner. Based on the site visit, three different fuel models were used in the fire behavior modeling effort presented herein. Fuel model attributes are summarized in Table 1. Modeled areas include Coast live oak and western sycamore Riparian with non-native chaparral and shrub understory (Fuel Model SH4 = Timber-Shrub) occur along the river bottomlands west, north, and south of the site. Mature tree canopies for coast live oak trees (*Quercus agrifolia)* and western sycamore trees (*Platanus racemosa*) are assumed to have a canopy base height ranging from 35 to 45 feet off the ground. Canopy bulk density, the weight of canopy fuels per cubic foot of volume, is assumed to be the maximum allowable value in BehavePlus to represent broadleaf trees which, given canopy density and leaf size, have more weight per area than conifer trees (the standard for this value input in BehavePlus (Heinsch and Andrews 2010)). Foliar moisture, the moisture content of canopy foliage, is assumed to be 100%, a reasonable estimate in lieu of site-specific data (Scott and Reinhardt 2001).

Table 1: Existing Fuel Model Characteristics

Fuel Model	Description	Location	Fuel Bed Depth (Feet)
Sh4	Riparian Habitat (Timber Shrub)	Riverbed that runs below the northern and western boundaries, as well as along below the debris disposal area along the southern portion of the site.	>8.0 ft.
Sh5	High Load, Dry Climate Shrub	Adjoining, single-family properties without maintenance.	>4.0 ft.
Gs1	Low Load, Dry Climate Grass-Shrub	Fuel type will occur post development within Zone B - Irrigated zone.	1.0 ft.
Gs2	Moderate load, Dry Climate Grass-Shrub	Fuel type will occur post development within 50% thinning zone.	<3.0 ft.
FM8	Irrigated Landscape	Fuel type will occur post development within Zone A - setback irrigated zone.	<1.0 ft.

Topography

Slope is a measure of angle in degrees from horizontal and can be presented in units of degrees or percent. Slope is important in fire behavior analysis as it affects the exposure of fuel beds. Additionally, fire burning uphill spreads faster than those burning on flat terrain or downhill as uphill vegetation is pre-heated and dried in advance of the flaming front, resulting in faster ignition rates. Slope values ranging from 18 to 45% were measured around the perimeter of the proposed project site from U.S. Geological Survey (USGS) topographic maps.

Weather

Historical weather data for the Bradbury region was utilized in determining appropriate fire behavior modeling inputs for the Proposed Project area fire behavior evaluations. To evaluate different scenarios, data from both the 50th and 97th percentile moisture values were derived from Remote Automated Weather Station (RAWS) and utilized in the fire behavior modeling efforts conducted in support of this report. Weather data sets from the Henninger Flats Station RAWS[4] were utilized in the fire modeling runs.

RAWS fuel moisture and wind speed data were processed utilizing the Fire Family Plus software package to determine atypical (97th percentile) and typical (50th percentile) weather conditions. Data from the RAWS was evaluated from August 1 through November 30 for each year between 1994 and 2018 (extent of available data record) for 97th percentile weather conditions and from June 1 through September 30 for each year between 1994 and 2018 for 50th percentile weather conditions.

Following analysis in Fire Family Plus, fuel moisture information was incorporated into the Initial Fuel Moisture file used as an input in BehavePlus. Wind speed data resulting from the Fire Family Plus analysis was also determined. Initial wind direction and wind speed values for the two BehavePlus runs were manually entered during the data input phase. The input wind speed and direction is roughly an average surface wind at 20 feet above the vegetation over the analysis area. Table 2 summarizes the wind and weather input variables used in the Fire BehavePlus modeling efforts.

[4] https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCHEN
Latitude: 34.1142 Longitude: -118.0536; Elevation: 2,800 ft.)

Table 2: Variables Used For Fire Behavior Modeling

Model Variable	Summer Weather (50th Percentile)	Peak Weather (97th Percentile)
Fuel Models	Sh4 and Sh5	FM4, Sh4, and Sh5
1 h fuel moisture	5%	2%
10 h fuel moisture	6%	3%
100 h fuel moisture	9%	5%
Live herbaceous moisture	39%	30%
Live woody moisture	78%	60%
20 ft. wind speed	19 mph (sustained winds)	18 mph (sustained winds); wind gusts of 50 mph
Wind Directions from north (degrees)	200 and 290	0 and 80
Wind adjustment factor	0.4	0.4
Slope (uphill)	18 to 38%	20 to 45%

Fire Behavior Modeling Effort

As mentioned, the BehavePlus fire behavior modeling software package was utilized in evaluating anticipated fire behavior adjacent to the Proposed Project site. Four focused analyses were completed, each assuming worst-case fire weather conditions for a fire approaching the project site from the north, east, west, and south/southwest. The results of the modeling effort included anticipated values for surface fires (flame length (feet), rate of spread (mph), and fireline intensity (Btu/ft/s)) and crown fires (critical surface intensity (Btu/ft/s), critical surface flame length (feet), transition ratio (ratio: surface fireline intensity divided by critical surface intensity), transition to crown fire (yes or no), crown fire rate of spread (mph), critical crown rate of spread (mph), active ratio (ratio: crown fire rate of spread divided by critical crown fire rate of spread), active crown fire (yes or no), and fire type (surface, torching, conditional crown, or crowning)). The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews, Bevins, and Seli 2008). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire. Fire spread rate represents the speed at which the fire progresses through surface fuels and is another important variable in initial attack and fire suppression efforts (Rothermel and Rinehart 1983). Spotting distance is the distance a firebrand or ember can travel down wind and ignite receptive fuel beds.

FIRE BEHAVIOR MODELING RESULTS

The results presented in Tables 3 and 4 depict values based on inputs to the BehavePlus software and are not intended to capture changing fire behavior as it moves across a landscape. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. For planning purposes, the averaged worst-case fire behavior is the most useful information for conservative fuel modification design. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

Based on the BehavePlus analysis, worst-case fire behavior is expected in untreated, surface shrub and chaparral fuels northeast and east of the proposed Project site under Peak weather conditions (represented by Fall Weather, Scenario 3). The fire is anticipated to be a wind-driven fire from the north/northeast during the fall. Under such conditions, expected surface flame lengths reach 42 feet with wind speeds of 50+ mph. Under this scenario, fireline intensities reach 18,499 BTU/feet/second with fast spread rates of 6.2 mph and could have a spotting distance up to 2.3 miles away.

Based on the BeahvePlus analysis (Table 5), post development fire behavior is expected in irrigated and replanted with plants that are acceptable with Los Angeles County Fire Department (LACFD) (Zone A – FM8 and Zone B – Gs1), as well in an area with 50% thinning of the existing shrubs (Zone C - Gs2) under peak weather conditions (represented by Fall Weather, Scenario 3b). Under such conditions, expected surface flame length is expected to be significantly lower, with flames lengths reaching approximately 19 feet with wind speeds of 50+ mph. Under this scenario, fireline intensities reach 3,450 BTU/feet/second with relatively slow spread rates of 2.9 mph and could have a spotting distance up to 1.4 miles away. Therefore, the 200-foot Fuel Modification Zone (FMZ) proposed for the Chadwick Ranch Estates Project is approximately 4-times the flame length of the worst case fire scenario under peak weather conditions and would provide adequate defensible space to augment a wildfire approaching the perimeter of the Project site.

Table 3: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

Fire Scenario	Flame Length[1] (feet)	Spread Rate[1] (mph[5])	Fireline Intensity[1] (Btu/ft/s)	Spot Fire[1] (miles)	Surface Fire to Tree Crown Fire	Tree Crown Fire Rate of Spread (mph)	Crown Fire Flame Length (feet)
Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub[2,3] (Sh4)	10.9'	0.9	1,013	0.5	Crowning [4]	0.8	110.8'
Sagebrush scrub (Sh5)	19.5'	1.5	3,599	0.7	No	N/A	N/A
Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	12.8' (23.5')[6]	1.1 (4.2)	1,453 (5,471)	0.5 (1.5)	Crowning	1.0 (4.1)	133.1'
Sagebrush scrub (Sh5)	25.0' (41.8')	2.1 (6.4)	6,184 (18,966)	0.8 (2.3)	No	N/A	N/A
Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)							
Sagebrush scrub (Sh5)	24.0' (41.3')	1.9 (6.2)	5,697 (18,499)	0.8 (2.3)	No	N/A	N/A
Scenario 4: 18% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	10.5'	0.8	933	0.4	Crowning	0.8	110.8'
Sagebrush scrub (Sh5)	18.8'	1.4	3,328	0.6	No	N/A	N/A

Note:

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.
3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph.

Table 4: RAWS BehavePlus Fire Behavior Model Results – Post Project Conditions

Fire Scenario	Flame Length (feet)	Spread Rate (mph)[5]	Fireline Intensity (Btu/ft./sec)	Spot Fire (Miles)[6]
Scenario 1: 38% slope, Summer, On-shore Winds (Post Development)				
FMZ Zone A (FM8)	1.6'	0.1	16	0.1
FMZ Zone B (Gs1)	5.4'	0.5	221	0.3
FMZ Zone C (Gs2)	7.8'	0.7	500	0.4
Scenario 2: 43% slope, Fall, Offshore, Extreme Winds (Post Development)				
FMZ Zone A (FM8)	2.0' (2.6')	0.1 (0.1)	25 (46)	0.1 (0.3)
FMZ Zone B (Gs1)	7.0' (12.1')	0.7 (2.4)	387 (1,283)	0.3 (1.0)
FMZ Zone C (Gs2)	10.1' (19.1')	1.0 (3.9)	870 (3,450)	0.4 (1.4)
Scenario 3: 20% slope, Fall, Offshore, Extreme Winds (Post Development)				
FMZ Zone A (FM8)	1.9' (2.6')	0.1 (0.1)	23 (46)	0.1 (0.3)
FMZ Zone B (Gs1)	6.7' (12.1')	0.7 (2.4)	355 (1,283)	0.3 (1.0)
FMZ Zone C (Gs2)	9.7' (18.9')	0.9 (3.8)	797 (3,380)	0.4 (1.3)
Scenario 4b: 18% slope, Summer, On-shore Winds (Post Development)				
FMZ Zone A (FM8)	1.6'	0.1	18	0.1
FMZ Zone B (Gs1)	5.2'	0.5	202	0.2
FMZ Zone C (Gs2)	7.5'	0.6	455	0.3

The following describes the fire behavior variables (Heisch and Andrews 2010) as presented in Tables 3 and 4:

Surface Fire:

- Flame Length (feet): The flame length of a spreading surface fire within the flaming front is measured from midway in the active flaming combustion zone to the average tip of the flames.
- Fireline Intensity (Btu/ft/s): Fireline intensity is the heat energy release per unit time from a one-foot wide section of the fuel bed extending from the front to the rear of the flaming zone. Fireline intensity is a function of rate of spread and heat per unit area, and is directly related to flame length. Fireline intensity and the flame length are related to the heat felt by a person standing next to the flames.
- Surface Rate of Spread (mph): Surface rate of spread is the "speed" the fire travels through the surface fuels. Surface fuels include the litter, grass, brush and other dead and live vegetation within about 6 feet of the ground.

[5] mph = miles per hour
[6] Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph.

Crown Fire:

- Transition to Crown Fire: Indicates whether conditions for transition from surface to crown fire are likely. Calculation depends on the transition ratio. If the transition ratio is greater than or equal to 1, then transition to crown fire is Yes. If the transition ratio is less than 1, then transition to crown fire is No.
- Crown Fire Rate of Spread (mph): The forward spread rate of a crown fire. It is the overall spread for a sustained run over several hours. The spread rate includes the effects of spotting. It is calculated from 20-ft wind speed and surface fuel moisture values. It does not consider a description of the overstory.

Fire Type: Fire type is one of the following four types: surface (understory fire), torching (passive crown fire; surface fire with occasional torching trees), conditional crown (active crown fire possible if the fire transitions to the overstory), and crowning (active crown fire; fire spreading through the overstory crowns). Dependent on the variables: transition to crown fire and active crown fire.

The information in Table 5 presents an interpretation of the outputs for five fire behavior variables as related to fire suppression efforts. The results of fire behavior modeling efforts are presented in Tables 3 and 4. Identification of modeling run locations is presented graphically in Figure 5 of the FPP.

Table 5: Fire Suppression Interpretation

Flame Length (ft)	Fireline Intensity (Btu/ft/s)	Interpretations
Under 4 feet	Under 100 BTU/ft/s	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 to 8 feet	100-500 BTU/ft/s	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 to 11 feet	500-1000 BTU/ft/s	Fires may present serious control problems -- torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11 feet	Over 1000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

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Appendix D

LACoFD Acceptable Plant List by Fuel Modification Zones

Appendix D:
Acceptable Plant List by Fuel Modification Zone

Botanical Name	Common Name	Zone[1]	Minimum Distance from Structure[2]
Ground Cover			
Acacia redolens 'Desert Carpet'/'Low Boy'	Desert Carpet Acacia	B	30
Achillea tomentosa	Woolly Yarrow	A	
Ajuga reptans	Carpet Bugle	A	
Arctostaphylos (Prostrate Varieties)	Manzanita	B	
Artemisia californica (Cultivars)	Sagebrush - Prostrate Forms	B	30
Artemesia 'Powis Castle'	NCN	B	
Baccharis pilularis 'Pigeon Point'/'Twin Peaks'	Prostrate Coyote Brush	B	
Campanula poscharkyana	Serbian Bellflower	A	
Ceanothus gloriosus	Point Reyes Ceanothus	B	
Cerastium tomentosum	Snow-In-Summer	A	
Chamaemelum nobile	Chamomile	A	
Cistus salviifolius 'Prostratus'	Sageleaf Rockrose	B	
Coprosma kirkii	Mirror Plant	B	
Coreopsis auriculata 'Nana'	Tickseed	A	
Cotoneaster (Prostrate Varieties)	Cotoneaster	B	
Dalea greggii	Trailing Indigo Bush	B	
Delosperma alba	White Training Ice Plant	A	
Dichondra micrantha	Dichondra	A	
Drosanthemum floribundum	Rosea Ice Plant	A	
Duchesnea indica	Indian Mock Strawberry	A	
Dymondia margaretae	NCN	A	
Erigeron glaucus	Seaside Daisy	A	
E. karvinskianus	Santa Barbara Daisy	B	
Euonymus fortunei 'Colorata'	Purple-Leaf Winter Creeper	B	
Festuca cinerea(ovina'Glauca')	Blue Fescue	A	
F. rubra	Red Fescue	A	
Fragaria chiloensis	Wild Strawberrry	A	
Gazania Hybrids	Trailing Gazania	A	
Geranium incanum/sanguineum	Cranesbill	A	
Glechoma hederacea	Ground Ivy	A	
Helianthemum nummularium	Sunrose	A	
Herniaria glabra	Green Carpet	A	
Heuchera species and Cultivars	Coral Bells	A	
Hypericum calycinum/coris	Aaron's Beard	B	
Iberis sempervirens	Evergreen Candytuft	A	
Iva hayesiana	Poverty Weed	B	30
Juniperus (Prostrate species/cultivars)		B	
Laurentia fluviatilis	Blue Star Creeper	A	
Lysimachia nummularia	Moneywort	A	
Liriope spicata	Creeping Lily Turf	A	

Liriope muscari	Lily Turf	A	
Mahonia repens	Creeping Mahonia	B	
Myoporum 'Pacificum' & 'Putah Creek'	Pacific Myoporum	B	
M. parvifolium	NCN	A	
Oenothera berlandieri	Mexican Evening Primrose	B	
O. stubbei	Baja Evening Primrose	A	
Ophiopogon japonicus	Mondo Grass	A	
Pachysandra terminalis	Japanese Spurge	A	
Pelargonium peltatum/tomentosum	Ivy Geranium	A	
Persicaria capitata	Pink Clover	A	
Phlox subulata	Moss Pink	A	10
Phyla nodiflora (Lippia repens)	Lippia	A	
Potentilla tabernaemontanii	Spring Cinquefoil	A	
Ribes viburnifolium	Catalina Perfume	B	
Rosmarinus officinalis (Prostrate Varieties)	Prostrate Rosemary	B	30
Scaevola 'Mauve Clusters'	NCN	A	
Salvia sonomensis	Creeping Sage	B	
Sedum species	Stonecrops	A	
Senecio mandraliscae/serpens	Kleinia/Blue Chalksticks	A	
Soleirolia soleirolii	Baby's Tears	A	
Teucrium cossonii majoricum	Germander	A	
T. X lucidrys 'Prostratum'	Prostrate Germander	A	
Thymus species	Mother of Thyme	A	
Trachelospermum jasminoides	Star Jasmine	A	
Trifolium fragiferum	White Clover	A	
Verbena species (Prostrate Varities)	Garden Verbena	A	
Vinca minor	Dwarf Periwinkle	A	
Viola odorata	Sweet Violet	A	
Wedelia trilobata	Yellow Dot	B	
Zoysia tenuifolia	Korean Grass	A	
Miscellaneous Perennials, Grasses, Ferns etc.			
Acorous gramineous and Cultivars	Sweet Flag	A	
Agapanthus africanus	Lily of the Nile	A	
Alstroemeria cooperi	Peruvian Lily	A	
Armeria species	Thrifts	A	
Bamboos	Bamboo	B	30
Bergenia cordifolia	Heart Leaf Bergenia	A	
Cycas species	Cycads	A	
Cyrtomium falcatum	Holly Fern	A	
Davalia tricomanoides	Rabbits Foot Fern	A	
Epilobium canum	California Fuchia	B	
Helictotrichon sempervirens	Blue Oat Grass	A	15
Hemerocallis hybrids	Daylily	A	
Iris douglassiana	Coastal Iris	A	
Iris germanica	Bearded Iris	A	

Kalanchoe species	Kalanchoe	A	
Leymus condensatus 'Canyon Prince'	Canyon Prince Wild Rye	B	
Lobelia laxiflora		A	10
Pelargonium species	Geranium	A	
Penstemon species	Beard Tongue	A	
Plumeria	Plumeria	A	
Phlebodium aureum	Rabbits Foot Fern	A	
Tulbaghia violacea	Society Garlic	A	
Zephyranthes candida	Zephyr Lily	A	
Shrubs			
Abelia grandiflora (Prostrata)	Glossy Abelia	A	10
Abutilon hybridum	Flowering Maple	A	10
Acanthus mollis	Bear's Breech	A	
Agave species	Agave	A	
Aloe species	Aloe	A	
Alyogyne huegelii	Blue Hibiscus	A	10
Arbutus unedo (Dwarf Cultivars)	Dwarf Strawberry Tree	A	10
Arctostaphylos species	Manzanita	B	
Aucuba japonica	Japanese Aucuba	A	
Baccharis species	Various	B	
Berberis thunbergii	Japanese Barberry	B	
B. thunbergii ' prostrate cultivars'		A	10
Bougainvillea sp.	Bougainvillea	B	
Buddleja davidii	Butterfly Bush	B	
Buxus microphylla japonica	Japanese Boxwood	A	10
Caesalpinia (Shrub Forms)	Bird of Paradise Bush	A	10
Camellia species	Camellia	A	10
Calliandra californica/eriophylla	Baja Fairy Duster	B	
Callistemon citrinus	Lemon Bottlebrush	B	
C. viminalis "Little John"	NCN	A	10
Calycanthus occidentalis	Western Spice Bush	B	
Carissa macrocarpa and Cultivars	Natal Plum	A	10
Carpenteria californica	Bush Anemone	A	10
Cassia artemisioides	Feathery Cassia	A	30
Ceanothus species	Wild Lilac	B	30
Cercocarpus betuiloides	Mountain Mahogany	B	30
Choisya ternata	Mexican orange	B	
Cistus species	Rockrose	B	
Comarostaphylis diversifolia	Summer Holly	B	
Convolvulus cneorum	Bush Morning Glory	B	
Coprosma pumila/repens	Mirror Plant	B	
Cotoneaster species & cultivars	Cotoneaster	B	
Crassula species	NCN	A	
Cuphea hyssopifolia	False Heather	A	
Cycas revoluta	Sago Palm	A	

Dasylirion quadrangulatum/wheeleri	Mexican Grass Tree	A	10
Dendromecon harfordii	Island Bush Poppy	B	
Dietes bicolor/irioides	Fortnight Lily	A	
Dodonaea viscosa (Purpurea)	Hopseed Bush	B	
Elaeagnus pungens & cultivars	Silverberry	B	
Encelia californica	Coast Sunflower	A	10
E. farinosa	Brittle Bush	B	
Erigonum giganteum	St. Catherine's Lace	B	
Escallonia species	Escallonia	A	10
Euonymus japonica & cultivars	Evergreen Euonymus	A	10
Euphorbia species		A	
Euryops pectinatus	NCN	A	
Fatsia japonica	Japanese Aralia	A	
Fouquieria splendens	Ocotillo	A	
Fremontodendron species & cultivars	Flannel Bush	B	
Gardenia jasminoides	Gardenia	A	
Garrya elliptica	Coast Silktassel	B	
Grevillea species & cultivars	Grevillea	B	
Grewia occidentalis	Lavender Starflower	B	
Hakea suaveolens	Sweet Hakea	B	
Hebe species & cultivars	Hebe	A	10
Hesperaloe parviflora	Red Yucca	A	
Hibiscus rosa - sinensis	Chinese Hibiscus	A	10
Ilex species	Holly	B	
Juniperus species	Juniper	B	
Justicia brandegeana	Shrimp Plant	A	10
J. californica	Chuparosa	B	
Keckiella cordifolia	Heart-Leaved Penstemon	B	
Kniphofia uvaria	Red-Hot Poker	A	
Lantana Camara & hybrids	Lantana	A	10
Larrea tridentata	Creosote Bush	B	
Lavandula species	Lavender	A	10
Lavatera assurgentiflora/maritima	California Tree Mallow	B	
Leonotis leonrus	Lion's Tail	B	
Leptospermum scoparium & varities	New Zealand Tea Tree	B	
Leucophyllum species		B	
Ligustrum japonicum	Wax-leaf Privet	A	10
Lupinus species	Lupine	B	
Mahonia aquifolium ('Compacta')	Oregon Grape	A	10
M. fremontii	Desert Mahonia	B	
M. 'Golden Abundance'	NCN	B	
M. lomariifolia	Venetian Blind Mahonia	A	
Malosma - See Rhus			
Malva species	Mallow	A	10
Melaleuca nesophila	Pink Melaleuca	A	10
Mimulus species (Diplacus)	Monkey Flower	A	10
Myrica californica	*Pacific Wax Myrtle*	*B*	

Myrsine africana	*African Boxwood*	*A*	*10*
Myrtus communis 'Compacta'	Dwarf Myrtle	A	10
Nandina domestica (including dwarf varieties)	Heavenly Bamboo	A	
Nerium oleander	Oleander	B	
N.o. 'Petite Salmon'	NCN	A	10
Opuntia species	Prickly Pear, Cholla etc.	A	
Phlomis fruticosa	Jerusalem Sage	A	
Phoenix roebelenii	Pygmy Date Palm	A	
Phormium tenax and Cultivars	New Zealand Flax	A	
Photinia fraseri	Photinia	B	
Pittosporum tobira ('Variegata')	Tobira	B	
P.t.'Wheeler's Dwarf'	Dwarf Pittosporum	A	
Punica granatum 'Nana'	Dwarf Pomegranate	A	10
Prunus ilicifolia	Hollyleaf Cherry	B	
Pyracantha species	Firethorn	B	
Rhamnus california/crocea	Coffeeberry	B	
Rhaphiolepis indica and Cultivars	India Hawthorn	A	10
Rhus integrifolia/laurina	Lemonade Berry	B	40
R. ovata	Sugar Bush	B	30
Ribes species	Currant/Gooseberry	A	10
Romneya coulteri	Matilija Poppy	B	
Rosa species (except R. californica)	Rose	A	
Rosmarinus officinalis & cultivars	Rosemary	B	
Salvia species - native varieties	Sage	B	
S. greggii/leucantha	Autumn Sage	A	10
Santolina chamaecyparissus/rosmarinifolius	Lavender Cotton	A	10
Simmondsia chinensis	Jojoba	B	
Strelitzia nicolai/regina	Bird of Paradise	A	
Tagetes lemmonii	Copper Canyon Daisy	B	
Tibouchina urvilleana	Princess Flower	A	10
Trichostema lanatum	Wooly Blue Curls	B	
Viburnum species	Viburnum	A	10
Westringia fruticosa	Coast Rosemary	A	10
Xylosma congestum	Shiny Xylosma	B	
X.c. 'Compacta'	Compact Xylosma	A	10
Yucca species	Yucca	B	
Trees			
Acacia farnesiana	Sweet Acacia	A	15
A. greggii	Catclaw Acacia	B	
A. salicina	Willow Acacia	A	15
A. smallii	NCN	A	15
A. stenophylla	Shoestring Acacia	A	15
Acer negundo	Box Elder	B	
A. palmatum	Japanese Maple	A	
A. saccharinum	Silver Maple	B	30

Aesculus californica	California Buckeye	B	
Agonis flexuosa	Peppermint Tree	B	
Albizia julibrissin	Silk Tree	B	
Alnus rhombifolia	Alder	B	
Arbutus unedo ('Marina')	Strawberry Tree	A	15
Archontophoenix cunninghamiana	King Palm	A	
Bauhinia variegata	Purple Orchid Tree	B	
Betula pendula	European White Birch	A	10
Brachychiton acerifolius/populneus	Flame Tree/Bottle Tree	B	
Brahea armata/edulis	Blue Hesper Palm	A	10
Butia capitata	Pindo Palm	A	10
Callistemon citrinus	Lemon Bottlebrush	B	
C. viminalis	Weeping Bottlebrush	A	15
Calocedrus decurrens	Incense Cedar	B	
Calodendrum capense	Cape Chestnut	B	
Cedrus deodara	Deodar Cedar	B	30
Ceratonia siliqua	Carob	B	30
Cercidium floridum/microphyllum	Blue Palo Verde	A	
Cercis occidentalis/canadensis	Western Redbud	A	10
Chamaerops humilis	Mediterranean Fan Palm	A	10
Chilopsis linearis	Desert Willow	A	15
Chionanthus retusus	Chinese Fringe Tree	A	10
Chitalpa X tashkentensis	Chitalpa	A	10
Chorisia speciosa	Floss Silk Tree	B	
Cinnamomum camphora	Camphor Tree	B	30
Citrus species	Citrus	A	10
Cocculus laurifolius	Laurel Leaf Snail Seed	B	
Cordyline australis	Giant Dracaena	A	
Cyathea cooperi	Australian Tree Fern	A	
Dicksonia antarctica	Tazmanian Tree Fern	A	
Dracaena draco	Dragon Tree	A	
Eriobotrya deflexa/japonica	Bronze Loquat/Loquat	A	10
Erythrina species	Coral Tree	B	
Feijoa sellowiana	Pineapple Guava	A	10
Ficus species	Fig	B	50
Fraxinus species	Ash	B	30
Geijera parviflora	Australian Willow	A	15
Ginkgo biloba	Maidenhair Tree	A	15
Gleditsia triacanthos	Honey Locust	A	15
Grevillea robusta	Silk Oak	B	
Heteromeles arbutifolia	Toyon	A	15
Hymenosporum flavum	Sweetshade Tree	A	15
Jacaranda mimosifolia	Jacaranda	B	
Juglans californica	Black Walnut	B	
Koelreuteria bipinnata/paniculata	Chinese Flame Tree	B	
Lagerstroemia indica	Crape Myrtle	A	10
Laurus nobilis	Sweet Bay	B	

Leptospermum laevigatum	Australian Tea Tree	A	15
Liquidambar formosana	Chinese Sweet Gum	A	15
L. styraciflua	American Sweet Gum	B	
Liriodendron tulipfera	Tulip Tree	B	
Lithocarpus densiflorus	Tanbark Oak	B	
Lophpstemon confertus (Tristania)	Brisbane Box	A	15
Lyonothamnus floribundus	Catalina Ironwood	A	15
Magnolia grandiflora	Southern Magnolia	B	
M. X soulangeana	Saucer Magnolia	A	10
Maytenus boaria	Mayten Tree	A	10
Melaleuca quinquenervia	Cajeput Tree	A	15
Metasequoia glypstroboides	Dawn Redwood	A	15
Metrosideros excelsus	New Zealand Christmas Tree	A	10
Morus alba	White Mulberry	B	
Olea europea	Olive - Fruitless only	A	15
Parkinsonia aculeata	Jerusalem Thorn	A	10
Phoenix dactylifera	Date Palm	B	
Pinus species	Pine	B	75
Pistacia chinensis	Chinese Pistache	B	
Pittosporum phillyraeoides	Willow Pittosporum	A	10
P. rhombifolium	Queensland Pittosporum	B	
Platanus racemosa	California Sycamore	B	
Podocarpus gracilior/macrophyllus	Fern Pine/Yew Pine	B	
Populus fremontii	Fremont Cottonwood	B	
Prosopis chilensis	Chilean Mesquite	B	
P. glandulosa	Honey Mesquite	A	15
Prunus cerasifera 'Atropurpurea'	Purple-leaf Plum	A	10
Punica granatum	Pomegranate	B	
Pyrus calleryana/kawakamii	Ornamental Pear	A	15
Quercus species	Oak	B	30
Rhus lancea	African Sumac	B	
Robinia ambigua	Locust	B	
Sapium sebiferum	Chinese Tallow Tree	B	
Schefflera actinophylla	Queensland Unbrella Tree	A	
Sophora japonica	Japanese Pagoda Tree	B	
Stenocarpus sinuatus	Firewheel Tree	A	10
Syagrus romanzoffianum	Queen Palm	A	
Tabebuia species	Trumpet Tree	A	15
Tipuana tipu	Tipu Tree	B	
Tupidanthus calyptratus	Tupidanthus	A	
Trachycarpus fortunei	Windmill Palm	A	
Umbellularia californica	California Bay	B	
Washingtonia filifera	California Fan Palm	B	30
Zelkova serrata	Sawleaf Zelkova	B	

Source: Los Angeles County Fire Department, Fuel Modification Unit.

Notes:

1. The plant list above is intended to be a representative sample of which plants are appropriate in Zones A or B considering their size, moisture content, leaf litter production, and chemical

composition.

2. Plants with certain physical and chemical characteristics make them more flammable and should not be planted close to structures in fire hazard areas. These trees should be spaced to allow a minimum canopy clearance at maturity from the structure as specified in the above table.
3. Landscape Designers may choose plants that are not on this list and may be acceptable if their plant characteristics are fuel modification zone appropriate.
4. Additionally, selecting regionally appropriate plants and the consideration of climate and microclimate adaptability is the responsibility of the Landscape Designer.

Appendix E

LACoFD Fuel Modification Zone Undesirable Plants List

Botanical Name	Common Name	Comment*
Adenostoma fasciculatum	Chamise	F
Adenostoma sparsifolium	Red Shank	F
Artemesia californica	California Sagebrush	F
Carpobrotus edulis	Hottentot-fig	F, I
Cortaderia spp.	Pampas Grass	F, I
Cupressus spp.	Cypress	F
Eriogonum fasciculatum	Common Buckwheat	F
Eucalyptus spp.	Eucalyptus	F
Jasminum humile	Italian Jasmine	F
Plumbago auriculata	Cape Plumbago	F
Tecoma capensis	Cape Honeysuckle	F

*F = flammable, I = Invasive

Notes:

1. Certain plants are considered to be undesirable in the landscape due to characteristics that make them highly flammable. These characteristics can be either physical or chemical. Physical properties would include large amounts of dead material retained within the plant, rough or peeling bark, and the production of copious amounts of litter. Chemical properties include the presence of volatile substances such as oils, resins, wax, and pitch. Plants with these characteristics should not be planted close to structures in fire hazard areas. These species are typically referred to as "Target Species" since their complete or partial removal from the landscape is a critical part of hazard reduction. Therefore, any plant listed in the above table is not allowed as part of an acceptable Fuel Modification Plan.
2. Plants on this list that are considered invasive are a partial list of commonly found plants. There are many other plants considered invasive that should not be planted in a fuel modification zone and they can be found on The California Invasive Plant Council's Website www.cal-ipc.org/ip/inventory/index.php. Other plants not considered invasive at this time may be determined to be invasive after further study.
3. For the purpose of using this list as a guide in selecting plant material, it is stipulated that all plant material will burn under various conditions.
4. The absence of a particular plant, shrub, groundcover, or tree, from this list does not necessarily mean it is fire resistive.
5. All vegetation used in Fuel Modification Zones and elsewhere within the Chadwick Ranch Estates Project site shall be subject to approval of the L.A. County Fire Department's Fuel Modification Unit or Fire Code official.