Appendix F2

Fire Protection Plan

FIRE PROTECTION PLAN
The Meadows at Bailey Canyon Specific Plan Project
City of Sierra Madre

Prepared by:

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Executive Summary

This Fire Protection Plan (FPP) has been prepared for The Meadows at Bailey Canyon Specific Plan Project (project or proposed project) located in the city of Sierra Madre, California. 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 Sierra Madre Fire Department (SMFD) along with project-specific measures based on the site, its intended use, and its fire environment.

This document provides analysis of the site's fire environment and its potential impact on the project as well as the project's potential impact on the existing fire protection service. Requirements and recommendations herein are based on site-specific fire environment analysis and project characteristics and incorporates area fire planning documents, site risk analysis, and standard principles of fire protection planning.

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 nearby undeveloped land could cast embers onto the property. Once the project is built, the project's on-site fire potential will be much lower than its current condition due to conversion of wildland fuels to buildings, parking areas, managed landscapes, fuel modification areas, improved accessibility for fire personnel, and structures built to the latest ignition and ember resistant fire codes.

It is important to note that the fire safety requirements that will be implemented on this site, including ignition resistant construction standards, along with requirements for water supply, fire apparatus access, fuel modification and defensible space, interior fire sprinklers and five minute or less fire response travel times were integrated into the code requirements and internal guidelines based on results of post-fire assessments, similar to the "After Action Reports" that are now prepared after large fire events. When it became clear that specifics of how structures were built, how fire and embers contributed to ignition of structures, what effects fuel modification had on structure ignition, how fast firefighters could respond, and how much (and how reliable) water was available, were critically important to structure survivability, the Fire and Building codes were revised appropriately.

The developed portion of this property is proposed for improvements that include construction of 42 single family homes on roughly 17.30 acres. The entire site has been designed with fire protection as a key objective. The site improvements are designed to facilitate emergency apparatus and personnel access throughout the site. Public streets provide access to every building. Water availability and flow will be consistent with requirements including fire flow and hydrant distribution required by local and state codes. These features along with the ignition resistance of all buildings, the interior sprinklers, and the pre-planning, training and awareness will assist responding firefighters through prevention, protection and suppression capabilities.

As detailed in this FPP, the project site's fire protection systems will include a redundant layering of protection methods that have proven to reduce overall fire risk. The requirements and recommendations included herein are performance based and site–specific, considering the project's unique characteristics rather than a prescriptive, one-size-fits-all approach. The fire protection systems are designed to increase occupant and building safety, reduce the fire risk on site, to minimize risks associated with typical uses, and aid the responding firefighters during an emergency. No singular measure is intended to be relied upon for the site's fire protection, but rather, a system of fire protection measures, methods, and features combine to result in enhanced fire safety, reduced fire potential, and improved safety in the development.

Early evacuation for any type of wildfire emergency at the project is the preferred method of providing for homeowner safety, consistent with the SMFD current approach for evacuation. As such, the project's Owner and Property Management Company will formally adopt, practice, and implement a "Ready, Set, Go!" approach to site evacuation. The "Ready, Set, Go!" concept is widely known and encouraged by the State of California and most fire agencies, including; Pre-planning for emergencies, including wildfire emergencies, focuses on being prepared, having a well-defined plan, minimizing potential for errors, maintaining the site's fire protection systems, and implementing a conservative (evacuate as early as possible) approach to evacuation and site uses during periods of fire weather extremes.

Based on the results of this FPP's analysis and findings, the following FPP implementation measures will be provided by The Meadows at Bailey Canyon Specific Plan Project as part of the proposed development plan. These measures are discussed in more detail throughout this FPP.

1. Project buildings will be constructed of ignition resistant[1] construction materials and include automatic fire sprinkler systems based on the latest adopted Building and Fire Codes for occupancy types.
2. Fuel Modification will be provided as needed around the perimeter of the site, as required by SMFD. If an area exits where adequate fuel modification cannot be achieved, exterior building construction will be further enhanced to provide a 2-hour rated exterior wall with no openings, or with fire rated and protected door openings, based on requirements and approval of SMFD.
3. Landscape plantings will not utilize plants that have been found to be highly flammable.
4. Fire apparatus access roads will be provided throughout the development and will provide at least the minimum required unobstructed travel lanes and clearances required by applicable codes. Primary access and internal circulation will comply with the requirements of the SMFD.
5. Buildings will be equipped with automatic fire sprinkler systems meeting SMFD requirements.
6. Water capacity and delivery provide for a reliable water source for operations and during emergencies requiring extended fire flow.
7. The developer will provide homeowners informational brochures at time of occupancy, which will include an outreach and educational role to ensure fire safety measures detailed in this FPP have been implemented and prepare development-wide "Ready, Set, Go!" plans.

[1] A type of building material that resists ignition or sustained flaming combustion sufficiently to reduce losses from wildland-urban interface conflagrations under worst-case weather and fuel conditions with wildfire exposure of burning embers and small flames, as prescribed in CBC, Chapter 7A and State Fire Marshal Standard 12-7A-5, Ignition-Resistant Materials.

1 Introduction

This Fire Protection Plan (FPP) has been prepared for The Meadows at Bailey Canyon Specific Plan Project (project or proposed project) in the City of Sierra Madre (City). The purpose of the FPP is to assess the potential impacts resulting from wildland fire hazards and identify the measures necessary to adequately mitigate those impacts. Additionally, this plan generates and memorializes the fire safety requirements of the Fire Authority Having Jurisdiction (FAHJ), which is the Sierra Madre Fire Department (SMFD). Requirements and recommendations are based on site-specific project characteristics and incorporate input from the project applicant and the FAHJ.

As part of the assessment, the plan has considered the property location, topography, surrounding combustible vegetation (fuel types), climatic conditions, and fire history. The plan addresses water supply, access, structural ignitability and fire resistive building features, fire protection systems and equipment, impacts to existing emergency services, defensible space, and vegetation management. The plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect one or more at-risk communities and essential infrastructures. The following tasks were performed toward completion of this plan:

- Gather site specific climate, terrain, and fuel data;
- Collect site photographs;
- Process and analyze the data using the latest 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 and the project site; 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.

Field observations were utilized to augment existing digital site data in generating the fire behavior models and formulating the recommendations presented in this FPP. Refer to Appendix A for site photographs of existing site conditions.

1.1 Applicable Codes and Regulations

This FPP demonstrates that the project will comply with applicable portions of Sierra Madre Fire Department Fire Prevention Standards. The project will also be consistent with the 2019 edition of the California Building Code (CBC), Chapter 7A; 2019 edition of the California Fire Code (CFC), Chapter 49; and the 2018 edition of the International Fire Code (IFC) as adopted and amended by SMFD. Additionally, SMFD references Fire Prevention Standards for informational purposes in clarifying and interpreting provisions of the CFC, National Fire Protection Association (NFPA) and California Public Resources Code (PRC). Chapter 7A of the CBC focuses primarily on preventing ember penetration into buildings, a leading cause of structure loss from wildfires.

Thus, it is an important component of the requirements of this FPP, given the project's wildland-urban interface (WUI) location is in an area designated as a Very High Fire Hazard Severity Zone (VHFHSZ). The designations of Fire Hazards are based on topography, vegetation, and weather, amongst other factors with more hazardous sites, which include steep terrain, un-maintained fuels/vegetation, and WUI locations. As described in this FPP, the project will meet all applicable fire and building code requirements for building in these higher fire hazard areas, or meet the intent of the code through the application of site-specific fire protection measures. These codes have been developed through decades of after-fire structure save and loss evaluations to determine what causes building loss during wildfires. The resulting fire codes now focus on mitigating former structural vulnerabilities through construction techniques and materials so that the buildings are more resistant to ignitions from direct flames, heat, and embers, as indicated in the 2019 California Building Code (Chapter 7A, Section 701A Scope, Purpose and Application).

1.2 Project Summary

1.2.1 Location

The approximately 17.30-acre site (Assessor's Parcel Number 5761-002-008) is located at 700 North Sunnyside Avenue, within the northwestern portion of the City of Sierra Madre, within the County of Los Angeles, California (Figure 1, Project Location).

The entirety of the proposed property lies within the local responsibility area (LRA) VHFHSZ, as statutorily designated by CAL FIRE (2007) and the SMFD (Figure 2, Fire Hazard Severity Zones Map).

1.2.2 Existing Land Use

The project site is currently undeveloped. Improvements include various access roads, scattered ornamental trees, and limited infrastructure.

1.2.3 Surrounding Land Uses

The northwestern portion of the project site borders the City of Pasadena, while the San Gabriel Mountains are located just north of the site. The site is bordered by Bailey Canyon, Bailey Canyon Debris Basin, and Bailey Canyon Wilderness Park to the east, existing single-family residential development to the south and west, and the Mater Dolorosa Retreat Center, which is primarily used to host religious and silent retreats and other activities, to the north. It should be noted that the Mater Dolorosa Retreat Center is on the same parcel as the project site and there is an access road through the site to the Mater Dolorosa Retreat Center. However, the Mater Dolorosa Retreat Center is not a part of the project site.

1.2.4 Project Description

The project would involve development of 42 detached single-family residential units and approximately 3.04-acre dedicated neighborhood park, within the 17.30-acre project site (Figure 3, Conceptual Site Plan). The proposed project components are outlined in greater detail below. In addition, the proposed project includes an approximately 35-acre open space dedication area, located on the hillside to the north of the project and the existing Mater Dolorosa Retreat Center, which would be dedicated to the City.

1.3 Project Location

The project is proposed for the 17.30-acre vacant site in the City of Sierra Madre located at 700 North Sunnyside Avenue in the northwestern portion of the City of Sierra Madre. The project site is surrounded by Bailey Canyon and

Bailey Canyon Wilderness Park to the east, and existing single-family residential development to the south and west, and the Mater Dolorosa Retreat Center, which is primarily used to host religious and silent retreats and other activities, to the north. It should be noted that the Mater Dolorosa Retreat Center is on the same legal parcel as the project site, which is currently split within three different lots; however, a lot line adjustment would be processed to adjust the boundaries of the three existing lots that make up the Mater Dolorosa Retreat Center and the project site. The lot line adjustment would consolidate the two southern lots that make up the project site as one lot and adjust the northern boundary of this new lot further to the north.

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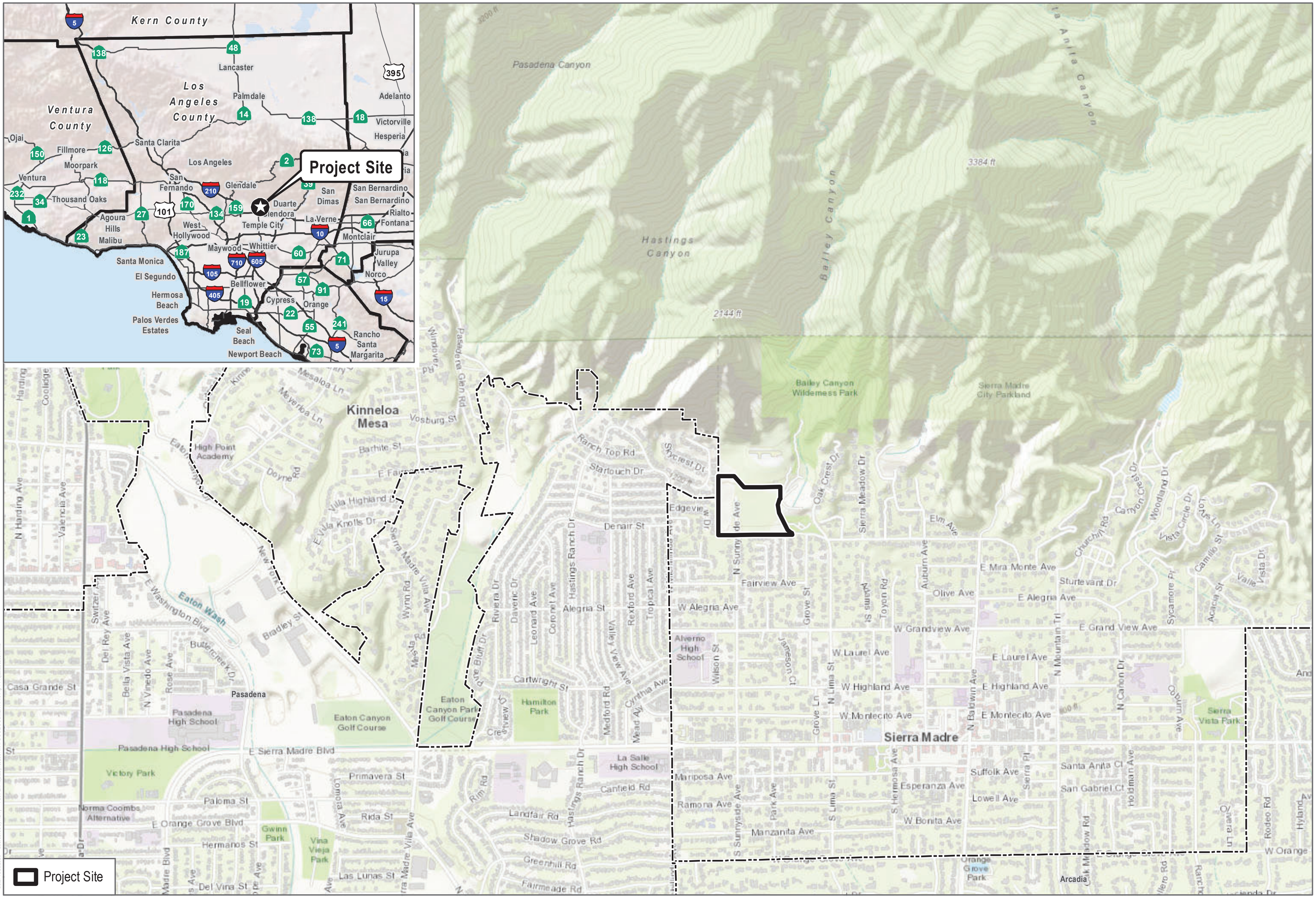

SOURCE: County of Los Angeles 2020; Bing Maps

DUDEK

0 1,000 2,000 Feet

FIGURE 1

Project Location

Fire Protection Plan for the Meadows at Sierra Madre Project

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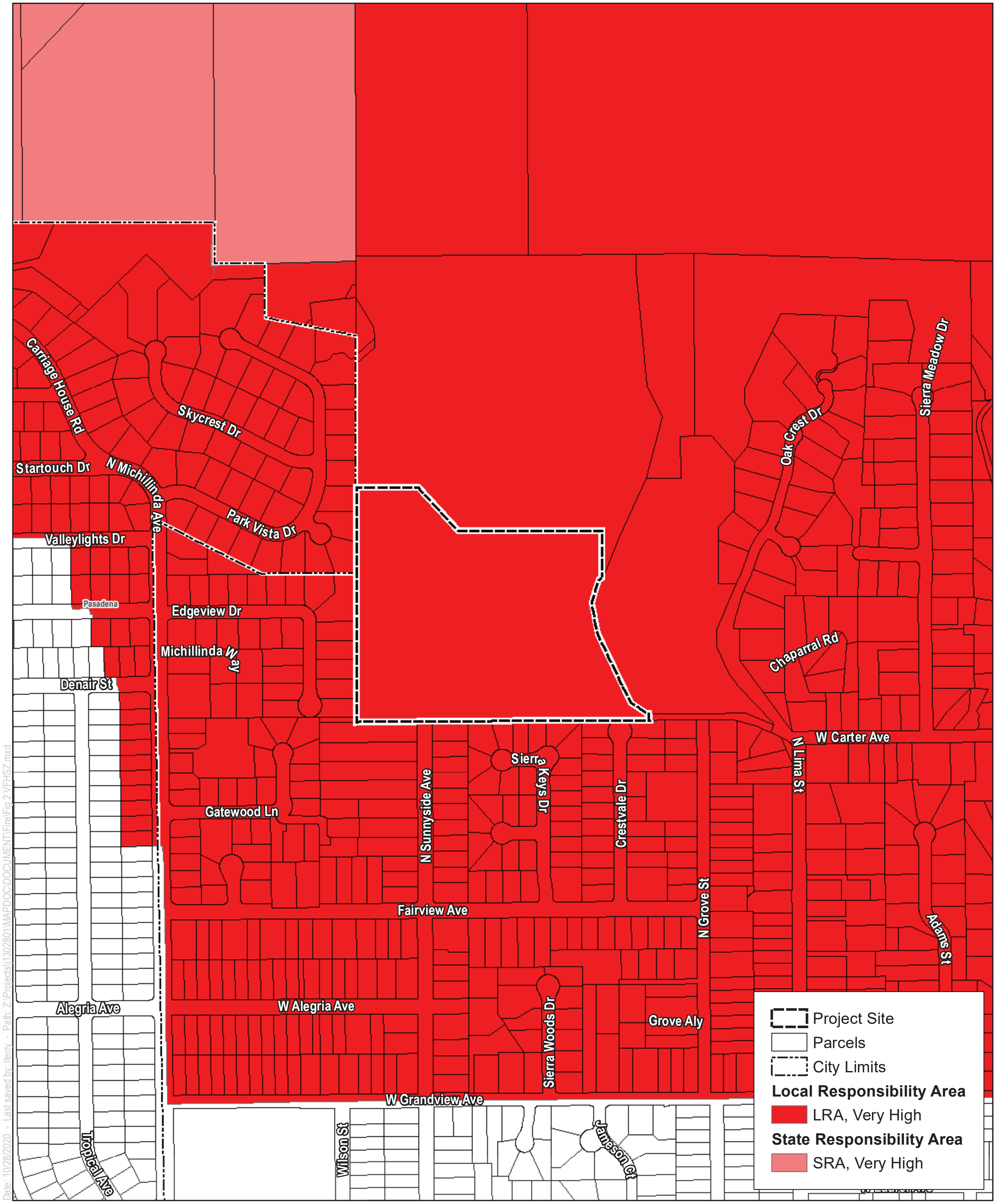

SOURCE: BASEMAP-COUNTY OF LOS ANGELES; FIRE DATA-CALFIRE

DUDEK

0 250 500 Feet

FIGURE 2

Fire Hazard Severity Zones Map

The Meadows at Sierra Madre

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LEGEND

PROJECT BOUNDARY (17.30 AC)

LOW DENSITY RESIDENTIAL (9.19 AC)

OPEN SPACE (0.35 AC) - NOTE: LANDSCAPE AT LOT A TO BE MAINTAINED BY MDRC

PARK SPACE (3.04 AC)

GRADING AND LANDSCAPE BUFFER (1.04 AC)

SOURCE: Fuscoe, 2021

FIGURE 3

Conceptual Site Plan

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2 Project Site Risk Analysis

2.1 Field Assessment

A field assessment of the project area was conducted on July 10, 2020, to confirm/acquire site information, document existing site conditions, and to determine potential actions for addressing the protection of the project's proposed structures. While on site, Dudek's Fire Protection Planner 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 are:

- Vegetation estimates and mapping refinements
- Fuel load analysis
- Topographic features documentation
- Photograph documentation
- Confirmation/verification of hazard assumptions
- Ingress/egress documentation.

Field observations were utilized to augment existing site data in generating the fire behavior models and formulating the recommendations detailed in this report.

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, climate, and vegetation (fuels). 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.

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 fire spread down-slope in the absence of wind. Flat terrain tends to have little effect on fire spread, resulting in fires that are driven by wind.

The project site is just below the base of the San Gabriel Mountains, which are north of the site. The site is relatively flat and gently sloping downward from north to south. Elevation at the site ranges from approximately 1,105 feet AMSL at the lower, southeastern portion of the site to 1,220 feet AMSL at the higher, northwestern portion of the site.

A topographic feature that may present a fire spread facilitator is the adjacent canyon, which may serve to funnel or channel winds, thus increasing their velocity and potential for influencing wildfire behavior. Immediately to the east of the site is Bailey Canyon and the Bailey Debris Basin.

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 site 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 project site includes adjacent topography that could create unusual weather conditions, thus the site is subject to periodic extreme fire weather conditions that occur throughout foothill portions of Los Angeles County.

Throughout Southern California, and specifically at the project site, climate has a large influence on fire risk. The climate of Los Angeles County is typical of a Mediterranean area, with warm, dry summers and cold, wet winters. Temperatures average (average annual) around 61°F and reach up to 100°F. Precipitation has been averaging less than 16 inches and typically occurs between December and March. The prevailing wind is an on-shore flow between 7 and 11 mph from the Pacific Ocean.

Fires can be a significant issue during summer and fall, before the rainy period, especially during dry Santa Ana wind events. The seasonal Santa Ana winds can be particularly strong in the project area as warm and dry air is channeled from the dry, desert land to the east. Although Santa Ana events can occur anytime of the year, they generally occur during the autumn months, although the last few years have resulted in spring (April - May) and summer events. Santa Ana winds may gust up to 75 miles per hour (mph) or higher. This phenomenon markedly increases the wildfire danger and intensity in the project area by drying out and preheating vegetation (fuel moisture of less than 5% for 1-hour fuels is possible) as well as accelerating oxygen supply, and thereby, making possible the burning of fuels that otherwise might not burn under cooler, moister conditions.

2.2.3 Vegetation

2.2.3.1 Fuels (Vegetation)

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. The vegetation on site is primarily disturbed habitat (mowed annual grasses) with scattered ornamental trees. With residential development to the west and south, the monastery to the north, and debris basin to the east, there is minimal native vegetation nearby the site.

The area proposed for development and within the project grading limits will be converted to roads, structures, and landscaped vegetation following project completion.

2.2.3.2 Vegetation Dynamics

Vegetation characteristics are used to model fire behavior, discussed in Section 3, Anticipated Fire Behavior, 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, non-native grass dominated plant communities become seasonally prone to ignition and produce lower intensity, higher spread rate fires. In comparison, sage 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.

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, while fire exclusion tends to convert grasslands to shrublands, over time. In general, biomass and associated fuel loading will increase over time, assuming that disturbance (fire, or grading) 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 fuel modification zones on site. The fuel modification areas on this site will consist of irrigated and maintained landscapes that will be subject to regular maintenance and will not be allowed to accumulate excessive biomass (live or dead) over time, which results in reduced fire ignition, spread rates, and intensity.

2.2.4 Fire History

Fire history is an important component of an FPP. Fire history data provides valuable information regarding fire spread, fire frequency, most vulnerable areas, and significant ignition sources, amongst others. In turn, this understanding of why fires occur in an area and how they typically spread can then be used for pre-planning and designing defensible communities.

Fire history represented in this FPP uses the 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 FRAP database[2], 74 wildfires 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 under 5 acres to 160,000 acres (2009 Station Fire) and the average fire size is approximately 4,500 acres (although excluding the Station Fire, the average is just over 2,300 acres). The 2020 Bobcat Fire (115,796 acres) is the most recent fire. The Los Angeles County Fire Department 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 wildfire-occurrence intervals ranged between 0 (multiple fires in the same year) to 15 years. The average interval between fires is 2 years. Based on this analysis, it is expected that there will be wildland fires within 5 miles of the project site on a regular to semi-regular basis, 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. The proximity of the project to large expanses of open space to the north 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.

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 adjacent to the project site given characteristic site features such as topography, vegetation, and weather. Dudek utilized BehavePlus software package version 6 (Andrews, Bevins, and Seli 2008) to analyze potential fire behavior for the northern, eastern, southern, and western edges 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 BehavePlus analysis, including fuel moisture and weather input variables, is provided in Appendix C.

3.2 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. These fire scenarios incorporated observed fuel types representing the dominant on-site and off-site vegetation on vacant land to the north and east, in addition to slope gradients, and wind and fuel moisture values for both the 97th percentile weather (fall, off-shore winds). Modeling scenario locations were selected to better understand different fire behavior that may be experienced on or adjacent to the site.

Vegetation types, which were derived from available resource materials and confirmed during the field assessment for 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 development. 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, two different fuel models were used in the fire behavior modeling effort presented herein. Fuel model attributes are summarized in Table 1.

Table 1. Fuel Model Characteristics

Fuel Model Assignment	Vegetation Description	Location	Fuel Bed Depth (Feet)
Gr1	Moderate Load, Dry Climate Grass	Represents mowed grasslands (disturbed habitat) throughout the property.	<2.0
8	Compact litter	Represents irrigated landscapes and paved streets in proposed development.	<0.5

The results of fire behavior modeling analysis for pre- and post-project conditions are presented in Tables 2 and 3, respectively. Identification of modeling run (fire scenarios) locations is presented graphically in Figure 4, BehavePlus Analysis Map.

Table 2. Fire Behavior Modeling Results for Existing Conditions

Fire Scenarios	Flame Length (feet)	Fireline Intensity (BTU/feet/second)	Spread Rate (mph²)	Spotting Distance* (miles)
Scenario 1: mowed grasslands, 10% uphill slope, 40 mph high wind speed				
Fuel Model Gr1	4.0	115	0.7	0.4
Scenario 2: mowed grasslands, 10% uphill slope, 40 mph high wind speeds				
Fuel Model Gr1	4.0	115	0.7	0.4

* Spotting distance from a wind driven surface fire.

Table 3. Fire Behavior Modeling Results for Post-Project Conditions

Scenario	Flame Length (feet)	Fireline Intensity (BTU/feet/second)	Spread Rate (mph²)	Spotting Distance* (miles)
Scenario 1: Irrigated landscaping, 3% uphill slope, 40 mph high wind speed				
Irrigated landscaping/ pavement (FM8)	3.0	62	0.2	0.3
Scenario 2: Irrigated landscaping, 3% uphill slope, 40 mph high wind speeds				
Irrigated landscaping/ pavement (FM8)	3.0	62	0.2	0.3

* Spotting distance from a wind driven surface fire.

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; rather, the models provide a worst-case wildfire behavior condition as part of a conservative approach. 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 would be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

Fire Behavior Modeling Results for Existing Conditions

Fire Scenarios	Flame Length (feet)	Fireline Intensity (BTU/feet/second)	Spread Rate (mph)	Spotting Distance (miles)
Scenario 1: mowed grasslands, 10% uphill slope, 40 mph high wind speed				
Fuel Model Gr1	4.0	115	0.7	0.4
Scenario 2: mowed grasslands, 10% uphill slope, 40 mph high wind speeds				
Fuel Model Gr1	4.0	115	0.7	0.4

1. Spotting distance from a wind driven surface fire.

Fire Behavior Modeling Results for Post-Project Conditions

Scenario	Flame Length (feet)	Fireline Intensity (BTU/feet/second)	Spread Rate (mph)	Spotting Distance (miles)
Scenario 1: Irrigated landscaping, 3% uphill slope, 40 mph high wind speed				
Irrigated landscaping/pavement (FM8)	3.0	62	0.2	0.3
Scenario 2: Irrigated landscaping, 3% uphill slope, 40 mph high wind speeds				
Irrigated landscaping/pavement (FM8)	3.0	62	0.2	0.3

SOURCE: AERIAL-BING MAPPING SERVICE

DUDEK

0 125 250 500 Feet

FIGURE 4
BehavePlus Analysis Map
Fire Protection Plan for the Meadows at Sierra Madre Project

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3.3 Fire Behavior Summary

3.3.1 Existing Condition

As presented in the fire modeling analysis location map (Figure 4), wildfire behavior in mowed grasslands, presented as a Fuel Model Gr1, can be expected to have flame lengths of approximately 4 feet with 40 mph winds (extreme fire weather conditions). Spread rate for mowed grasslands fuel beds is about 0.2 mph (extreme offshore winds). Spotting distance, where airborne embers can ignite new fires downwind of the initial fire, would be about 0.3 miles.

3.3.2 Post-development Condition

As presented in Table 2, Fire Behavior Results for Existing Conditions, Dudek conducted modeling of the site for post-development fuel recommendations for this project. The fuel modification area includes paved streets and irrigated landscaping on the periphery of the project. For modeling the post-development condition, the fuel model assignment was re-classified for irrigated landscaping (Fuel Model 8). Conversely, the irrigated landscape areas experience a reduction in flame length and intensity. The 4-foot (mowed grass fuel bed) tall flames predicted during pre-development modeling during extreme weather conditions are reduced to about 3 feet tall at the outer edges of the development due to the higher live and dead fuel moisture contents.

3.4 Project 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 grasslands and shrublands, like those found adjacent to the Center 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, and the regions fire history, it can be anticipated that periodic wildfires may start on, burn onto, or spot into the site. The most common type of fire anticipated in the vicinity of the project site is a wind-driven fire from the northeast moving through the native vegetation in the Angeles National Forest.

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, 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 site landscape.

4 Emergency Response and Service

4.1 Emergency Response

The project site is located within the Sierra Madre Fire Department (SMFD) response area. Table 4, Closest Responding Fire Stations Summary, presents a summary of the location, equipment, staffing levels, maximum travel distance, and travel time for the three closest, existing fire stations responding to the project. In addition to the Sierra Madre Fire Station 41, Pasadena Fire Station 37 and Arcadia Fire Station 107 would also respond to the project site as part of the Verdugo Unified Command dispatch system. Travel distances are derived from Google road data while travel times are calculated applying 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). The ISO response travel time formula discounts speed for intersections, vehicle deceleration and acceleration, and does not include turnout time.

Table 4. Closest Responding Fire Stations Summary

Station No.	Location	Equipment	Staffing*	Maximum Travel Distance	Travel Time (min.)
Sierra Madre No. 41	242 W Sierra Madre Blvd Sierra Madre, California	E41, RA41	One staffed Type 1 engine; one staffed ambulance.	1 mile	2.35
Pasadena No. 37	3430 E Foothill Blvd Pasadena, California	E37	One staffed Type 1 engine.	2.3 miles	4.56
Arcadia No. 107	79 W Orange Grove Ave Arcadia, California	E107	One staffed Type 1 engine.	2.7 miles	5.24

* Complete staffing levels not available.

SMFD Fire Station 41 is staffed 24/7 with career firefighters, would provide initial response to the project, and is located at 242 W Sierra Madre Blvd in Sierra Madre. Station 41 has one staffed Type 1 engine, and one staffed rescue ambulance (contract with Los Angeles County Fire Department), and will be capable of responding within three minutes to the proposed entrance of the project.

Secondary response would be provided from either Pasadena Fire Station 37 or Arcadia Fire Station 107. Station 37 is located at 3430 E Foothill Blvd in Pasadena, and can respond in about five minutes to the project site. Station 37 has one staffed Type 1 engine. Arcadia Station 107 is located at 79 W Orange Grove Ave in Arcadia and can respond in just over five minutes. Station 107 has one staffed Type 1 engine.

Within the area's emergency services system, fire and emergency medical services are also provided by other Fire Departments. Generally, each agency is responsible for structural fire protection and wildland fire protection within their area of responsibility. However, mutual aid agreements enable non-lead fire agencies to respond to fire emergencies outside their district boundaries. In the project area, fire agencies cooperate under a regional unified command structure (Verdugo Unified Response[3]), in addition to the statewide master mutual aid agreement for

3 Verdugo Unified Response, https://www.glendaleca.gov/government/departments/fire-department/verdugo-fire-communications/verdugo-fire-history/unified-response

wildland fires. There are also mutual aid agreements in place with neighboring fire agencies and typically include interdependencies that exist among the region's fire protection agencies for structural and medical responses, but are primarily associated with the peripheral "edges" of each agency's boundary.

4.2 Estimated Calls and Demand for Service from the Project

Emergency call volumes related to typical projects, such as new residential developments, can be reliably estimated based on the historical per-capita call volume from a particular fire jurisdiction. The SMFD documented 759 total incidents for FY 2014–2015 (see Table 5). The City's per capita annual call volume is approximately 70 calls per 1,000 persons, or a per capita call volume of 0.07. The City of Sierra Madre has a total population of about 11,000 persons.

Based on the proposed development plans, the project's estimated population of 133 is calculated to generate up to nine calls per year. The estimated incident call volume at buildout 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 42 single-family lots with an average unit occupancy of 3.15 people per single-family dwelling unit, which calculates to a total population of approximately 132 people (3.15 x 42 DU = 133). Using the SMFD estimate per capita call volume of 0.07 (70 annual calls per 1,000 population), the project's estimated 133 people would generate up to nine (9) additional calls per year. The type of calls expected would primarily be medical-related.

Table 5. 2014–2015 Call Volume Totals for Closest Fire Stations

Response Jurisdiction	Sierra Madre Station 41	Pasadena Station 37	Arcadia Station 107
Fire	11.7%	17.0%	14.4%
Medical Aid (EMS)	71.1%	78.1%	79.2%
Other	11.1%	4.2%	5.5%
Annual Total Response	**759**	**1,853**	**909**
FD Responses to Sierra Madre	**751**	**5**	**48**
Average Calls Per Day	**2.08**	**5.08**	**2.49**

Source: Verdugo Communications 2014–2015

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 project would include 42 new single-family residential lots. The development is conservatively projected to add up to 9 calls per year, mostly medical, initially within Station 41's first-in response jurisdiction. The addition of nine (9) call per year is not considered a significant impact. A busy suburban fire station would run 10 or more calls per day. An average station runs about five calls per day.

The level of service demand for the 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 or more calls per day. Station 41 would respond to an additional nine (9) 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.

5 Fire Safety Requirements: Buildings, Fire Protection, Infrastructure, and Defensible Space

The SMFD Fire Code and 2019 CFC and 2019 CBC adopted by reference (with several modifications) governs the building, infrastructure, and defensible space requirements detailed in this FPP. The project will meet applicable codes or will provide alternative materials and/or methods, if warranted. The following summaries highlight important fire protection features.

Prior to bringing combustible materials onto the site, utilities shall be in place, fire hydrants operational, an approved all-weather roadway, or an approved road surface alternative in place, and interim fuel modification zones established and approved.

A response map update, including roads and fire hydrant locations, in a format compatible with current SMFD mapping shall be provided to Sierra Madre Fire Department.

5.1 Specific Fire Safety Code Sections

As described in this FPP, the project will comply with all applicable fire and building code requirements for building in higher fire hazard areas, or meet the intent of the code through the application of site-specific fire protection measures. The project will be compliant with the following:

- 2019 California Building Code (CBC) as adopted and amended by SMFD (Chapter 7A focuses primarily on preventing ember penetration into buildings);
- 2019 California Residential Code (CRC) (Sec. 337 focuses on construction in the WUI);
- 2019 California Fire Code (CFC) as adopted and amended by SMFD (Chapter 49 focuses on requirements for Wildland-Urban Interface fire areas);
- Fire Prevention Standards for informational purposes in clarifying and interpreting provisions of the CBC and CFC (National Fire Protection Association, NFPA);
- California Public Resources Code (PRC).

In addition, the following amended CBC and CFC requirements included in the Sierra Madre Municipal Code (Sec. 15.04.030 and 15.28.010) will also be complied with the following:

- Exterior walls will be of one-hour, fire-resistive construction;
- Glass in exterior walls (i.e., windows, doors) will be double-glazed;
- Roof soffits, eaves, open patios, carports, porches, unenclosed underfloor areas and all open structures, attached or detached, will be protected on the under side with one-hour fire-resistive materials;
- Roof coverings will be fire-retardant (Class A rated).

5.2 Ignition-Resistant Building Construction

All new structures within the project site will be constructed to current Building and Fire Code standards. Each of the proposed buildings will comply with the enhanced ignition-resistant construction standards of the 2019 CBC as adopted and amended (specifically Chapter 7A). These requirements address roofs, eaves, exterior walls, vents, appendages, windows, and doors and result in hardened structures that have been proven to perform at high levels (resist ignition) during the typically short duration of exposure to wildfires. Appendix D provides a summary of the requirements for ignition resistant construction.

While these standards will provide a high level of protection to structures in this development, there is no guarantee 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[4] (WUI) built to these codes have proven to be very ignition resistant. Likewise, radiant and convective heat impacts on structures have been reduced through the enhanced building design and materials requirements of the CBC (particularly Chapter 7A). Additionally, provisions for modified fuel areas separating wildland fuels from structures have reduced the number of fuel-related structure losses.

Most of the primary components of the layered fire protection system provided for the project are required by the SMFD. The components have been proven effective for minimizing structural vulnerability to wildfire and, with the inclusion of required interior sprinklers (required in the 2019 Building/Fire Code update), of extinguishing interior fires, should embers succeed in entering a structure.

Even though these fire safety 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)
   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

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

    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).
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 Fire Sprinkler System to code for all habitable residential dwellings.

5.3 Fire Protection Systems

5.3.1 Water Supply

Water service for the project site would be provided by the City of Sierra Madre as the project site is within the City's service area. The internal waterlines will supply sufficient fire flows and pressure to meet the demands for required on site fire hydrants and interior fire sprinkler systems for all structures. The Sierra Madre Fire Prevention Standards and 2019 CFC require the following: static water pressure will remain above 20 psi at 2,500 gallons per minute when meeting the fire requirements for a two-hour duration.

5.3.2 Hydrants

Fire Hydrants shall be located along fire access roadways and adjacent to each structure, as determined by the SMFD Fire Marshal and current fire code requirements to meet operational needs. Fire Hydrants will be consistent with applicable Design Standards.

5.3.3 Automatic Fire Sprinkler Systems

All proposed houses will be protected by an automatic fire sprinkler system. Fire sprinklers systems shall be in accordance with SMFD, and National Fire Protection Association (NFPA) Standard 13D. Fire sprinkler plans for each structure will be submitted and reviewed by SMFD for compliance with the applicable fire and life safety regulations, codes, and ordinances as well as the SMFD Fire Prevention Standards for fire protection systems.

5.4 Infrastructure

5.4.1 Fire Apparatus Access Roads

The project would involve the construction of new structures and roadways on the project site. Project site access, including road widths and connectivity, will be consistent with the City's roadway standards and the 2019 CFC Section 503. Additionally, approved paved access roadways shall be installed prior to any combustibles being brought on site.

The roadway system design includes the following:

- Direct access provided to all structures with interconnecting roadways;
- Through roadways (no dead-ends are proposed), hence no designated fire department turnarounds will be required for the project site;
- The existing West Carter Avenue access improved to meet fire apparatus access road requirements;
- Roadways with a minimum 20-foot unobstructed width (30- and 36-foot wide roadway surfaces are proposed) and a minimum 26-foot width within 25 feet of hydrants;
- Hydrants installed along the roadways and within the project itself.

Site access, including road widths and connectivity, will comply with all requirements and will include the following:

- Primary access to the project site would be provided from North Sunnyside Avenue. Carter Avenue would provide emergency access only.
- All roads comply with access road standards of not less than 24 feet, unobstructed width and are capable of supporting an imposed load of at least 75,000 pounds.
- 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.
- Roadway design features (e.g., speed bumps, humps, speed control dips, planters, and fountains) that could interfere with emergency apparatus response speeds and required unobstructed access road widths will not be installed or allowed to remain on roadways.
- Access roads shall be completed and paved prior to issuance of building permits and prior to the occurrence of combustible construction.
- Developer will provide information illustrating the new roads, in a format acceptable to the SMFD for updating of Fire Department response maps.

5.4.2 Premises Identification

Identification of roads and structures will comply with SMFD Fire Prevention Standards, as follows:

- 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.
- 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.
- Proposed streets within the development will be named, with the proper signage installed at intersections to satisfaction of the Department of Public Works.
- Streets will have street names posted on non-combustible street signposts; letters/numbers will be per SMFD standards.
- Temporary street signs shall be installed on all street corners within the project prior to the placing of combustible materials on site. Permanent signs shall be installed prior to occupancy of buildings.

5.4.3 Pre-Construction Requirements

Prior to bringing lumber or combustible materials onto the site, site improvements within the active development area shall be in place, including utilities, operable fire hydrants, an approved, temporary roadway surface, and construction phase fuel modification zones established. These features will be approved by the fire department or their designee prior to combustibles being brought on site.

5.5 Defensible Space and Vegetation Management

5.5.1 Defensible Space

WUI fire protection requires a systems approach, which includes the components of infrastructure and water, structural safeguards (addressed in this FPP), and adequate defensible space setbacks. This section provides defensible space details for the project.

5.5.2 Fuel Modification Zone Requirements

A fuel modification zone (FMZ) is a strip of land where combustible vegetation has been removed and/or modified and partially or totally replaced with more appropriately spaced, drought-tolerant, fire resistant plants in order to provide a reasonable level of protection to structures from wildland fire. A typical landscape/fuel modification installation often consists of a 100-foot wide fuel management area from the lot boundary extending outwards towards undeveloped areas.

Cohen (1995) performed structure ignition fire research studies that suggest, as a rule-of-thumb, larger flame lengths and widths require wider fuel modification zones to reduce structure ignition. For example, valid Structure Ignition Assessment Modeling 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 requires about 130 feet of clearance to prevent structure ignitions from radiant heat (Cohen and Butler 1996). For this fire study example, bare wood was used, which is more combustible unlike fire resistant stucco, masonry or cementitious exterior materials.

Based on the conceptual site plan, the buildings on the project site have adequate on-site fuel modification, which consists of asphalt roadways and irrigated landscaping. There are no areas proposed within the project footprint that will have native vegetation in a natural or non-irrigated setting that may be subject to fuel modification; instead, all areas will either be developed, paved or landscaped and irrigated.

Appendix E, Conceptual Site Fuel Modification Plan shows the locations where the fuel modification areas are to be located. In some cases, achievement of the 100 feet fuel modification area includes already developed and maintained landscapes that are off-site and act as reciprocal fuel modification.

Vegetation management will be implemented as an interim FMZ throughout the construction phase as there may be periods of time where structures are exposed to wildland fuels.

5.5.2.1 Fuel Modification Zone Discussion

An important component of a fire protection system for this project is the provision for ignition-resistant construction and modified vegetation buffers. The Fire and Building codes, structure ignition resistance requirements will enable the structures to withstand the type of wildfire that may occur in the fuels outside the development footprint. Fire behavior modeling, as previously presented, was used to predict flame lengths and was not intended to determine sufficient fuel modification zone widths. However, the results of the fire modeling provide important fire behavior projections, which is key supporting information for determining buffer widths that would minimize structure ignition and provide "defensible space" for firefighters.

Based upon Dudek's analysis of the project, the fire environment, the enhanced building features, fire protection systems, and exterior site design layout, a traditional FMZ configuration is not necessary. Instead a "Fuel Modification Area" is recommended, as described below, that will take advantage of the project's setting and design layout. While the eastern side of the project is most susceptible to an approaching wildfire, the adjacent Bailey Canyon Debris Basin is maintained free of vegetation providing an off-site fuel break. The internal circulation system includes paved roadways along the eastern and northern sides of the project thereby providing over 40 feet of noncombustible defensible space in both locations. Irrigated greenbelts along the perimeter of the project, and an irrigated park along the southern side of the project, provide fire and ember resistant landscaping for additional protection and fuel modification zone equivalency. The combination of paved streets and irrigated greenbelt landscaping provides for at least 100 feet of FMA around all buildings: 200 feet FMA on the southern side of the project, 62 to 100 feet on the eastern side, and over 100 feet on the northern side. West of the project is an existing residential development that provides FMA equivalent landscape.

The combination of these fire prevention measures provide at a minimum the equivalency of a 100-foot fuel modification zone, if not more so.

5.5.2.2 Fuel Modification Area – Irrigated/Paved Zone

The Fuel Modification Area (FMA) is designated primarily for the eastern perimeter of the project, yet it will also apply to the irrigated landscaped areas and interior slopes throughout the project for maintenance purposes. The FMA will start from the edge of the developed pads to the boundary of the project and include the interior slopes, greenbelts and park.

All highly flammable native vegetation, shall be removed. The project's plant palette will be approved by the fire department. A permanent, automatic irrigation system will be installed throughout the project to maintain hydrated plants.

The FMA includes the following key components:

- All trees shall be planted and maintained at a minimum of 10 feet from the tree's drip line to any combustible structure
- Tree spacing of a minimum 10 feet between canopies
- Mature trees shall be limbed to eight feet or three times the height of understory plants to prevent ladder fuels, whichever is greater. No tree limb encroachment within 10 feet of a structure or chimney, including outside barbecues or fireplaces
- Tree maintenance includes limbing-up (canopy raising) six feet or one-third the height of the tree

- Maintenance including ongoing removal and/or thinning of undesirable combustible vegetation, replacement of dead/dying plantings, maintenance of the programming and functionality of the irrigation system, regular trimming to prevent ladder fuels[5].
- A minimum of 36 inch wide pathway with unobstructed vertical clearance around the exterior of each structure (360°) provided for firefighter access (2019 CFC, Section 503.1.1). Within this clearance area, landscape such as low ground covers and shrubs are permitted so long as their placement and mature height do not impede firefighter access, consistent with purpose of this guideline.
- Trees and tree form shrub species that naturally grow to heights that exceed two feet shall be vertically pruned to prevent ladder fuels.
- Ground covers within first three feet from structure restricted to non-flammable materials, including stone, rock, concrete, bare soil, or other. Combustible ground covers, such as mulch or wood chips, are prohibited adjacent to structures with an exterior stucco wall and weep screed.

5.5.3 Vegetation Management Maintenance

Vegetation management, i.e., assessment of fuel condition and removal of dead and dying and undesirable species, as well as thinning as necessary to maintain specified plant spacing and fuel densities, shall be completed annually each year, and more often as needed for fire safety, as determined by the SMFD.

The individual homeowners shall be responsible for all vegetation maintenance on their lots in compliance with this plan and the SMFD requirements. The City will ensure private homeowner lots comply with this plan initially and on an ongoing basis. CBC Chapter 7A requirements for ongoing maintenance of fire resistive building materials and fire sprinkler systems will be included in the CC&R's and Deed encumbrances for each lot.

The FMA required for the project will be maintained initially by the developer.

On-going/as-needed fuel modification maintenance during the interim period while the project is built out, will include necessary measures for consistency with the FPP, including the following:

- Removal or thinning of undesirable combustible vegetation and replacement of dead or dying landscaping.
- Maintaining ground cover at a height not to exceed 18 inches. Annual grasses and weeds shall be maintained at a height not to exceed 3 inches.
- Removing accumulated plant litter and dead wood. Debris and trimmings produced by thinning and pruning should be removed from the site or chipped and evenly dispersed in the same area to a maximum depth of 4 inches.
- Removing all prohibited plant species included on the prohibited species list in Appendix F.
- Maintaining manual and automatic irrigation systems for operational integrity and programming. Effectiveness should be regularly evaluated to avoid over or under-watering.
- Complying with these FPP requirements on a year-round basis. Annual inspections are conducted following the natural drying of grasses and fine fuels, usually during the months of May and June, depending on precipitation during the winter and spring months.

5 Plant material that can carry a fire burning in low-growing vegetation to taller vegetation is called ladder fuel. Examples of ladder fuels include low-lying tree branches and shrubs, climbing vines, and tree-form shrubs underneath the canopy of a large tree.

5.5.4 Annual Fuel Modification Zone Compliance Inspection

To confirm that the project's FMAs and landscape areas are being maintained according to this FPP and the SMFD's vegetation maintenance requirements, it is recommended that inspection and report from a qualified SMFD-approved third party inspector in May/June of each year certifying that vegetation management activities throughout the project site have been performed. Annual inspection fees are subject to the current Fire Department Fee Schedule.

5.5.5 Construction Phase Vegetation Management

Vegetation management requirements shall be implemented at project commencement and throughout the construction phases. Vegetation management shall be performed pursuant to the SMFD 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.

6 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 SMFD's current approach within the City of Sierra Madre. As such, it is recommended that the project would adopt, practice, and implement a "Ready, Set, Go!" approach to evacuation. The "Ready, Set, Go!" concept is widely known and encouraged by the State of California[6] 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. SMFD would review and approve all wildfire educational material/programs before printing and distribution.

6 https://www.fire.ca.gov/media/4996/readysetgo_plan.pdf

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7 Conclusion

This FPP for The Meadows at Bailey Canyon Specific Plan Project provides guidance for vegetation maintenance for the proposed FMA and landscaped areas on the site. As described, vegetation maintenance measures will be provided on all sides of the proposed development. The requirements and recommendations provided in this FPP have been designed specifically for the project. This analysis and its fire protection justifications are supported by fire science research, results from previous wildfire incidents, and fire agencies that have approved these concepts. The project design features, asphalt roads and parking stalls, and a fully irrigated landscape, would provide a level of safety equivalent to a 100-foot wide FMZ.

Ultimately, it is the intent of this FPP to guide the fire protection efforts for the project in a comprehensive manner. Implementation of the measures detailed in this FPP will reduce the risk of wildfire at this site and will improve the ability of firefighters to fight fires on the properties and protect property and neighboring resources, irrespective of the cause or location of ignition.

It must be noted that during extreme fire conditions, there are no guarantees that a given structure will not burn. Precautions and minimizing actions identified in this report are designed to reduce the likelihood that fire will impinge upon the project or threaten its occupants/visitors. Additionally, there are no guarantees that fire will not occur in the area or that fire will not damage property or cause harm to persons or their property. Implementation of the required enhanced construction features provided by the applicable codes and the fuel modification requirements provided in this FPP will reduce the site's vulnerability to wildfire. It will also help accomplish the goal of this FPP to assist firefighters in their efforts to defend structures.

It is recommended that the project maintain 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 the Center, determine that it is safer to temporarily refuge employees 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 it is important for anyone living at the WUI to educate themselves on practices that will improve safety.

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Appendix A

Representative Site Photographs

Photograph Log

The Meadows at Sierra Madre Project

Photograph 1. View of southern open area near main entrance gate. Note lack of unmaintained fuels – this area would be developed.

Photograph 2. View of main entrance and tree lined roadway.

Photograph 3. View of gated roadway to the south along Sunnyside Avenue.

Photograph 4. View of lower meadow/development area.

Photograph 5. Areas to the right and left of photo would be developed.

Photograph 6. View of development area and existing trees.

Photograph 7. View under olive grove canopy – well maintained an minimal surface fuel.

Photograph 8. Additional view under olive grove – would remain adjacent to developed area.

Photograph 9. View of the nearest wildland fuels – east of the Retreat Center. Project is setback south of the Retreat Center and these fuels..

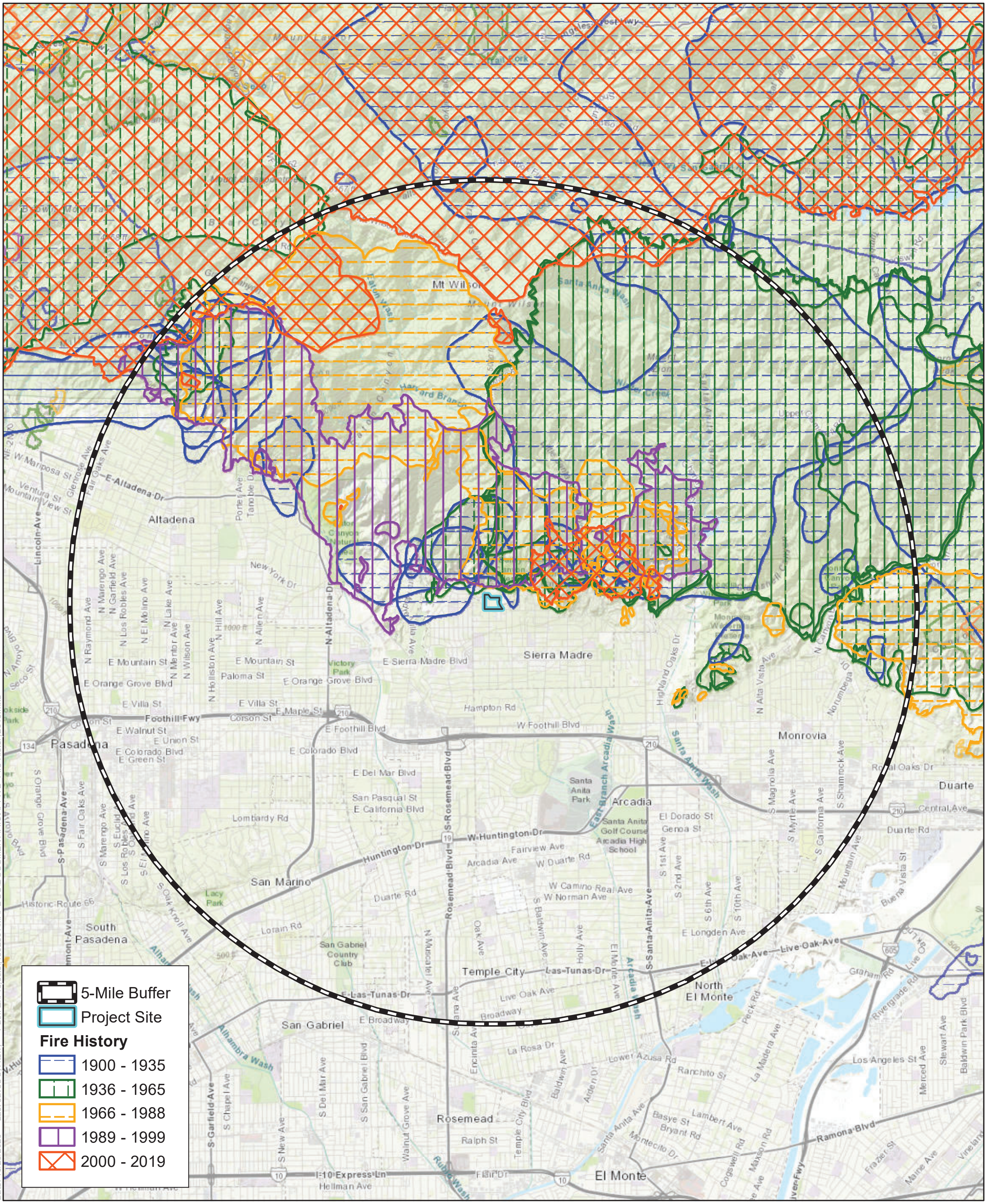
Photograph 10. View of managed landscape north of the Project site between Project and wildland fuels.

Photograph 11. View of area north of the Retreat Center – note maintained fuel modification zone.

Photograph 12. View into Bailey Canyon and reservoir to the east of the Project site.

Appendix B

Project Vicinity Fire History Map



SOURCE: BASEMAP-ESRI; FIRE DATA-CALFIRE 2019

DUDEK

0 1 2 Miles

APPENDIX B

Fire History Map

The Meadows at Sierra Madre

Appendix C

BehavePlus Fire Behavior Analysis

1 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 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, V6, 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, BehavePlus 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 BehavePlus and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling includes a high level of analysis and information detail to arrive at reasonably accurate representations of how wildfire would move through available fuels on a given site. Fire behavior calculations are based on site specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. Predicting wildland fire behavior is not an exact science. As such, the minute-by-minute movement of a fire will probably never be predictable, especially when considering the variable state of weather and the fact that weather conditions are typically estimated from forecasts made many hours before a fire. Nevertheless, field-tested and experienced judgment in assessing the fire environment, coupled with a systematic method of calculating fire behavior yields surprisingly accurate results. To be used effectively, the basic assumptions and limitations of fire behavior modeling applications must be understood.

1. 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 the dead fuels less than 0.25 inches 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.
2. 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.
3. Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, creating their own weather, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
4. Fourth, fire behavior computer modeling systems are 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 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 in a particular landscape. The type and quantity will depend upon soil, climate, geographic features, and fire history. 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.

2 Modeling Inputs

2.1 Fuels

The seven fuel characteristics help define the 13 standard fire behavior fuel models (Anderson 1982) and the more recent custom fuel models developed for Southern California (Weise and Regelbrugge 1997). According to the model classifications, fuel models used for fire behavior modeling (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 modeling efforts. 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
- 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 (Scott and Burgan 2005) developed for use in the BehavePlus modeling system. These new models attempt to improve the accuracy of the 13 standard 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 40 new 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.

For The Meadows Specific Plan Project BehavePlus analyses, fuel model assignments were based on observed field conditions. As is customary for this type of analysis, the terrain and fuels directly adjacent to the proposed development and fuel modification zones (FMZ) 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.

Disturbed habitat (mowed grasslands) was observed throughout the proposed development site. This fuel type can produce flying embers that may affect the project, but defenses have been built into the structures to prevent ember penetration. Table C-1 provides a description of the fuel model (Fuel Model Gr1[1]) observed on the site that was subsequently used in the analysis for this project. Dudek also conducted modeling of the site for post-development recommendations for this project (Table C-2). Fuel modification includes paved streets and irrigated landscaping on the periphery of the Project. For modeling the post-development condition, the fuel model assignment was re-classified from Gr1 to Fuel Model 8.

Table C-1. Existing Fuel Model Characteristics

Fuel Model Assignment	Vegetation Description	Location	Fuel Bed Depth (Feet)
Gr1	Moderate Load, Dry Climate Grass	Represents mowed grasslands (disturbed habitat) throughout the property.	<2.0 ft.

Table C-2. Post-development Fuel Model Characteristics

Fuel Model Assignment	Vegetation Description	Location	Fuel Bed Depth (Feet)
8	Compact litter	Represents irrigated landscapes and paved streets in proposed development.	<0.5 ft.

2.2 Weather

To evaluate different scenarios, analyses were conducted for both the 50th percentile weather (summer, on-shore winds) and the 97th percentile weather (fall, off-shore winds) conditions. Fuel moisture and wind speed information data was incorporated into the BehavePlus modeling runs. The input wind speed and direction is roughly an average surface wind at 20 feet above the vegetation over the analysis area. Table C-3 summarizes the weather and wind input variables used in the BehavePlus modeling efforts.

1 Fuel Model GR1 uses dynamic transfer of herb fuel load from live to dead. The primary carrier of fire is sparse grass, though small amounts of fine dead fuel may be present. The grass in GR1 is generally short, either naturally or by heavy grazing, and may be sparse or discontinuous. Moisture of extinction of GR1 is indicative of dry climate fuel beds, but may also be applied in high-extinction moisture fuel beds, because in both cases predicted spread rate and flame length are low compared to other GR models. Surface Fuel Model Descriptions, National Wildfire Coordinating Group, www.nwcg.gov.

Table C-3. Fuel Moisture and Wind Inputs

Variable	Summer Weather Condition (50th Percentile)	Peak Weather Condition (97th Percentile)
1h Moisture	5%	1%
10h Moisture	6%	2%
100h Moisture	12%	6%
Live Herbaceous Moisture	48%	30%
Live Woody Moisture	96%	50%
20-foot Wind Speed (mph)	20	40
BehavePlus Wind Adjustment Factor	0.4	0.4

2.3 Slope

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. For the BehavePlus analysis, the slope value (10%) was determined by field observation at the locations for each modeling scenario. Slope gradients for landscaped areas are assumed to be relatively flat (3%).

3 BehavePlus Analysis

To objectively predict flame lengths, intensities, and spread rates, the BehavePlus V6 fire behavior modeling system (Andrews, Bevins, and Seli 2004) was used in four modeling scenarios and incorporated observed fuel types representing the dominant on-site and off-site vegetation, slope gradients, and wind and fuel moisture values. Modeling scenario locations were selected to better understand different fire behavior that may be experienced on or adjacent to the site. The results of fire behavior modeling analysis for pre- and post-development conditions are presented in Tables C-4 and C-5, respectively. Identification of modeling run (fire scenarios) locations is presented graphically in Fire Protection Plan Figure 4, BehavePlus Fire Behavior Analysis Map exhibit in the Project's FPP.

Fire Scenario locations and descriptions:

- Scenario 1. Fire flaming front approaching from the San Gabriel Mountains to the north through the existing mowed grasslands vegetation on site (Fuel Model Gr1), with strong northeastern Santa Ana winds. Post-development includes the irrigated landscaping and paved streets (Fuel Model 8).
- Scenario 2. Fire flaming front approaching from the northeast from Bailey Canyon towards the eastern side of the project, through the existing mowed grasslands (Fuel Model Gr1), with strong northeastern Santa Ana winds. Post-development includes the irrigated landscaping and paved streets (Fuel Model 8).

Table C-4. Fire Behavior Modeling Results for Existing Conditions

Fire Scenarios	Flame Length (feet)	Fireline Intensity (BTU/feet/second)	Spread Rate (mph)	Spotting Distance (miles)
Scenario 1: mowed grasslands, 10% uphill slope, 40 mph high wind speed				
Fuel Model Gr1	4.0	115	0.7	0.4
Scenario 2: mowed grasslands, 10% uphill slope, 40 mph high wind speeds				
Fuel Model Gr1	4.0	115	0.7	0.4

Notes:
Spotting distance from a wind driven surface fire.

Table C-5. Fire Behavior Modeling Results for Post-Project Conditions

Scenario	Flame Length (feet)	Fireline Intensity (BTU/feet/second)	Spread Rate (mph)	Spotting Distance (miles)
Scenario 1: Irrigated landscaping, 3% uphill slope, 40 mph high wind speed				
Irrigated landscaping/ pavement (FM8)	3.0	62	0.2	0.3
Scenario 2: Irrigated landscaping, 3% uphill slope, 40 mph high wind speeds				
Irrigated landscaping/ pavement (FM8)	3.0	62	0.2	0.3

As presented in Table C-4 (Existing Conditions), wildfire behavior in mowed grasslands, presented as a Fuel Model Gr1, can be expected to have flame lengths of approximately 4.0 feet with 40 mph winds (extreme fire weather conditions). Spread rate for mowed grasslands fuel beds is about 0.2 mph (extreme offshore winds). Spotting distance, where airborne embers can ignite new fires downwind of the initial fire, would be about 0.3 miles.

As presented in Table C-5 (Post-Project Conditions), Dudek conducted modeling of the site for post-development fuel recommendations for this project. Fuel modification includes paved streets and irrigated landscaping on the periphery of the Project. For modeling the post-development condition, the fuel model assignment was re-classified for irrigated landscaping (Fuel Model 8). Conversely, the irrigated landscape areas experience a reduction in flame length and intensity. The 4.0-foot (mowed grass fuel bed) tall flames predicted during pre-development modeling during extreme weather conditions are reduced to about 3.0 feet tall at the outer edges of the development due to the higher live and dead fuel moisture contents.

It should be noted that the results presented in Tables C-4 and C-5 depict values based on inputs to the BehavePlus software. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis, but models provide a worst-case wildfire condition as part of a conservative approach. Further, this modeling analysis assumes a correlation between the project site vegetation and fuel model characteristics. 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.

The information in Table C-6 pertains to interpretation of flame length and fireline intensity as it relates to fire suppression efforts. Based on the post-development calculated flame lengths of under 3.0 feet tall, fire fighters should be able to conduct a direct attack on the fire.

Figure 1. Flame length is the distance measured from the average flame tip to the middle of the flaming zone at the base of the fire. It is measured on a slant when the flames are tilted due to effects of wind and slope. Flame length is an indicator of fireline intensity. nwcg.gov

Table C-6. 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

Ignition-Resistant Construction Requirements

APPENDIX D
Ignition Resistant Construction Requirements

As of the date of this fire protection plan, the following are the requirements for ignition resistant construction for The Proposed Project, including requirements under Chapter 7A of the California Building Code (CBC). In addition, exterior building construction including roofs, eaves, exterior walls, doors, windows, decks, and other attachments must meet the most current CBC Chapter 7A ignition resistance requirements at the time of building permit application.

1. All structures will be built with a Class A roof assembly, including a Class A roof covering. Roofs shall have a roofing assembly installed in accordance with its listing and the manufacturer's installation instructions.
2. Where the roof profile allows a space between the roof covering and roof decking, the spaces shall be constructed to prevent the intrusion of flames and embers, be fire stopped with approved materials or have one layer of minimum 72 pound mineral-surfaced non-perforated cap sheet complying with ASTM D 3909 installed over the combustible decking. However, openings on barrel tiles or similar roof coverings, must be fire stopped (bird stopped) with approved materials to prevent the accumulation of debris, bird nests, etc. between the tiles and decking material.
3. When provided, exposed valley flashings shall be not less than 0.019-inch (No. 26 galvanized sheet gage) corrosion-resistant metal installed over a minimum 36-inch-wide underlayment consisting of one layer of minimum 72 pound mineral-surfaced non-perforated cap sheet complying with ASTM D 3909 running the full length of the valley.
4. All rain gutters, down spouts and gutter hardware shall be constructed from metal or other non-combustible material to prevent wildfire ignition along eave assemblies.
5. All chimney, flue or stovepipe openings attached to a fireplace, stove, or other solid or liquid fuel burning equipment or device shall be equipped with an approved spark arrester. An approved spark arrester is defined as a device intended to prevent sparks from escaping into the atmosphere and constructed of nonflammable materials, having a 12-gauge minimum thicknesses with openings no greater than ½ inch, or other alternative material the Fontana Fire Protection District determines to provide equal or better protection. It shall be installed to be visible for the purposes of inspection and maintenance.
6. The exterior surface materials shall be non-combustible, including hard or ignition resistant, such as stucco. In all construction, exterior walls shall extend from the top of the foundation to the roof and terminate at 2-inch nominal solid blocking between rafters at all roof overhangs, or in the case of enclosed eaves, terminate at the enclosure.
7. All eaves, fascias, and soffits will be enclosed (boxed) with non-combustible materials. This shall apply to the entire perimeter of each structure. Eaves of heavy timber construction are not required to be enclosed as long as attic venting is not installed in the

eaves. For the purposes of this section, heavy timber construction shall consist of a minimum of 4”x 6” rafter tails.

8. Paper-faced insulation shall be prohibited in attics or ventilated spaces.
9. Automatic interior fire sprinklers for single-family residences shall be installed according to the National Fire Protection Association (NFPA) 13D 2016 edition - *Standard for theInstallation of Sprinkler Systems in One and Two-family Homes and Manufactured Homes*.
10. Roof vents, dormer vents, gable vents, foundation ventilation openings, ventilation openings in vertical walls, or other similar ventilation openings shall be louvered and covered with 1/8-inch, noncombustible, corrosion-resistant metal mesh or other approved material that offers equivalent protection. Turbine attic vents shall be prohibited.
    - Specialized vents with baffle systems or other methods to catch burning embers, such as Brandguard (www.brandguardvents.com) or approved equivalent shall be considered by the San Diego County Fire Authority and Building Official for all structure vents on all homes/garages in the Proposed Project.
11. Attic or foundation ventilation louvers or ventilation openings in vertical walls shall not exceed 144 square inches per opening and shall be covered with 1/8” inch mesh corrosion-resistant metal screen or other approved material that offers equivalent protection. Ventilation louvers and openings may be incorporated as part of access assemblies.
12. No attic ventilation openings or ventilation louvers shall be permitted in soffits, in eave overhangs, between rafters at eaves, or in other overhanging areas.
13. All fences and gate assemblies (fences, gates, and fence posts) attached or within five feet of a structure shall be of non-combustible material or pressure-treated exterior fire-retardant wood.
14. All projections (exterior balconies, decks, patio covers, unenclosed roofs and floors, and similar architectural appendages and projections) or structures less than five feet from a building shall be of non-combustible material, one-hour fire resistive construction on the underside, heavy timber construction, pressure-treated exterior fire- retardant wood or ignition resistant construction. When such appendages and projections are attached to exterior fire- resistive walls, they shall be constructed to maintain same fire-resistant standards as the exterior walls of the structure.
15. Accessory structures attached to buildings with habitable spaces and projections shall be in accordance with Chapter 7A of the CBC.

16. Detached accessory structures located less than 50 feet from a building containing habitable space shall be constructed in accordance with Chapter 7A of the CBC.
    - ***Exception:*** *Accessory structures less than 120 square feet in floor area located at least 30 feet from a building containing a habitable space.*
17. Exterior doors shall be approved non-combustible construction, solid core wood and shall conform to the performance requirements of standard SFM 12-7A-1 or shall be of approved noncombustible construction, or solid core wood having stiles and rails not less than 1⅜ inches thick with interior field panel thickness no less than 1¼ inches thick, or shall have a fire-resistance rating of not less than 20 minutes when tested according to National Fire Protection Association (NFPA) 252.
18. All glass or other transparent, translucent or opaque glazing materials, that is used in exterior windows, including skylights, or exterior glazed door assemblies shall be constructed of multipane glazing with one tempered pane meeting the requirements of Section 2406 (2013 CBC) Safety Glazing. .
19. Vinyl window assemblies are deemed acceptable if the windows have the following characteristics:
    - Frame and sash are comprised of vinyl material with welded corners
    - Metal reinforcements in the interlock area
    - Glazed with insulating glass, annealed or tempered (one layer of which must be tempered glass).
    - Frame and sash profiles are certified in AAMA Lineal Certification Program.
    - Certified and labeled to ANSI/AAMA/NWWDA 101/LS2-97 for Structural Requirements.

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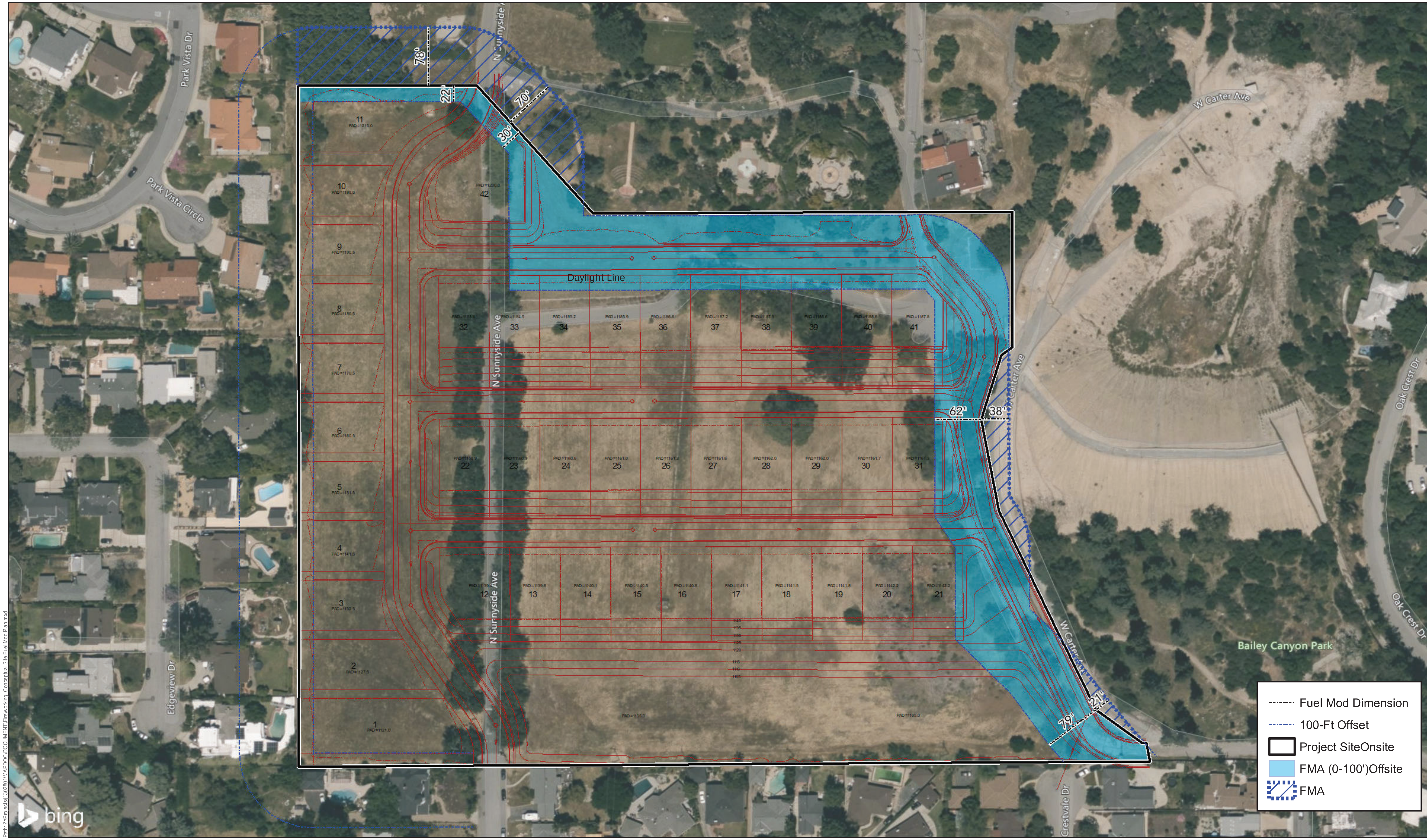
Appendix E

Conceptual Site Fuel Modification Plan



SOURCE: AERIAL-BING MAPPING SERVICE

DUDEK

0 60 120 240 Feet

APPENDIX E

Conceptual Site Fuel Modification Plan

Fire Protection Plan for the Meadows at Sierra Madre Project

Appendix F

Prohibited Plant List

UNDESIRABLE PLANT LIST

The following species are highly flammable and should be avoided when planting within the first 50 feet adjacent to a structure. The plants listed below are more susceptible to burning, due to rough or peeling bark, production of large amounts of litter, vegetation that contains oils, resin, wax, or pitch, large amounts of dead material in the plant, or plantings with a high dead to live fuel ratio. Many of these species, if existing on the property and adequately maintained (pruning, thinning, irrigation, litter removal, and weeding), may remain as long as the potential for spreading a fire has been reduced or eliminated.

BOTANICAL NAME	COMMON NAME
Abies species	Fir Trees
Acacia species	Acacia (trees, shrubs, groundcovers)
*Adenostoma sparsifolium***	Red Shanks
*Adenostoma fasciculatum***	Chamise
Agonis juniperina	Juniper Myrtle
Araucaria species	Monkey Puzzle, Norfolk Island Pine
*Artemesia californica***	California Sagebrush
Bambusa species	Bamboo
Cedrus species	Cedar
Chamaecyparis species	False Cypress
Coprosma pumila	Prostrate Coprosma
Cryptomeria japonica	Japanese Cryptomeria
Cupressocyparis leylandii	Leylandii Cypress
*Cupressus forbesii***	Tecate Cypress
Cupressus glabra	Arizona Cypress
Cupressus sempervirens	Italian Cypress
Dodonea viscosa	Hopseed Bush
*Eriogonum fasciculatum***	Common Buckwheat
Eucalyptus species	Eucalyptus
*Heterotheca grandiflora***	Telegraph Plant
Juniperus species	Junipers
Larix species	Larch
Lonicera japonica	Japanese Honeysuckle
Miscanthus species	Eulalia Grass
*Muehlenbergia species***	Deer Grass
Palmae species	Palms
Picea species	Spruce Trees
*Pickeringia Montana***	Chaparral Pea
Pinus species	Pines
Podocarpus species	Fern Pine
Pseudotsuga menziesii	Douglas Fir
Rosmarinus species	Rosemary
*Salvia mellifera***	Black Sage
Taxodium species	Cypress
Taxus species	Yew
Thuja species	Arborvitae
Tsuga species	Hemlock
*Urtica urens***	Burning Nettle

** San Diego County native species

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County of Los Angeles Fire Department. 1998. Fuel Modification Plan Guidelines. Appendix I, Undesirable Plant List, and Appendix II, Undesirable Plant List.