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OLIVENHAIN-ENCINITAS FIRE EVACUATION PLAN ANALYSIS REPORT

ENCINITAS, CA.

DATE: March 10, 2021

Prepared for Olivenhain Community Group

By

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SECTION 1
INTRODUCTION

This Fire Safety and Evacuation Plan Analysis Report (FSEPAR) has been prepared at the request of the Olivenhain Community Group) for the purpose of validating the effectiveness of the Olivenhain-Northeast Encinitas Evacuation Plan (hereafter, The Plan) in the incorporated City of Encinitas, CA.

The purpose of the FSEPAR is to:

- Assess the potential impacts resulting from off-site wildland fire hazards
- Review the current Evacuation Plan for accuracy and effectiveness
- Analyze Fire Behavior Influencing The Plan using Fire Modeling
- Assess anticipated fire behavior with current Evacuation Plan time parameters

1.1 Location, Description and Environmental Setting

1.1.1 Location

The Olivenhain community is located in the northeast sections of the City of Encinitas. It is approximately 3-1/2 miles east of the Pacific Ocean and thirty-seven (37) miles north of the United States-Mexico international border.

1.1.2 Community Description

Olivenhain is the eastern-most suburban community in the City of Encinitas, located in the North County area of San Diego County.

Olivenhain is a suburban area of single-family custom homes with large lots (ranging between one-half and five acres) set in rolling hills with relatively narrow, winding streets and roads. Most neighborhoods have a mixture of home ages, with nearly all of the residential units built between 1970 and 1999.

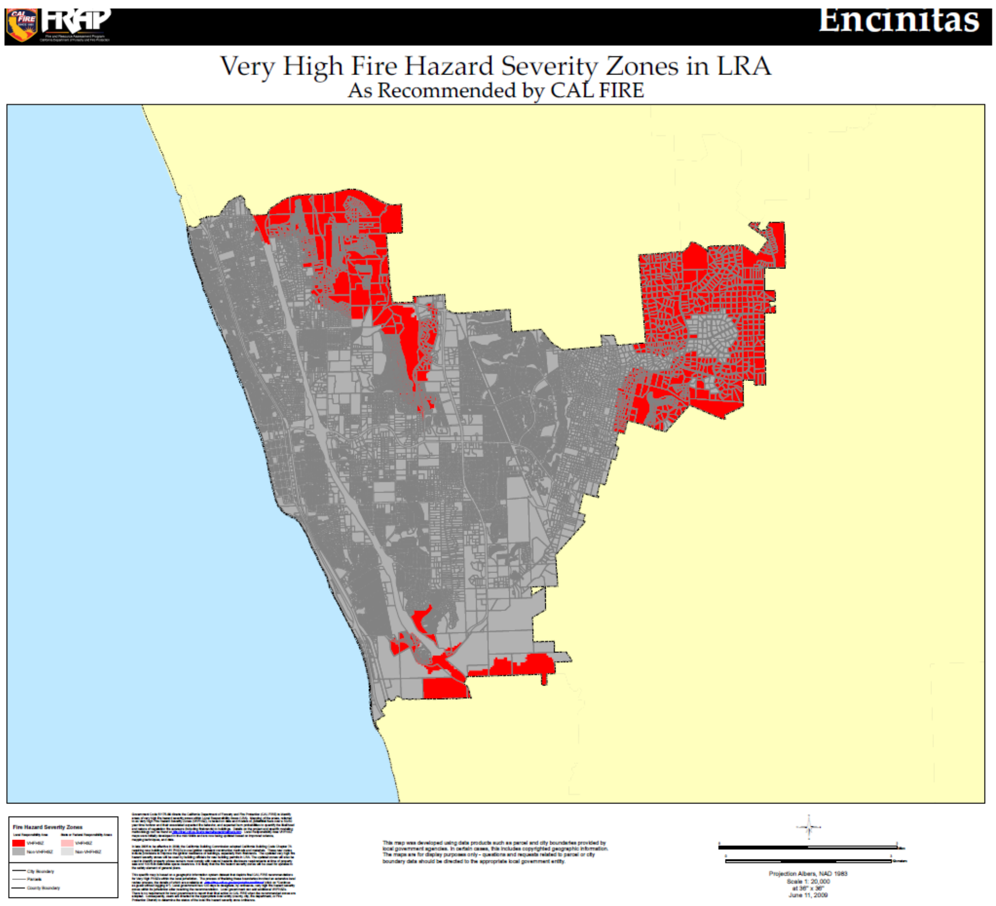
Olivenhain has an extensive network of recreational trails used by pedestrians and equestrians.

As reported in the San Diego Union Tribune and *Wildfire Today* (September 28, 2008), the Forest Area Safety Task Force identified Olivenhain as one of three areas in San Diego County that are most susceptible to large, damaging wildfires. These three areas have not had a major fire event in approximately fifty (or more) years. The projections are based on the age and density of vegetative fuel beds, geographic characteristics and proximity to population centers. The Task Force's objective in identifying these specific areas is to identify where State and Federal funds could be used to preventative and mitigation work projects to lower community fire risks by fuel thinning efforts and construction of new firebreaks.

The area identified by the Task Force affecting Olivenhain is approximately 32,000 acres of land that also encompass portions of Rancho Penasquitos in the City of San Diego, Rancho Santa Fe and the Rancho Santa Fe sub-communities of Fairbanks Ranch, Del Dios and 4-S Ranch.

1.1.2.1 Fire Severity Hazard Zones

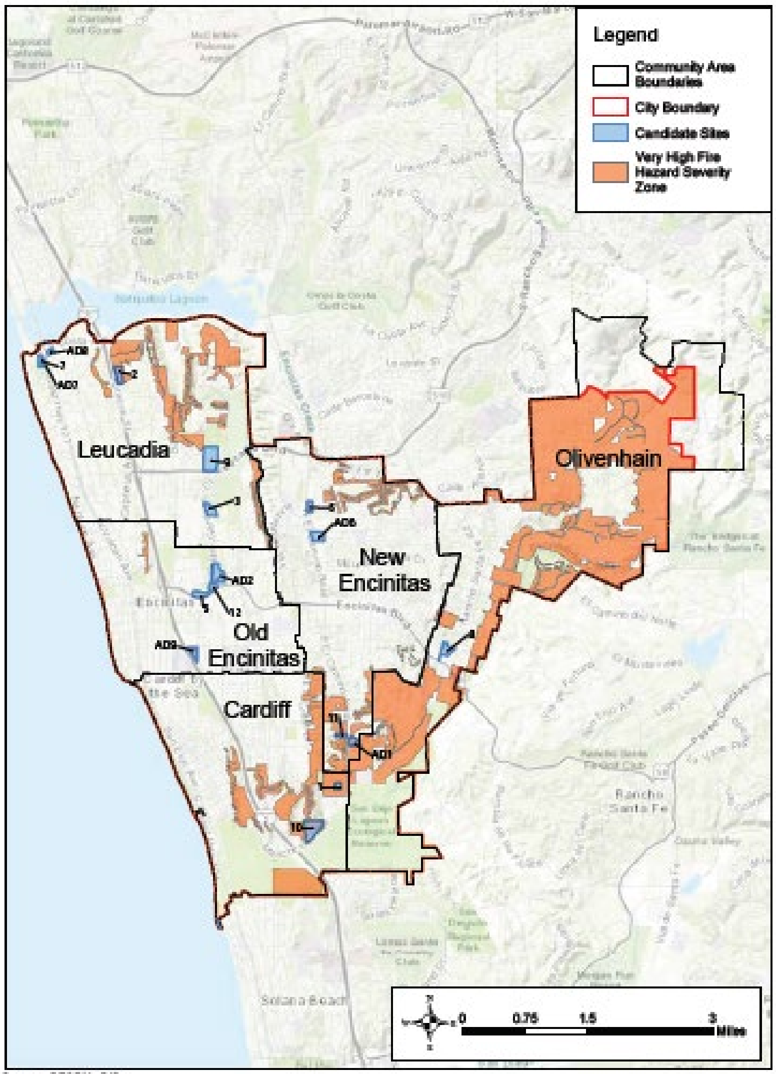
The California Office of the State Fire Marshal, through the California Department of Forestry and Fire Protection (CAL-FIRE) Fire & Resource Assessment Program (FRAP), has published Recommended Very High Fire Severity Maps in Local Responsibility Areas (LRA) for all Counties (unincorporated lands) and Cities (incorporated lands).



The northeast corner of the City of Encinitas, which includes the Olivenhain sub-community, has been designated as a Very High Fire Severity Area (VHFSA).

Government Code Section 51179 allows local agencies (City of Encinitas) to designate , by ordinances, VHFSA lands within their individual jurisdictions if any standards imposed by the ordinance that are equivalent to, or more restrictive than, the standards imposed by the Government Code.

The City of Encinitas has designated more extensive VHFSA lands in the City than CAL-FIRE mapping indicates. The majority of Olivenhain and the Escondido Creek wetlands habitat and southeastern portions of the City are included in the designated VHFSA mapped-lands.



Source: RECON, GIS.

1.1.2.1.1 Background Information on Fire Severity Areas

While all of California is subject to some degree of fire hazard, there are specific features that make some areas more hazardous.

CAL FIRE is required by law to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZ), influence how people construct buildings and protect property to reduce risks associated with wildland fires.

The Fire Hazard Severity Zone maps were developed using a science-based and field-tested computer model that assigns a hazard score based on those factors influencing the likelihood of fire and projected fire behavior if an ignition occurs. Many factors are considered, such as fire history, existing and potential fuel (natural vegetation), flame length, blowing embers, terrain, and typical weather for the area. There are three hazard zones in state responsibility areas: moderate, high and very high. Urban and wildland areas are treated differently in the model, but the model does recognize the influence of burning embers traveling into urban areas, which is a major cause of fire spread.

The Fire Hazard Severity Zones identify fire hazard, not fire risk.

"Hazard" is based on the physical conditions that influence the likelihood that an area will burn over a 30 to 50-year period without considering fire safety modifications such as fuel reduction efforts.

Fire Hazard Elements

Vegetation Fire Hazard Elements considers the potential vegetation over a 30- to 50-year time horizon. Vegetation is "fuel" to a wildfire and changes over time.

Hazard determination parameters include:

- Topography - Fire typically burns faster up steep slopes.
- Weather - Fire moves faster under hot, dry, and windy conditions.
- Crown Fire Potential - Under extreme conditions, fires burn to the top of trees and tall brush.
- Ember production and movement - Fire brands are embers blown ahead of the main fire. Fire brands influence the spread of wildfires. They also infiltrate buildings through unprotected openings, resulting in ignitions of the buildings.
- Likelihood - Chances of an area burning over a 30- to 50-year time period based on history and other factors. Hazard considers the potential vegetation over a 30- to 50-year time horizon.

"Risk" is the potential damage a fire can do to the area under existing conditions, including any modifications such as defensible space, irrigation and sprinklers, and ignition resistant building construction which can reduce fire risk. Risk considers the susceptibility of what is being protected.

Fire Hazard Severity Zone maps are intended to be used for:

• Implementing wildland-urban interface building standards for new construction

• Natural hazard real estate disclosures at time of real estate sales

• 100-foot defensible space clearance requirements around buildings
• Property development standards such as road widths, water supply and signage
• Consideration in city and county general plans

Fire Hazard Severity Zones are created by computer modeling in areas of similar terrain, vegetation, and fuel types. These areas have relatively similar burn probabilities and fire behavior characteristics. The zone size varies from 20 acres and larger in urbanized areas to 200 acres and larger in wildland areas. Urban areas are treated differently in mapping due to the significant changes in both fuel conditions and burn probability that occur as areas become urbanized.

Urban zones are delineated based on minimum area and average parcel size. They must be at least 20 acres in size, and contain average parcel sizes that are less than two acres per parcel. In most counties, urban zones were developed using parcel data. Where such data was not available parcel density was interpreted using census data and statewide vegetation map data. In practice, the majority of areas mapped as urban zones have parcel sizes less than one acre, with highly developed infrastructure and ornamental vegetation.

1.1.2.1.2 Analysis of Fire Severity Area Designations

Based on physical site visits and analysis of aerial photography images, the designation of the Olivenhain sub-community as a Very High Severity Area is justified:

- The Escondido Creek drainage passing through the community is a wetland habitat with strict fuel management constraints.
- The Escondido Creek drainage has an extremely high concentration of various and unmanaged vegetative fuel types, with decadent high dead-to-live canopy/crown content and large tons per acre fire loading.
- There are large expanses of unmanaged chaparral and other brush species vegetation present across the landscape, often intermixed and inside of developed residential neighborhoods.
- Chaparral, brush and scrub vegetation communities do not appear to be subject to standard Wildland-Urban Interface Zone fuel management practices, providing direct linkages for fire propagation from natural vegetative fuels to adjacent structural fuel packages.
- The majority of the community has a substantial number of flammable tree species planted in close proximity to, and often overhanging, residential and commercial buildings.
- Fuel modification and defensible space construction and maintenance around residential and commercial buildings is marginal in some areas.
- Fire modeling of the off-site and in-community vegetation fuel beds indicate that downwind fire brand depositions may be as long as 2 miles from the fire front, with 100% ignition of receptive downwind vegetation, resulting in separate fires requiring fire department intervention.

- Fire modeling of off-site brush, chaparral and scrub vegetation species indicate, with high degree of accuracy, rapid to extreme rates of spread.
- Fire history within and outside of the Olivenhain sub-community indicates that there have been no major fires impacting the area for an extended period of time (90+ years).
- The Fire Return Interval for most California native brush, scrub and chaparral fuels ranges between ten (10) and one-hundred (100) years
- Long (50 to 100+ years) Fire Return Intervals are indicative of high intensity burning of large areas of fuel with flame lengths exceeding 2.4 meters and high severity fires where most of the vegetation above ground level is completely destroyed.

1.1.2.2.1 – Roads

Rancho Santa Fe Road

Rancho Santa Fe Road is a public road with a south-to-north configuration, beginning approximately 0.35 miles southeast of its intersection with Encinitas Blvd. and ending at its intersection with South Santa Fe Avenue in the City of San Marcos, a driving distance of approximately 7.9 miles.

Rancho Santa Fe Road & Encinitas Blvd. Intersection, Looking North of Rancho Santa Fe Road

North of Encinitas Blvd., Rancho Santa Fe Road has two lanes and an improved paved width of approximately thirty-one (31') feet. There are single north-bound and southbound driving lanes at this location. The road surface is distressed asphaltic concrete, also known as macadam paving or asphalt, which requires repairs and repaving.

Rancho Santa Fe Road near Encinitas Blvd., Looking North

Rancho Santa Fe Road remains a relatively narrow two-lane public paved roadway with a straight line configuration. It angles slightly in a southwest-to-northeast direction, for approximately 1.01 miles. The area is essentially semi-rural residential, with the majority of intersections with side streets controlled by four-way stop signs.

Typical Rancho Santa Fe Road Conditions North of Encinitas Blvd.

<u>Encinitas Blvd.</u>

Encinitas Blvd. has an east-to-west configuration, beginning at its intersection with Rancho Santa Fe Road and ending at its intersection with North Coast Highway 101, a distance of approximately 3.5 miles.

Encinitas Blvd provides five traffic lanes, two for west-bound traffic, two for east-bound traffic and a center divide turning lane for its entire length through the City of Encinitas. The surface covering is also macadam/asphalt and some portions of the roadway have distressed pavement in need of repair and repaving.

Typical Road Conditions on Encinitas Blvd., West of Rancho Santa Fe Road

<u>Manchester Avenue</u>

Manchester Avenue is a public street that begins at the intersection also shared by Rancho Santa Fe Road and Encinitas Blvd.

Manchester Avenue has a north-to-south configuration with two travel lanes for most of its 2.57 mile length before intersecting with the right-of-way corridor with Interstate 5.

Typical Road Conditions on Manchester Avenue South of Rancho Santa Fe Road

1.1.2.2.2 - 2016 Average Daily Trip Report Findings

The City of Encinitas commissioned a Traffic Study for primary streets in 2016. Analysis of the data indicates the following twenty-four and one-hour traffic loading for the following streets for 2015:

Rancho Santa Fe Road

- Between El Mirlo/La Bajada and Manchester Avenue – 18500 daily/770 hour
- Between Encinitas Blvd and El Camino Norte – 13200 daily/ 550 hour

Manchester Avenue

- Between Interstate 5 and El Camino Real – 19600 daily/ 817 per hour
- Between El Camino Real & Encinitas Blvd – 6000 daily/250 per hour

Encinitas Blvd.

- Between El Camino Real & Balour – 26800 daily/1117 hour
- Between Balour & Delphinium – 27400 daily/1142 hour
- Between Delphinium & Saxony – 31700 daily/1321 hour
- Between Saxony & Interstate 5 – 32400 daily/1350 hour

El Camino Real

- Between Manchester & Santa Fe Drive – 23000 daily/958 per hour
- Between Santa Fe Drive & Encinitas Blvd – 33200 daily/ 1384 hour

The El Camino Real right-of-way corridor is included in the analysis because a portion of the evacuation traffic may be diverted off Encinitas Blvd. in a south bound direction during Santa Ana north east wind event fires.

1.3 Environmental Setting

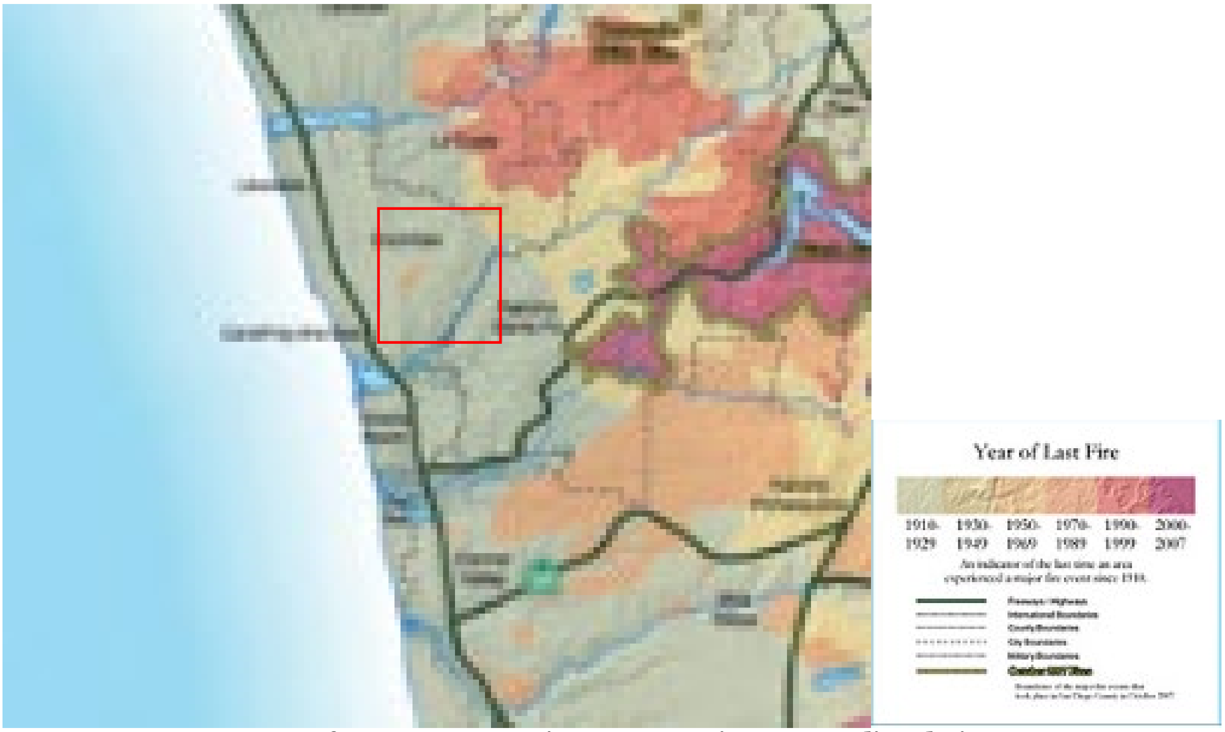
1.1.3.1 Dates of Site Inspections/Visits

The Olivenhain community and its various evacuation routes and roadways were visited and evaluated on:

- January 24, 2021
- January 31, 2021
- February 28, 2021

1.1.3.2 Fire History

According to the San Diego CAL-FIRE Burn History Maps, there has not been a major fire inside the Olivenhain sub-community since the 1910 to 1929 era.



Excerpt of CAL-FIRE San Diego County Fire Map – Olivenhain Area

CAL-FIRE defines a “major wildfire” as large, extended day incidents burning ten (10) acres of more.

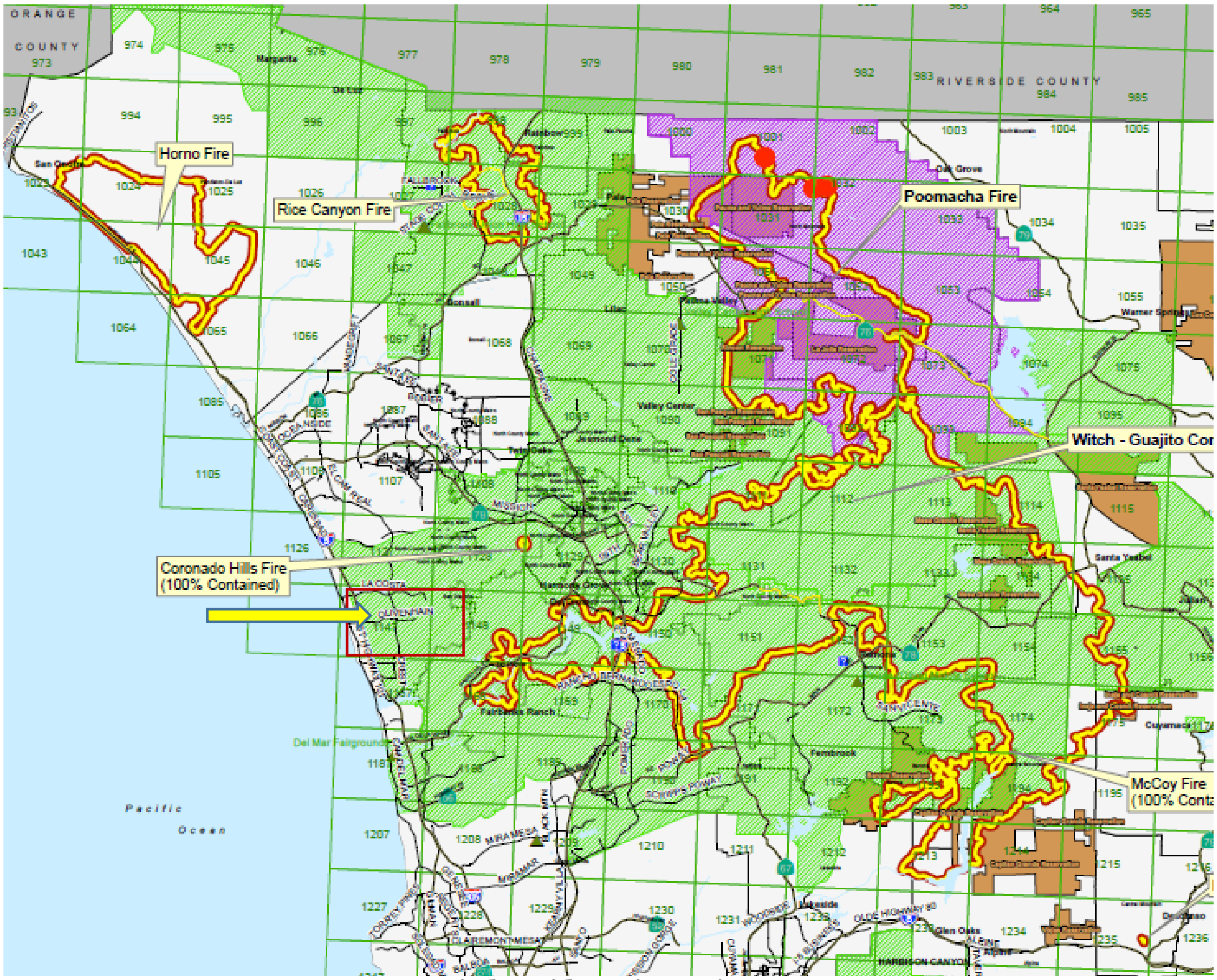
According to the City of Encinitas Emergency Preparedness – Identified Hazards webpage, recent and historical wildfire events occurred in Olivenhain in 1943, 1980 and 1996.

During the 1970 Laguna Fire event in Eastern San Diego County, a 500-acre brush fire east of Encinitas threatened the community before it was stopped at El Camino Real.

In October 1996, the Harmony Grove Fire started near the intersection of Harmony Grove and Elfin Forest Roads during Santa Ana wind conditions. The fire burned 8600 acres and 100 homes and crossed Rancho Santa Fe Road on its southwest perimeter and burned into the La Costa sub-community of the City of Carlsbad. An estimated 3000 people were evacuated ahead of the flame front, clogging Rancho Santa Fe Road in the process. Four homes in Encinitas were burned during this incident.

The Harmony Grove Fire would have entered the Olivenhain area had the initial northeast Santa Ana wind conditions continued throughout the burning period. However, the winds shifted as the fire approached the community and directed fire away from the area and into the southern areas of the City of Carlsbad. In doing so, the northbound evacuation routes stipulated in the Olivenhain Evacuation Plan were overrun and blocked by the flame front.

On October 21, 2007, the Witch Creek Fire started in the Witch Creek area near Santa Ysabel during a Santa Ana Wind event. The fire burned in a southwesterly direction, crossed over Interstate 15, causing significant damage in Lake Hodges, Del Dios and Rancho Santa Fe. While not directly impacting the City, the fire burned to the southeast of the Olivenhain community. The Witch Fire burned 247, 800 acres, destroyed 1852 buildings and forced the evacuation of approximately 500,000 people, including 200,00 in the City of San Diego.



2007 Witch Incident Fire Perimeter Map
Olivenhain & Encinitas Indicated by Red Box and YELLOW Arrow

1.1.3.3 <u>Climate</u>

Like most of Southern California, San Diego County and Olivenhain has a Mediterranean Climate typified by warm to hot dry summers and mild to cool winters. Summer temperatures range between the mid-nineties and low one hundreds during the summer and fall months with occasional extraordinarily hot, dry spells similar to desert conditions occurring. Rainfall averages nine to fifteen inches at the lower elevations of San Diego County. Santa Ana winds are one of the most notable weather conditions in Southern California and San Diego County. Typically, these dry winds occur during the late summer and fall months (September through November) but may happen at any time during the year. With combined adiabatic (compression) heating (for every 1000 feet of elevation decline, temperature increases five degrees) and wind velocities exceeding 40 miles per hour, Santa Ana winds severely exacerbate wildfires, especially during drought conditions.

The U.S. Forest Service Weather Information Management System provides information about weather patterns in San Diego County. Daily afternoon weather observations in San Diego County were analyzed for forty-four years (1961-2005) at selected fire stations. San Diego County is divided into five climate zones between the coast and desert. Weather data between April and December are used to represent the annual fire season in San Diego County, with the most severe fire weather conditions in September and October. The following table was derived by the analysis of San Diego County's Coastal and Interior Climate Zones.

Worst Case Weather and Burning Conditions, Interior Zone

Period	Temperature	Humidity	Wind Speed	Burning Index
Summer	90-109	5-9%	18 mph	153
Santa Ana	90-109	5-9%	24 mph	168
Peak	90-109	5-9%	56 mph	-

Worst Case Weather and Burning Conditions, Coastal Zone

Period	Temperature	Humidity	Wind Speed	Burning Index
Summer	90-109	10-14	19mph	57
Santa Ana	90-109	0-4%	21 mph	112
Peak	90-109	0-4%	26 mph	-

SECTION 2
ANTICIPATED OFF-SITE/IN-COMMUNITY FIRE BEHAVIOR

2.1 Fire Behavior Model

2.1.1 Summary Narrative

After site visits to the Encinitas and the surrounding area, fire behavior for unmanaged, hazardous vegetative fuel beds within ten miles of Olivenhain sub-community were analyzed.

Vegetation fuel models, terrain and topographical inputs were determined by site visits and comparing the findings with two- and three-dimensional maps.

Weather inputs were derived from the County of San Diego Interior Zone Burning Conditions Guidelines Table, 2003 Cedar Fire and 2014 Cocos Fire weather and fuel parameters. Cedar Fire weather and burning characteristics have been established as worst-case fire behavior conditions in San Diego County.

The above data inputs were subjected to primary analysis by the BEHAVE-Plus 5.0.5 Wildland Fire Modeling program to determine potential wild fire behavior in the Olivenhain area.

The BEHAVE-Plus Fire Behavior Prediction and Fuel Modeling System is a computer-based systematic method of predicting wild land fire behavior. It was developed by the U.S. Forest Service at the Intermountain Forest Fire Laboratory, Missoula, Montana, and is used by wild land fire experts and scientists nationwide. BEHAVE-Plus is designed to predict fire spread and describes fire behavior only at the flame front of a fire.

The primary parameter of the BEHAVE fire behavior calculations are dead fuels less than one-quarter (1/4") inch in diameter that readily carry fire across the landscape. Fuels larger than three (3) inches in diameter are not included in the BEHAVE calculations. The BEHAVE fire model describes a wildfire spreading through surface fuels, which are the burnable materials within six (6) feet of the ground and contiguous to the ground.

A second fire modeling program, FireMap, was used to help validate BEHAVE-Plus modeling outputs.

FireMap was developed to perform data-driven predictive modeling and analysis of fires that have high potentials for rapid spread. It enables "what-if" analysis of fire scenarios during pre-incident planning analysis and during real-time fire forecasting. The program is programmed with information about previous fires, past and current weather conditions and information on vegetation and landscapes from a variety of GIS and other sources of information.

Data and modeling sources include:

- FARSITE fire modeling
- Historical fire perimeters – CAL-FIRE FRAP Program and USGS GeoMAC
- Fuels – USGS LANDFIRE Program

2.1.2 Use of Fire Model Inputs – Caveat

The BEHAVE-Plus Fire Behavior Model is a tool used by fire authorities to estimate the behavior of fire moving towards a structure under certain assumptions. The Fire Behavior Modeling is only an estimate and is not designed to replace the experience of the local Fire Authority, who is familiar with local wildfire behavior. The Behave-Plus fire model is not the only recognized fire model that is available; it is one of two fire models identified in this Analysis. BEHAVE is noted as the model currently used by most fire consultants.

Wildland fire behavior calculations have been modeled for the hazardous vegetative fuels on undeveloped lands northeast and south of Olivenhain under Santa Ana wind events and during normal, late summer afternoon weather conditions to determine how wildfires originating in these areas might impact the developed residential and commercial buildings along established evacuation routes in Olivenhain. These projections are based on "worst case" fire scenarios for both environmental conditions.

The computer-based BEHAVE-Plus Version 5.0.5 was used to develop the fire behavior assessments impacting these areas.

Data input values included the following factors:
- Vegetation Fuel Model
- Slope of terrain/topography
- Projected wind speed
- Anticipated weather conditions
- Data collected during Preserve site observations
- Vegetative fuel characteristics observed during site observations
- Typical conditions during the local fire season

The BEHAVE Fire Behavior Calculations display the expected:
- Rate of Fire Spread (expressed in feet per minute)
- Fire Line Intensity (Btu/ft./sec)
- Flame Lengths (feet) for the different vegetation fuel models
- Ember shower distances

The fire behavior values are generally based on peak Santa Ana and typical wind conditions expected in Olivenhain's climate zone.

2.1.3 Fire Behavior Modeling Summary

The data was analyzed by BEHAVE modeling for identification of the following fire behavior parameters:
- Rate of Spread, measured in feet per minute
- Flame length in feet, for horizontal depth of flame front
- Ember shower distance
    - Distance in miles (or portions of miles) downwind of flame front
    - Susceptibility of ignition in percentage points

The BEHAVE program output parameters displays Rate of Spread (ROS) in Chains per Hour. A "chain" is a measured distance of sixty-six (66') feet. The ROS per minute is calculated by a) multiplying the chain distance by sixty (66') feet and (b) dividing this new distance by sixty (60) minutes.

As noted above, flame length is the horizontal *depth* of the flame front and is *not* to be confused by flame height. Flame height is a measurement based on the heat release rate of burning vegetation.

Ember shower distance, termed “Spotting Distance" by BEHAVE, is the distance downwind from the flame front that wind and convection currents will carry burning fire brands, embers or other burning materials before they are deposited by gravity into receptive vegetation fuel beds or other fuels. Susceptibility is a measure of the percentages of ignitions that will occur in the receptive downwind vegetation fuels.

After the BEHAVE modeling was performed, the output data was analyzed and placed in the following Tables:

Table 2.2.1.2 (a) and (b) indicates the *initial* modeled fire behavior for an incident originating at the County of San Diego Department of Parks & Recreation Escondido Creek-University Heights Open Space Preserve, located in the Northern Escondido Creek drainage on Harmony Grove Road, and traveling cross-country in a southwesterly direction towards the Olivenhain and Encinitas in a Coastal Sage and Chaparral vegetation habitat.

Table 2.2.2.1 (a) and (b) indicates *initial* modeled fire behavior from a wildfire beginning in the southern Escondido Creek drainage and moving towards the Rancho Santa Fe Road and Encinitas Blvd. intersection under normal, late summer afternoon wind patterns. The wildfire scenario originates within an unmanaged Coastal Sage and Chaparral vegetation community approximately 1.43 miles from the intersection and moves in a northern and northeastern direction.

2.2.1 Fire Behavior Threat Analysis, Fire Originating in the Northern Escondido Creek Drainage, Santa Ana Wind Event

For purposes of this Analysis, a wildfire event starts at the Escondido Creek-University Heights Open Space Preserve on Harmony Grove Road. The predicted fire behavior of this incident is a worst-case scenario anticipated for a northeast Santa Ana wind event with extreme fire conditions.

The Escondido Creek-University Heights Preserve is approximately 3.37 miles west of the central business district of the City of Escondido, on unincorporated lands in San Diego County, California. It is also approximately 3.5 miles northeast of eastern edge of Olivenhain, 6.5 miles from the intersection of Rancho Santa Fe Road and Encinitas Blvd. and nine (9) miles from downtown Encinitas.

The Preserve is located adjacent to the north side of the Harmony Grove Road right-of-way corridor. Its southwestern border of the Preserve is approximately 1.12 miles north of the Lake Hodges dam and spillway. The Preserve is essentially encircled by six other Preserves owned by the Department of Parks and Recreation, including the Del Dios Highlands County Preserve.

The topography of the Preserve consists of prominent, steep sided mountains, multiple moderately steep to extremely steep side drainages and canyons along primary slopes and meadows of various degrees of flatness and expansiveness.

Vegetation on the Preserve, and on both sides of the Escondido Creek drainage, is a mixture of Southern California Chaparral, and Coastal Sage shrub and brush types. The grass, chaparral and brush-shrub type fuels have different continuities, ranging from moderately-interrupted to dense and uninterrupted, with maximum fuel heights exceeding five (5') feet over extended areas of the drainage. A significant amount of the vegetation appears to have a high dead-to-live fuel ratio.

Site visits to the Escondido Creek Drainage have determined that the vegetative fuels could be classified as one or more of the following Fuel Types:

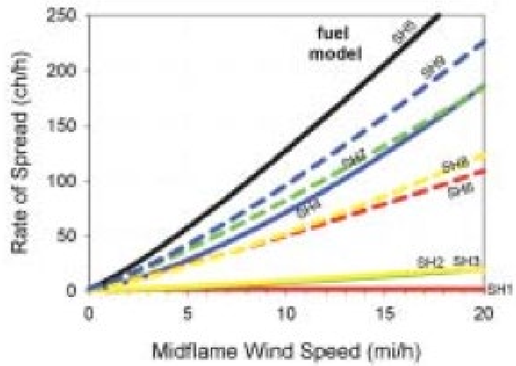
- Fuel Model GS-2, Moderate Load, Dry Climate Grass-Shrub
- Fuel Model SH-5, Heavy Load, Dry Climate Shrub
- Fuel Model SCAL-18 Southern California Coastal Sage Shrub
- Fuel Model 4, Chaparral
- Fuel Model TU-5

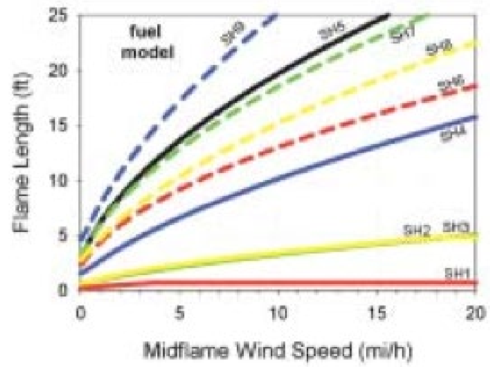
The impact of the 2014 Cocos Fire on vegetation ecology immediately around and adjacent to the Preserve created generalized type-conversion of vegetative fuels over an extensive area.

The 1996 Harmony Grove Fire also caused fuel type conversions further southwest of the Open Space Preserves along the path of the drainage. Current and former fuel beds in the drainage are, or were, Fuel Models SH-5, High Load Dry Climate Shrubs and SH-7, Very High Load Dry Climate Shrubs, both of which are equivalent to Fuel Model 4 (Chaparral) in the older Fuel Model literature.

2.2.1.1 Vegetative Fuel Fire Assessment

The primary carrier of fire in the SH fuel models is live and dead shrub twigs and foliage, in combination with dead and down shrub litter. A small amount of herbaceous fuel may be present, especially in SH1 and SH9, which are dynamic fuel models (their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content). The effect of live herbaceous moisture content on spread rate and flame length can be strong in those dynamic SH models.





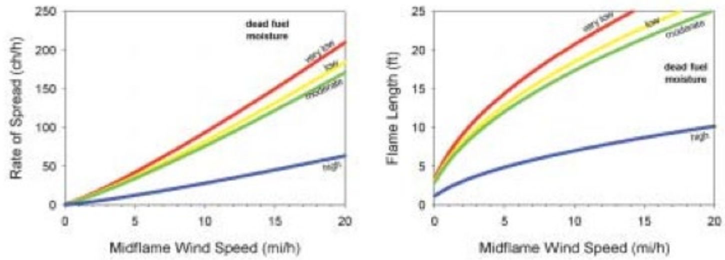
SH-5 Heavy Load, Dry Climate Shrubs

The primary carrier of fire in SH-5 is woody shrubs and shrub litter. There will be a heavy concentration of fuel loading of 6.5 tons or more. Vegetation will have relatively uninterrupted canopies with depths between four (4’) to six (6’) feet deep and across. The Rate of Spread and Flames Lengths will be very high. The extinction moisture content is low at 15%.

Typical Vegetation on Wild Willow Hollow Road at the Escondido Creek-University Heights Open Space Preserve
6 foot tall fuel measuring stick for reference

SH-7 Very Heavy Load, Dry Climate Shrubs

The primary carrier of fire in SH-7 is woody shrubs and shrub litter. The vegetative fuel has very heavy shrub loading, with a depth of four (4 to 6') to six feet. The Rate of Spread, while considered high, is lower than SH-5 fuels, but the flame lengths are similar and usually very high. Fuel loading is 6.9 tons per acre and the extinction moisture content is low at 15%.



Fuel Model 4 – Chaparral

Fuel Model 4, as described in *Aids for Determining Fuel Models for Estimating Fire Behavior*, applies to shrub type vegetation that have high to extreme fire intensities with fast spreading fires that involve the foliage and live and dead fine woody materials in the crowns of a nearly continuous over-story.

Typical FM-4 shrub fuels are stands of mature brush or shrubs, with canopies heights of six (6') feet or more.

Besides the flammability of foliage, the dead woody material in chaparral stands significantly contributes to fire intensity. A deep litter layer may also hamper fire suppression efforts.

Fuel loading per acre has several variables:

- 3"diameter, dead and live vegetation – 13.0 tons
- ¼" diameter, dead and live vegetation – 5 tons
- Live load foliage – 5 tons
- Total potential fuel loading – 23 tons per acre

Comparison of Fuel Model SH-5 Heavy Load Shrub on Wild Willow Hollow Road (left) and Fuel Models Sh-7 and FM-4 (right) on Mountain Side South of Harmony Grove Road (January 2020)

2.2.1.2 Fire Behavior Threat Analysis

An evaluation of the Escondido Creek Drainage indicates it may be exposed to a number of foreseeable wild fire threats. For purposes of this Analysis, the modeled and predicted fire behavior was a worst-case scenario based on the environmental and weather parameters and anticipated fire behavior on the Preserve, the Drainage and the evacuation routes in the Olivenhain community.

Fuel Model SH-5, Heavy Load Dry Climate Shrub, was selected for the typical burning conditions scenarios denoted in the Table 2.2.1.2(a). This fuel model is the most prevalent vegetation type present in the heavy, dense chaparral habitat community on the *north* side of Harmony Grove Road at the area of origin.

Santa Ana Northeast winds, with velocities of 30 mph, or more, will influence the fire's head (leading edge of the flame front) and drive the fire across the landscape in a southwesterly direction with a high rate of flame spread. Rate of spread, based on wind speed, topography and vegetative fuel types is anticipated to 668 feet per minute (7.6 miles per hour).

For purposes of the fire behavior analysis, a mid-fall Santa Ana wind event occurs, duplicating the weather and fuel conditions present at the point of origin for the 2014 Cocos Fire:

- 100 degrees,
- 3- 10% RH,
- NE winds 21, gust to 28

Location	Fuel Model	Rate of Spread	Flame Length	Ember Shower Distance/%
Harmony Grove Road, Northeast Corner of Preserve	SH-5	585.42 feet/minute (6.65 mph)	44.6 feet	1.7 miles / 100%

Table 2.2.1.2(a) Fuel Model SH-5 – Heavy Load Dry Climate Shrub Burning Conditions Northern Escondido Creek Drainage

Location	Fuel Model	Rate of Spread	Flame Length	Ember Shower Distance/%
Harmony Grove Road, Northeast Corner of Preserve	FM-4	668.47 feet/minute (8.35 mph)	59.5 feet	1.7 miles / 100%

Table 2.2.1.2(b) Fuel Model 4 Comparison– Chaparral Burning Conditions Northern Escondido Creek Drainage

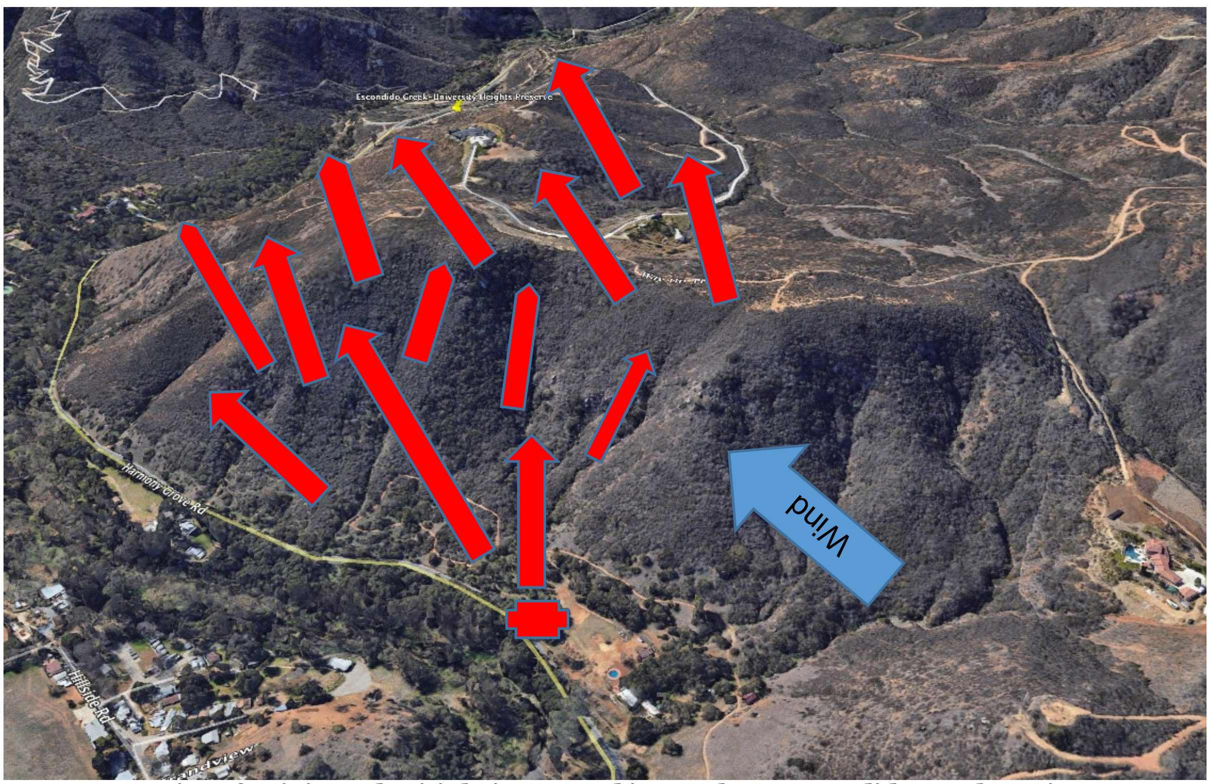
The fire starts near the northeast corner of the Escondido Creek-University Heights Preserve along the west shoulder of the Harmony Grove Road right-of-way, approximately 700 feet west of its intersection with Wilgen Drive. The area of origin is off-site from the northeastern corner of the Preserve.

The vegetation along Harmony Grove Road at this location is primarily annual grass and weed species subject to early extinction in late spring as temperatures rise and precipitation ends before the summer season. The right of way corridor is also lined on both sides with overhanding trees with light to moderate foliage growth in the canopies. Small independent single specimens of trees are also found in the meadow extending from Harmony Grove Road to the base of the mountainside.

From the base of the mountainside westward, and in a southerly direction, the vegetation changes from light grassy fuels to medium shrub and chaparral fuels with estimated re-growth heights of three (3') to four (4') feet.

For purposes of this analysis, the point of origin at the western shoulder of Harmony Grove Road is approximately 400 feet from the base of the mountainside.

The fire will start under twenty-one (21) mph northeast wind velocities, wind-aligned topography, 100 degree temperatures and 10% relative humidity. Influenced by these conditions, the fire will travel in a southwesterly direction onto Preserve lands at high to extreme rates of spread.



Point of Origin and Initial Fire Spread in Northern Escondido Creek Drainage During Santa Ana Event Fire and Weather Conditions

Under influence of winds and wind-aligned topography, the flame front will burn into worst-case Fuel Model 4 Chaparral vegetation. FM-4 will have a straight line rate of spread across the landscape of 607.7 chains per hour or 40,108.2 feet/7.6 miles per hour. This is equivalent to burning the length of 2.228 100-yard football fields per minute. The Fuel Model 4 chaparral habitat can be expected to return on the northern slopes of the Escondido Creek drainage as time continues progressing into the future after the last fire event in the area.

NOTE: Burning Conditions change as the fire progresses down-canyon under different geographic and topographic influences

After moving across and up-slope through the Preserve lands, the flame front will reach the residential enclave at the ridgeline and will continue burning primarily in a southwestern direction. The flame front can be expected to follow the hillside slopes and drainage under the influence of the northeast winds, with rapid rates of spread. The flame front will create potential direct flame contact, convective and radiant heat exposures to all buildings and structures in the residential enclave at the top of the ridgeline. Firebrands lofted by convection will land in the vegetation island between these homes, in the Open Space lands inside the Preserve, and in the chaparral and Coastal Sage habitat lands west of Wild Willow Hollow Road, igniting receptive and unmanaged vegetation and, potentially, any non-fire resistive buildings and structures been built in the area.

Under the influence of northeast Santa Ana winds, the flame front will progress rapidly cross-slope and downslope in a southwesterly direction. The fire will have a high intensity fire front that will continue moving in a cross-slope westerly along the exposed slopes on the north side of Harmony Grove Road. Natural vegetation in this area will be heavy load chaparral fuel types, with varying canopy loading and relatively unbroken fuel continuity and compactness. Fuel height was modeled as approximately four feet in height for purposes of this evaluation.

Fire behavior may be unpredictable due to gusty winds; erratic winds; wind eddies on ridgelines. These conditions will influence rapid fire extension downslopes and into natural chimneys. Natural topographic features associated with the development of fire whirls are present along the prominent ridge lines and natural drainages with prominent peaks.

Long-range spotting with firebrands deposited in receptive vegetation downwind for distances over two miles will be inevitable. At some point during active burning, fire brands will be deposited across Harmony Grove Road, creating fire spread on both sides of the Escondido Creek drainage, with high to extreme rates of spread and heat release rates.

South of the Preserve, in the remainder of the Escondido Creek Drainage, the canyon is a moderately narrow with multiple and prominent side drainages along the main slopes that are direct alignment with the Santa Ana winds influencing fire behavior.

Fire entering these topographic features will generally progress in straight-line alignments in the side drainages toward the various ridgelines. As fire enters wind and topography aligned canyons, it will be rapidly drawn downwind and through the topographical features towards the southwest. Rate of Spread will accelerate in the topographical draw as the wind in the narrow canyon is channeled upward, with a major flame fronts developing and making multiple major runs towards the ridge.

When a flame front reaches a ridgeline, fire behavior may change significantly.

Natural topographic features associated with the development of fire whirls are present on most mountainsides, natural drainages, and prominent peaks. Unstable, erratic winds, in combination with topographical outcroppings and unevenly heated ground, could trigger fire whirls, resulting in unpredictable rates of spread and intensity. Fire behavior at the bottom of the slope will be impacted by the erratic fire behavior developing upslope.

Firebrands lofted by convection will land in the vegetation on the back side of the mountain and, potentially, in the topographical drainages and fingers in the Drainage. These spot fires will tend to grow rapidly and burn significant acreages before controlled.

Further explanation about the about the effects of narrow, steep-sided side canyons and drainages impact fire behavior is necessary:

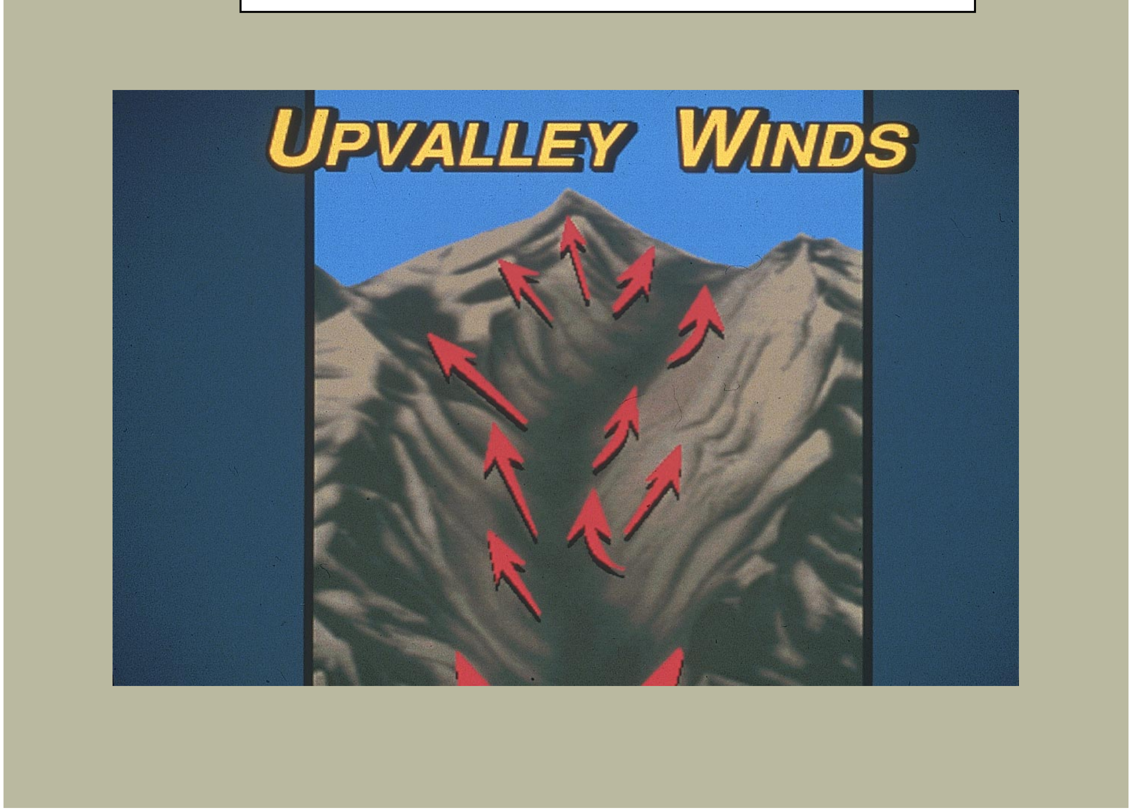
Fires burning on one slope of a narrow canyon radiates and convects a large amount of heat energy towards the opposite non-burning slope. These heat processes can dry and pre-heat susceptible fuels on the non-burning canyon side, making it highly susceptible to ignition from ember showers and, when the flame front reaches the bottom of the canyon, direct flame contact.

Occasionally, the entire non-burning slope, or large portions of it, can ignite instantaneously (area ignition) or in a matter of a few minutes (a condition identified as a “blow-up”). In other cases, the fire progression may create flame front passage across the drainage bottom at multiple points, creating a hazardous condition for civilians trying to evacuate the area and fire suppression crews working to control the fire.

As noted above, the west aspect of the mountainside cross-slope drainages forming what is collectively termed “chimneys.” Fires burning into these topographical features create a “chimney effect”, with similar effects as occur in a typical building chimney.

A chimney is a steep narrow chute with three walls, similar to a box canyon. The chimney effect occurs when an unstable air mass at the surface, and bottom of the chute, create a convection current through the canyon, drawing air from the bottom of the chute and exhausting it at the top. When the flame front enters the chute, normal upslope winds and convective heat flow rapidly upward and are funneled by the chimney’s topographical shape, pre-heating the vegetation within it and predisposing them to rapid ignition and rates of spread.

Diagrams Showing Typical Channeling of Winds through Canyons



Fires influenced by Santa Ana wind events tend to become large incidents, initially beyond local control efforts.

In 1971, Kerr and associates characterized eight types of large fires, based on their relationship between the fire's convection column and wind effects. These parameters are based on:

- Rates of spread
- Spotting (ember show) ignition potential
- Smoke drift

Fire Type	Fire Behavior & Wind Impacts	Dominant Features
I	Towering convection column with light surface winds	Moderate to rapid fire spread persistent until changes in the atmosphere or fuel
II	Towering convection column over a slope	Rapid short-term spread with convection cut-off at ridge crests
III	Strong convective winds with strong surface winds	Fast, shifting spread with short-range spotting
IV	Strong vertical convection cutoff by wind shear	Steady or shifting spread with occasional long-range spotting
V	Leaning convection column with moderate surface winds	Rapid, shifting spread with both short and long range spotting
VI	No rising convection column under strong surface winds	Very rapid spread driven by wind and fire energy; frequent close spotting
VII	Strong surface winds in mountainous topography	Rapid spread both up and down slope with frequent spotting and area ignition
VIII	Multiple head fires (mostly types I through V)	Broad fire front with two or more independent convection columns

Summary of Large Fire Types

Santa Ana wind event fires tend to have Type VI, VII and VIII burning characteristics.

Type VI fires are wind-driven with strong surface winds that prevent the convection column from rising more than a short distance above the ground surface. Smoke is often carried forward in a narrow ribbon for perhaps 100 miles or more with slight dissipation. Spotting is confined to a short distance in front of the flame front.

Type VII fires burn under Type VI conditions but in mountainous terrain. They spread up or down windward slopes with extreme rapidity while showering a great number of fire brands downwind into receptive vegetative fuels. This causes area ignition, coupled with high velocity turbulent winds in lee areas, resulting in a rapid development of mass fire with extreme heat release rates and considerable convection activity. The combination of these factors causes very complex fire behavior patterns.

Type VIII fires have multiple separate flame fronts. Any intensely burning fire having any of the burning characteristics of Type I – VII fires tend to fragment into two or more heads fires when the flame front becomes long. Causes include fuel variations, changes in terrain, barriers to flame passage and separate convective weather and fire behavior cells within the incident area. Multiple heads can result in unburned islands of vegetation inside of the burned perimeter of the fire.

Finding: *The last major fires to impact the Escondido Creek Drainage were the 1996 Harmony Grove Fire and the May 2014 Cocos Fire, both of which were Type VII fires.*

2.2.1.3 Projected Fire Behavior

There is a need to characterize rate of spread and intensity of any wild fire that could potentially impact the Preserve lands.

During planning stages, this information can be used to define the conditions under which a prescribed burn could be ignited. The rate of spread of potential fire intensity gives planners the ability to:

- Define stated objectives for the prescribed burn
- Define strategies for maintaining control of the prescribed burn

Predicted rates of spread and intensity are also important for determining fire suppression strategies during a wild fire event.

There is a wide range of fire characteristics, with rate of spread and intensities spanning three magnitudes of order.

Rate of Spread

Rate of spread is measured from any point on the fire perimeter in a direction perpendicular to that perimeter. Rate of spread can vary considerably due to changing conditions influencing fire behavior; it is identified as an average value over a given time period.

The fastest rate of spread is at the flame front, with flank spread rates having an intermediate value and backing fires having the slowest figures. However, a backing fire can change quickly with a wind shift, changing a slow spreading flanking fire into a major fast spreading head fire.

Slope and wind affect the rate of spread because both can tip the flame front toward or away from the available fuels. Interaction between wind and slope depends on the magnitude and direction of influence of each. If the wind is blowing upslope, there is a cumulative effect, with the flame front progressing rapidly upslope. During Santa Ana events, the reverse effect may, and often does, occur, with the flame front moving rapidly downslope under wind influences.

ROS (ft./min)	Typical Fire Situation	Equivalent To:
1	Litter fire, no wind, no slope	Line building rate for one person in heavy vegetation
25	Aged medium slash, 100% Slope	Backpacker climbing 100% slope
250	Low sagebrush, Santa Ana winds	Brisk walk on level ground
800	Chaparral, Santa Ana Wind	Good pace for marathon run
1200	Dry short grass, high wind	4 minute mile

Rate of Spread

Finding: *BEHAVE fire modeling indicates that the Rate of Spread for fires in the Escondido Creek Drainage range between 319 and 998 feet per minute.*

Intensity and Flame Length

"Intensity" is heat release rate per unit of time.

There are several ways of characterizing intensity. Reference is sometimes made to the intensity of the whole fire, but quantification of intensity for a specific area of the perimeter is more appropriate for most applications.

"Reaction Intensity" is a heat release rate per minute from one square foot of fuel while in the flaming zone.

"Heat per Unit Area" is the heat released from a square foot of fuel for the entire time the flaming zone is in that area. Heat per Unit Area is calculated from the reaction intensity times the residence time of the fire moving through the fuel and is a factor of the fuel's diameter. Heat per Unit Area is also known as Heat Release Rate per Unit Area (HRRUPA).

HEAT LOAD BTU/square foot	FUEL CONSUMED Tons/acre	Energy Release in 1 SF would:
300	0.75 (grass)	Warm up 2 quarts of stew
1200	3 (tall grass)	Boil away 1 pint of water
4000	10 (1 inch of pine duff)	Open car thermostat (5 gallon system)
12000	30 (thinning slash)	Heat 10 Pulaski heads to cherry red
48,000	120 (heavy logging debris)	Melt an aluminum engine block

Total Heat Load

Finding: *BEHAVE fire modeling indicates that the Heat Load for fires in the Escondido Creek Drainage range between 2235 and 3367 BTU/square foot*

FL (feet)	FIRE LINE INTENSITY (BTU/ft./sec)	FIRE SUPPRESSION INTERPRETATION
<4	<100	Fire can be generally attacked at the head or flanks per persons using hand tools. Hand line should hold the fire
4-8	100-500	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. Dozers, engines, aircraft can be effective

8-11	500-1000	Fires present serious control problems; control efforts at head probably ineffective
>11	>1000	Crowning, spotting and major runs are probable. Control efforts at head ineffective

Fire Line Intensity Values

Finding: *BEHAVE fire modeling indicates that the minimum flame length for fires on the Preserve ranges between 38.3 and 59.5 feet*

Rates of Spread and Firefighter Deployment Operations

Examination of firefighter deaths and near-miss accidents in wild land environments have revealed the presence of a number of common denominators in these incidents:

- Drought conditions
- Temperatures above 90 degrees
- Relative humidity less than 24%
- Fine (grass) fuel moistures less than 6%
- Ignition probability 80-90%
- Frequent spotting occurs
- A significant wind event is in progress

Despite publication of this information over the past few decades, firefighters continue to fail to identify these factors and, further, do *not* identify a time when tactical operations *should* be disengaged under *extreme* burning conditions.

The US Forest Service has developed a Disengagement Guideline Chart to give fire attack crews a rapid reference tool that identifies when fire conditions have reached a critical point where retreat to Safety Zones is necessary. The Chart is intended for Indirect Fire Attack Strategies, operations in patchy and unburned fuels, areas where there is re-burn potential, and where multiple spot fires are occurring.

When Disengagement Criteria is met, firefighters *must* retreat via established escape routes to pre-determined Safety Zones or previously burned area where there is no re-burn potential.

The Disengagement Guidelines Chart features four criteria, with different sub-sets of factors to be considered: 1) Mid-flame wind speed; 2) relative humidity levels: 3) Slope steepness; and 4) air temperatures

The following criteria on the Disengagement Guidelines Chart can be present during Santa Ana – Northeast Wind Events:

- Mid-flame Wind Speeds exceeding 2-8 mph
- Temperatures above 70 degrees
- Slopes exceeding 25%

- Relative humidity below 10%

The Cedar Fire conditions, used as worst-case fire behavior conditions for San Diego County, have the following parameters:

- Mid-Flame Wind Speeds – 30 mph (before 50% reduction for calculation)
- Temperature – 85 degrees
- Relative humidity – 5 to 8%, depending on weather observation locations
- Fine grass fuel moisture – 1%

Findings: *Comparing Disengagement Criteria and Cedar Fire parameters, fire behavior in Escondido Creek Drainage lands under Santa Ana wind event conditions* ***will*** *exceed Disengagement Criteria, indicative of the need for indirect fire suppression operations at long-range distances ahead of the active (and multiple) flame fronts.*

Criteria	Dis-engagement Points	Cedar Fire-Santa Ana Events
Mid-flame Wind Speed	Exceeds 2-8 mph	15-30 mph
Temperatures	Exceeds 70 degrees	85 degrees
Slopes	Exceed 25%	Average 40% on Preserve
Relative Humidity	Below 24%	5 to 8%
Grass Fuel Moisture	Less than 6%	1%
Ignition Probability	80 to 90%	100%

BEHAVE Calculated Rates of Spread

Based on fire history and BEHAVE fire modeling, a flame front moving across the landscape from unmanaged Escondido Creek-University Heights Open Space Preserve and entering lands within the Escondido Creek drainage will have high fire intensity/heat release rates and rapid to extreme rates of spread, depending on fuel type.

Fuel Model	ROS – hourly	ROS – minute	ROS - MPH
GS-2	17,133.6 feet	285.56 feet	3.245 mph
SH-5	30,274.2 feet	504.57 feet	5.73375 mph
SH-7	19,146.6 feet	319.11 feet	3.62625 mph
FM-4	51,354.8 feet	855.91	9.72 miles

Averaged Rates of Spread for Vegetation Fuel Models

Based on fire history and BEHAVE fire modeling, a flame front moving in a southwesterly direction through the Escondido Creek Drainage will have high fire intensity/heat release rates and rapid to extreme rates of spread, depending on fuel type.

The *highest* Rate of Spread for SH-5, Heavy Load Heavy Load, Dry Climate Shrub environment was modeled as 585 feet per minute, 6.65 miles per hour, or 9.75 feet per second.

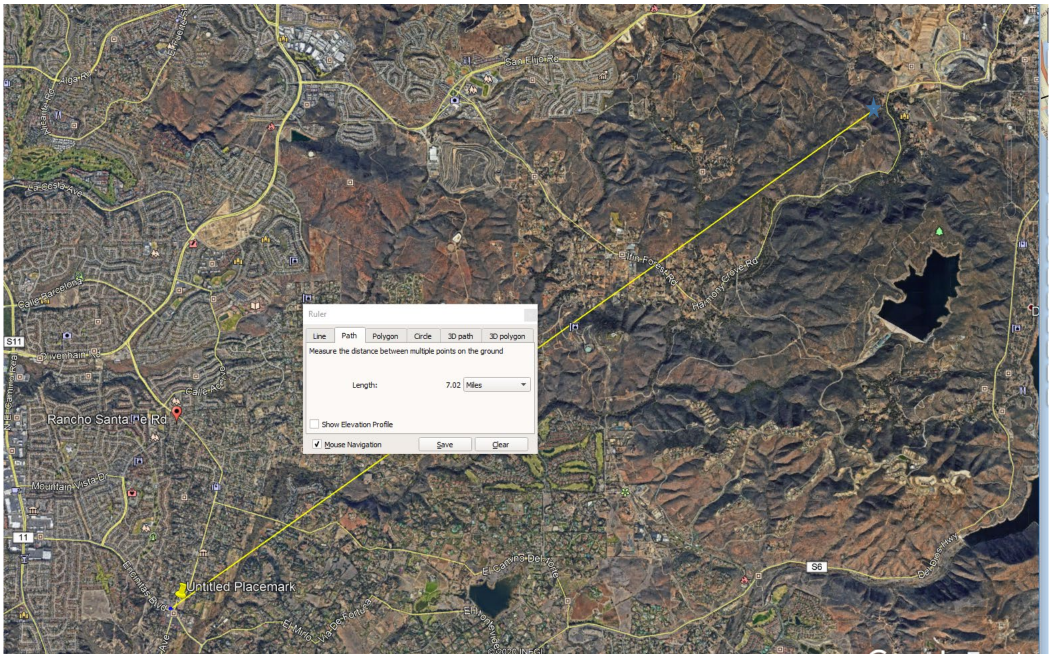
The *highest* Rate of Spread for Fuel Model # 4 Chaparral fuel environment was modeled as 988 feet per minute, 11.22 miles per hour or 16.46 feet per second.

BEHAVE Spotting Distances

The modeling analysis indicates that a typical Santa Ana wind event will release and loft numerous fire brands into the atmospheric by convective heat energy. As the convective heat energy produced by fire behavior diminishes, those fire brands and embers will be deposited downwind of the main fire front by gravity. On reaching the ground and any receptive vegetation, these ember showers ignite separate fires that *will* require suppression by fire department resources.

For Fuel Model 4 Chaparral, which creates the *most extreme* fire behavior characteristics in California, BEHAVE estimates that ember showers will occur approximately 1.7 miles downwind of the main fire front. Ignitions in receptive downwind vegetation is calculated at 100% under Santa Ana wind event conditions. This means that out of 100 firebrands, *each* of the 100 fire brands *will* start a suppressible fire in the downwind vegetation it lands in that requires fire department intervention.

The following diagram, based on BEHAVE fire modeling, explains the impact of a wildfire starting at the Escondido Creek-University Heights Open Space Preserve under Santa Ana wind event conditions.



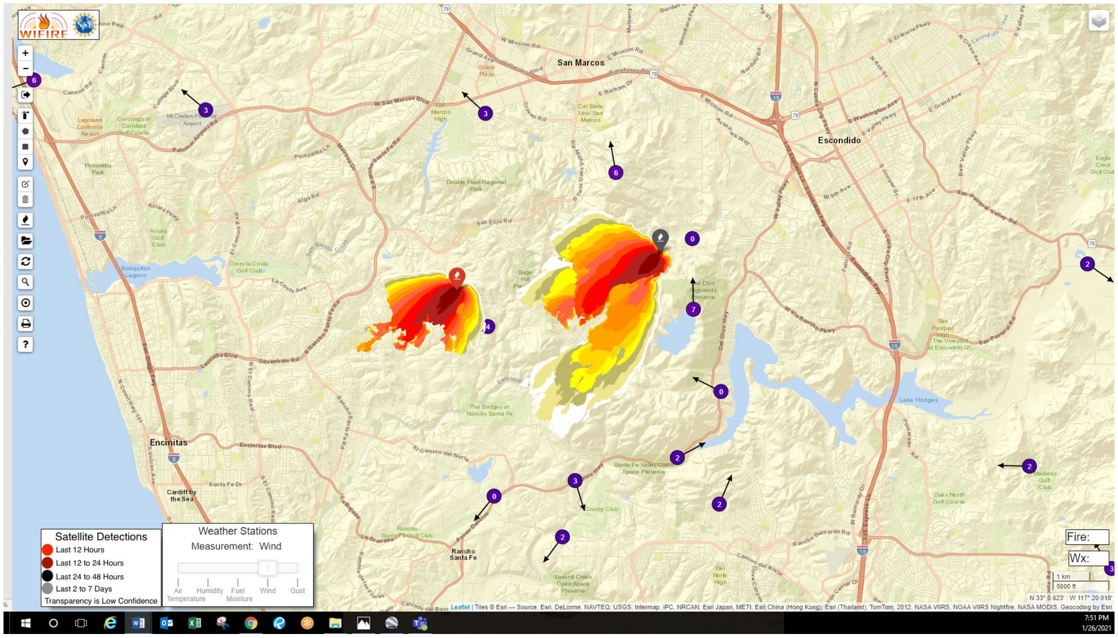
The aerial photograph displays the straight line 7.02 mile northeast-to-southwest distance between the intersection of Rancho Santa Fe Road and Encinitas Blvd. (yellow "Untitled Placemark" thumbtack symbol) and the fire's point of origin at the Escondido Creek-University Heights Open Space Preserve (blue star). The northeast-to-southwest configured line represents wind-aligned topography carrying a wildfire flame front across the landscape during a northeast wind-Santa Ana weather event.

Fires under Santa Ana wind event conditions in chaparral and Coastal Sage Scrub vegetation communities will produce rates of spread ranging from 5.74 M.P.H. and 11.2 m.p.h. Given the 7.02 miles separation distance between the Escondido Creek-University Heights Open Space and Olivenhain the following table estimates when the wildfire could potentially reach the intersection of Rancho Santa Fe Road and Encinitas Blvd. under worst-case extreme burning conditions.

Rate of Spread	Distance	Arrival Time	Deficit
5.74 mph	7.02 miles	1.22 hours (73 min)	+ 13 minutes
7.6 mph	7.02 miles	0.92 hours (55 min)	- 5 minutes
9.72 mph	7.02 miles	0.72 hours (43 min)	- 17 minutes
11.2 mph	7.02 miles	0.62 hours (37 min)	-23 minutes

Escondido Creek Drainage BEHAVE Estimated Rates of Spread

The following screen shot is from the WIFIRE Fire Map Program analysis of two related fires in the Escondido Creek Drainage.



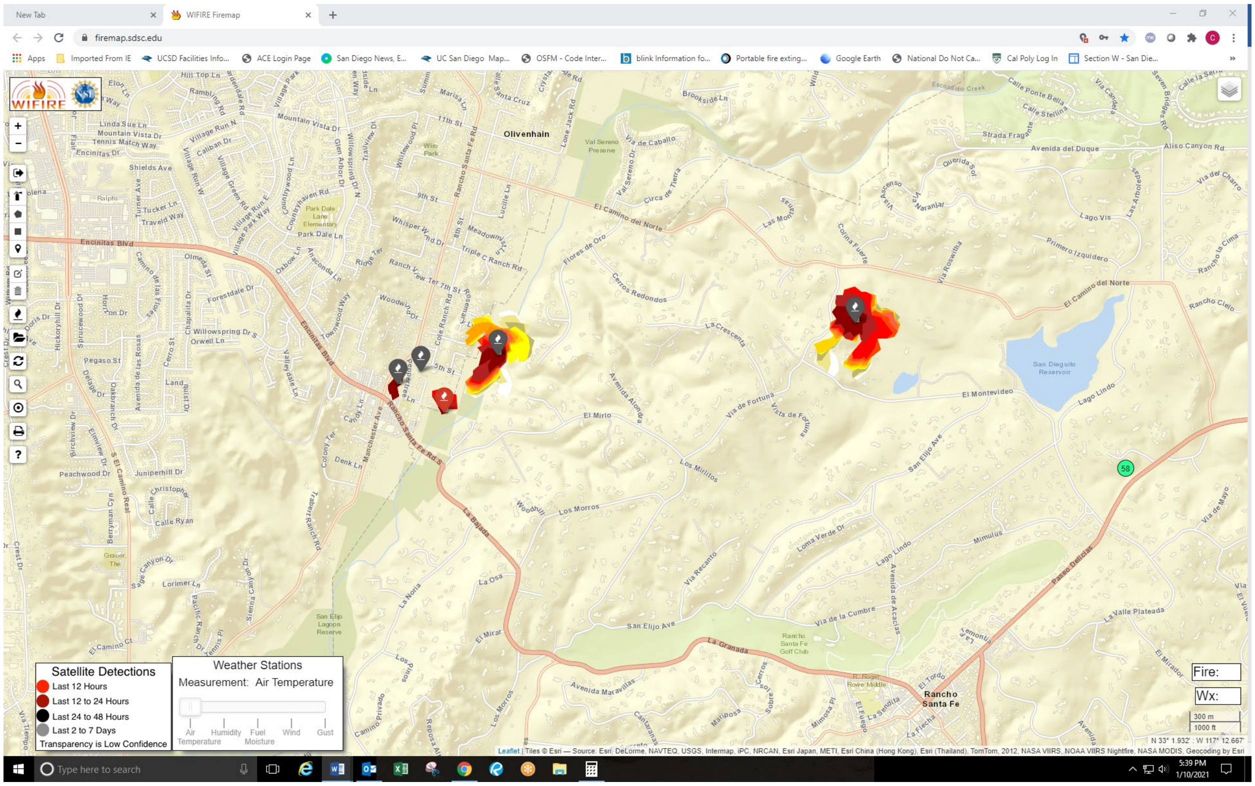
Santa Ana Wind Event Fire using 2014 Cocos Fire Environmental Factors

Fire Map is a GIS-based system that performs fire behavior modeling under the sub-program FARSITE developed by the U.S. Forest Service. FireMap determines resident vegetative fuel models using the U.S. Geological Service LANDFIRE program, selected remotely located weather stations (RAWS) and historical fire behavior information from the CAL-Fire FRAP and USFS Geo-Mac programs.

The fire behavior represented in the screen shot reproduction presents modeling for a primary fire starting at the Escondido Creek-University Heights Open Space Preserve and a secondary fire starting as a result of downwind fire brand deposits from the main fire's flame front as it moves across the landscape. The main and secondary fire are 1.7 miles apart, the BEHAVE predicted spotting distance after data analysis. The fire perimeter growth rate is for a period of six (6) hours, the program's current maximum time line.

Based on the fire spread patterns, the output parameters of FireMap are *far* less conservative than those produced by the BEHAVE fire modeling program, as indicated in the modeling map above.

Additional FireMap modeling was performed, also resulting in *lower* than anticipated fire behavior and spread outputs using the 2014 Cocos Fire parameters for the first modeling run when compared to BEHAVE's analysis of fire conditions. The modeled fires were placed in relatively close proximity to the published Olivenhain evacuation routes to determining if fires beginning in developed suburban residential areas had the potential to overrun and directly impact those roadway corridors.



Santa Ana Wind Event Conditions – Based on January 10, 2021 Weather Criteria

In the above analysis, five separate fire scenarios were placed within 2-1/2 miles of the intersection of Rancho Santa Fe Road and Encinitas Blvd. for the purpose of determining if one or more of the fires would overrun existing Olivenhain residential neighborhoods in a six hour long burn period. The following observations and conclusions were made:

- The fire on the undeveloped lands near the Rancho Santa Fe and Encinitas Blvd. intersection with annual grass vegetation burned out in an hour (or under) and did not impact surrounding residential properties)
- The hypothetical fire immediately north of the intersection did not burn. This site was identified as Non-Burnable lands, indicating Fuel Model NB-1 Suburban Development.
- The fire east of El Mirlo burned out within one hour.
- The fourth fire, located east and between Rosemary Lane and 5th Street, was placed in a heavily vegetated and relatively flat wetlands area. This fire was exposed in direct alignment with northeast Santa Ana winds and had a burn duration of six hours. The size and shape of this fire clearly indicated it burned around and through existing residential development lands

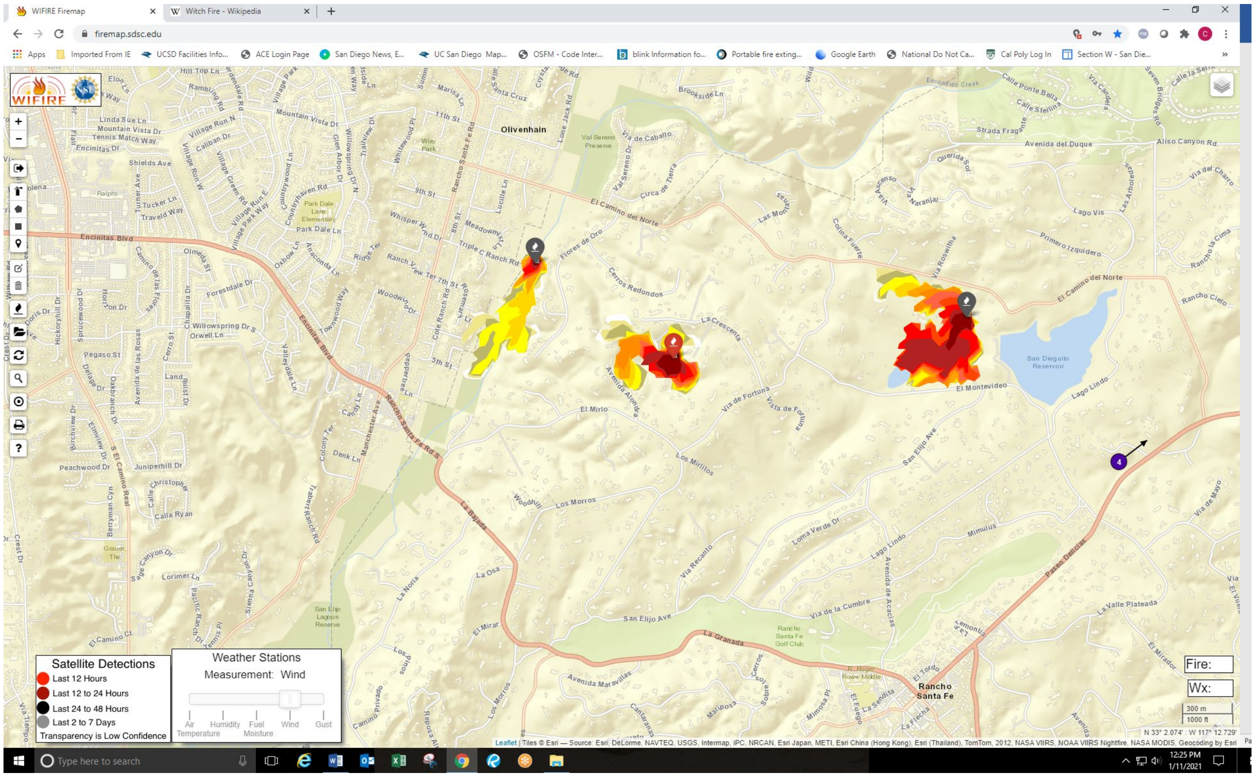
- The fifth fire, located west of San Dieguito Reservoir, had a burn duration of six hours. The size and shape of this fire clearly indicated it burned around and through existing residential development and agricultural lands.

Approximate Projected Burn Area for Hypothetical Fire # 4

Typical Wetlands Vegetative Fuels for Hypothetical Fire # 4

Approximate Projected Burn Area for Hypothetical Fire # 5

Typical Vegetative Fuel Loading for Hypothetical Fire #5
Looking South from Intersection of El Camino del North & Colina Fuerte



<u>Santa Ana Wind Event Fires, Based on 2007 Witch Creek Fire Conditions</u>

This series of hypothetical fires were analyzed under the more extreme fire conditions present during the 2007 Witch Fire Complex. In this analysis, three separate fire scenarios were placed within 2-1/2 miles of the intersection of Rancho Santa Fe Road and Encinitas Blvd to determine if one or more of the fires would overrun adjacent residential neighborhoods during a six hour long burn period. Two of the fires, those on the west and east sides, were placed in approximately the same locations as in the second fire analysis. The third, representing a fire starting from a downwind ember shower from the eastern fire, started in the area south of La Crescenta Road, west of Via de Fortuna and north of Avenida Alondra.

The following observations and conclusions were made:

- The western and eastern fires exhibited fire behavior and burn perimeters very similar for the previously modeled fires in these areas under the hypothetical January 2021 winter Santa Ana wind event fires.
- All events burned for the maximum six hour time limit for the modeling program
- The central fire incident's size and shape of this fire clearly indicated it burned around and through existing residential development lands

Approximate Projected Burn Area for Hypothetical Center Area Fire

Hose Lay Production Rates

Training and Certification Production Rates

During Basic CAL-FIRE Firefighter Academies, firefighter candidates are expected to perform a 550 foot-long progressive hose lay in five (5) minutes, or 1.6 feet per second.

Operational Production Rates

During Strike Team deployments, the California Fire Service and Rescue Emergency Mutual Aid System *Strike Team/Task Force Leader Manual* indicates that a three (3) engine company progressive hose lay operation with nine (9) firefighters should have a production rate of 100 feet every four (4) minutes (0.42 feet per second).
The following table shows firefighter travel rates compared to rate of fire spread for various conditions.

Slope (%)	FF Rate of Travel (ft/s)	Wind speed (mi/h) 20'	Fire spread rate, Flame length, Safety zone minimum size											
			Grass[1]			Shrubs[2]			Crown Fire[3]			Surface Fire Beneath Tree Canopies[4]		
			R/S (ft/s)	FL (ft)	SZ (ft)	R/S (ft/s)	FL (ft)	SZ (ft)	R/S (ft/s)	FL (ft)	SZ (ft)	R/S (ft/s)	FL (ft)	SZ (ft)
Flat (0)	4	0	.07	3	12	.07	5	20	.1	10	40	.03	4	16
		10	1.4	11	44	1.6	21	84	1.3	70	280	.2	10	40
		20	3	16	16	4	33	132	3	145	580	.5	14	52
		30	6	20	80	8	42	168	5	220	880	.8	17	68
Low (10-20)	3	0	.1	4	16	.1	7	28	.2	20	80	.05	5	20
		10	1.5	11	44	1.7	21	84	1.4	75	300	.2	10	40
		20	4	16	64	4	33	132	4	150	600	.5	14	52
		30	6	21	84	8	42	168	5	225	900	.8	17	68
Moderate (20-40)	2	0	.4	7	28	.3	11	44	.2	25	100	.1	6	24
		10	1.8	12	48	1.9	23	92	1.7	80	320	.3	11	44
		20	4	17	68	5	34	136	4	160	640	.6	14	56
		30	6	21	84	8	43	172	6	235	940	.8	17	68
Steep (40-60)	1	0	.9	9	36	.7	15	60	1.1	55	220	.2	9	36
		10	2	13	52	2	28	112	2	100	400	.4	12	48
		20	4	18	76	5	35	140	4	175	700	.6	15	60
		30	7	22	88	8	44	176	6	250	1000	.9	18	72

(**Source:** ***Strike Team/Task Force Leader Manual)***

Production in Chaparral Type Fuels

Analysis of rates of fire spread through chaparral type fuels indicate disparities between, hose line production rates and firefighter travel rates:

- BEHAVE modeling of rate of fire spread in SH-5 is 8.195 feet per second
- Training hose line production rate is 1.6 feet per second
- Fire ground hose line production rate is 0.42 feet per second
- Fastest firefighter travel time on flat ground is 4 feet per second,
- Firefighter travel rate reduces to 2 feet per second on moderate steep (20-40%) slopes
- Firefighter travel rate further reduces to one foot per second on steep slopes between 40 and 60%.

This data indicates that a direct fire attack on chaparral type fuels on the slopes in the center canyon area of the Preserve cannot physically stop the advancement of the fire across the landscape.

Fire suppression operations under these conditions requires a lengthy extended hose lay operation along the flanks, with indirect attacks, in the form of aerial retardant drops, helicopter water drops and construction of bulldozer lines and other control lines, in advance of the flame front.

2.2.2 Fire Behavior Threat Analysis, Fire Originating in the Southern Escondido Creek Drainage, Normal Late Summer Weather Conditions

For purposes of this Analysis, a wildfire event occurs with its origin in the Southern Escondido Creek drainage adjacent to Manchester Avenue. The predicted fire behavior of this incident occurs during a typical late summer afternoon conditions with southwest winds.

The southern Escondido Creek drainage is approximately 0.23 miles east of, and parallel to, Rancho Santa Fe Road and also runs parallel to Manchester Avenue with a northeast to southwest direction. The point of origin for this fire is approximately 1.38 miles south of the intersection of Rancho Santa Fe Road and Encinitas Blvd. and is east of the Manchester Avenue right-of-way corridor.

The topography of the Escondido Creek drainage appears relatively flat and level but, in actuality, has a visually imperceptible downslope run over a broad riverine plain.

Vegetation in the Escondido Creek drainage is a mixture of Southern California Coastal Sage shrubs, grasses and other woody wetlands plant communities.

Riparian woody plant communities are comprised of shrub lands and hard wood woodlands and forests.

Willows dominate most of the shrub lands; other shrub types are rare. Other trees within these areas are generally cottonwoods, sycamores and oaks. The extent of riparian plant communities has been greatly reduced from pre-settlement times in California due to agricultural development and urbanization.

Non-native invasive plants have altered historical plant community composition and stand structures. Flammable non-natives include salt cedar and giant reed, which increase fire rate of spread factors and burning intensity.

Most ignitions in riparian wetlands communities are human-caused. Most fires are set in summer and fall, but burning seasons can extend from spring to late fall. When fires occur, they are generally during the annual "fire season" and have a limited extent with varying intensity and type (low-high; surface; mixed; crown). It is safe to assume that wetlands environments will burn readily during extended periods of prolonged drought.

Most riparian vegetation is fire resilient; flooding is often a more important driver of succession than fire. Adaptations of vegetation to flooding produces thick bark, sprouting and masting that enable the plants to recover quickly from fire effects.

Non-native and invasive plant species easily invade wetlands communities. Many of California's riparian communities have undergone significant changes in species composition because of non-native invasive plants. Giant reed (arrundo) and salt cedar are generally the most prevalent invasive non-native plants affecting California riparian environments. Both are implicated in the increasing fire frequency and intensity in some riparian zones. Giant reed and salt cedar increase the amount and continuity of vegetation fuels in the environment, which alters fire behavior, producing more severe and intense fires.

A significant amount of the vegetation appears to have a high dead-to-live fuel ratio.

Site visits to the southern Escondido Creek Drainage have determined that the vegetative fuels could be classified as one or more of the following Fuel Types:

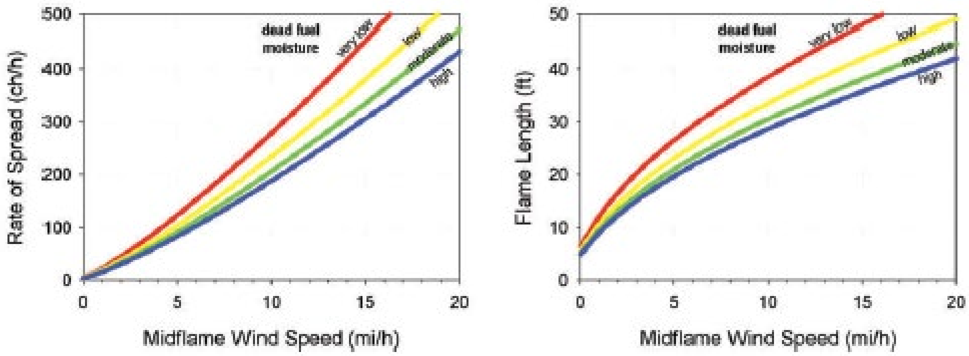
- Fuel Model GS-2, Moderate Load, Dry Climate Grass-Shrub
- Fuel Model SCAL-18 Southern California Coastal Sage Shrub
- Fuel Model TU-5 Very High Load Dry Climate Timber Litter
- Fuel Model GR-8 High Load, Very Coarse Humid Climate Grass
- Fuel Model GR-9 Very High Load, Very Coarse Humid Climate Grass
- Fuel Model SH-5, Heavy Load, Dry Climate Shrubs

Fuel Model GS-2 Moderate Load Dry Climate Grass & Shrubs, Southern Escondido Creek Area along Manchester Avenue

2.2.2.1 Vegetative Fuel Fire Assessment

Fuel Model GR-8 High Load, Very Coarse Humid Climate Grass

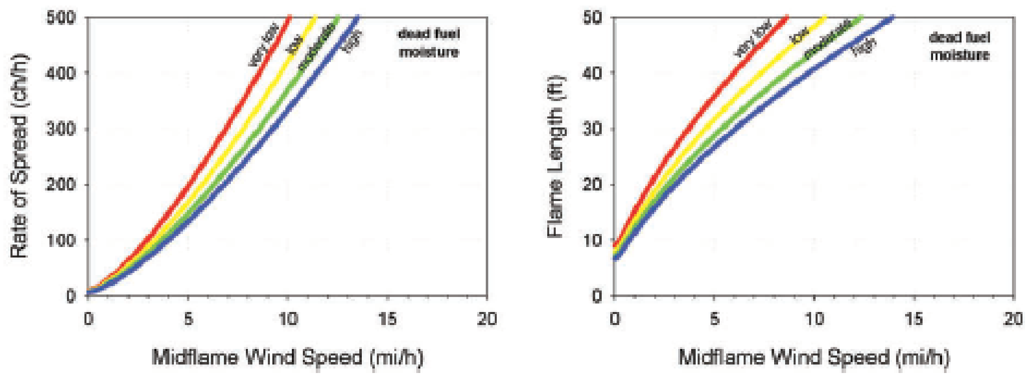
The primary carrier of fire in Fuel Model GR-8 is continuous, very coarse, humid climate grass. Spread rate and flame lengths can be extreme if grass is fully cured. The fine fuel loading is 7.8 tons per acre and extinction moisture is 30%.



Fuel Model GR-9, Very High Load, Humid Climate Grass

The primary carrier of fire in GR-9 is dense, tall grass. The fine fuel load is 10 tons per acre and the loading and Depth of vegetation is high, with fuels at least six (6') tall. The extinction moisture content is 40%; spread rates and flame length can be extreme when the grass is fully or mostly cured.

Very High Load, Humid Climate Grass (Dynamic)



The GR-8 and GR-9 Fuel Model vegetation inside the Escondido Creek wetlands habitat is characterized by the invasive Arrundo species, also known as Giant Reed.

Arrundo is a semi-natural herbaceous stand found in riparian areas, along low gradient streams, ditches and coastal marshes between elevations of sea level to 500 meters.

Arrundo is an aggressive, introduced perennial grass that grows in clumps to heights of six meters. The roots are extensive and densely matted. Plants can form dense, floating mats in streams and rivers.

Arrundo is one of the fastest growing land plants in the world. It forms massive thickets of vegetation that can cover several acres, virtually eliminating all other plant species along with the high biodiversity, structural diversity and wildlife habitat of riparian systems. Stem density increases as it nears the water's edge and stands are self-regenerating.

Arrundo chokes riverbanks and stream channels, crows out native plants, interferes with flood control, increases fire potential and reduces wildlife habitat.

Fire Characteristics:

The tangled shoots and dry leaves are flammable at maturity. Its underground rhizomes, however, survive most fires.

Management Considerations:

Arrundo has naturalized from plantings throughout warmer areas of California, where it was once used along ditches for erosion control. It is considered the greatest threat to riparian habitats in Southern California where millions of dollars have been spent to eradicate it from river systems and estuaries. Agricultural runoff can provide nutrient inputs into riparian systems, where Arrundo takes advantage of enriched nitrogen and potassium levels to outperform native plants.

The California Invasive Plant Council (CAL-IPC) identifies Arrundo as a High Mitigation species. Each invasive plant species is evaluated by CAL-IPC based on thirteen specific criteria. In addition to the criteria, a combination of other factors may indicate that a species has a particular and significant potential for invading new ecosystems that triggers an Alert designation.

High Rating species are those that have severe ecological impacts on physical processes, plant and animal communities and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most of the High Rating species are widely distributed ecologically. A High Rating indicates a need for removal and control of the species.

Arrundo- Giant Reed Type Infestation in Escondido Creek Wetlands Habitat
Rancho Santa Fe Road Overpass East of Encinitas Avenue

Non-Native Grasslands

Various species of non-native and potentially invasive grasslands can become a dominant species of multiple habitats. The non-native grassland communities can commonly become dominate over native grasslands, the understory of oak woodlands, and other vegetation types in Southern California. It invades low areas with deep soils, creating dense cover and a perpetual thatch.

This type of vegetation are usually a cool-season annual grass with a moderate CAL-IPC invasive ranking. Most of their seeds germinate after the first significant rain in the fall. Germination is best on a seedbed of thatch. Most seeds survive the sporadic wetting and drying cycles that occur throughout the growing cycle. Plants set seed and die by the end of the growing season in the spring.

<u>Fire Characteristics</u>

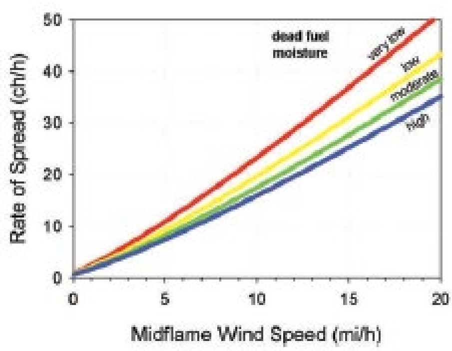
The dominance of non-native annual grasses have changed the ecology of herbs and herbaceous landscapes. Summer and fall fires have little direct impact of these grasses. Fast-burning and relatively cool fires do not kill the seeds. Some brome seeds germinate after a fire in light open conditions, but best germination occurs within a thatch layer.

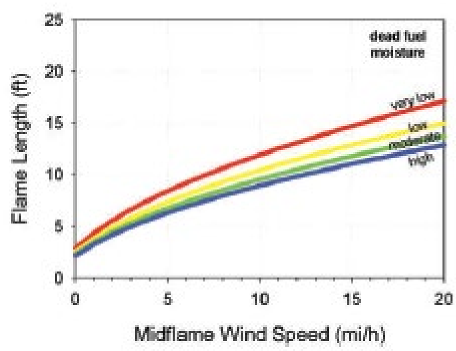
Typical Grasslands Community in the Southern Escondido Creek Area

Fuel Model TU-5, Very High Load, Dry Climate Timber-Shrub

The primary carrier of fire in Fuel Model TU-5 is heavy forest litter with shrub and small tree understory. Spread rate is moderate and flame lengths are moderate. The fuel loading is seven tons per acre and the extinction moisture content is 25%.

Very High Load, Dry Climate Timber-Shrub





Fuel Model TU-5 applies to multiple species of wetlands adapted trees found in the Escondido Creek habitat.

Of special concern is the presence of various species of Eucalyptus trees, which are found in clusters along the entire length of the waterway within the jurisdictional boundaries of the City of Encinitas. The eucalyptus is well established and is currently unmanaged. It supports a number of individual tree specimens with estimated crown heights of thirty feet or more.

The under-story vegetation in the Escondido Creek wetlands habitat is similarly unmanaged, with a moderate to dense loading of shrub, brush and grass type fuels. The understory fuels create a “ladder” fuel arrangement where ground based fuels readily transmit ground fires up to the overhead vegetated crown of the trees.

Further analysis of the vegetation indicates that the primary carrier of fire in the eucalyptus grove at ground level will be the forest litter, smaller tree understory and the herbaceous shrub fuels. The herbaceous fuel load has both live and dead vegetative matter that is a function of fuel moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model. Fire spread rates and flame lengths will be moderate to rapid, as projected and confirmed by BEHAVE fire modeling.

Eucalyptus Grove in the Southern Escondido Creek Wetlands Habitat Southern Manchester Avenue Area

BEHAVE fire modeling indicates that grove understory fuels are capable of firebrand showers at considerable distances. This fuel type most closely matches Fuel Model TU-5 and was modeled as such.

BEHAVE fire modeling usually does *not* analyze non-ground type fuels or fuels with diameters of more than one (1") inch. However, some fuel models, and specifically TU-5, do allow fire modeling of torching and fire behavior in the eucalyptus tree canopies.

It should be noted, however, that under a typical Santa Ana wind events, eucalyptus tree canopies, when ignited, can, anecdotally, deposit embers and firebrands for 1.3 mile or more downwind in receptive vegetation fuel beds, causing suppressible fires.

BEHAVE FIRE MODELING, EUCALYPTUS WOODLAND, FM TU-5

Topography	Wind	ROS	Flame Length	Spotting
0% Slope	Northeast, 30 mph	207.68'/min.	19.2 feet	1.3 mile/100%

0% slope (STL factors)		300'/minute	220 feet	+1 mile

Table 2.2.2.1 (a) Eucalyptus Woodland Fire Behavior

BEHAVE modeling for eucalyptus canopy crown fires indicate that the trees will burn with HURRPA values of 3365 BTU/square foot; fire line intensities of 3495 BTU per foot per second; and critical surface intensities of 738 BTU per foot per second (or 778.1103 kW/sf) that is radiantly transferred to the ground below the canopy crown fire. For comparison, the average HRR required to bring a typical single family dwelling room to flashover is approximately *one* (1) megawatt (1000 kW).

Eucalyptus groves commonly have up to 900 trees per acre, compared to thirty to fifty trees for other species.

Eucalyptus Intermingled with Other Wetlands Habitat Trees Immediately East of Rancho Santa Fe Road and Encinitas Blvd.

Experiments in Australia indicate that *each* eucalyptus tree has the potential of releasing a peak Heat Release Rate (HRR) between 50 and 300 kW/m^{2}, (0.05 to 0.3 megawatts), depending on internal fuel moisture. This is in addition to the ground-based fire beneath the trees.

Ground Litter and Debris Fire in Typical Eucalyptus Grove

The *Strike Team/Task Force Leader Manual* issued by the CAL-OES indicates the following fire behavior is applicable to vegetation canopy crown fires in the eucalyptus grove for fires occurring on relatively flat ground under Santa Ana wind event conditions:

- Rate of Spread – five (5') feet per second (300 feet per minute)
- Flame Length – 220 feet
- Downwind ember show – greater than 1 mile

Analysis of rates of fire spread through canopy fuels with 30 M.P.H. winds indicate the following hose line production rates and firefighter travel rates:

- Production Table rate of fire spread is five (5) feet per second
- Training hose line production rate is 1.6 feet per second
- Fire ground hose line production rate is 0.42 feet per second
- Fastest firefighter travel time on flat ground is 4 feet per second

This data indicates that an indirect fire attack on canopy crown fires on relatively flat ground beneath the eucalyptus grove cannot physically stop the advancement of the fire across the landscape.

Additionally, ground-based firefighters beneath a well-established canopy fire cannot survive the radiant heat exposure of a 778 kW/0.778 megawatt fire.

According to the National Fire Academy's *Fire Dynamics Course Guide* and the *SFPE*

Handbook of Fire Protection Engineering, the following radiation heat flux damage occurs to the human body:

- Skin burns occur between 4.7 and 5.0 kW/m²
- Pain threshold is at 1.5 kW/m²
- Potential debillitating pain at one minute elapsed time occurs at 2.1 kW/m²

For a grove with 900 trees, a 5 kW/m² heat flux measurement is 0.0018519% of a total 270,000 KW heat flux exposure.

Crown and Ground Fire, Australian Eucalyptus Grove

Analysis of rates of fire spread through the woodland type *ground* fuels indicate the following hose line production rates and firefighter travel rates:

- BEHAVE modeling of rate of fire spread in TU-5 is 1.0395 feet per second
- Production Table indicates rate of fire spread is six (6) to eight (8) feet per second
- Training hose line production rate is 1.6 feet per second
- Fire ground hose line production rate is 0.42 feet per second
- Fastest firefighter travel time on flat ground is 4 feet per second

This data indicates that an direct fire attack on woodland fuels below the eucalyptus grove may not effectively stop the advancement of the fire across the landscape, particularly if the fire is well established in the fuel bed prior to the arrival of fire suppression resources.

Eucalyptus Conclusions

While the CAL-IPC inventory analysis indicates that eucalyptus has a rating of "limited" or "moderate", the species should be ranked as a "high priority" for removal and control. This priority is based on:

- Eucalyptus' tendency to displace native vegetation communities
- The extent of their presence on the landscape
- The ability to produce thousands of saplings in a small area over a short period of time

In addition to the biological threat to established habitat, eucalyptus has severe, unwanted fire behavior characteristics:

- Resin content can increase fire intensity
- Unmanaged ground debris encourages laddering of fire involving combustible fuels into tree crowns
- Transition from a slow moving, moderate intensity ground fire to a high intensity, fast-moving crown fire
- Propagation of downwind ember showers into susceptible ground vegetation by dislodgement of canopy materials during windy conditions

Fuel Model SH-5, High Load, Dry Climate Shrubs

Fuel Model SH-5 vegetation in and adjacent to the Escondido Creek wetlands habitat is typified by California Sage Brush, Chamise Chaparral and Diegan Coastal Sage Scrub.

California Sage Brush Alliance

This is a much-branched shrub up to 2.5 meters tall with a 30-60% relative cover in shrub canopies. Leaves have a strong aroma and are gray-green, soft and entire to divided segments into narrow linear segments. Leaves are drought deciduous and may contain chemicals that inhibit germination or growth of some plants.

Stands of this alliance occur in coastal scrub settings throughout the central and southern California Coast Ranges. It is found particularly on steep slopes and in high abundance on protected, north-facing hillsides.

This alliance sprouts moderately well after fires, though sprouting is diminished in older and larger plants and when high intensity fires occur. Sprouting can vary geographically, with shrubs in coastal sites sprouting more readily than on inland sites. Seedling emergence is low after fires but buried seeds may require some exposure to fire to break seed dormancy. Short fire returns can deplete the species' seed bank; higher intensity or more frequent fires make stands vulnerable to local extinction because most regeneration is from seeds.

Fire return interval is medium at 20 to 100 years.

Burning characteristics:

- Seasonality –later summer-early fall
- Size and extent of burning – medium to large; up to and beyond stand
- Complexity - low
- Intensity – moderate to high
- Severity – high to very high
- Type of burning – activate independent crown

Management Issues:

- Decreasing in wildlands with increased fire frequency, presence of non-native grasses and air pollution
- Successful restoration requires conditions where shrubs can establish, mature and develop seed banks

Chamise Chaparral

This species is dominant (50-60% coverage) in shrub canopies with other intermixed species. They have an evergreen canopy that is continuous or intermittent and less than 4 meters high. Habitats include varied topography with shallow dimorphic soils.

The species rejuvenates between fires by continuously producing new sprouts from a semi-buried lignotuber. Stands older than 60 years produce little new growth as dead stem biomass increases. Ecologists attribute stand stagnation to the accumulation of chemicals in the soil that inhibit decomposition, humidification and nitrification.

Following fire disturbances, chamise sprouts from surviving buds of semi-buried lignotubers. Dormant seeds are also stimulated to germinate by heat and charate during the first rainy season after a fire. Post-fire dominance comes from vigorous sprouting and some seedling production and dense stands can develop in 10 years with complete canopy closure after 20 years.

The alliance's fire return cycle is typically under 100 years. Shrubs can persist through long fire-free intervals. Inland stands are associated with longer fire intervals than coastal stands. High intensity fires can delay sprouting more than low intensity fires, because shrubs create few sprouts. High fire intensities decrease germination and seedling emergence because seeds concentrate at or near the soil surface, subjecting them to heat-kill.

Burning characteristics:

- Seasonality – summer to early fall
- Size and extent of burning – medium to large
- Intensity – high
- Severity – high
- Type of burning –activate independent crown fire
- High flammability

Management Issues:

- When browsed intently, produces few sprouts which are very susceptible to eradication
- Pigs, sheep and goats remove the more palatable species as stands open due to grazing
- The species is suitable for revegetation because of its well-developed root system and drought resistance

Fires in this alliance can be intense, fast spreading and potentially large. Stands develop fuel loads capable of supporting moderately intense fires within 15 years, making them extremely susceptible to short interval fires. High mortality of seedlings and sprouts is likely with recurrent fires on lands seeded with annual grasses. The presence of grasses increases the likelihood of early re-burns.

Fires occurring at short intervals (less than 10 years) have the potential to cause significant changes in species density and composition.

Diegan Coastal Sage Scrub

California sagebrush, California buckwheat and chamise are co-dominant in the shrub canopy with *Artemisia californica, Artemisia tridentate. Encelia californica, Salvia apiana and S. mellifera.*

These shrubs are less than 3 meters in height with a sparse herbaceous layer in intermittent to continuous canopies. Their habitats are on both lower and upper slopes on all aspects, at elevations between 0 and 1200 meters. They are found on upland slopes, intermittently flooded arroyos, channels and washes and rarely flooded low gradient deposits.

These species are well adapted to low to moderate intensity fires and they typically respond to post-fire regeneration from buried seeds after low intensity and lower frequency fires. Frequent fires can deplete the seed bank at times when non-native species may be increasing, making the coastal scrub species vulnerable to local extinction.

The fire return interval is medium – 15 to 30 years.

Burning characteristics:

- Seasonality – late summer to fall
- Size and extent of burning – medium to large; up to and beyond stand
- Complexity – low to moderate
- Intensity – moderate to high
- Severity – +Moderate to very high
- Type of burning – Surface-passive crown to active independent crown fire

Management Issues:

These species establish after disturbance by fire, flooding or livestock use. It rarely sprouts and longer living species replace it in areas with long periods between disturbances. The species have decreased in Southern California, most likely to more frequent fires and increased nitrogen deposition, conditions more favorable to annual grasses. Successful restoration requires stable conditions where shrubs can establish, mature and develop seed banks.

Typical Fuel Model GS-2 and SH-5 Vegetation, Southern Escondido Creek Area

High Concentrations of Chamise Chaparral, California Sage Brush and Diegan Coastal Sage Scrub East of Manchester Avenue and Southern Escondido Creek Wetlands

2.2.2.2 Anticipated Fire Behavior

The normal summer, late afternoon south and southwest winds found in the area are occasionally strong and gusty.

These winds tend to be cooler, have relatively moist air and usually have higher relative humidities of 40% or more. They are considered a serious wildfire weather condition when wind speeds are over 20-MPH and when relative humidity is 30% or lower.

For purposes of fire behavior analysis, a fire starts in the wetlands habitat west of the combined intersection of El Camino Real/La Noria and Stonebridge Lane and east of Manchester Avenue and adjacent to the SDGE-Sempra Energy Transmission Line right-of-way corridor.

Fires starting at this location will be influenced by typical summer, late afternoon southwest winds typical to the area (BLUE arrow). The winds will push the fire deeper into the wetlands habitat in a southwest to northeast direction, away from, and parallel to, right-of-way corridor for Manchester Avenue (RED arrows).

Once established in the wetlands habitat, the fire front will move steadily north under continued valley bottom wind influences.

The western flank of the fire will be the “inactive” side of the fire, as it will be pushing into the southwest wind moving across the landscape, retarding its advance. The flame front can be expected to follow the wetlands channel to the northwest under the retarding influence of the wind, with moderate to rapid rates of spread. The flame front will create potential direct flame contact, convective and radiant heat exposure to the vegetation in the western and northwestern portions of the wetlands channel, pre-heating the fuel canopies, causing faster ignitions and thermochemical reactions as the fire spreads across the landscape.

The eastern flank of the fire will be more “active side” of the fire, moving under unrestricted and direct wind influences that push the flames through the vegetative fuels. There will be a free influx of continuous airflow; this accelerates burning conditions and fire behavior.

Figure 2.2.2.2(a) Anticipated Fire Behavior Based on BEHAVE Fire Modeling and Terrain Configuration

Conflicting Simultaneous Wind Patterns

Of concern for this fire scenario is the potential for erratic fire behavior due to conflicting wind influences.

The normal late afternoon wind flow is from the southwest to northeast across the landscape (BLUE arrows, Figure 2.2.2.2.b). When the wind flow reaches the valley perimeter mountainside west and north of Manchester Avenue, the normal expected tendency would be that a portion of the air movement might descend over the north aspect of the slope into the valley below (RED arrows, Figure 2.2.2.2.b).

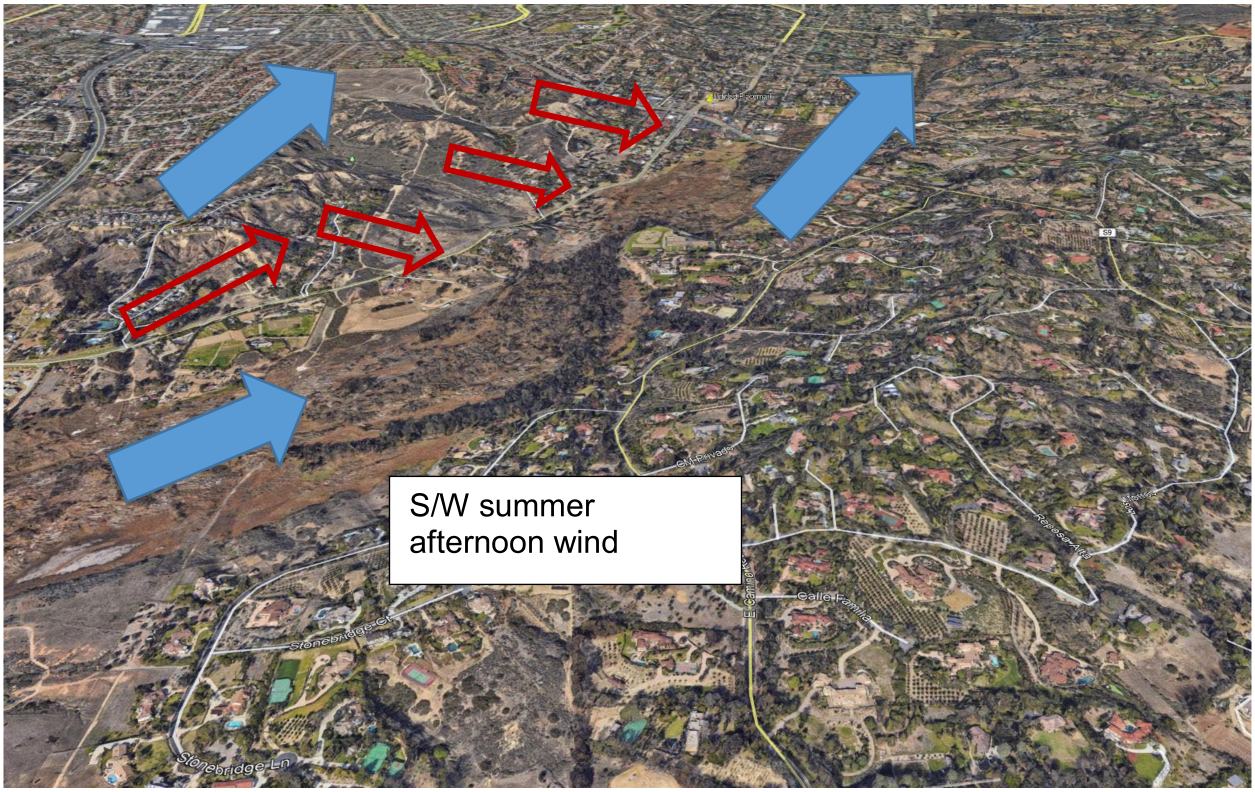


Figure 2.2.2.2(b) - Typical Late Afternoon Summer Air Flows (looking north)

Afternoon airflows are a function of diurnal wind patterns, which feature a reversal of direction twice per day. Typically, upslope/up-valley and plain-to-mountain flows occur during daytime and downslope, down-valley and mountain-to-plan flows occur at nighttime.

Diurnal winds are a function of daytime land surface exposure to radiant solar heat energy. As the temperature increases from morning to afternoon, temperature differences between the ground and air mass result in the development of a convective airflow in the atmosphere. Heated air becomes lighter and moves upward into the air mass. To reestablish equilibrium, cooler and heavier air from outside of the immediate environment is drawn inward toward the area whose temperature is being raised by solar radiant heat energy. Diurnal wind cycles are generally better developed during the summer, particularly when skies are clear.

Slope wind systems are a diurnal thermally driven wind system that blows up or down slope. The daytime upslope winds are a branch of a closed circulation loop produced by inclined warm atmospheric boundary layers that form above the slopes. During the day, particularly in afternoons, the heated air in the boundary layer above a slope rises up the slope while continuing to gain heat from the underlying land mass.

Valley winds are thermally driven winds blowing along the axis of a valley, with up-valley winds during daylight hours. Valley winds *are* the lower branch of the closed circulation pattern arising out of the valley when the air is warmer than air further down the valley at the same altitude. Unlike slope winds, valley winds are not necessarily a function of the slope of the valley floor. Valley winds depend on geometric factors including the shape and aspect of the valley and any cross-valley variations including tributaries.

Horizontal pressure gradients driving valley wind flows develop as a function of height between air columns with different vertical temperatures over the valley and the adjacent plain. The changing atmospheric pressure distribution and vertical profiles of the valley cause the winds to develop gradually over a daily cycle and produce weak to moderate wind speeds.

The area-height relationship between the valley and surrounding slopes, also known as topographic amplification factor, indicates that the daily temperature range in the valley is amplified by the smaller mass of heated air in the confined valley compared to the larger volume with the same Depth and surface area at its top over the adjacent plain. The higher temperature in the plain during daylight hours causes a pressure gradient to develop between the valley and plain that drives up-valley winds. This is especially true during the daytime, when convective boundaries can rise above ridge heights.

Of concern is the effect of colliding winds from the top of valley perimeter slopes, moving in a cross-valley direction, and the valley winds towards and upslope under influences of the daily diurnal valley wind flow circulation pattern.

Valley wind systems are often modified or overpowered by larger thermally or dynamically driven wind flows above the valley. Background flows above hilly or mountainous terrain are driven by large-scale pressure gradients superimposed on the along-valley pressure gradients. When atmospheric stability is low in the valley, winds aloft over the valley slopes can be brought down into the valley, especially when a convective pattern has been established. The wind direction may not be in alignment with the valley axis, creating cross-valley flow at the upper elevations of the valley. During the daytime, ridge-level winds may significantly modify the subsidence over the valley center and produce asymmetrical cross-valley circulation. A weak ridgetop wind may flush out the upper part of the valley; stronger winds can intrude into the valley and even reach the valley bottom. The difference between sea (southwest) breeze temperature and valley winds can also significantly change both phenomena.

Typical downslope winds, depending on local conditions, descend from ridges, with speeds ranging, on average, between 2 and 5 miles per hour. Valley winds occur in mid to late afternoon, with speeds of 10 to 15 miles per hour. Sea breezes, which occur in daylight hours when cool air from high pressure over coastal waters moves inland to replace heated air rising above the warmer land mass, have typical speeds of 10 and 20 miles per hour.

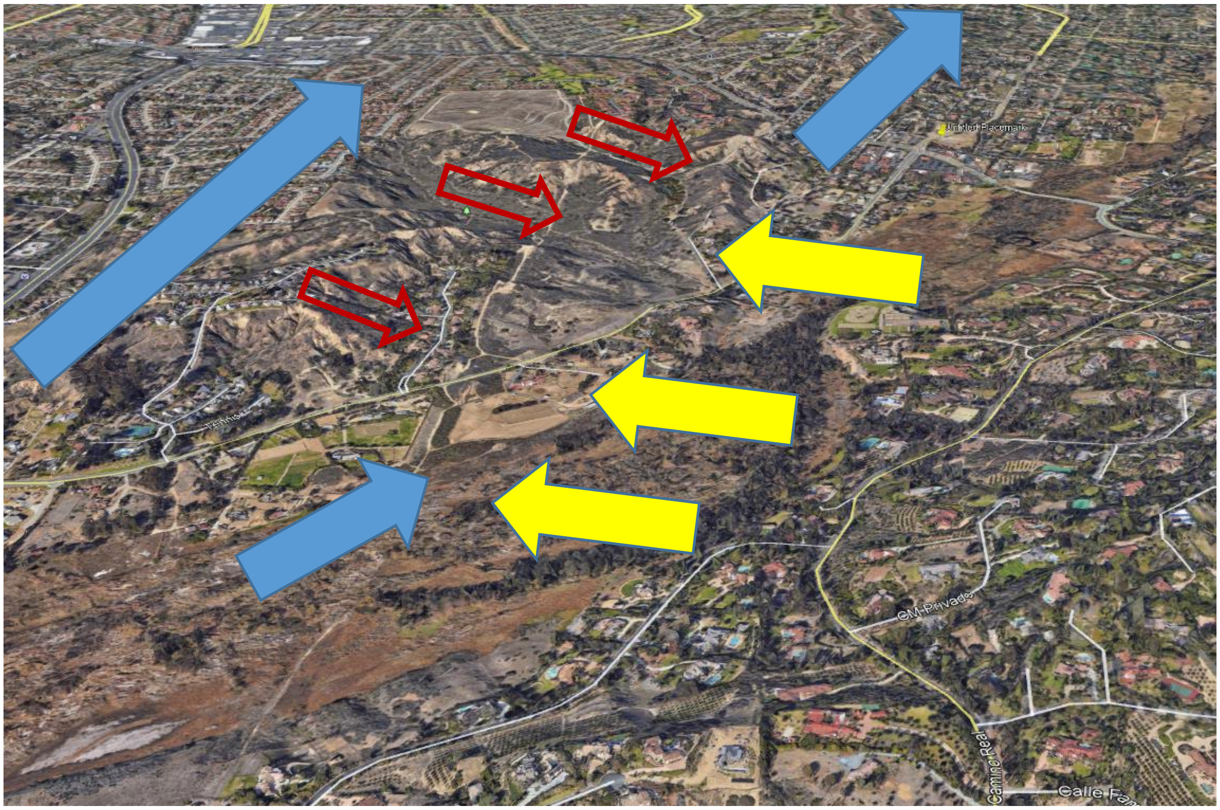


Figure 2.2.2.2.c - Diagrammatic Depiction of Conflicting Sea and Valley Winds (Yellow Arrows – Valley Winds)

When the valley atmosphere is unstable (low stability), convective heat transfer and wind patterns are encouraged, resulting in significant amounts of vertical air movement. Increased atmospheric vertical movement contributes to fire behavior by:

- Allowing convection columns to reach greater heights
- Producing stronger in drafts and convective updrafts
- Increasing the number of embers and firebrands that can be lofting into the convection column by updrafts
- Increasing the occurrence of dust devils and fire whirls
- Increasing the potential for gusty surface winds

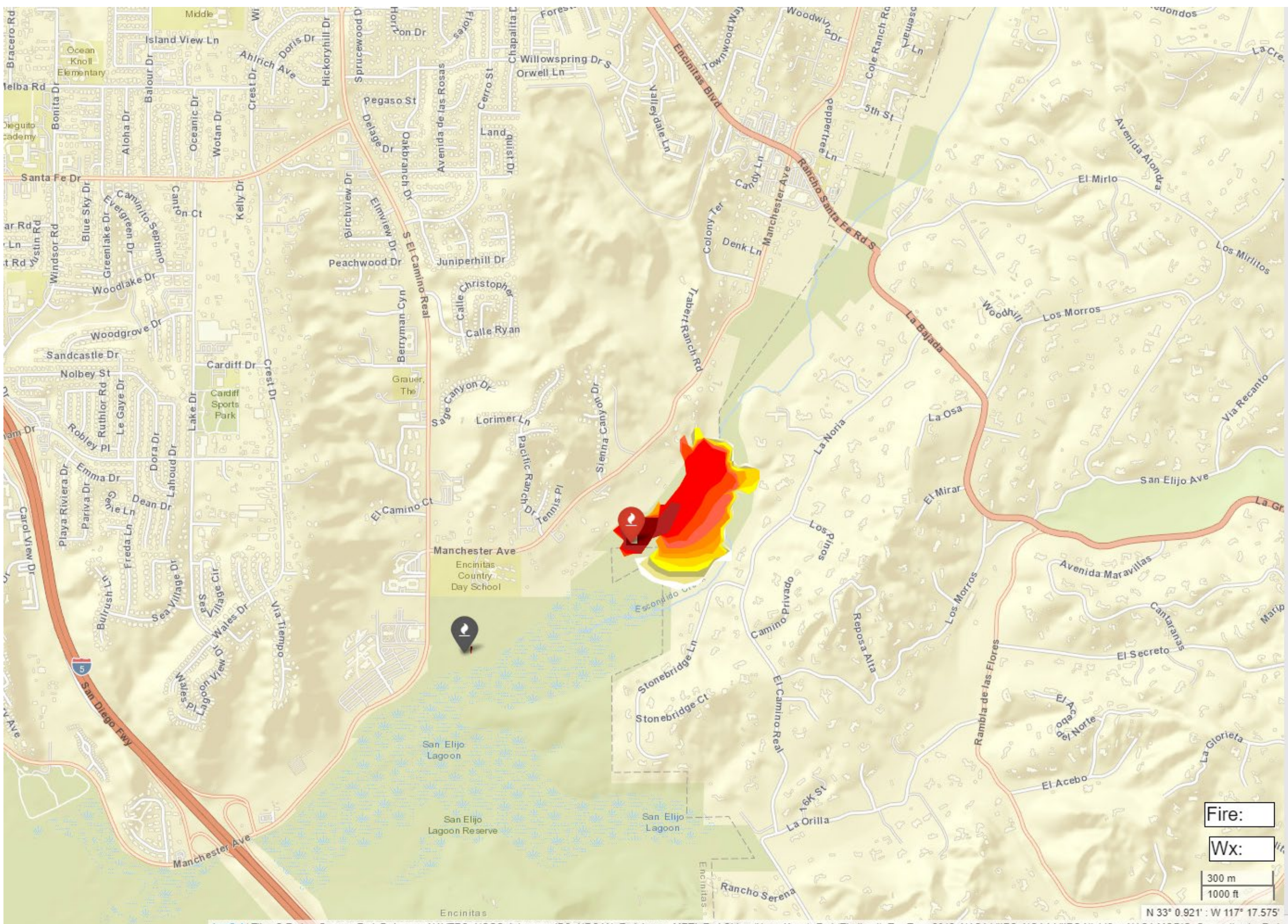
The collision of sea breezes and up-valley winds can create the following additional conditions that affect fire behavior:

- Updrafts at ridgetops leading to wind eddies behind the ridge line
- Battling or shifting winds – winds that constantly change direction and then go back to the original direction
- Wildland fires burn hotter and with more intensity in unstable atmospheric and wind conditions

Fire whirls commonly develop when opposing winds collide. These occur particularly on wind-sheltered (leeward) sides of slopes and on ridges under the following conditions:

- Hot days
- Dry, unevenly heated ground
- Clear skies with light winds
- Intense burning conditions in the immediate environment

Fire whirls can range from 10 to 100 feet in diameter may have heights between 10 and 3000 feet, with wind speeds of 20 to 70 miles per hour. In extreme cases, fire whirls have burned quickly through and across Safety Zones and burned and overturned vehicles.



FireMap *Six-Hour Fire Modeling of Southern Escondido Creek Fire*

Firebrands and ember showers will also ignite vegetation ahead of the flame front in the wetlands habitat north of the area of origin.

Typical Fuel Types and Loading of Wetlands Habitat
East of Manchester Avenue and South of Rancho Santa Fe Road

Fire behavior inside the wetlands habitat will be divided between two elements:

- Ground fuels
- Aerial fuels

Ground-level vegetation was evaluated and classified as Fuel Model TU-5, Very High Load, Dry Climate Timber-Shrub. Analysis of the wetlands habitat indicates that ground fuels are not managed and that vegetation stands extend from the ground upward into the tree canopies. Fires originated at ground level will extend vertically into tree canopies because there are no vertical or horizontal barriers between ground and aerial fuels.

Based on BEHAVE fire modeling calculations, ground based vegetation fires, of themselves, are within fire suppression capabilities of ground-based firefighters using *indirect* fire attack strategies. Initially, firefighters may not be able to stop forward spread of the fire across the landscape until the flame front reaches a non-burnable fuel model area, where fire behavior will rapidly diminish and may stop.

However, if the ground fire extends upwards into aerial tree canopies, different firefighting tactics and strategy are required to insure firefighter safety.

BEHAVE FIRE MODELING, EUCALYPTUS WOODLAND, WETLANDS HABITAT FM TU-5

Topography	Wind (mph)	ROS	Flame Length	Spotting	Fuel Model
0% Slope Ground Fire	20 - 30 mph	62.37'/min.	19.2 feet	0.8 mile/100%	TU-5
0% slope Fire in Tree Canopies	20 - 30 mph	300'/minute	220 feet	+1 mile	TU-5
0% Slope	20 - 30 mph	1103'/minute	80.1 feet	2 miles/100%	GR-9 Wetlands Reeds
O% Slope	20 - 30 mph	152'/minute	13.8 feet	0.6 miles/100%	GS-2 Grass-Shrub
O% Slope	20 - 30 mph	299'/minute	32.7 feet	1.1 miles/ 100%	SH-5 Heavy Load Shrub

Table 2.2.2.1 (b) – Anticipated Fire Behavior in Wetlands Habitat

Ground fires transitioning into the aerial vegetation canopies will change fire behavior in the following ways:

- Rate of spread increases by over five (5) times its original value
- Flame lengths increase approximately eleven (11) times the original value
- Heat Release Rates increase ten (10) times the original value.
- A destructive crown fire throughout the Wetlands Habitat will occur
- Firebrand deposition and major fire runs through the fuels are possible; control efforts at the flame front become ineffective.

SECTION 3
OLIVENHAIN EVACUATION PLAN BACKGROUND INFORMATION

3.1 Introduction to Olivenhain Evacuation Plan

The City of Encinitas has developed and implemented an Evacuation Plan for the Olivenhain Community. This document was revised in December 2019.

The goal of the Olivenhain Evacuation Plan, while not specifically stated in the document, is to *maximize* the preservation of life while *reducing* the number of people that *must* be evacuated and the distance they must travel to seek safe refuge.

The Plan describes how emergency personnel will cooperate and what decisions they will make and implement when responding to a disaster requiring an evacuation.

A further objective is lessening the impact of large-scale evacuations within Encinitas and any surrounding jurisdictions that could serve as evacuation host communities.

The 2006 Department of Homeland Security Appropriations Act indicates that it is imperative for all States (and local communities) to insure that sufficient resources are devoted to putting evacuation plans in place for the complete evacuation of residents, including special needs groups and residents without access to transportation, as well as plans for the sustenance of evacuees, are needed in advance of and after such events occur.

Locally, large wildfires in San Diego County have highlighted the need for establishing community-based evacuation plans that are ready to implement *before* fast-moving fires impact population centers.

3.1.1 San Diego County Emergency Operations Plan Annex Q Guidelines

Large scale evacuations are complex, multi-jurisdictional efforts requiring coordination between many disciplines, agencies and organizations. Evacuations are a single element of many in incident response operations. Emergency services and other public safety organizations play key roles in ensuring that an evacuation is effective efficient and safe.

San Diego County Emergency Operations Plan Annex Q provides the basis for coordinating and responding to Level II (moderate) evacuation scenarios.

Level II evacuations are incidents that impact two or more communities where evacuation travel distance between the impacted area and a safe zone does not exceed thirty (30) miles. The County has also developed guidelines for a Level I (catastrophic) evacuation.

The City of Encinitas and Olivenhain community are exposed to many hazards, all of which have the potential for disrupting communities, cause damage and produce casualties.

San Diego County Office of Emergency Services has identified the following hazards as the most plausible that will impact the County, all of which may foreseeably require the evacuation of several communities:

- Dam failures
- Earthquakes
- Floods
- Tsunamis
- Wildfires

- Terrorism

San Diego OES has concluded that *all* of these hazards *will* impact the City of Encinitas and the surrounding communities of Del Mar, Carlsbad, Solana Beach and Oceanside.

San Diego OES has also determined the number of persons who are potentially exposed to these hazards in Encinitas:

	Dam Failure	Earthquake	100 Year Flood	Tsunami	Wildfire High Risk Probability
Exposed Population	1204	64,145	653	388	57,529
Shelter Estimates	60	3207	33	19	2876

- **Exposed population are adapted from San Diego County Multi-Jurisdictional Hazard Mitigation Plan**
- **Shelter Estimates are based on the assumption that 5% of the exposed population will require public shelter**

Cities in San Diego County develop their individual evacuation plans based on Level II (moderate severity) evacuation scenarios.

Activation of evacuation plans may occur on a strictly local level *or* when two or more communities will be impacted by an evacuation.

Local plans *must* be consistent with San Diego County Emergency Operations Plan Annex Q guidelines. Annex Q recognizes that *most* incidents requiring an evacuation *will occur with little or no warning*.

Most of the populations-at-risk *will* evacuate when officials recommend they do so. However, some individuals, regardless of the threats, will refuse to evacuate. Of those evacuating, most will use their personal vehicles to leave the impacted areas.

The majority of evacuees will seek shelter with relatives or friends or in commercial accommodations rather than in public shelter facilities. County OES estimates that approximately 5% of the population will require public shelter assistance.

3.1.1.1 Evacuation Response Decisions

Evacuation response decisions, including decisions to initiate evacuations, are based on the following priorities, in descending order:

- Maximizing preservation of lives
- Protecting the environment
- Protecting property
- Protecting the economy.

Before making the decision to evacuate or shelter populations in place, the following factors must be considered:

- The capacity to *safely* move or shelter *all* population groups
- Roadway conditions
- Health and safety issues
- Duration of sheltering
- How to *reduce* the number of people who *must* evacuate
- The distance evacuees must travel to obtain safe refuge

Evacuation or sheltering-in-place decisions *must* be *carefully* evaluated against the timing and nature of the incident. Generally, these decisions are made in the field at the Incident Command Post after input from firefighters and law enforcement officers.

An evacuation is an organized and supervised effort that relocates people from an area of danger to a safe location. Although evacuation *is* an effective method of moving people out of dangerous areas, due to operational complexities and the stress caused in people and systems, it should be considered as a ***last*** resort strategy *whenever* possible.

Evacuation orders are issued when there is a clear and *immediate* threat to the health and safety of the population and the Incident Commander determines it is the best available life safety protection strategy.

An Evacuation Strategy has three levels:

1. Evacuation warnings – alerting the population in affected areas of potentials threats to life and property. An Evacuation Warning considers the probability that an area *will* be impacted by the incident within a specific time period and prepares people for an Evacuation Order.
2. Evacuation Order – requires the immediate movement of the population out of the area because of an imminent threat to life.
3. Shelter-in-Place – the population remains at their current locations. This strategy is *only* used when evacuations pose a greater threat than remaining in place, generally resulting in higher potential for life loss if people begin leaving the affected area *or* when evacuations are impractical because of time constraints, obstructed evacuation routes, or, in the case of wildfires, when extreme and unpredictable rates of spread and fire intensity make evacuations impossible.

NOTE: California Penal Code Section 409.5 does *not* authorize forcible *or* mandatory evacuations. There is *no* statutory authority to *forcibly* remove people who do not want to be evacuated *except* for those who enter a closed area *after* the area was closed for evacuation purpose.

3.1.1.2 Primary Evacuation Routes

Primary evacuation routes consist of major interstates, highways and prime arterials in San Diego County. The following major interstates and highways applicable to the Olivenhain community have been identified as primary transportation routes for an evacuation effort:

- Interstate 5
- Interstate 8
- Interstate 15

- Interstate 805
- SR 52
- SR 56
- SR 76
- SR-78

Evacuation routes must be identified before they are announced to the public. These routes are based on the location and extent of an incident and should include as many pre-designated transportation routes as possible.

Selecting appropriate evacuation routes should consider the following characteristics:

- Shortest routes to the designated safe area
- Maximum roadway capacity
- Ability to increase roadway capacity using traffic control strategies
- Maximum number of lanes that provide continuous flow through the evacuation area
- Minimum number of potentially hazardous points and bottlenecks (bridges, tunnels, lane reductions, etc.)

Evacuation of *any* area requires a *significant* commitment of resources and the coordination of efforts between numerous public, private and community/non-profit organizations.

Any incident may or may not allow time for responders to conduct evacuation notification in advance of an immediate threat to life safety.

Incidents may be termed as either "notice" or "non-notice" events for the amount of time available for evacuation efforts. For "no-notice" events occurring with little or no advance awareness of life safety risks, evacuation operations may *not* be feasible.

For example, establishing a contra-flow evacuation strategy involves having twenty-four (24) to seventy-two (72) hours of prior notice before potential evacuations. "No notice" events, such as earthquakes or wildfires do *not* allow contra-flow to be established in advance of the event.

For "notice" incidents, every attempt must be made to assist residents with a safe evacuation process.

The risk to first responders is also an important consideration that must be evaluated before implementing the evacuation.

If an emergency only impacts a single jurisdiction, the decision to evacuate is made the local level with regional collaboration. Based on available information, the local jurisdiction will generally make the determination to evacuate communities on a case-by-case as the need arises. Local jurisdictions may activate their Emergency Operations Center and will conduct evacuations according to their own Emergency Operations Plans.

3.1.1.3 Determination of Theoretical Evacuation Times

The amount of time needed for evacuating a given area can be determined by dividing the number of vehicle needing to evacuate by total roadway capacity.

Annex Q establishes the following formula do determine how much time is needed for evacuation:

Evacuation Time (ET) = (Evacuation Population/Average Vehicle Occupancy)/Roadway capacity

Roadway capacity represents the maximum number of vehicles that can reasonably be accommodated along the evacuation route. It is measured in the number of vehicles per hour, but can fluctuate based on the number of available lanes, number of traffic signals, construction activity, accidents and obstructions.

3.2 Olivenhain Evacuation Plan

The Olivenhain Evacuation Plan is a sixteen (16) page document providing a *basic* framework for evacuating the Olivenhain sub-community.

The responsibility and decisions to evacuate residents are assigned to each individual community in the San Diego County Operational Area. During wildfires, the Incident Commander (Fire Authority Having Jurisdiction) renders the decision about which neighborhoods require evacuation and, in Encinitas, the San Diego County Sheriff's Department carries out those orders.

The estimated exposed population to wildfires in the Olivenhain community is, based on the 2000 Census, 5866 people during evenings and weekends and 5240 residents during daylight hours. It is estimated that approximately 411 persons who will require transportation during emergency evacuations.

For evacuation planning purposes, the weekend population factor of 5866 persons is used in The Plan. The at-risk Olivenhain residents are approximately 11% of the San Diego County OES estimated threatened Encinitas population (57,529) who will be impacted by wildfire events.

The Plan recognizes that a wildfire will result in widespread damage throughout the eastern portions of Encinitas and Olivenhain. The affected area includes buildings east of Rancho Santa Fe Road north of Encinitas Blvd. and south of Olivenhain Road.

3.2.1 Evacuation Traffic Flows

Based on an exposure population of 5866 people, a road capacity of 1000 vehicles per hour, and an average vehicle occupancy of 1.5 persons, the estimated evacuation time during weekends and evening periods would be three hours and fifty-five minutes and three hours and forty-two minutes during weekday daylight hours. The primary mode of transportation during an evacuation will be privately owned vehicles.

Two evacuation scenarios are provided for in the Olivenhain Evacuation Plan.

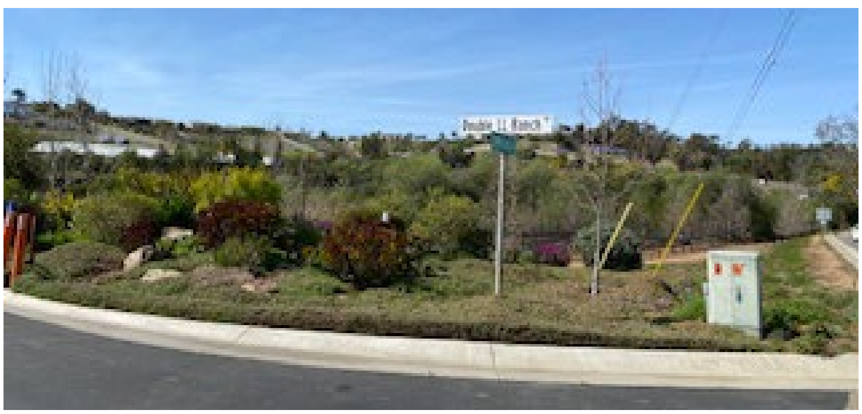
3.2.1.1 Scenario A – Fire Approaching From the East

The first scenario ("A") is a fire approaching Encinitas/Olivenhain from the east from a fire starting in the Harmony Grove or Rancho Santa Fe areas.

The Olivenhain sub-community is divided into two evacuation route schemes:

The exposed population north of the intersection of Dove Hollow and Double LL Ranch Road will be evacuated through the Double LL Ranch Road gate, with evacuees following the following routes:

1.	S/B on Copper Crest Road (to Lone Jack Road)
2.	South-west on Lone Hill Lane (to Lone Jack Road)
3.	S/B on Lone Jack Road
4.	S/B on Lone Hill Lane (to Dove Hollow Rd.)
5.	W/B on Dove Hollow Road
6.	W/B on Double LL Ranch Road



"Emergency Gate" at Double LL Ranch Road

The exposed population south of Dove Hollow Road/Double LL Ranch Road will be evacuated along Lone Jack Road and El Camino del Norte:

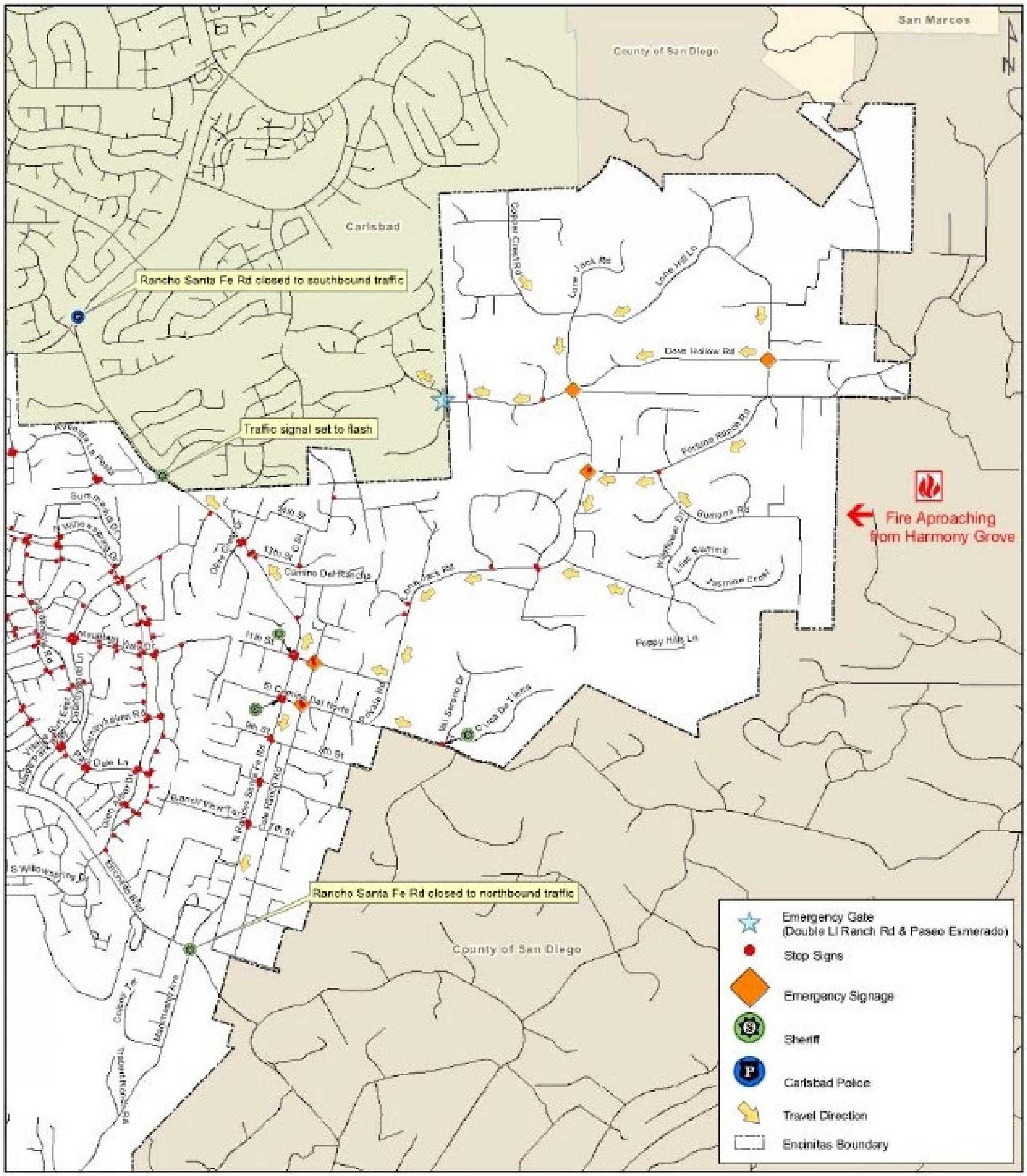
1.	S/B on Rancho Summit Dr. (to Fortuna Ranch Road)	4922 B-1
2.	W/B on Fortuna Ranch Road (to Lone Jack Road)	4921 C-2
3.	S/B on Western Springs Road (to Fortuna Ranch Road)	4921 D-2
4.	W/B on Bumann Road (to Fortuna Ranch Road)	4921 D-2
5.	North on Wildflower Drive (to Fortuna Ranch Road)	4921 D-2
6.	W/B on El Camino Del Norte	4722 A-1, B1
7.	W/B Camino Del Rancho	4821 B-1
8.	S/B on Rancho Santa Fe Rd.	4820 C-1, C-2

Evacuation traffic exiting Lone Jack Road and streets to the north will be directed north-bound on Rancho Santa Fe Road, with no access to south-bound Rancho Santa Fe Road.

Evacuation traffic exiting El Camino del Norte and streets to the south will be directed south on Rancho Santa Fe Road, with no access to north-bound Rancho Santa Fe Road.

If necessary, a gated utility access road from Morning Sun Drive to Village Park Way can be made available to divert traffic from Rancho Santa Fe Road.

Due to the narrow roadways and the deployment of fire apparatus in the affected areas, contra flow evacuation traffic operations will not be an effective strategy.



Scenario "A" Evacuation Routes

3.2.1.2 Scenario B – Fire Approaching from the South

The second scenario ("B") is a fire approaching Encinitas/Olivenhain in the Escondido Creek wetlands habitat from the south.

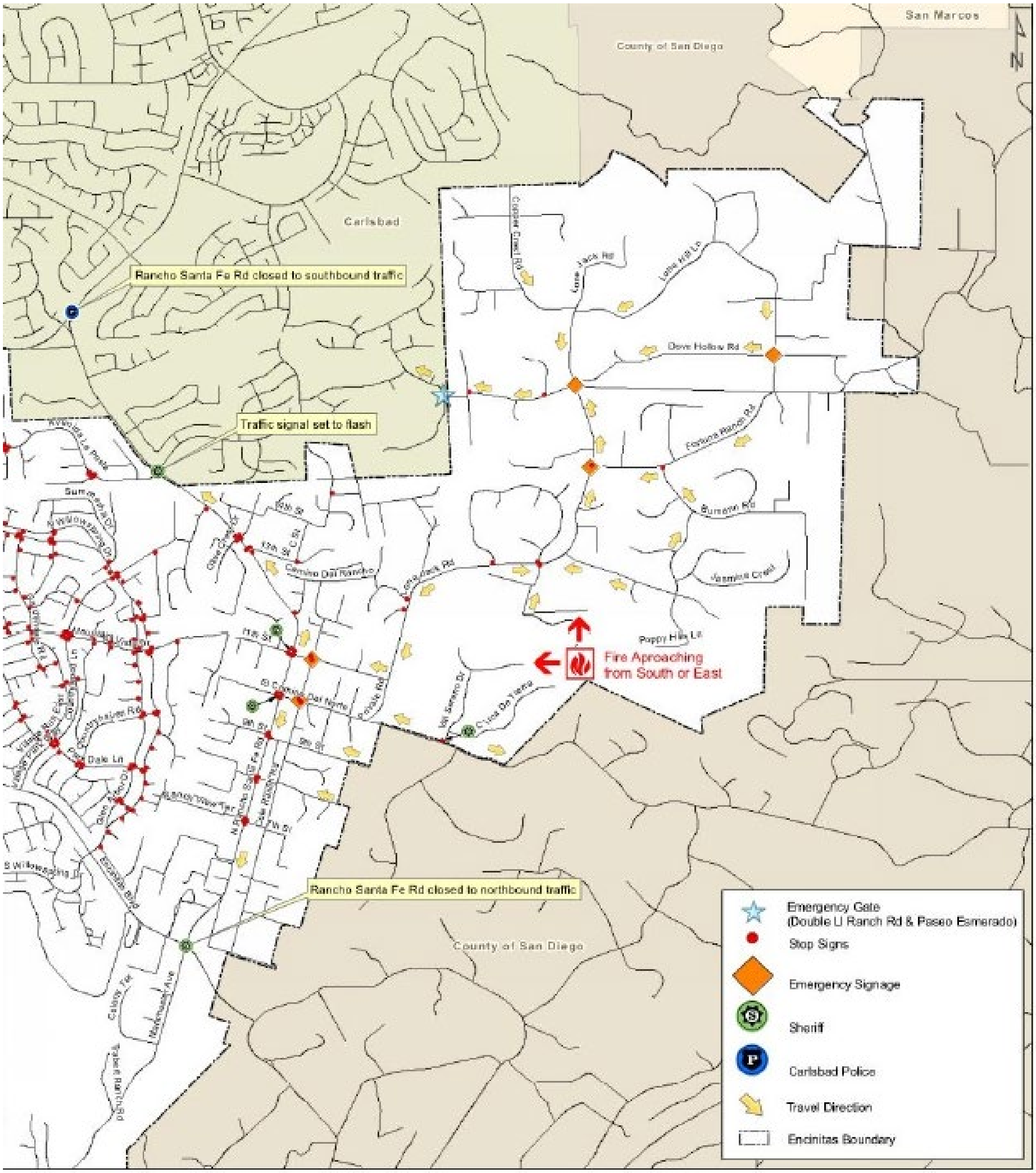
The Olivenhain sub-community is also divided into two evacuation route schemes for this Scenario:

The exposed population north of the intersection of Dove Hollow and Double LL Ranch Road will be evacuated through the Double LL Ranch Road gate, with evacuees following the following routes:

1.	S/B on Copper Crest Road (to Lone Jack Road)
2.	South-west on Lone Hill Lane (to Lone Jack Road)
3.	S/B on Lone Jack Road
4.	S/B on Lone Hill Lane (to Dove Hollow Rd.)
5.	W/B on Dove Hollow Road
6.	W/B on Double LL Ranch Road
7.	S/B on Rancho Summit Dr. (to Dove Hollow Road)
8.	W/B on Fortuna Ranch Road (to Lone Jack Road--North)
9.	North/North-west on Bumann Road (to Fortuna Ranch Rd)
10.	N/B on Wildflower Drive (to Bumann Road)
11.	East on Wildflower Valley Drive (to Lone Jack Road—North)
12.	N/B on Brookside Lane (to Lone Jack Road—North)
13.	N/B on Lone Jack Road (3000 block and higher)

The exposed population south of Dove Hollow Road/Double LL Ranch Road will be evacuated along Lone Jack Road and El Camino del Norte:

1	S/B on Lone Jack Road (2900 block and lower)
2.	S/B on Val Sereno Drive (to El Camino Del Norte)
3.	W/B on El Camino Del Norte
4.	E/B on 9th Street (to Rancho Santa Fe Road)
5.	S/B on Rancho Santa Fe Rd.



Scenario B Evacuation Routes

3.2.2 Other Evacuation Criteria

3.2.2.1 Public and Private School Evacuations

Evacuations of public schools are normally conducted by transporting students on school buses to other school outside the risk area.

Another strategy is to transport students on school buses to a reunification center where they can be picked up by their parents. In these cases, the local jurisdiction must provide timely information to parents and guardians about where to pick up their children, along with security precautions that have been implemented to safeguard them.

Finding: *The Olivenhain Evacuation Plan does not address school evacuation issues.*

There are numerous schools in the affected evacuation area, none of which have busses to transport students off-site.

There are approximately 2000 students at six schools in the immediate evacuation area:

- Olivenhain Pioneer elementary (570)
- Diegueno middle (937)
- Village Bloom preschool (~30)
- The Rhoades elementary and middle (310)
- Encinitas Country Day kindergarten and preschool (~60)
- Bright Horizons (~60)

Without school provided emergency transportation, an evacuation warning and order encourages parents to travel to their children's schools, adding additional traffic into and out of the evacuation zone.

3.2.2.2 Evacuation of Animals

Any emergency causing the evacuation and sheltering of people impacts livestock and other animals inside the impacted area.

Many people *refuse* to evacuate if they *cannot* take their animals with them.

- 25% of pet owners will refuse to evacuate *without* their animals
- 30-50% of pet owners *inadvertently* leave their animals behind
- 50-70% of pet owners *will* attempt to re-enter closed areas to rescue their animals

Under the County Emergency Operations Plan, Animal Control Officers, San Diego Humane Society and other private animal care shelters will assist in the rescue, transport and sheltering of large and small animals. Only non-emergency resources and personnel will be used to rescue and transport animals during an evacuation event.

Large Animal Evacuations

Under the County Emergency Operations Plan, livestock owners *are* responsible for maintaining their own plans and means of transporting large animals during an evacuation.

Jurisdictions *cannot* assume that owners will have their own trailers. Animal Services will provide support transporting large animals by using Animal Service trailers or with Humane Society and volunteer group trailers.

According to San Diego County OES, the City of Encinitas has approximately 25,000 households. The number of pets in these households have been estimated as:

- Dogs – 14,180 households (+/- 48%)
- Cats – 15,491 households (+/- 38%)
- Birds – 1724 households (6%)
- Horses – 996 households (2%)

The Plan does not consider the impact of large capacity animal vehicle-trailer combinations using evacuation routes.

These vehicles require large turnaround areas, few of which are provided along the relatively narrow and winding roadways present in the affected area. Given the narrow roads in the area, long wheelbase animal rescue vehicles will foreseeably have slow travel times and maneuvering speeds, both in an unloaded and loaded condition. The Plan does not analyze the travel times of these combination vehicles under emergency conditions on the evacuation routes.

3.2.3 Evacuation Route Analysis

Evacuation traffic is essentially funneled along two routes out of the area, based on the Olivenhain sub-community being divided into two zones based on addressing and location along the Lone Jack Road corridor.

Residents south of the 3000 block of Lone Jack Road and the intersection of Dove Hollow/Double LL Ranch Road/Lone Jack Road are directed south and west along Lone Jack Road to its intersection with Rancho Santa Fe Road. At this intersection, residents will be directed south on Rancho Santa Fe Road, where they will proceed to ***undetermined*** safe zones.

Residents north of the 3000 block of Lone Jack Road and the intersection of Dove Hollow/Double LL Ranch Road/Lone Jack Road are directed to the intersection of Lone Jack Road and Double LL Ranch Road, where they are directed west and into a gated community along privately maintained roads.

For both Wildfire Evacuation Scenarios A and B, the written evacuation route description ends at this gated entrance. The published Scenario A map indicates evacuation traffic will continue west-bound through the area beyond the gate to a second "emergency gate" at the municipal borders separating Encinitas from the City of Carlsbad. Scenario "A" does ***not*** indicate how and where residents will proceed to pre-determined safe zones.

Analysis of the Evacuation Routes has identified two potentially critical flaws:

1. The Plan relies on roadway capacities with a minimum flow rate of 1000 vehicles per hour (v.p.h.)

2. The Plan does not take into consideration the impact of the northern evacuation routes being overrun by wide spread and dynamic flame fronts, forcing *all* evacuation traffic onto a single and central route – Rancho Santa Fe Road.

3.2.3.1 Pre-determined Roadway Capacities

Each roadway type has a different classification and capacity. Freeways and highways have the highest capacity, averaging 2200 vehicles per lane at a speed of 30 m.p.h.

Table 3.2.3.1 identifies the San Diego County OES minimum, maximum and mean peak hourly peak hourly capacities for the identified major transportation thoroughfares in Encinitas, as shown below.

If the road runs east to west, the westbound lanes are represented in the "AB" column and eastbound lanes are represented in the "BA" column. If the road runs north-to-south, northbound lanes are designated in the "AB" column and southbound lanes in the "BA" column.

	"AB"			"BA"		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
	North/West	N/W	N/W	South/East	S/E	S/E
El Camino Real	702	5324	3819	500	5324	3584
Hwy 101	1482	3300	2844	1482	3300	2803
Leucadia Olivenhain	1152	5100	2536	1000	3760	2473

Table 3.2.3.1 San Diego County OES Pre-Determined Roadway Capacities

Research of available average daily trip and hourly roadway capacity information has identified c*onflicting* data. Identification of conflicting information indicates that the estimated Olivenhain evacuation timing *may be erroneous* and that *longer evacuation durations are foreseeable* under emergency field conditions.

The following evacuation traffic flow discrepancies have been identified:

Encinitas Blvd.

Sources of information indicate there are two flow rates for Encinitas Blvd.

- 941 vehicles/hour (SANDAG)
- City of Encinitas Traffic Report – 1142 to 1350 vehicle/hour, depending on location

El Camino Real

Sources of information indicate there are two potential variable flow rates for El Camino

Real

- City of Encinitas Traffic Study - 958 to 1314 vehicles per hour, depending on location
- SANDAG – 702 to 5324 v.p.h; mean 3584 v.p.h

Rancho Santa Fe Road

The 2016 City of Encinitas Traffic Study concluded that Rancho Santa Fe Road has a roadway capacity of *550* vehicles per hour. This is a deficit of *450* vehicles per hour compared to the evacuation plan parameter of 1000 vehicles per hour over the evacuation route.

Manchester Avenue

At the combined intersections of Rancho Santa Fe Road, Encinitas Blvd. and Manchester Avenue, Manchester Avenue, which has a south-to-north configuration, flows directly in the northbound Rancho Santa Fe Road corridor. Manchester Avenue continues southbound from the combined intersection as a two-lane narrow, winding road that parallels the Escondido Creek wetlands habitat. Between Encinitas Blvd. and El Camino Real, Manchester Avenue has an hourly traffic flow of 250 vehicles.

Because of its restricted roadway corridor, exposure to large sections of unmanaged natural vegetative fuel beds with flame front burn-over potential, and constricted traffic flow rates, Manchester Avenue is ***not*** designated as an evacuation route for the Olivenhain community. However, because of its natural southerly progression from the three-way intersection at Encinitas Blvd., it is anticipated that *some* evacuees will, nonetheless, attempt to use this route as an egress pathway out of the area.

With a roadway capacity of 250 vehicles per hour, Manchester Avenue between Encinitas Blvd. and El Camino Real has a 750 per hour deficit along its corridor.

El Camino del Norte

The 2016 City of Encinitas Traffic Study concluded that El Camino de Norte has a roadway capacity of *287.5* vehicles per hour. This is a deficit of *712.5* vehicles per hour compared to the evacuation plan parameter of 1000 vehicles per hour over the evacuation route.

Lone Jack Road

The 2016 City of Encinitas Traffic Study concluded that Lone Jack Road has a roadway capacity of *279.166* vehicles per hour. This is a deficit of *721.834* vehicles per hour compared to the evacuation plan parameter of 1000 vehicles per hour over the evacuation route.

Typical Roadway Conditions on Lone Jack Road North of Double LL Ranch Road

El Camino del Norte and Lone Jack Road exemplify the typical two-lane roads in the Olivenhain evacuation area.

Research for roadway capacities for the two-lane roads identified in the Olivenhain Evacuation Plan could not locate corroborating data for normal traffic flow rates.

Analysis using Google-Earth aerial photography (and its measuring tool) for Olivenhain developed the following road widths along proposed evacuation roadways:

- Dove Hollow Road – 18 feet wide
- Double LL Ranch Road – 28 feet wide
- Lone Hill Road 32 feet wide
- Lone Jack Road – 38 feet wide
- Fortuna Ranch Road – 45 feet wide
- Cole Ranch Road – 28 feet wide
- Val Serreno Road – 30 feet wide
- Copper Crest Road – 36 feet wide
- Dove Hollow Road – 20 feet wide
- Rancho Summit – 28 feet wide (decomposed granite unpaved surface)
- Bumann Road – 24' feet wide
- Wildflower Drive – 32 feet wide
- Camino del Rancho – 50 feet wide
- Brookside Lane – 20 feet wide

NOTE: Google Earth aerial imagery *may* be outdated in reference to current and updated road conditions and widths.

Averaging the estimated roadway capacities of El Camino del Norte and Lone Jack Road, the resulting roadway capacity of 283.333 vehicles per hour can be applied by extrapolation to the other similar evacuation roadways in the area. This is a deficit of *716* vehicles per hour compared to the evacuation plan parameter of 1000 vehicles per hour over the evacuation route.

Averaging the estimated roadway capacities of Rancho Santa Fe Road, El Camino del Norte and Lone Jack Road, the resulting roadway capacity of 355.55 vehicles per hour can be applied by extrapolation to the other similar evacuation roadways in the area. This is a deficit of *644* vehicles per hour compared to the evacuation plan parameter of 1000 vehicles per hour over the evacuation route.

Averaging the estimated roadway capacities of Rancho Santa Fe Road, El Camino del Norte, Lone Jack Road and Manchester Avenue, the resulting roadway capacity of 341.66 vehicles per hour can be applied by extrapolation to the other similar evacuation roadways in the area. This is a deficit of *658* vehicles per hour compared to the evacuation plan parameter of 1000 vehicles per hour over the evacuation route.

3.2.3.2 Revised Evacuation Route Time Estimates – All Evacuation Routes Open

To clarify exit timing along the proposed evacuation routes, without either the northern or southern roadways impacted and overrun by a wide-based flame front, the number of occupants per vehicles and the roadway traffic flow capacities were adjusted to provide more realistic estimates for clearing the impacted neighborhoods.

Olivenhain Evacuation Plan Parameters

1.5 persons/vehicle = 3910 vehicles

100% southbound on Rancho Santa Fe Road - 7.109 hours (550 vph)
60% northbound out of area (2346 vehicles) - 6.85 hours (342 vph)
40% southbound - 1564 vehicles - 4.57 hours (342 vph)

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2 persons/vehicle = 2933 vehicles

100% on RSF Road - 2.93 hours at 1000 vph

100% on RSF Road at 550 vph - 5.33 hours
60% North - 1776 vehicles - 3.22 hours (550 vph)
40% south - 1174 vehicles - 2.13 hours (550 vph)

100% on RSF Road at 342 vph = 8.5 hours
60% north - 1776 (342 vph) = 5.2 hours

40% south - 1174 (342 vph) = 3.44 hours

3 persons/vehicle = 1956 vehicles

100% on RSF Road at 1000 vph = 1.2 hours

100% on RSF Road at 550 vph -3.5 hours
60% North - 1774 vehicles - 3.22 hours (550 vph)
40% south - 783 vehicles -1.43 hours (550 vph)

100% on RSF Road at 342 vph = 8.5 hours
60% north - 1776 (342 vph) = 5.2 hours
40% south - 783 (342 vph) = 2.28 hours

4 Persons/vehicle - 1467 vehicles

100% on RSF Road at 1000 vph = 1.5 hours

100% on RSF Road at 550 vph = 2.67 hours
60% North - 881 vehicles - 1.6 hours (550 vph)
40% south - 587 vehicles - 1.1 hours (550 vph)

100% on RSF Road at 342 vph = 2.7 hours
60% north - 881 (342 vph) = 2.5 hours
40% south - 587 (342 vph) = 1.72 hours

In the event that a wildfire is approaching from the extreme north and northeast corners of the City and Olivenhain and the a portion of the pre-planned Scenario A became untenable, and ***all*** evacuation traffic is diverted to Rancho Santa Fe Road, the following evacuation times would apply:

Rancho Santa Fe Road, estimated hourly capacity of 550 vehicles, the estimated evacuation time of 3910 cars is **7.1 hours.**

When vehicles using Rancho Santa Fe Road and turn onto Encinitas Blvd, with an hourly capacity of 941 vehicles, the estimated additional evacuation time is **4.2 hours.**

Total Evacuation Time Using Only Rancho Santa Fe Road and Encinitas Blvd. = 11.4 hours

The eleven hour time frame exceeds the estimated evacuation time indicated in the Evacuation Plan by 322%.

Placing three occupants in each vehicle (1995 vehicles), evacuation time for the estimated population on Rancho Santa Fe Road is 3.5 hours with an additional 2.12 hours once Encinitas Blvd is reached and is used by evacuees for a total of **5.62 hours**.

For a best-case evacuation timing, placing four occupants in each vehicle (1467 vehicles), evacuation time for the estimated population on Rancho Santa Fe Road is 2.55 hours with an additional 1.55 hours once Encinitas Blvd is reached and is used by evacuees for a total of **4.1 hours.**

Using the averaged evacuation route roadway capacities, foreseeable field evacuation times were estimated from the Northern portions of Olivenhain to the tri-way intersection at Encinitas Blvd. /Rancho Santa Fe Road/Manchester Avenue:

Number of Evacuating Vehicles	Occupants/vehicle	Average Flow Rate	*Estimated Evacuation Time*
3911	1.5	283 vph	***13.82 hours***
3911	1.5	342 vph	***11.44 hours***
3911	1.5	356 vph	***10.99 hours***
3911	1.5	550 vph	***7.2 hours***
1955	3	283 vph	***6.91 hours***
1955	3	342 vph	***5.72 hours***
1955	3	356 vph	***5.49 hours***
1955	3	550	***3.56 hours***
1467	4	283 vph	***5.19 hours***
1467	4	342 vph	***4.29 hours***
1467	4	356 vph	***4.13 hours***
1467	4	550 vph	***2.67 hours***

Table3.2.3.2.1- Estimated Evacuation Times Using Traffic Flow Rate Data

Note: The estimated times do ***not*** reflect evacuation traffic turning onto Encinitas Blvd. and continuing west-bound to designated safe areas (***see below)***

For a *worst*-case, *most conservative* evacuation time, the roadway capacity data for Encinitas Blvd. was averaged, producing a flow of 1150 vehicles per hour:

Number of Vehicles	Encinitas Blvd. Evacuation Time	North-South Evacuation Time	*Total Evacuation Time*
3910	3.4 hours	13.82 hours	***17.22 hours***
1955	1.7 hours	5.72 hours	***7.42 hours***
1467	1.27 hours	5.19 hours	***6.46 hours***

Table 3.2.3.2.2 – Worst Case Estimated Evacuation Times

For a *best* case, *most liberal* evacuation times, with Encinitas Blvd flowing 1350 vehicles per hour and Rancho Santa Fe flowing 1000 vehicles per hour:

Number of Vehicles	Encinitas Blvd. Evacuation Time	North-South Evacuation Time	Total Evacuation Time
3910	3.4 hours	3.55 hours	***6.95 hours***
1955	1.45 hours	1.96 hours	***3.41 hours***
1467	1.1 hours	1.5 hours	***2.6 hours***

Table 3.2.2.3 – Best Case Estimated Evacuation Times

Number of Vehicles	Worst Case Evacuation Time	Best Case Evacuation Time	*Difference*
3910	17.22 hours	6.95 hours	***10.27 hours***
1955	7.42 hours	3.41 hours	***4.01 hours***
1467	6.46 hours	2.6 hours	***3.86 hours***

Table 3.2.3.2.4 - Difference between Best and Worst Case Estimated Evacuation Times

Using the 550 v.p.h rating of Rancho Santa Fe Road and an 1150 v.p.h rating for Encinitas Blvd. at the tri-way intersection, the following evacuation times are determined:

Number of Vehicles	Rancho Santa Fe Road Evacuation Route	Encinitas Blvd. Evacuation Route Timing	*Total Evacuation Time*
3910 (1.5 occupants)	7.2 hours	3.4 hours	***10.6 hours***
1955 (3 occupants)	3.56 hours	1.7 hours	***5.26 hours***
1467 (4 occupants)	2.67 hours	1.27 hours	***3.94 hours***

Table 3.2.3.2.5- Estimated Realistic Evacuation Times

Findings

1. Evacuation times determined for all Olivenhain and Northern Encinitas residents being diverted onto Rancho Santa Fe Road and Encinitas Blvd. rise dramatically over the Evacuation Plan estimated evacuation time allowances when all evacuation routes are otherwise open for use.
2. Based on congested normal and evacuation traffic flows on Rancho Santa Fe Road, it ***is*** foreseeable that evacuation traffic on evacuation routes intersecting with Rancho Santa Fe Road may ***not*** be able to merge with southbound evacuation traffic flows without stringent and dynamic traffic control procedures.
3. Based on an average vehicle length of twenty (20') feet, southbound traffic will produce a *worst*-case back-up of vehicles that is approximately 14.9 miles long (20' x 3910 vehicles with 1.5 passengers per vehicle).
4. Based on an average vehicle length of twenty (20') feet, southbound traffic will produce a *best*-case back-up of vehicles that is approximately 5.6 miles long (20' x 1467 vehicles with four passengers per vehicle).

In 2019, the *Encinitas Advocate* published an article about Rancho Santa Fe Road's daily commuter traffic problems. The article indicates that 13,000+ vehicles use Rancho

Santa Fe Road, which is commensurate to the City's ADT Report findings, and found that southbound traffic typically backs up for several miles during normal daily morning commute times. The process reverses during daily afternoon commute times. Rancho Santa Fe Road is a relatively narrow, two-lane right-of-way corridor, with its northern sector's seven intersections controlled by stop signs instead of traffic lights. The article reinforces the Findings and Conclusions rendered above about worst- and best-case traffic backups during an emergency evacuation scenario.

5. The information presented in these Findings and Conclusions clearly indicate that ***all*** evacuation routes ***must*** be kept open during a wild fire event and that early evacuation trigger point identification and implementation are necessary to provide a reasonable amount of time to effect an evacuation with the northern Encinitas/Olivenhain Communities.

3.3 Available Evacuation Time Analysis

3.3.1 Introduction

Wildfires present significant challenges and have highly dynamic contexts in which emergency managers must make protection action decisions while adapting to an ever changing situation. Protective action decisions using the most preferred course of protection action *can* change with *little* notice, causing reassessment of the original decision according to the new conditions.

Protective actions depend on "trigger points".

Trigger points are agreed upon events that represent a time or place when a fire crosses a geographical or anticipated condition on the landscape. Trigger point activations are either a spontaneous decision during dynamic fire events or may represent a pre-set event or condition for timing an evacuation based on different emergency scenarios.

Trigger Points are ***not*** discussed in the Olivenhain Evacuation Plan.

When compared to San Diego County EOP Annex D parameters. The Olivenhain Evacuation Plan does not follow the approved plan template for activating evacuation operations.

Annex Q provides a dual-level evacuation decision process, with an Evacuation Warning issued to the public, followed by either an Evacuation Order or a Shelter-in-Place directive.

The Evacuation Warning alerts the population in an affected area of a *potential* threat to life and property. The Warning considers the *probability* that an area *will* be impacted within a given time frame and prepares people for a *potential* Evacuation Order.

An Evacuation Order requires the *immediate* movement of people out of an affected area because of an *imminent* threat to life.

The Shelter-in-Place Directive advises people to remain at their *current* location because an evacuation *will* cause a *higher* loss-of-life potential. SIP Directives are also used when a physical withdrawal from an area is impractical because of incident conditions and dynamics. SIP attempts to provide safe havens inside the impacted area(s).

The Olivenhain Plan directs Fire Department to follow the following procedures:

- "Review plans and procedures" when a Red Flag Warning is issued
- For fires progressing west from Escondido, Poway or Rancho Bernardo – initiate (start) a Phased Evacuation *or* order a Voluntary Evacuation
- For wildfires in San Marcos, Harmony Grove, Elfin Forest, Carlsbad or Rancho Santa Fe – Evacuation Scenario "A" Mandatory Evacuation is *immediately* (by prescriptive language in the plan and otherwise by inference) initiated.
- For wildfires in Olivenhain, Escondido Creek or Rancho Santa Fe – Evacuation Scenario "B" Mandatory Evacuation is *immediately* (by prescriptive language in the plan and otherwise by inference) initiated.

The Olivenhain Plan provides minimal or no guidance on:

- Issuing an Evacuation Warning to the public before activating Evacuation Orders.
- The definition of a "Phased Evacuation" and how it will implemented
- The definition of a "Voluntary Evacuation" and how it will implemented and controlled
- The timing, issuance and implementation of a Shelter-in-Place Directive when physical community evacuations cannot be accomplished without the potential of a large loss of life among evacuees.

Protective action decisions *must* analyze the perceived timing of *foreseeable* events during dynamic fire incidents. This is critically important in relationship to evaluating when a flame front will arrive at particular locations in the incident area. In short, how much time is available to select and implement a protective action before it is no longer a viable strategy?

The option to leave an area given sufficient available time is generally called an "early evacuation", whereas the option with little or no time to evacuate is termed "late evacuation."

Similarly, the timing to decide whether or not to seek shelter is also important:

- Is it made well in advance of the approaching fire OR
- Is it made at the last possible moment
- Is there sufficient time to notify threatened populations

- Is there sufficient time to evacuate the threatened population and move them to a safer location or evacuation center

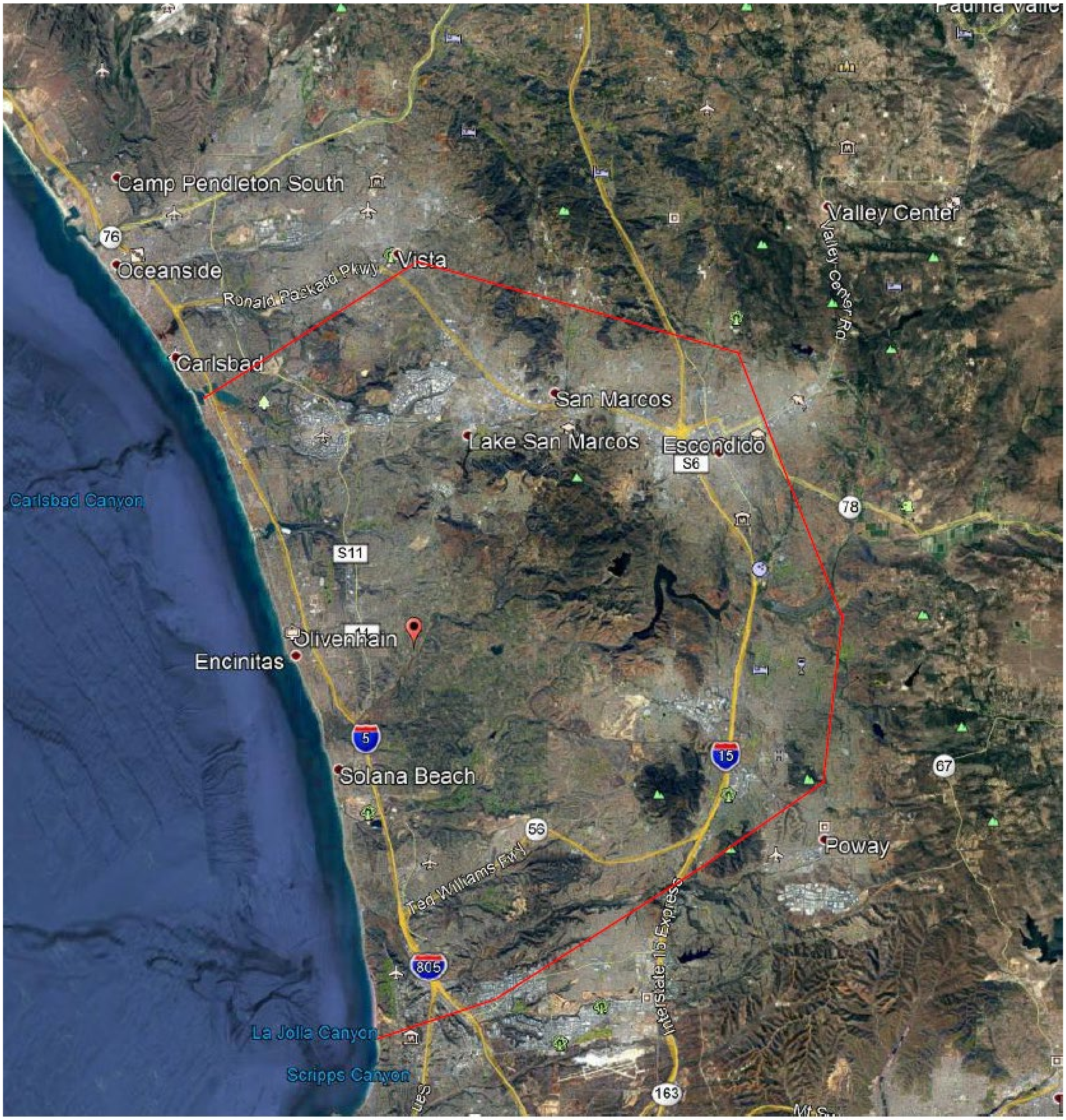
3.3.2 Available Evacuation Time Analysis

The Required Safe Evacuation Time (RSET) is a combination of threat identification, travel time to the egress point and estimated evacuation time to a safe off-site location.

The Available Safe Evacuation Time (ASET) is the amount of time between detection of a threat to a community and the point at which the fire enters the community and creates untenable conditions for the population, the built environment, livestock and infrastructure.

For a fire safety performance-based design to be considered a safe alternative, ASET time values for community members ***must*** be ***longer*** than Required Safe Evacuation Time (RSET) values for the fire conditions present in the environment.

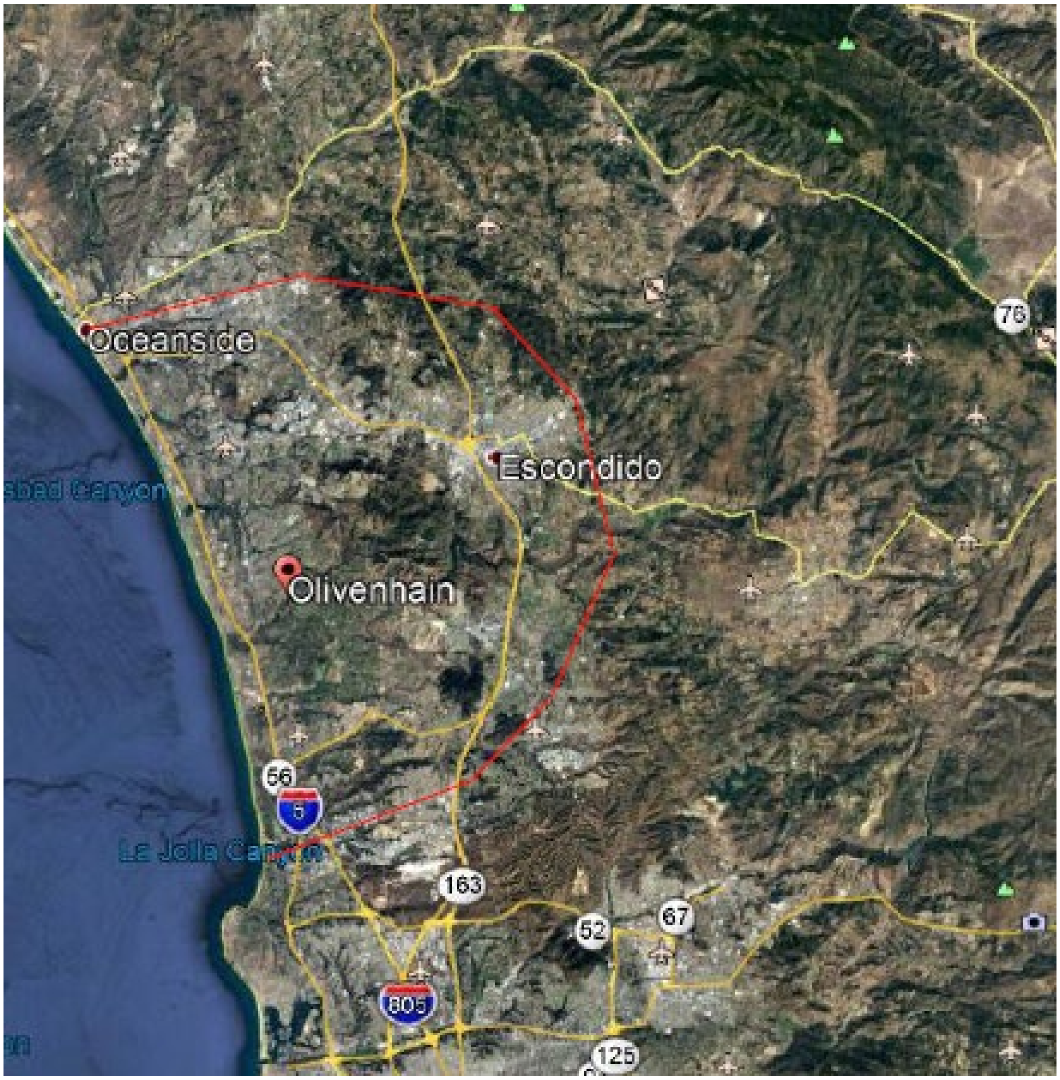
Using anecdotal San Diego County guidelines for "worst case" late summer afternoon wildfires, assuming a four mile-per-hour spread rate, evacuation warnings should be initiated when the fire is approximately ten miles away and traveling towards the intersection of Encinitas Blvd. and Rancho Santa Fe Road. The ten miles distance, with a rate of spread of 4 mph, provides residents with a 2.5-hour ASET evacuation window.



Ten Mile Evacuation Trigger Point Radius from Encinitas Blvd. & Rancho Santa Fe Road

Non-Santa Ana Wind Event Wildfires

Using similar San Diego County anecdotal guidelines for "worst case" Santa Ana wind events, assuming an 8.2 mile-per-hour spread rate, evacuation warnings should be initiated when the fire is approximately twelve miles away and traveling towards Olivenhain. The twelve miles distance, with a rate of spread of 8.2 mph, provides residents with a 1.5-hour ASET evacuation window.



12 Mile Evacuation Trigger Points – Santa Ana Wind Events

3.3.2.1 Evacuation Scenario #1 – Non-Santa Ana Wind Events

Using the County Non-Santa Ana Wind Event Ten Mile Evacuation Trigger Point for a fire approaching Olivenhain from the south, evacuating vehicles have a RSET value of 4.5 hours (*with a twenty minute safety factor added*).

For 2.5 hour non-Santa Ana Wind Event ASET Value, best-case evacuation time from the Olivenhain is 4.5 hours, *a **two** hour **deficit** for the evacuation estimate.*

Finding: *The anticipated ASET-RSET ratios provide ASET values **greater** than RSET Values; the proposed road system, based on the County of San Diego evacuation trigger points, does **not** provide a safe performance-based design evacuation period for non-Santa Ana wind event fires.*

Mitigation Recommendations:

According to established evacuation trigger points, the ASET value for a non-Santa Ana Wind event fire with an 4 mph rate of spread is 2.5 hours (150) minutes or a distance of ten (10) miles from Olivenhain.

To provide safe and conservative performance-based evacuation design, with a 270-minute RSET timing parameter, the evacuation trigger point requires adjusting the trigger point perimeter with a minimum additional distance of eight (8) miles from Olivenhain, as indicated below:

120 (2 hour deficit) minutes

4 mph ROS = 352 feet per minute x 120 minutes =95040 feet
195040 feet/5280 =**18 miles**

Revised Evacuation Trigger Point: 10 miles (standard trigger point) + 18 miles (RSET value) = **28 miles trigger point adjustment**

Math Check – 4.5 hours x 60 minutes = 270 minutes x 352 feet/minute = 95040 feet /5280' = 18 miles

3.3.2.2 Evacuation Scenario #2 – Santa Ana Wind Events

For vehicles evacuating Olivenhain *during* a Santa Ana wind event fires, using a single egress route, the RSET value is 4.5 hours. The County Evacuation Trigger Point Standard provides a 1.5 hour (90 minute) ASET factor.

For 1.5 hour Santa Ana Wind Event ASET Value, best-case evacuation time from the Olivenhain is 4.5 hours, *a **three** hour **deficit** for the evacuation estimate.*

***Finding:** The anticipated ASET-RSET ratio provides ASET values **more** than RSET Values; the proposed road system, based on County of San Diego evacuation trigger points, does **not** provide a nominally safe performance-based design evacuation period for Santa Ana wind event fires.*

Mitigation Recommendations:

According to evacuation trigger points, the ASET value for a Santa Ana Wind event fire with an 8.2 mph rate of spread is ninety (90) minutes or a distance of twelve (12) miles from Olivenhain.

To provide safe and conservative performance-based evacuation design, with a 90-minute RSET timing parameter, the evacuation trigger point requires adjusting the trigger point perimeter with a minimum additional distance of twenty-four (24) miles from Olivenhain, as indicated below:

180 (3 hour deficit) minutes

8.2 mph ROS = 704 feet per minute x 180 minutes =126,180 feet
126,180 feet/5280 = **23.89772727 miles**

Revised Evacuation Trigger Point: 12 miles + 24 miles = **36 miles**

Math Check – 4.5 hours x 60 minutes = 270 minutes x 704 feet/minute = 190080 feet /5280' = 36 miles

Typical Evacuation Traffic Impacts during Wildfire Events (Australia)

Southbound Evacuation Traffic from Malibu California Wildfire Event

The above photographs depict typical evacuation traffic that may be present on the southern portions of Rancho Santa Fe Road during a major wildfire event.

Alpine Evacuation Traffic - October 2003 Cedar Fire
Victoria Parkway Terrace – 65' Improved Paved Width

Results of Australian Evacuation Route Overrun by Flame Front

Results of Camp Fire (California) Evacuation Route Overrun by Flame Front

The above photographs depict the potential and foreseeable impact of a wildfire flame front overrunning typical evacuation traffic on any of the designated Olivenhain evacuation routes during a major wildfire event when *insufficient* evacuation times exist.

Findings:

1. The Plan does not consider foreseeable obstructions to evacuation traffic flow caused by traffic accidents.
2. The Plan does not provide sufficient traffic control personnel along evacuation routes to facilitate egress in an orderly and effective manner.
3. Multiple intersections on Rancho Santa Fe Road are controlled by stop signs. Without adequate traffic control efforts, panicked evacuees will attempt to force their way from side streets onto Rancho Santa Fe Road, inevitably causing collisions with other vehicles using the evacuation roadway.

3.4 Evacuation Dynamics

Reliance on restricted emergency egress routes is problematic from several perspectives:

- Fire-related human behavior characteristics
- Resource allocation limitations during emergency events
- Shelter-in-Place Considerations

3.4.1 Fire-Related Human Behavior

Research has been performed to understand the effects of stress on emergency evacuation behavior. Stress during an emergency can be brought on by several different and complex conditions or states. Other than the obvious threat from physical harm, fires can cause other conditions/states including uncertainty/ambiguity, information overload and time pressure.

Uncertainty/ambiguity for residents can occur because of:

- Missing or incomplete information
- Unreliable information – actual or perceived
- Ambiguous or conflicting information – more than one interpretation of facts is presented

Information overload occurs when an individual or group perceives that there is too much information being provided and this data cannot be filtered in the time available. Information overload is also related to time pressures.

Time pressure causes residents to think that their situation is urgent and that they have only a limited amount of time to perform certain actions.

All of these conditions become stressors, leading residents to feel a physical state of stress or anxiety. To experience acute stress, only *some* of the stressors must be present, the individual is aware of their stress, they are motivated to resolve the situation but they remain uncertain about the eventual outcome.

One of the major ways stress impacts evacuation decision-making is that it narrows a person's perspectives. Stress makes it more difficult to perceive clues from the environment; people only pay attention to a limited number of clues. This causes them to miss important pieces of information about the event that they need to insure their ability to make safer and more effective decisions.

Another effect of stress on behavior and decision making is that people are more likely to make less risky decisions, which exacerbates the recognized behavior trait ***that people tend to use familiar exits <u>instead</u> of less known or unknown exit pathways during emergency events.***

Jonathon Sime has researched the impact of the influence of the built environment on evacuation behavior. This work relates to the Affiliative Model, where people will use those exits familiar to them before an emergency event. Sime, through his research, also found that people attempt to use the exit route that they used to enter a building, room or area. The Affiliative Model also predicts that if an egress route is not used regularly and repeatedly, and is thus unfamiliar to the general population, it is less likely to be used during fire evacuations. Therefore, people will prefer to use the most familiar egress driving routes; this situation is also exacerbated during emergencies.

According to The Plan, certain areas within the Community are provided with emergency gates placed across designated evacuation routes. While residents might be "aware" of these emergency egress routes, they will probably ***not*** be used because:

- They *know* the gate is *always* closed on a *daily* basis
- They *know* it is *not* the *normal* egress pathway used to leave the neighborhood

As an engineering response to fire-related human behavior, this indicates a *natural* reticence to use *unfamiliar* evacuation routes in favor of those used on a regular basis; therefore removal of gates from emergency evacuation routes would encourage residents to use the access point on a regular basis, reinforcing its location and availability during emergency conditions.

<u>3.4.2 Resource Allocations</u>

The Plan indicates that emergency egress routes must be controlled or manipulated by either Sheriff's Deputies, firefighters or CERT volunteers to allow access to evacuation routes during emergency events.

Reliance of law enforcement or fire resources to open gates or other access points does *not* take into consideration resource limitations and availability to perform logistical support functions during dynamic and rapidly evolving emergency incidents.

Using CERT members to open egress points or establish route indicators can be problematic because:

- *Specific* personnel *must* be designated to perform these functions and may *not* be available during an event
- The CERT member must be available 24-7-365 to perform the task
- CERT members, under high stress and dynamic wildfire events, may evacuate prior to performing their tasks based on their perception of the events unfolding around them

Under established local and State disaster plans, and for consistency of operations, the local law enforcement agency is responsible for implementing evacuations.

Fire department resources should *not* actively engage in or direct evacuation of residents. The established mission of the fire department is to provide resources to provide incident stabilization, suppression and control functions.

SECTION 4
OLIVENHAIN EVACUATION PLAN EVALUATION

4.1 Evacuation Strategies, San Diego County Annex Q

There are a number of evacuation planning strategies in the San Diego County EOP that can, at the discretion of the local community, be implemented during an evacuation effort. These strategies can enhance traffic flows and reduce overall evacuation times:

- Contra-flow
- Traffic signal coordination
- Closure of on- and off-ramps
- Intelligent Transportation Systems
- Segregation of pedestrian and vehicular traffic
- Exclusive bus routes
- Phased evacuations
- Phased release of parking facilities
- Use of designated marking and road barriers

This Section evaluates how the Annex Q Evacuation Strategies are included or excluded from The Plan.

4.1.1 Contra-Flow Operations

Contra-Flow is a strategy where one or more lanes of a roadway is/are reversed to allow an increase of traffic flow in one direction.

Contra-Flow Operations can be implemented on highways and arterial roadways, with highways and freeways being the preferred corridors with their inherent divided directions of traffic flow, access controlled configurations and lack of traffic signals.

The development of contra-flow evacuations includes clearly identifying the beginning and end points of the operation. However, the foreseeable potential of traffic congestion at the origin and termination of the contra-flow corridor can significantly diminish their effectiveness. Implementation of this strategy requires the deployment of appropriate signs, signals and barriers and the use of law enforcement personnel.

For safety considerations, Contra-Flow Operations should *only* occur during *daylight* hours. Emergency return lanes should also be designated. Contra-Flow Operations in San Diego County are *limited* to *small* segments of roads.

Contra-Flow Operations require a minimum of twenty-four (24) to seventy-two (72) hours of advance notice to implement.

Finding: *Contra-Flow Operations are mentioned in The Plan, but are deemed unreliable because of the narrow and winding characteristics of the available evacuation routes within the Community.*

Finding: *The Plan does not mention the necessary time frame required for implementing Contra-Flow Operations.*

Finding: *Contra-Flow Operations are primarily a law enforcement function; The Plan is a Fire Department document that assigns, by inference, responsibility for implementing law enforcement operations to the Sheriff Department's planning and supervisory personnel.*

4.1.2 Traffic Signal and Stop Sign Coordination and Timing

Traffic signal coordination and timing plans are intended to maximize traffic flow in the outbound direction during evacuations. Depending on the extent of the evacuation, coordination may be needed both locally and regionally to "re-time" the traffic signal systems.

It is important to identify non-programmable signals along all evacuation routes. These can be plugged into non-centrally programmed traffic signal boxes, which will then generate flashing yellow and red lights to manage traffic. Individual jurisdictions should determine whether local traffic signals can be controlled from a central location and the availability and capability of back-up power sources.

Finding: *The Plan indicates that certain traffic signals and stop sign directional flow control will be modified, with references to specific locations on the Plan maps.*

Finding: *When an Evacuation Order is announced, the Fire Department Duty Chief notifies the City's Public Works Department to provide traffic control in the evacuation area and to place directional signs and bagging of stop signs along the designated evacuation routes.*

Finding: *The Public Works Department is responsible for performing the following traffic control functions:*

- *Instituting traffic control measures*
- *Deploying directional signs and message boards*
- *Bag the stop signs identified on the evacuation plan*
- *Post signs on cross streets indicating that through traffic does not stop*

Finding: *The Plan indicates that Public Works has two trailer able and programmable sign message boards, thus potentially limited the effectiveness of these resources.*

Finding: *The Plan does not specifically indicate (but infers) that the Sheriff's*

Department is responsible for maintaining traffic flow rates along evacuation routes. The Plan states that the evacuation will be coordinated by the law enforcement agencies involved. Given the Plan is a Fire Department operations document, responsibility for implementing and coordinating law enforcement efforts is, by inference, assigned to the Sheriff's Department.

Finding: *The CHP is cited as assisting all other agencies with routing and traffic control. Given the CHP's limited resources is San Diego County, it is foreseeable that CHP resources will more likely be assigned to insure that traffic flows along major highways and freeways are maintained to avoid blockage or extensive back-ups on the County designated major evacuation routes.*

4.1.3 Closure of On- and Off-Ramps

Closure of outbound on-ramps on designated evacuation routes reduces congestion on these roadways that occur because of traffic originating at intermediate locations between the start of the evacuation route and the eventual destinations of evacuees.

In addition to reducing congestion, closure of outbound on-ramps helps eliminate roadway intersection and/or entrance queuing. Closure of outbound off-ramps will ensure evacuees remain on designated evacuation routes. This strategy requires coordinated operations between the CHP, CAL-Trans, the Sheriff's Department and other emergency personnel to place and staff barricades at the top of these ramps throughout the evacuation route.

Finding: *Closure of freeway ramps may not necessarily be a factor in the Olivenhain Evacuation Plan due to physical distance, geographic and topographic barriers, and remoteness from the impacted area.*

Finding: *Freeway on-ramps for evacuation traffic are located at the extreme distal zones of the proposed evacuation routes. Unless safe zones are designated a significant distance away from the City, use of Interstate 5 to reach non-impacted areas of refuge may not be a foreseeable strategy.*

4.1.4 Intelligent Traffic Systems

Intelligent Traffic Systems include a range of technology based tools that allow traffic and emergency managers to monitor traffic conditions, respond to capacity reducing events and provide real-time intelligence of road conditions.

San Diego County is equipped with numerous forms of IT including roadway electronic surveillance, automatic vehicle location, changeable message signs and the Highway Advisory Radio network. These technologies provide real-time information to the San Diego Transportation Management Center, which integrates CAL-Trans Traffic Operations, CAL-Trans Maintenance and the CHP Communications into a unified, co-located communication and command center.

The TMC provides communications, surveillance and computer infrastructure for coordinated traffic management. Using ITS, the TMC can quickly detect, verify and respond to incidents, including recommending different evacuation routes because of roadway congestion.

Finding *– the Olivenhain Evacuation Plan does not acknowledge the use or presence of Intelligent Traffic Systems along the proposed evacuation routes.*

Finding *– area surveys of the evacuation routes did not reveal any indications or installations of Intelligent Traffic System related infrastructure*

4.1.5 Segregation of Pedestrian and Vehicular Traffic

This strategy designates certain urban roadways as for use for pedestrians only. This provides physical separation during evacuations, reduces confusion, and increases the safety and efficiency of the evacuation.

Certain short notice events, such as tsunamis, involve the immediate evacuation area on foot instead of in vehicles. Resources needed to accomplish implementation of vehicle/pedestrian separation on evacuation routes include appropriate signage, signals, barriers and deployment of emergency management personnel and communications equipment.

Finding: *The Olivenhain Evacuation Plan makes no mention of this Strategy.*

Finding: *Given the travel distances involved and the nature of the natural vegetative fuels producing high heat release rates and rapid to extreme rates of spread under foreseeable Santa Ana/Northeast Wind Events, evacuations on foot are not a viable strategy for the impacted residents in the northeast corner of the City.*

4.1.4.1 Exclusive Bus Routes

This strategy uses certain lanes along evacuation routes exclusively for buses and other large capacity vehicles. Exclusive bus routes have the option of being used along alternative evacuation roadways. Using this strategy can greatly increase the number of people that can be evacuated in a given period of time.

Finding: *The Evacuation Plan makes no mention of this strategy.*

Finding: *While this Strategy includes means and methods of moving large numbers of people with reduced potential traffic, the length, relatively narrow configuration and minimal availability of turnaround areas reduces the viability of this Strategy.*

4.1.4.2 Phased Evacuations

Phased evacuations reduce the number of vehicles on evacuation routes by controlling access in stages and sections. This strategy can also be used to prioritize the evacuation of certain communities that in close proximity to immediate danger.

Finding: *The Phased Evacuation Strategy is briefly mention in the Plan; no specific details have been developed to indicate when Phased Evacuations should be employed or how they will be implemented.*

4.1.4.3 Phased Release of Parking Facilities

The strategy also limits the number of potential vehicles permitted on evacuation routes.

To implement this strategy, parking facilities are inventoried before events and categorized according to their size, location and other relevant factors. Public resources are allocated to coordinate logistics of the strategy and to enforce compliance with the phased release protocols. This may cause evacuees to use public transportation instead of private vehicles.

***Findings**: There are a minimal number of medium to large scale parking facilities located along the proposed evacuation routes.*

4.1.5.9 Use of Designated Markings and Road Barriers

Designated signs and other road markings play a key role in accomplishing safe and efficient evacuations. Signs, flags and other identification markings can be used to guide evacuees along the evacuation route.

Barriers will be used in conjunction with other transportation strategies to ensure that evacuees stay on designed routes or block them from entering closed areas.

Signage identifying dedicated evacuation routes have been distributed through limited portions of the Olivenhain community; these are specifically found along certain portions of the Lone Jack Road area.

Surveys of the evacuation routes reveal that the posted evacuation signage is not readily identifiable during non-emergency travel along the roadways. The signs designating the evacuation route are positional, with the full content of the signs hidden from view from drivers until needed (YELLOW arrow)

Typical Road Conditions and Field of Vision on Lone Jack Road

Two Position, Concealed Wildfire Evacuation Route Sign on Lone Jack Road

Dual Position Wildfire Evacuation Route Sign at Double LL Ranch Road

Unless residents of the evacuation area are aware of the location *and* content of the signage, they most likely will not, under the influence of evacuation stress and foreseeable smoke conditions, recognize or respond to the signs while driving out of the area.

Evacuation Sign Mitigation

For enhanced recognition and response to posted evacuation signage in the impacted areas, the content of the signs should not be concealed on a day-to-day basis.

Concealment of the signs, and their content, is contrary to the Affiliative Principle, where people associate emergency actions in relationship to their daily activities and perceptions. Repeatedly seeing evacuation signs and travel directions subconsciously reinforces their presence and residents may more readily respond to their message during stressful evacuation conditions.

Several fire jurisdictions in San Diego County have accepted, on a performance-based design /alternative means of compliance basis, identifying designated evacuation routes in remotely located residential areas and sub-division developments with clearly visible signage.

Typically, the Evacuation Route designation signs are spaced at regular intervals, facing on-coming traffic, throughout impacted residential areas and provided with directional arrows showing the approved egress path out of the area. The signs comply with traffic sign composition and construction standards.

The Evacuation Plan relies heavily on deploying City employees to set up or manipulate signs directing residents to approved egress pathways and bagging stop signs along evacuation routes to promote traffic flow rates.

Finding: *City Public Works employees foreseeably need to respond from field locations back to the Public Works field station to pick up any supplies needed to "bag" traffic and stop signs unless such supplies are normally carried in their assigned vehicles.*

The following response scenario may be typical:

- Public Works employees are performing field operations when an Evacuation Order is instituted
- Public Works employees respond from their field assignment back to the Public Works Operations Station to obtain needed supplies (ten to fifteen minute delay)
- Traffic control equipment (programmable traffic sign trailers) and supplies are picked up (ten minutes or longer)
- Employees drive from the Operations Station to the impacted area – additional twenty minutes using either a designated southern route (6.5 miles) or northern route (6.3) miles
    - Southern Route - Calle Magdalene to Encinitas Blvd. to Rancho Santa Fe Road to Lone Jack Road
    - Northern Route – Operations Station to Saxony Road t0 Leucadia Blvd. to Olivenhain Road to Rancho Santa Fe Road to Lone Jack Road
- Manipulation of signs and reprogramming of traffic signals commence

Finding: *Public Works employees, initially working in the field, will have a time delay of approximately forty-five minutes after the evacuation order is given before signage and other traffic control measures will be implemented.*

- Public Works vehicles assigned to evacuation response operations can become entangled in the evacuation traffic, further delaying deployment of stop sign bagging operations and reprogramming of traffic signals.

4.2.3 Evacuation Plan Content

Analysis of the Olivenhain Evacuation Plan has identified a number of problematic issues which may require resolutions and mitigations.

4.2.3.1 Section I – Evacuation Data

4.2.3.1.1 Estimated At-Risk Population

Page 1 of The Plan indicates that the estimated number of residents threatened during a wildfire event varies between 5240 persons normal typically weekdays and 5866 residents during night time and weekend hours.

The Exposed Population data reflects the ***2000*** census for the Olivenhain area, which was *twenty* (20) years ago, with two intervening Census cycles occurring since the original estimates were made. The Plan has not been updated to reflect the current population of the sub-community.

Without a validated and current population estimate, the potential number of evacuees and the number of vehicles impacting evacuation routes cannot be accurately forecasted and validated.

Four adjacent communities to Olivenhain have recorded population increases and decreases since 2012:

Community	Early Population (year)	Latest Population 2019	Change
Northwest RSF	2936 (2015)	2510	**- 15%**
Fairbanks Ranch	3148 (2014)	2085	**- 34%**
Solana Beach	12931 (2012)	13356	**+ 4%**
Carlsbad	102342 (2011)	114253	**+11%**
Encinitas	59223 (2011)	62780	**+6%**

Further residential development has been occurring in the Olivenhain sub-community, particularly near the northeastern corner of the area. If this residential development follows the City's population upswing trend of 6%, the population of Olivenhain can be extrapolated to 6218 persons, up from 5866 residents indicated in the Population at Risk data.

The increase of 352 residents impacts the number of vehicles used to evacuate the community:

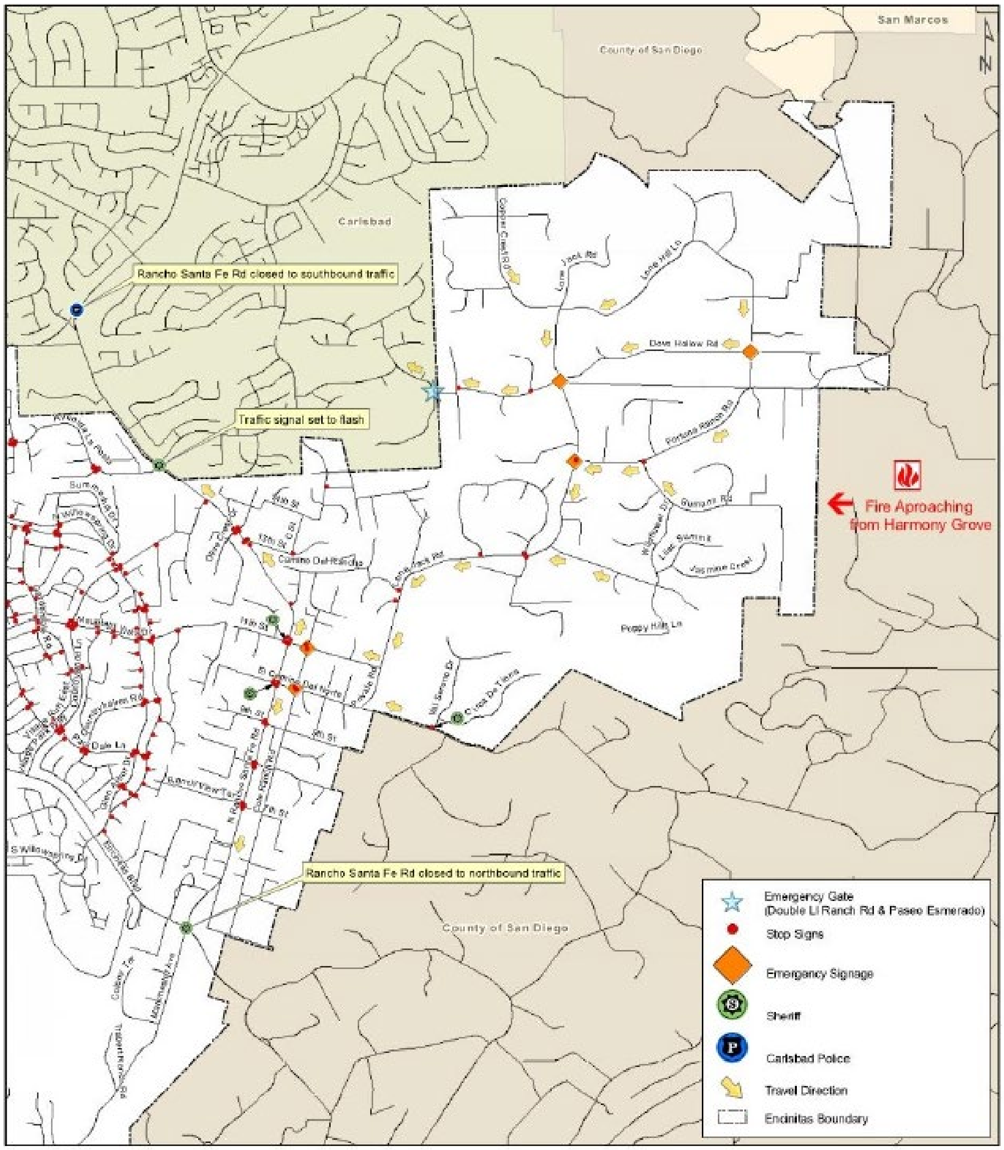
- Vehicle occupancy of 1.5 persons = 234 additional vehicles from original estimate
- Vehicle occupancy of 2 persons = 176 additional vehicles
- Vehicle occupancy of 3 persons = 118 additional vehicles
- Vehicle occupancy of 4 persons = 88 additional vehicles

Adding 234 additional vehicles to the original estimated 3910 vehicles evacuating Olivenhain creates total roadway impact of 4145 vehicles. With the hypothetical roadway capacity of 1000 vehicles per hour, evacuation time increases from 3.91 hours (3 hours 55 minutes) to a minimum of 4.145 hours (4 hours, 9 minutes), or roughly fifteen (15) minutes.

4.2.3.1.2 Affected Areas

On Page 1 of The Plan indicates it was been developed for the *Northeastern* portion of the City of Encinitas.

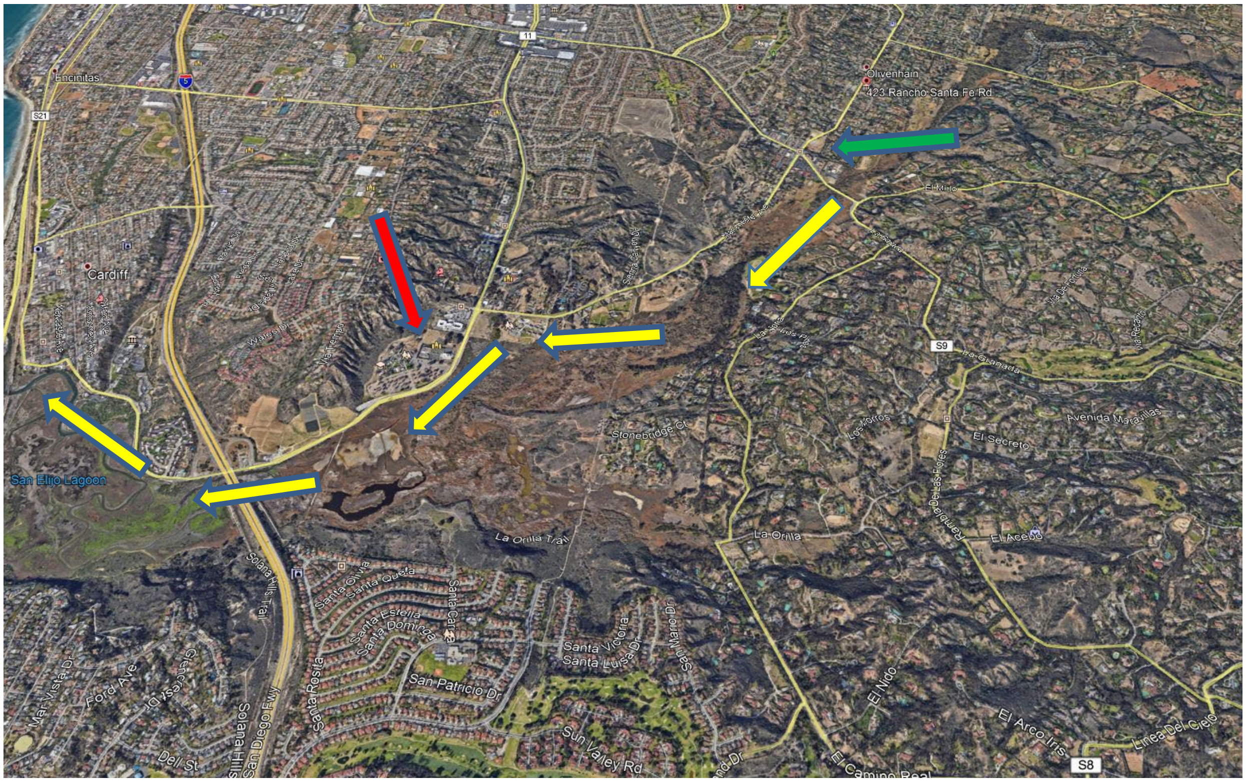
Both map exhibits for Scenario A, fire approaching from Harmony Grove, and Scenario B, fire approaching from south or east, validate that the plan focuses on the northeastern parts of Encinitas and, particularly, the Olivenhain sub-community.



Olivenhain Evacuation Map for Scenario" A" – Wildfire Approaching from Harmony Grove

On Page 2, the document affirms that the affected area includes buildings east of Rancho Santa Fe Road, north of Encinitas Blvd and south of Olivenhain Road. However, the document *adds* the neighborhoods on *either* side of Manchester Avenue, including Mira Costa College.

Manchester Avenue is south of the intersection of Encinitas Blvd. and Rancho Santa Fe Road (GREEN arrow), extending in a north-to-south configuration for approximately 1.2 miles to its intersection with El Camino Real. It then continues an additional one mile in an easterly to westerly configuration to the Interstate 5 right-of-way corridor and, finally 1-1/4 miles to San Elijo Avenue, which parallels the Pacific Ocean beachfront. Mira Costa College on located 0.25 miles south of the El Camino Real intersection is on the west side of Manchester Avenue (RED arrow).



Manchester Blvd. Route through Southeast and Southwest Encinitas

As indicated in the Olivenhain Evacuation Plan Traffic Control Point and Scenario A and B content, the evacuation area extends south to the intersection of Encinitas Blvd. and Rancho Santa Fe Road (GREEN arrow on the aerial image above).

The Evacuation Route narrative tables indicates that the exposed population south of Dove Hollow and Double LL Ranch Road will diverted south-bound onto Rancho Santa Fe Road, with a traffic control point established at its intersection with Encinitas Blvd. At this intersection, no further direction for traffic flow is provided, with the assumption evacuation traffic will be diverted westbound on to Encinitas Blvd.

The terminology used in the Affected Area Section is open to interpretation about which specific areas along Manchester Avenue are included in the Olivenhain Evacuation Plan.

As written, the Plan indicates that the *entire* length of Manchester Avenue is in the purview of the document.

This is problematic for the following reasons:

- The Plan states it covers the northeastern portions of the City; the Manchester Blvd corridor is in the southeast, south and southwestern portions of the City.
- *All* evacuation routes established in the Plan are *north* of the Manchester Avenue corridor and north of the Rancho Santa Fe Road and Encinitas Blvd. intersection.
- Mira Costa College is specifically listed in the Evacuation Plan as a "Potential Staging Area"
- The Manchester Avenue corridor and its intersecting and connecting roadways in the area are not listed in the prescribed evacuation route tables

4.2.3.1.3 Warning Activation; Events and Emergency Status

The Plan states:

"*... In the event of a wildfire, advise the Sheriff's Department, Encinitas Fire Department, Public Works Department and Encinitas EOC* ***to begin evacuation*** *of the affected areas. City of Encinitas will advise the San Diego County Sheriff's Department* ***to begin evacuation*** *away from the hazard areas, including unique institutions..."*

The standards for San Diego County Evacuation indicate that the local jurisdiction must notify the population of an affected area in an Evacuation Warning message of a *potential* threat to life and property. The Warning considers the probability that an area will be impacted within a given time frame and prepares people for a potential Evacuation Order.

An Evacuation *Order* requires the immediate movement of people out of an affected area because on an imminent threat to life.

As written, The Plan does *not* include the mechanism of a population pre-alert notice (Evacuation Warning) that a wildfire is a potential threat to their community. The Plan by-passes the Evacuation Warning Phase and *immediately* implements evacuation strategies *whenever*, by inference and prescriptive language of the document, there is a "wildfire" *somewhere* in the *vicinity* of the City.

The Plan does not define:
- What a "wildfire" is
- The extent of a wildfire mandating an emergency evacuation
- Where, specifically, a "wildfire" is in relationship to Olivenhain and the threat it would foreseeably need to present to implement the Evacuation Plan
- "Trigger Points" which, when crossed, would activate the Evacuation Plan.

In the Events Section of The Plan, three wildfire scenarios indicate that evacuations should be instituted:
- Wildfire progressing west from Escondido, Poway or Rancho Bernardo
    - Initiate Phased Evacuation OR
    - Order Voluntary Evacuation
- Wildfires in San Marcos, Harmony Grove, Elfin Forest, Carlsbad or Rancho Santa Fe
    - Mandatory Evacuation, Scenario A
- Wildfires beginning in Olivenhain, Escondido Creek and Rancho Santa Fe
    - Mandatory Evacuation, Scenario B

The Plan provides no guidance on procedures to be followed for a “Phased Evacuation” or a “Voluntary Evacuation”. Additionally, *neither* of these terms is defined in the document.

The prescriptive wording of the Events and Emergency Status section reinforces the concept that an immediate implementation of evacuation strategies is the preferred methodology, excluding the County standard of first providing an Evacuation Warning to residents.

4.2.3.1.4 Public Notification and Communications

4.2.3.1.4.1 - Initial Notification

The Plan indicates that the following basic information will be provided to residents during the initial Evacuation Order Notification:

- Whether to evacuate or shelter in place
- Areas to be evacuated
- Why and when residents should evacuate
- The time required for evacuation efforts
- Designated evacuation routes
- What residents should take from their homes
- How pets will be accommodated
- Other appropriate information

Shelter in Place

The Initial Notification section is the only location where the Shelter in Place strategy is mentioned in the Plan. ***(See Section 4.2.5 for additional details)***

Areas to be Evacuated

The Plan indicates that there will be Phased, Voluntary or total evacuations of the Olivenhain sub-community (based on Fire Scenario A and B mandatory evacuations).

Phased and Voluntary evacuations and their implementation strategies are *not* defined by the Plan.

While the Plan calls for total evacuation under Wildfire Scenarios A and B, the document, nonetheless, allows the Fire Department Incident Commander a certain level of discretion about which neighborhoods should be, or do not need to be, evacuated in the Decision to Evacuate Section.

Time Required for Evacuation

The Plan, based on traffic flow rates of 1000 vehicles/hour, indicates that the Olivenhain sub-community can be evacuated in approximately four hours.

The evacuation timing parameters, as indicated elsewhere in this Analysis, are flawed because of the inaccurate traffic flow estimate of 1000 v.p.h. over *all* roadways. Based on traffic flow analysis reports, the average vehicle flow rate over evacuation routes is closer to 356 v.p.h., which extends evacuation times significantly.

The Plan does not take into consideration the impact of additional evacuation entering the Olivenhain area from surrounding communities. (***See Section 4.2.6***)

4.2.3.1.4.2 - Public Alert and Warning Methods

Analysis of The Plan indicates that *half* of the City's Public Alert and Warning Methods rely on *electronic* media for distribution of Evacuation Information and Notices.

In the event of a major wildfire incident or Red Flag Weather Warning, devices powered by electricity, and not equipped with battery back-up systems or photovoltaic energy storage systems, will lose their power source. (***See Section 4.2.4 for further discussion***)

NOTE: *The Fire Department's website provides the community with comprehensive Disaster Preparedness and Evacuation pages that provide more in-depth knowledge of citizens' actions during wildfire emergencies than the Plan and its outline of actions to be taken.* ***(See Attachment B)***

4.2.3.1.4.3 - Designated Safe Zones

With the exception of two "Temporary Evacuation Points" (Olivenhain Town Hall and Little Oaks Park) and three Potential Mass Care Centers (Encinitas Community Center; Oak Crest Middle School' and San Dieguito Academy), the Olivenhain Evacuation Plan does *not* identify designated Safe Zones/Areas outside of the Affected Areas that residents would be directed to during evacuations.

The two Temporary Evacuation Points, on evaluation, are within the perimeter of the Affected Area and present civilian and firefighter safety issues.

Olivenhain Town Hall Property

The Olivenhain Town Hall is located at the intersection of Rancho Santa Fe Road and 7th Street.

Aerial View of Olivenhain Town Hall, Looking North

The Town Hall Facility is located on a relatively flat parcel measuring approximately 340 feet x 380 feet (129,200 square feet or 2.96 acres). The grounds of the facility are well-maintained, with ground vegetation generally removed throughout the premises to bare mineral soil.

Three areas could be used for temporary parking

- West side adjacent to Rancho Santa Fe Road – 140' x 94' (13,160 SF)
- South side, Center, adjacent to 7th Street – 76' x 30' (2280 SF)
- East Side , adjacent to Cole Ranch Road – 138' x 94' (12972 SF)

In an ideal parking lot configuration, with 19' long x 8' wide spaces, *not* including 20' drive lanes, the Town Hall area could accommodate up to 186 standard sized vehicles (4.75% of evacuating vehicles under Plan parameters of 3910 vehicles).

Olivenhain Town Hall Grounds

The Town Hall is approximately 1700 feet west of the Escondido Creek drainage; the wetlands habitat in the drainage is unmanaged, overgrown and subject to fire behavior beyond the control of local fire suppression forces on an initial attack basis.

Typical Vegetation Fuel Conditions, East End of 7th Street

BEHAVE fire modeling indicates that the vegetation inside the Escondido Creek wetlands habitat will produce downwind ember showers of 0.9 (4752 feet) mile for ground-based fires with 100% ignitions in receptive vegetation.

The eucalyptus grove surrounding the Community Hall *are* receptive fuels for ember showers originating from the Escondido Creek wetlands habitat and is within the BEHAVE fire modeling ember deposit distances.

Using the Town Hall property as a Temporary Evacuation Point potentially exposes residents using this area to the effects of a eucalyptus grove crown fire, as previously described in Section 2.2.2. Civilians, like firefighters, will ***not*** be able to withstand the heat effects of the Critical Surface Intensity of 778.1103 kW/sf radiantly transmitted from the tree crown fire to the ground below.

BEHAVE fire modeling indicates that, if provided, a Safety Zone for *firefighters* on the Town Hall property requires a minimum site of three-quarters of an acre with a minimum separation distance of seventy-seven (77) feet from the nearest vegetation (*including* trees).

Little Oaks Park

Little Oaks Park is located near the intersection of Lone Jack and Crystal Ridge Roads.

The park has a roughly inverted “L” shape, with the northeastern corner forming the horizontal leg of the “L”. The land segment adjacent to Lone Jack Road measures 112 feet (west-to-east) x 460 (south-to-north); the northeastern rectangle measures 246 feet (west-to-east) x 255 feet (south to north).

The entire eastern side of the park abuts unmanaged natural vegetative fuels, consisting of annual grasses, scrub and shrubs, and a dense grove of trees. A sixteen (16’) foot wide pedestrian-equestrian separates the eastern edge of the dirt parking lot from the unmanaged off-site vegetation.

Aerial View of Little Oaks Park, Looking North

Northwest Corner of Little Oaks Park

Center Section of Little Oaks Park – Looking East

The dirt parking lot provides an area that is approximately sixty six (66') feet wide (ground measured) by 220 feet long, or 14520 square feet. In an ideal parking configuration, *without* drive lanes, the area could accommodate 95 vehicles (2.4% of evacuation traffic).

BEHAVE fire modeling indicates that the ground vegetation (Fuel Model GS-2 Moderate Load Dry Climate Grass-Shrub) east of the Park will produce downwind ember showers of 0.9 (4752 feet) mile for ground-based fires with 100% ignitions in receptive vegetation. Estimated flame lengths for the vegetation is 18 feet, with a rate of spread of 274 feet per minute. The minimum safety separation distance *for firefighters* from the flame front is seventy-seven (77') feet.

With the available width of the combined parking lot and equestrian-pedestrian trail measuring 82 feet, evacuees will have a five (5') foot wide space to seek shelter in to avoid radiant heat exposure from the flame front.

BEHAVE fire modeling for the off-site trees was approximately the same as for the eucalyptus grove at the Olivenhain Town Hall site.

Finding: *Neither of the designated Temporary Evacuation Points identified in the Plan provide a safe refuge/haven area for evacuating residents due to the close proximity to unmanaged fuels and the anticipated heat release rates produced by this vegetation.*

Findings:

1. *The Plan does not identify Safe Areas inside in the City or in adjacent communities or how residents will travel to these locations.*
2. *Under Annex Q prescriptive guidelines, each City is required for designating Safe Areas, temporary evacuation sites, long-term evacuation centers and other infrastructure and facilities that are available for evacuee use.*
3. *Annex Q indicates that each jurisdiction should consider that evacuation routes to Safe Areas may be as long as thirty (30) miles.*

4.2.4 Electric and Other Gates in the Evacuation Area

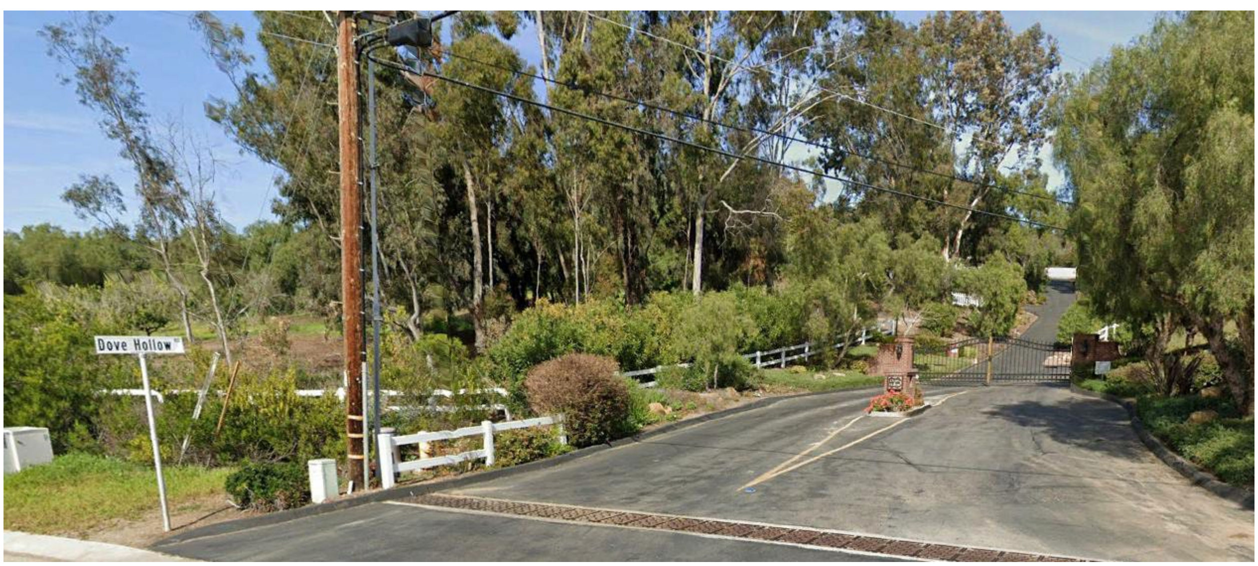
The Plan indicates that some proposed evacuation routes rely on exposed populations being evacuated through various gates:

- Double LL Ranch Road
- Morning Sun Drive to Village Park Way utility access road to bypass Rancho Santa Fe Road traffic flows

Double LL Ranch Road Gate

East side of Utility Road – Springwood Ln & Morning Sun Drive

Olivenhain site surveys have revealed the presence of numerous gated residential communities within the Affected Zone.



Dove Hollow Road Gated Community (Typical of Others in the Community)

Site surveys indicate that the electrically drive gates have Knox Box emergency switches that will override the gate system command functions.

More relevant to the discussion is the question of whether or not the security gates across fire apparatus access roads and evacuation routes are provided with battery back-up power supplies or mechanical manual disconnect devices in the event of power failures.

Anecdotally and historically, one of the first infrastructure systems that fail in a wildfire event is the electrical distribution supply system. This is generally caused by the fire's impact on the infrastructure, resulting in downed power lines and circuit shut-downs.

However, California has experienced an increasing number of intense wildfires that have resulting in devastating losses of life and billions of dollars in damages to property and infrastructure. With the continuing threat of wildfire, California has allowed Utility providers to cut power to electrical lines that may fail in certain weather conditions to reduce the likelihood that distribution systems that could cause or contribute to wildfires. The Public Safety Power Shutoff (PSPS) strategy reduces the risk of fire from the electrical infrastructure by temporarily cutting power to specific area.

San Diego Gas & Electric (SDGE) has been authorized by the California Public Utilities Commission to implement PSPS protocols during critical fire weather events. SDGE considers using PSPS protocols to prevent potential wildfires, but only as a last resort strategy during Red Flag Weather events.

SDGE implementation of PSPS in the Olivenhain community is a foreseeable event. Thus, unless electric-driven gates are provided with battery back-up power supplies or manual disconnect systems, access and use of proposed evacuation routes beyond gates across proposed evacuation routes may be unnecessarily obstructed or delayed.

Other issues with gates across evacuation routes are discussed in Section 3.4.1.

4.2.5 Shelter-in-Place Considerations

The Plan *minimally* acknowledges the potential need for "sheltering-in-place" in the event a rapidly spreading and dynamic wildfire incident. Shelter-in-Place is mentioned one time in the Evacuation Plan on page 3, Initial Notification section.

The Shelter In Place (SIP) strategy, despite claims of its recent consideration and implementation, can be traced back to the 1903 Montana fire storm known as "The Big Blow Up," where Ranger Edward Pulaski ordered forty-five firefighters into an abandoned mine, at gunpoint, to save their lives before being overrun by a flame front.

During the 2007 Witch and 2008 Tea Fires in California, residents chose to seek shelter inside the fire perimeter instead of attempting to evacuate when threatened by rapidly spreading wildfires.

While less common that evacuation, the SIP Strategy occurs in one of three conditions:

- When SIP is the only option because evacuation routes are exposed to or overrun by the wildfire flame front
- When evacuations are considered to be too risky because the location and intensity of a fire with rapid rates of spread is unknown and the perceived margin of safety for evacuation is too small to risk being overrun during evacuation transit to a safe location
- Residents choose to shelter in place inside of specially hardened building with enhanced defensible space, with the building providing an increased chance of surviving the fire

In recent years, the SIP strategy has garnered increasing attention in wildfire emergency planning for several reasons:

- On-going residential development and escalating fire losses in the wildland-urban interface areas results in a need for innovative strategies to protect lives and property
- The SIP Strategy (known as “Stay or Go”) was introduced in Australia to reduce the number of last-minute evacuations and improve structural survivability has increased awareness about the role of in-house sheltering during wildfires
- Many dense, fire prone communities have poor egress (in terms of the number of routes, direction of routes and capacity of routes) may not allow residents to evacuate in a sudden-onset fire scenario, which leads to a frantic search for viable alternative protections

The SIP Strategy is one of many protective actions/options take to reduce the impact of a wildfire emergency on a threatened population. For emergency managers, protective actions can include evacuations or controlling access to threatened areas. Emergency managers must approach this task with regard of successfully categorizing life and property safety and protection alternatives as a primary objective. SIP can either be seen as a life-saving option or it can include protecting life and property.

Generally, there are two options for providing protection actions in a dynamic wildfire situation with rapid rates of spread and direction of spread:

- Decisions to evacuate
    - Involves the question of where to evacuate to
    - Involves the question of when to evacuate
    - Involves the question of how an evacuation will take place
- Decisions to shelter in place
    - Choice of in-home sheltering
    - Choice of other than in-home sheltering locations

- Choice of protecting life and property objectives focusing on properly hardening the chosen building or location to protect lives inside the location of building
- When the choice of sheltering is other than a house, the goal becomes limiting loss of life or injury by choosing the proper type of shelter
- Proper shelter types can include a structure, safe area or body of water

SIP takes less time than evacuations but its effectiveness changes with the protective qualities offered by the selected shelter.

Evacuation is the process of removing people from the threatened area and is the *most* common method used because it offers a relatively high level of life protection ***if*** there ***is*** sufficient time available to clear the threatened area.

SIP offers protection against the direct effects of fire under a range of approaches, including:

- Harboring in buildings
- Harboring in safety zones
- Harboring at, in or near bodies of water

SIP can be sub-divided into two basic components:

- Refuge shelters
- In-home shelters

Refuge shelters do not necessarily require pre-constructed active defense for the sheltering occupants and often involves a short trip to the refuge site, either by vehicle or on foot.

Findings:

1. *No single protection action represents a universal solution to eliminating casualties in fire-prone areas. Each protection action has circumstances that may outweigh benefits of other forms of protection.*
2. *In general, evacuation and SIP protection actions have resulted in successful and unsuccessful outcomes in protecting people during wildfires*
3. *Continuing research into the protections provided by evacuations and sheltering in place indicates that SIP* ***should*** *remain a viable* ***back-up plan*** *to evacuations if an evacuation is not feasible or do not offer a higher level of life protection.*
4. *Evacuation trigger points, based on readily available fire modeling and County of San Diego Emergency Operations Plan Annex Q evacuation formulas, are not included within the narrative of The Plan*
5. *Traffic analysis and evacuation timing formulas based on fire modeling indicate that some, if not all, of the pre-selected Olivenhain evacuation routes*

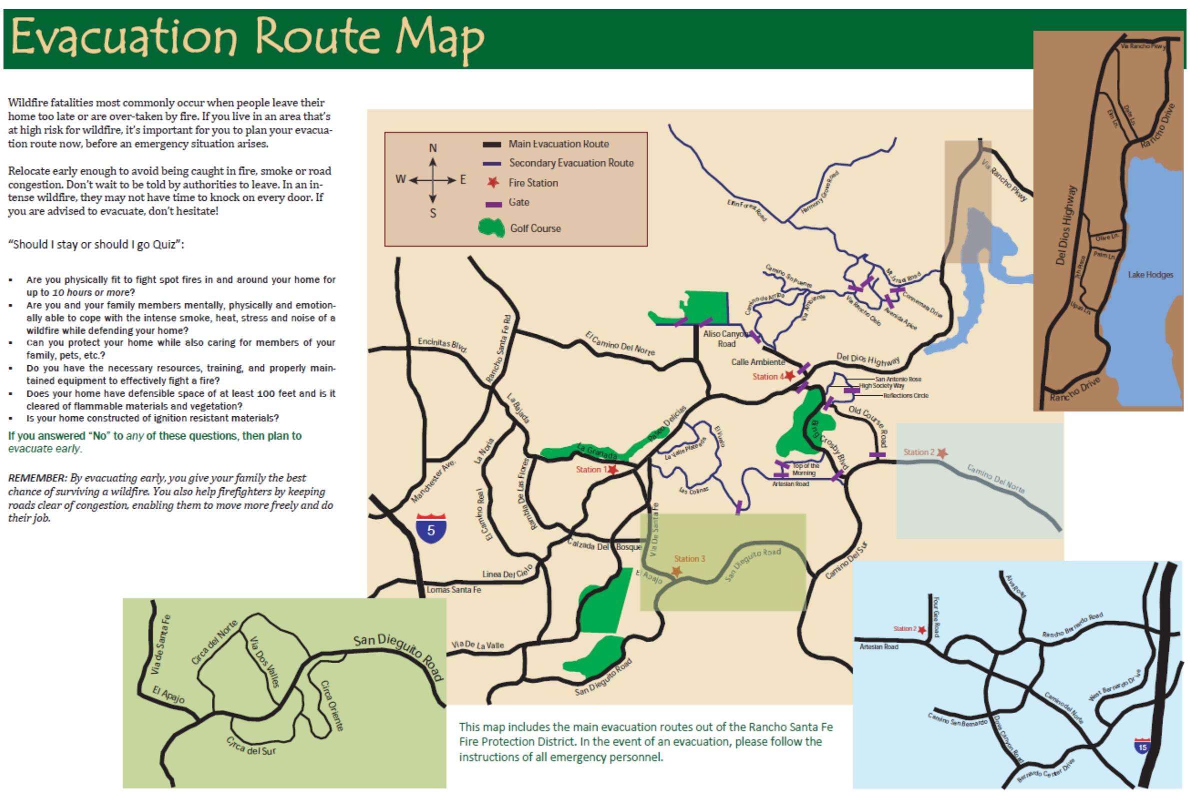
may not be effective due to extensive overcrowding of vehicles along the egress pathway.

<u>4.2.6 Impact of Out-of-Community Evacuation Traffic</u>

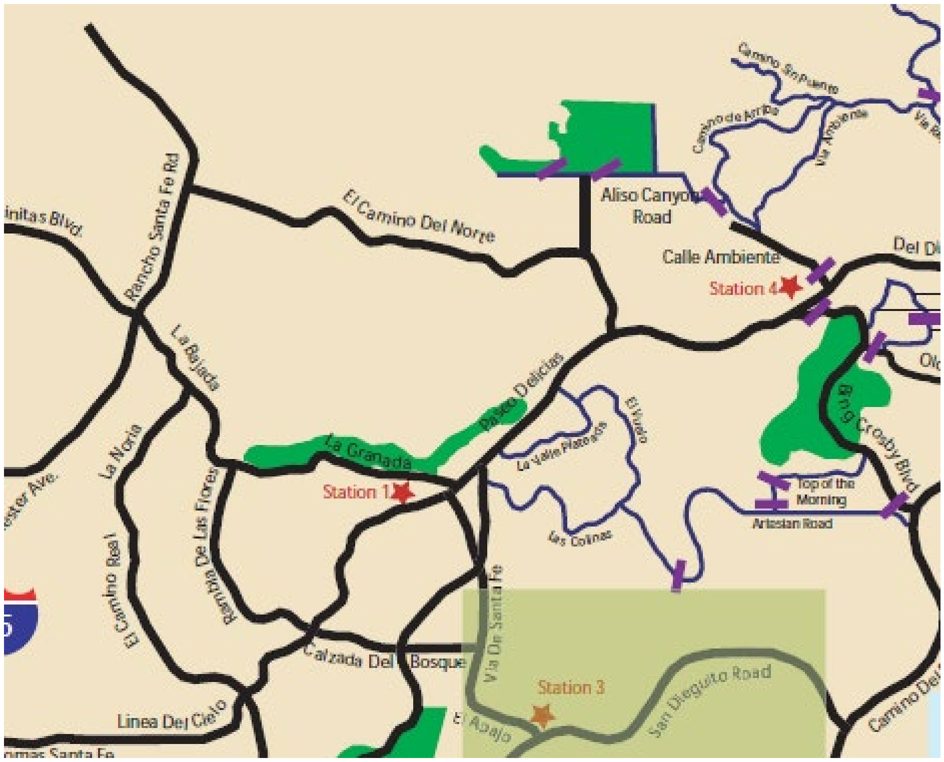
Other than indicating that the City of Carlsbad and the County of San Diego communities of Rancho Santa Fe, Elfin Forest and Harmony Grove will be Affected Jurisdictions, The Plan does not consider the effect of the additional evacuation traffic from these communities on the designated evacuation routes in Encinitas.

The communities of Rancho Santa Fe, Elfin Forest and Harmony Grove are located inside of the jurisdictional boundaries of the Rancho Santa Fe Fire Protection District.

Analysis of the evacuation maps published on the Rancho Santa Fe FPD website indicate that the majority of evacuation routes from its combined sub-communities lead directly into Olivenhain and Encinitas.



Rancho Santa Fe FPD Evacuation Map



Detail of Rancho Santa Fe Evacuation Map with Olivenhain Evacuation Plan Impact Area (Designated in Red Rectangle)

The Rancho Santa Fe Fire Protection District website indicates that the District covers 50 square miles and serves an estimated 34,000 residents.

Further research indicates that designated Rancho Santa Fe FPD westerly evacuation routes interconnected with Encinitas-Olivenhain evacuation routes would add approximately 6656 residents and their vehicles to the egress traffic flow, based on the following information:

- Northwestern Rancho Santa Fe – 2510 residents (2019 estimate)
- Fairbanks Ranch – 2085 residents (2019 estimate)
- Elfin Forest-Harmony Grove – 2061 residents (2004 estimate)

An additional 6656 residents potentially adds the following number of vehicles, based on occupancy, to the Olivenhain evacuation traffic:

- 1.5 persons/vehicle = 4438 vehicles (Olivenhain Evacuation Plan factor)
- 2 persons/vehicle = 3328 vehicles
- 3 persons/vehicle = 2218 vehicles
- 4 persons/vehicle = 1664 vehicles

Traffic Flow Rate 1000 Vehicles/Hour

Using The Plan's traffic flow parameter of 1000 vehicles per hour, the following additional evacuation times are added to Olivenhain's estimated evacuation times:

- 4438 vehicles = 4.438 hours (4 hours, 27 minutes)
- 3328 vehicles = 3.328 hours (3 hours, 20 minutes)

- 2218 vehicles = 2.218 hours (2 hours, 14 minutes)
- 1664 vehicles = 1.664 hours (1 hour, 40 minutes)

When added to the estimated Olivenhain Evacuation times, total traffic flow, using the single Rancho Santa Fe Road (in the event other routes are blocked by the fire perimeter and flame front) becomes:

- 4438 + 3910 vehicles = 8348 vehicles = 8.348 hours (8 hours, 21 minutes)
- 3328 + 2933 vehicles = 6261 vehicles = 6.261 hours (6 hours, 16 minutes)
- 2218 + 1956 vehicles = 4174 vehicles = 4.174 hours (4 hours, 11 minutes)
- 1664 + 1467 vehicles = 3131 vehicles = 3.131 hours (3 hours, 8 minutes)

Evacuation timing (for the single egress route) increases by the following amounts:

- 1.5 persons per vehicle = 4.438 hours (4 hours, 27 minutes)
- 2 persons per vehicle = 3.328 hours (3 hours, 20 minutes)
- 3 persons per vehicle = 2.218 hours (2 hours, 13 minutes)
- 4 persons per vehicle = 1.664 hours (1 hour, 40 minutes)

Averaged Traffic Flow Rate, 356 Vehicles/Hour

Using the averaged traffic flow value based on existing road conditions and traffic flow analysis, adding Rancho Santa Fe evacuation traffic to Olivenhain/Encinitas roadways causes the following adjustments to evacuation timing:

- 8348 vehicles = 23.45 hours total evacuation time
- 6261 vehicles = 17.6 hours total evacuation time
- 4174 vehicles = 11.7 hours total evacuation time
- 3131 vehicles = 8.8 hours total evacuation time

SECTION 5
SUMMARY & CONCLUSIONS

The Olivenhain Evacuation Route Safety Analysis has been prepared for the community of Olivenhain in the northeastern area of the City of Encinitas, CA.

The Analysis primarily focuses on the right-of-way corridors for Rancho Santa Fe Road between Encinitas Blvd and Olivenhain Blvd. The City of Encinitas maintains an Evacuation Plan which funnels evacuation traffic to these referenced intersections.

<u>Estimated Evacuation Times</u>

The Plan calculates an evacuation time of 3 hours, 55 minutes based on the following criteria:

- An Olivenhain population of 5866, based on the 2000 Census
- Estimated roadway capacities of 1000 vehicles per hour (v.p.h.)
- Overage evacuating vehicle capacity of 1.5 persons.

The criteria above are based on the evacuation formula provided in County of San Diego Emergency Operations Plan, Annex Q. However according to a 2016 City sponsored traffic report, the real-world road capacities are significantly lower than The Plan's parameters:

• El Camino del Norte – 287.5 v.p.h.
• Rancho Santa Fe Road – 550 v.p.h
. • Lone Jack Road – 279.16 v.p.h.

Basic Evacuation Route Information

The Evacuation Route narrative tables indicate that the exposed population will be diverted to one of three exits from the Olivenhain community:

• Via the emergency gate at Double LL Ranch road into the city of Carlsbad, after which no further direction for traffic flow is provided.

Evacuees unfamiliar with this residential neighborhood will need to find their way north on Paseo Esmerado and then left on either Avenida Pantera or Camino Arena to Camino Lindo to Calle Acervo. From Calle Acervo, they will eventually exit to Rancho Santa Fe Road, with the most direct route being west. The Plan fails to account for traffic simultaneously entering this intersection that are co-evacuating from Olivenhain and adjacent Carlsbad neighborhoods.

• North-bound onto Rancho Santa Fe Road, with a traffic control point established at its intersection with Olivenhain Blvd.

At this intersection, no further direction for traffic flow is provided, with the assumption evacuation traffic will be diverted westbound on to Olivenhain Blvd. However, before they reach this intersection, they will merge with the above evacuees at the Rancho Santa Fe Road-Calle Acervo intersection. The Plan designates this intersection to be set to flash, with no traffic control personnel to manage these merging evacuation traffic streams.

• South-bound onto Rancho Santa Fe Road, with a traffic control point established at its intersection with Encinitas Blvd. At this intersection, no further direction for traffic flow is provided, with the assumption evacuation traffic will be diverted westbound on to Encinitas Blvd.

The Plan fails to account for traffic simultaneously entering this intersection co-evacuating from Ranch Santa Fe neighborhoods via El Mirlo and La Bajada roads.

The evacuation analysis briefly addresses co-evacuating vehicles from adjacent neighborhoods in Rancho Santa Fe, Elfin Forest and Harmony Grove. These vehicles will add significant additional traffic on the Olivenhain evacuation routes, particularly the south-bound Rancho Santa Fe Road route.

The evacuation analysis does not consider obstructions caused by potential and foreseeable traffic accidents occurring along the evacuation routes. Indeed, The Plan calls for bagging stop signs along RSF Rd north-bound at Olive Crest Drive and at 13th St, and south-bound at 9th St, Wisperwind/8th St, and Ranch View Terrace/7th St. The Plan does not provide any traffic control personnel to facilitate the evacuation of the residents from any of these neighborhoods, almost guaranteeing panicked evacuees forcing their way onto RSF Rd as their only path to safety.

The Plan does not designate safe areas inside of the City's jurisdictional boundaries or in adjacent communities or how residents will travel to those locations. Under Annex Q prescriptive guidelines, each City is responsible for designating safe areas, temporary evacuation sites, long-term evacuation shelters and other infrastructure and/or facilities that are available for evacuee use. Annex Q also indicates that Cities should base their evacuation plans on Level II evacuation criteria with evacuation traffic traveling up to thirty (30) miles from an impacted area to the designated safe area.

The Plan does not consider the numerous schools within the affected evacuation area, none of which have busses to transport students thus ensuring parents will add additional traffic into and out of the evacuation zone.

The Plan does not consider the impact of large capacity animal vehicle-trailer combinations using the route; and reflect, like the Annex Q evacuation formula, theoretical travel times under existing day-to-day conditions along the evacuation routes.

Evacuation Trigger Points

The Plan does not consider or stipulate geographical or fire behavior conditions that would determine Evacuation Trigger Points.

Required Safe Evacuation Time (RSET) is a combination of threat identification, travel time to an egress point and estimated evacuation time to a designated safe area.

Available Safe Exit Time (ASET) is the amount of time between threat detection and the point at which a fire reaches the threatened community.

For a fire safety performance-based design to be considered as a safe alternative, ASET values must exceed RSET values for the fire conditions in the immediate environment.

Using San Diego County anecdotal guidelines for "worst case" Santa Ana wind events, assuming an 8.2 mile-per-hour spread rate, evacuation warnings (Trigger Point) should be initiated when the fire is approximately twelve miles away and traveling towards

Olivenhain. The twelve miles distance, with a rate of spread of 8.2 mph, provides residents with a 1.5-hour ASET evacuation window.

However, according to The Plan, the best-case evacuation time from Olivenhain is 3 hours 55 minutes, a two-and-a-half-hour deficit for the evacuation estimate.

To provide safe and conservative performance-based evacuation design, a 270-minute RSET timing parameter is required to provide for the evacuation and 30 minutes for threat identification and notification. The evacuation trigger point requires adjusting the trigger point perimeter to 36 miles, or a minimum additional distance of twenty-four (24) miles from the Olivenhain sub-community.

Fire Behavior Modeling

An incident was modeled using weather conditions typical of a Santa Anna wind driven fire as observed in the 2003 Cedar Fire, 2007 Witch Fire and 2014 Cocos Fire.

This fire model originates at the Escondido Creek-University Heights Open Space area located in the Escondido Creek Drainage adjacent to the eastern side of Harmony Grove Road and just west of the City of Escondido. Under influence of northeastern winds, the fire's rate of spread was calculated to be 607.7 chains per hour (equivalent to 7.06 miles per hour) using BEHAVE fire modeling outputs.

Aerial imagery of the Olivenhain-Harmony Grove area produces a straight-line distance of 7 miles between the fire's point of origin and the critical intersections of Rancho Santa Fe Road with Olivenhain and Encinitas Blvd. Such a wildfire event could reach these critical intersections in less than one hour and the eastern edge of the Olivenhain community in half that time.

Findings and Conclusions

1. The Plan is based on potentially obsolete data.
2. As formulated, the published evacuation times in the Plan understates realistic egress times, fails to address foreseeable complications and contingencies, and fails to account for co-evacuation of neighboring communities
3. As formulated, the 3 hour-55-minute evacuation time does not correspond to realistic evacuation ASET and RSET time values
4. Unless evacuation trigger points are adjusted significantly outward from the areas at risk, San Diego County safe evacuation Trigger Points provide insufficient time to initiate and complete evacuations before fires enter and impact the community
5. Fire modeling indicates that anticipated and foreseeable Santa Ana wind event fires within seven miles of Rancho Santa Fe Road could potentially reach portions of Olivenhain and cut off evacuation routes within an hour after ignition.
6. The Plan does not provide sufficient information about evacuation routes to designated safe locations or identify where potential safe locations are once residents

reach the critical Rancho Santa Fe Road intersections with Olivenhain and Encinitas Blvd.

SECTION 6
LIST OF PREPARERS AND PERSONS AND ORGANIZATIONS CONTACTED

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Encinitas, CA. 92024

Persons Contacted

SECTION 7
ATTACHMENTS AND REFERENCES

ATTACHMENTS

ATTACHMENT "A" – REDACTED OLIVENHAIN EVAUCATION PLAN

CITY OF ENCINITAS
FIRE DEPARTMENT

OLIVENHAIN EVACUATION PLAN

I. EVACUATION DATA

JURISDICTION: City of Encinitas

LOCATION: North-eastern portion of Encinitas; (SDCO Evacuation Map P.157). Note: Throughout the text, the acronym SDCO Evac Map is used to denote reference to the San Diego County Evacuation Planning Map Book

Sheriff Evacuation Zones 5050-5023,4920-4923, 4820-4823, 4720-4723

CONTACTS: WEEKDAYS AFTER-HOURS

City of Encinitas: Refer to Emergency Telephone Numbers List

DECISION TO EVACUATE:

It is the responsibility of each affected jurisdiction within the San Diego County Operational Area (OA) to make the decision as to whether to issue an evacuation order for their residents in the event of a wildfire. The Incident Commander decides what neighborhoods to evacuate and the Sheriff's Department carries out those orders.

ESTIMATED NUMBER OF PEOPLE THREATENED ("exposed population"):

Evening and Weekend Population: 5866

Daytime Population: 5240 (based on SANDAG estimate and 2000 census data)

ESTIMATED NUMBER OF PEOPLE THAT MAY REQUIRE TRANSPORTATION ASSISTANCE (Approximately 7% of exposed population; Refer to Homebound Vulnerable Residents List for specific addresses)**:**

411 persons

ESTIMATED EVACUATION TIME: (based on exposed population of 5866, estimated roadway capacity of 1,000 v.p.h. and an average occupancy of 1.5 persons per vehicle)**:**

Evening and Weekend: 3 hours, 55 minutes
Daytime: 3 hours, 42 minutes

OTHER THREATENED AREAS IN THE HAZARD ZONE:

1. Highways and Thoroughfares	OPEN/CLOSED	FROM/TO
a. Rancho Santa Fe Road		
b. Lone Jack Road		
c. Fortuna Ranch Road		
d. El Camino Del Norte		

AFFECTED JURISDICTIONS:

1. City of Encinitas
2. City of Carlsbad
3. County of San Diego (Elfin Forest, Harmony Grove, and Rancho Santa Fe)

AFFECTED AREAS:

Wildfire would result in widespread damage to the eastern portion of Encinitas (Olivenhain). The affected area would include structures east of Ranch Santa Fe Road, north of Encinitas Blvd. and south of Olivenhain Rd., as well as neighborhoods running on either side of Manchester Avenue including Mira Costa College.

WARNING ACTIVATION:

In the event of a wildfire, advise the Sheriff's Department, Encinitas Fire Department, Public Works Department, and Encinitas EOC to begin evacuation of the affected areas. City of Encinitas will advise the San Diego County Sheriff's Department to begin evacuations away from the hazard areas, including unique institutions as indicated on the following page.

Note: The facilities listed below comprise only a partial listing of institutions/agencies that may be impacted in the event of local wildfire. It is the responsibility of each jurisdiction to notify all residents, schools, hospitals, businesses and all other facilities/individuals within the affected areas of an evacuation order. The Public Safety Grid coordinates cited throughout this document are from the San Diego County Evacuation Planning Map Book.

KEY FACILITIES AND UNIQUE INSTITUTIONS WITHIN THE HAZARD AREA:

City of Encinitas - **NOTIFICATIONS TO BE MADE BY CITY OF ENCINITAS (refer to Emergency Telephone Numbers sheet for additional numbers):**

1. Olivenhain Guest Home (medically fragile patients), 350 Cole Ranch Road, Encinitas, (760) 753-5082 or 760-717-3117 (24 hour)

2. Mira Costa College (San Elijo Campus) 3333 Manchester Avenue, Encinitas (760) 795-6640 (MCPD Dispatch)

3. Olivenhain Municipal Water District, 1966 Olivenhain Rd., Encinitas (760)753-0155

4. Pilot Management (management company for homeowners association near Double LL Ranch /Lone Jack gate) (760) 635-1405

5. 4-Points Management Agency (management company for Wildflower Estates homeowners association) (760) 632-8661

6. San Elijo Lagoon County Park and Ecological Reserve 2710 Manchester Avenue, Encinitas (858) 495-5162

7. Olivenhain Pioneer Elementary School (Encinitas Union School District) 8000 Calle Acervo, Carlsbad, 92009 (760) 944-2000 or 518-6890

8. Households identified on the Homebound or Vulnerable Residents List or Map

PUBLIC NOTIFICATION AND COMMUNICATIONS

Initial Notification

The initial public notification shall provide basic information including:

- Whether to evacuate or shelter-in-place
- Areas to be evacuated
- Why and when residents should evacuate
- The time required for evacuation efforts
- Designated evacuation routes
- What residents should take from their homes
- How pets will be accommodated
- Other information deemed appropriate

Public Alert and Warning Methods

- AlertSanDiego Mass Notification system
  https://www.blackboardconnect.com/login
  Username:(All Chief Officers & Emergency Managers have their own user names)
  Password: (Each user has own password)
- Sheriff's Emergency Notification System – Wireless Emergency Alert (WEA)
- Local Emergency Override System (for Cox cable)
  (760) 305-8912, access code 482, brief tone then press #
- Emergency Alert System (EAS) through County OES
  - Television
  - Radio
- Emergency vehicles equipped with public address (PA) systems, including lifeguard vehicles
- Sheriff's ASTREA helicopter PA system
- Personnel equipped with bullhorns
- City website (activate static emergency page)
- City social media sites – Facebook, Twitter, Nextdoor
- Door-to-door canvassing
  - Emergency officials
  - Volunteers (CERT, Senior Patrol)
- Programmable message signs (Public Works—2 total)
- 2-1-1 information line

MODES OF TRANSPORTATION

The primary mode of transportation that will be used during jurisdictional evacuation efforts will be privately owned automobiles. The City and OA will use available resources, Memorandums of Understanding and Agreement (MOUs/MOAs) with public and private transportation agencies, and mutual aid to procure, coordinate, and provide adequate means of transportation for those people that do not own or have access to automobiles, have disabilities which limit their transportation options, or have other special needs.

TRAFFIC CONTROL POINTS:

No.	Location	SDCO Evac. Map	Responsible Agency
1.	Double LL Ranch Rd. & Paseo Esmerado	4921 A-1	Sheriff or Fire Department (open gate)
2.	Dove Hollow Road & Lone Hill Lane	4922 A-1	Public Works (directional signage)
3.	Lone Jack Road & Double LL Ranch Road	4921 C-1	Public Works (directional signage)

4.	Lone Jack Road & Fortuna Ranch Road	4921 C-2	Public Works (directional signage)
5.	Cole Ranch Road @ Lone Jack Road	4820 C-2	Public Works (directional signage)
6.	Cole Ranch Road @ El Camino Del Norte	4820 C-2	Public Works (directional signage)
7.	Rancho Santa Fe Rd. & Olivenhain Rd. (closed to s/b traffic onto Rancho Santa Fe Road)	4920 B-2	Carlsbad PD
8.	Rancho Santa Fe Rd. & Avenida La Posta (traffic signal set to flash)	4820 C-2	Sheriff
9.	Rancho Santa Fe Rd. & Lone Jack Road	4820 C-2	Sheriff
10.	Rancho Santa Fe Rd. & El Camino Del Norte	4820 C-2	Sheriff
11.	Rancho Santa Fe Rd. & Encinitas Blvd. (closed to n/b traffic onto Rancho Santa Fe Road). Traffic signal set to flash	4720 B-2	Sheriff
12.	El Camino Del Norte and Val Sereno Drive	4821 A-2	Sheriff

EVACUATION ROUTES:

<u>Scenario "A" Event (wildfire is outside city limits, approaching east from Harmony Grove or Rancho Santa Fe)</u>

Exposed population north of Dove Hollow Road/Double LL Ranch Road will be evacuated via the Double LL Ranch Rd. gate. Evacuation routes are as follows:

No.	Location	SDCO Evacuation Planning Map(s)
1.	S/B on Copper Crest Road (to Lone Jack Road)	4921 C-1
2.	South-west on Lone Hill Lane (to Lone Jack Road)	4921 C-1
3.	S/B on Lone Jack Road	4921 C-1
4.	S/B on Lone Hill Lane (to Dove Hollow Rd.)	4921 C-1
5.	W/B on Dove Hollow Road	4921 D-1
6.	W/B on Double LL Ranch Road	4921 C-1

Exposed population south of Dove Hollow Road /Double LL Ranch Road will be evacuated via Lone Jack Road and El Camino Del Norte:

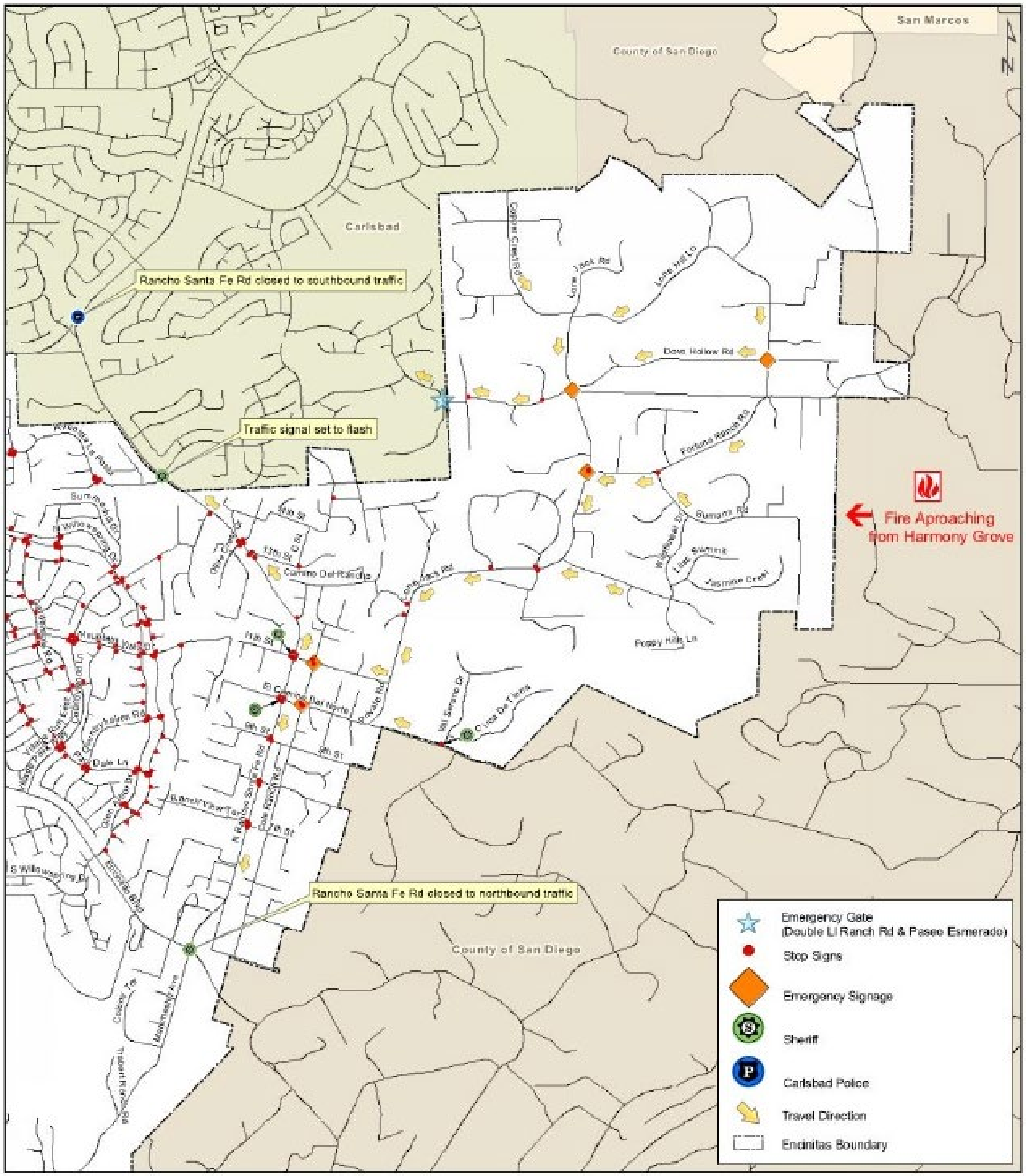
1.	S/B on Rancho Summit Dr. (to Fortuna Ranch Road)	4922 B-1
2.	W/B on Fortuna Ranch Road (to Lone Jack Road)	4921 C-2
3.	S/B on Western Springs Road (to Fortuna Ranch Road)	4921 D-2
4.	W/B on Bumann Road (to Fortuna Ranch Road)	4921 D-2
5.	North on Wildflower Drive (to Fortuna Ranch Road)	4921 D-2
6.	W/B on El Camino Del Norte	4722 A-1, B1
7.	W/B Camino Del Rancho	4821 B-1
8.	S/B on Rancho Santa Fe Rd.	4820 C-1, C-2

Traffic exiting Lone Jack Road and streets to the north will be directed north (no left turn) using on Rancho Santa Fe Road.

Traffic exiting El Camino Del Norte and streets to the south will be directed south (no right turn) on Rancho Santa Fe Road.

If necessary, a utility access road from Morning Sun Drive to Village Park Way is available to direct traffic off Rancho Santa Fe Road.

Due to the narrow roadways and need to possibly deploy firefighting resources to the affected areas, contra flow operations is not an effective option for evacuating residents.



Scenario A

Olivenhain Wildfire Evacuation Plan 7 Rev. 12/2/2019

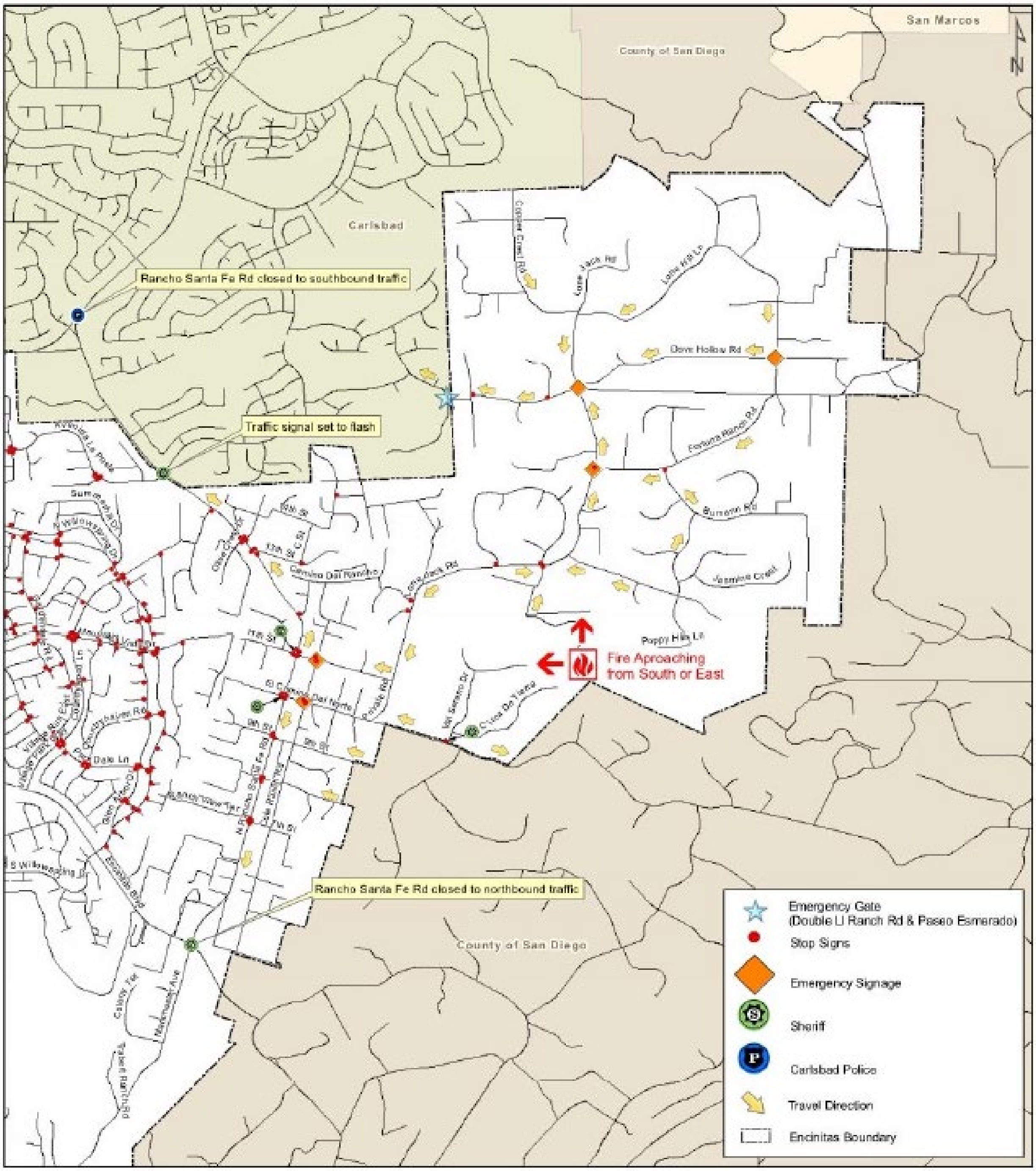
Scenario B Event (wildfire is in Escondido Creek in or near city limits and approachin from the south or east)

Exposed population north of 3000 block of Lone Jack Road will be evacuated via the Double LL Ranch Rd. gate. Evacuation routes are as follows:

No.	Location	Thomas Brother Map(s)
1.	S/B on Copper Crest Road (to Lone Jack Road)	4921 C-1
2.	South-west on Lone Hill Lane (to Lone Jack Road)	4921 C-1
3.	S/B on Lone Jack Road	4921 C-1
4.	S/B on Lone Hill Lane (to Dove Hollow Rd.)	4921 C-1
5.	W/B on Dove Hollow Road	4921 D-1
6.	W/B on Double LL Ranch Road	4921 C-1
7.	S/B on Rancho Summit Dr. (to Dove Hollow Road)	4922 B-1
8.	W/B on Fortuna Ranch Road (to Lone Jack Road--North)	4921 C-2
9.	North/North-west on Bumann Road (to Fortuna Ranch Rd)	4921 C-1
10.	N/B on Wildflower Drive (to Bumann Road)	4921 C-1
11.	East on Wildflower Valley Drive (to Lone Jack Road—North)	4821 C-1
12.	N/B on Brookside Lane (to Lone Jack Road—North)	4821 B-1
13.	N/B on Lone Jack Road (3000 block and higher)	4821 B-1,4921 C-2

Exposed population south of 3000 block of Lone Jack Road will be evacuated via Lone Jack Road and El Camino Del Norte:

1	S/B on Lone Jack Road (2900 block and lower)	4821 A-1
2.	S/B on Val Sereno Drive (to El Camino Del Norte)	4721 A-1
3.	W/B on El Camino Del Norte	4721 B-1, A-1
4.	E/B on 9th Street (to Rancho Santa Fe Road)	4820 C-2
5.	S/B on Rancho Santa Fe Rd.	4720 C-1



Scenario B

Olivenhain Wildfire Evacuation Plan 9 Rev. 12/2/2019

RESOURCES

Type 2 Barricades
Solar panel signal board (2)
Sign bags

AREA SECURITY

Access back into evacuated areas should be initially limited to:

- Emergency service and public works personnel
- Utility companies engaged in restoring utility services
- Contractors restoring damaged buildings, clearing roads and removing debris
- Commercial vehicles

ACCESS CONTROL POINTS

Intersection	S.D.County Evacuation Maps
Rancho Santa Fe Rd. & Olivenhain Rd. (closed to s/b traffic onto Rancho Santa Fe Road)	4920 A-1
Rancho Santa Fe Rd. & Encinitas Blvd. (closed to n/b traffic onto Rancho Santa Fe Road). Traffic signal set to flash	4720 B-2

SHELTER ESTIMATE (Approximately 20% of exposed population):

1173 persons
512 dogs (based on average 1.69 per household)
664 cats (based on average of 2.19 per household)
282 horses

POTENTIAL MASS CARE CENTERS:

Due to the unpredictability of wildfires and how they can spread rapidly, there will need to be flexibility in identifying shelters that are safely located outside the hazard zones.

NOTE: ***The need for activation to Mass Care Centers will be as recommended by local jurisdictions and as designated by the American Red Cross.***

Facility		Capacity
1.	Encinitas Community Center	318
2.	Oak Crest Middle School	127
3.	San Dieguito Academy	299

TEMPORARY HORSE/LIVESTOCK SHELTERS

1. Oakcrest Middle School (notify San Dieguito Union School District)
2. San Diego County Fairgrounds

POTENTIAL TRANSPORTATION/TEMPORARY EVACUATION POINTS (used to collect and transport people without transportation resources to evacuation points)

1. Olivenhain Town Hall, 423 Rancho Santa Fe Road, Encinitas (4720 C-2)

2. Little Oaks Park (Lone Jack Road at Crystal Ridge Road) (4821 A-1)

INITIAL COMMAND POSTS:

1. Encinitas Sheriff's Station, 175 N. El Camino Real, Encinitas, 760-966-3500 (4819 B-2)

2. Encinitas Emergency Operations Center (EOC) 505 S. Vulcan Avenue, Encinitas, [redacted] (4717 C-1)

3. Operational Area EOC, 5555 Overland Avenue, San Diego, [redacted] (2825 D-2)

POTENTIAL STAGING AREAS:

1. Oakcrest Park, 675 Balour Dr., Encinitas (4718 D-1)

2. San Dieguito High School, 800 Santa Fe Dr. (4718 B-2)*

3. Mira Costa College, 3333 Manchester Avenue (4519 B-2)

4. Paul Ecke Sports Park, 200 Saxony Rd. (4818 A-2)

5. Encinitas Community Center, 1140 Oakcrest Park Road* (4718 D-1)

* Also a potential mass care center

II. EVENTS AND EMERGENCY STATUS

EVENT	STATUS
Red Flag Warning	Review Plans and Procedures
Wildfire progressing west from Escondido, Poway or Rancho Bernardo	Initiate Phased Evacuation or order a Voluntary Evacuation
Wildfire(s) in San Marcos, Harmony Grove, Elfin Forest, Carlsbad or Rancho Santa Fe	Scenario A (refer to map) Mandatory Evacuation
Wildfire begins in Olivenhain. (Escondido Creek), Rancho Santa Fe	Scenario B (refer to map) Mandatory Evacuation
Wildfire threat has ceased	Repopulation

III. ACTIONS

A. CITY ACTIONS:

<u>Fire Department</u>

- Fire Duty Chief will verify that a wildfire affecting Olivenhain is imminent or has occurred.
- Duty Chief will notify the Sheriff's and request traffic control and evacuation operations and request that both Double LL Ranch Road emergency access gates be opened and secured in an open position using the cellular access control or knox key. If Sheriff's personnel are unavailable, Fire Prevention personnel or CBD #2216 can open both gates.

- Duty Chief will notify Public Works and request traffic control for the area and directional signage be placed along evacuation routes and stop signs bagged.

- Duty Chief will notify the Fire Chief.

- Upon notification by Fire Chief, City Manager (or designee) will activate the Emergency Operations Center (EOC).

- If necessary, activate the Community Emergency Response Team (CERT) to assist Sheriff's with traffic control.

- If necessary, the Encinitas Fire Department and Lifeguards can assist the Sheriff's Department with public notification and evacuation activities. Fire engines (6), chief officer (4) and lifeguard vehicles (3) are equipped with vehicle public address systems.

Public Works Department

- Institute traffic control measures. Deploy directional signage and message boards.

- Bag stop signs (stop signs are identified on the maps). Post signs on cross streets at four way stops indicating that through traffic does not stop.

- Post road closures on appropriate Web EOC status boards.

Traffic Engineering

- Develop and implement traffic control plan.

- Monitor traffic flow.

- Notify the City of Carlsbad of potential traffic impacts.

Emergency Operations Center

- Notify the Operational Area of the activation.

- Utilize AlertSanDiego Mass Notification System upon the issuance of an evacuation order and provide public information.

- Contact special facilities such as nursing homes and hospitals that may be impacted and request that they review and be prepared to implement their evacuation plans.

- Contact the American Red Cross for potential and confirmed evacuation and shelter needs of displaced population.

- Contact the San Diego County Fairgrounds for potential and confirmed evacuation and shelter needs for large animals (particularly horses), if necessary.

- Coordinate mutual aid necessary for evacuation.

- Establish Inter-jurisdictional coordination with the City of Carlsbad.

B. SHERIFF'S DEPARTMENT (LAW ENFORCEMENT) ACTIONS:

Law enforcement agencies are responsible for providing security, traffic control and evacuation operations within their areas of responsibility. The Sheriff's Department is responsible for directing evacuation activities within cities that have contracted with the Sheriff's Department for law enforcement services, in the unincorporated areas in their jurisdictions and when mutual aid is requested from allied agencies.

- Provide evacuation notification and advisory to unsafe areas.

- Identify transportation and evacuation points.

- Coordinate relocation of people to safe areas with other agencies.

- Search vacated areas to ensure that all people have received warnings.

- Provide initial field situation reports and updates from field units and Aerial Support to Regional Enforcement Agencies.

- Coordinate the provision of transportation resources to special needs populations.

- Provide traffic control measures for the evacuation effort (including the use of Senior Patrol volunteers).

- Provide security and access control to vacated areas.

- Coordinate information with Sheriff's Office, C.H.P. and Carlsbad Police Departments concerning evacuation from affected areas, including unique institutions as indicated on previous pages.

C. COUNTY OES ACTIONS

- Coordinate evacuation efforts with local jurisdictions that may be affected by the evacuation.

- Coordinate the release of warnings, instructions and other emergency public information related to the evacuation effort, including the use of AlertSanDiego and Wireless Emergency Alert (WEA) Mass Notification systems to provide information on affected areas and the location of mass care centers, road closures, and exit/evacuation routes.

- Coordinate with the Humane Society and County Animal Services to provide support with the transportation of large animals.

- Assist in re-entry, recovery operations and planning with other agencies as requested.

IV. PROCEDURES AND RESPONSIBILITIES

A. ALERTS AND WARNING

In responding to a wildfire, precautionary alerts are made by telephone to the affected jurisdictions. ***Numbers below are confidential and are not to be given out to the public*** **(refer to Emergency Telephone Numbers sheet for additional numbers):**

NORTHCOMM	[redacted]
Sheriff's Communications	[redacted]
Sheriff's Watch Commander	[redacted]
CHP Communications	[redacted]
City of Encinitas	[redacted]
City of Carlsbad Police Department	[redacted]
American Red Cross	[redacted]
San Diego Humane Society	[redacted]
Rancho Santa Fe Patrol	[redacted]
San Dieguito Union High School District	[redacted]
Encinitas Union School District	[redacted]

B. SITUATION ANALYSIS AND PRELIMINARY HAZARD/DAMAGE REPORT

1. As soon as possible, a situational analysis is done by the following agencies:

    a. The Encinitas Sheriff's Station, Public Works, Fire, Engineering, Development Services Departments and the Red Cross will perform ground damage surveys of the affected area within the city boundaries.

    b. Damage survey information is reported to the City EOC and the Operational Area.

2. The County OES coordinates the Situation Reports and the Hazard/Damage Assessment information with the affected agencies as listed under Section IV A, Alerts and Warnings.

C. EVACUATION

1. Evacuation is coordinated by the law enforcement agencies involved. CHP assists all agencies with routing and traffic control. For further information on evacuation procedures for the county area, see Annex C, San Diego County Operational Area Emergency Operations Plan.

2. Evacuation warning information may be disseminated via a variety of methods including, but not limited to: AlertSanDiego, WEA, helicopter, patrol units, City social media sites, news media, etc.

D. REPOPULATION

1. Provide ample time for residents' re-entry into evacuation area.

2. Repopulation efforts should be coordinated through the OA EOC and protocol effectively communicated with Law Enforcement and the National Guard.

IV. REFERENCES

Unified San Diego County OA Emergency Plan, Annex Q (Evacuation), September 2018
H.R. 2360, Department of Homeland Security Appropriations Act, 2006
Department of Homeland Security Preparedness Directorate No. 197
California Penal Code 409.5 (a) and (c)
Pets Evacuation and Transportation Standards Act of 2006

ATTACHMENT "B"
CITY OF ENCINITAS EMERGENCY PREPAREDNESS WEB PUBLICATIONS

Emergency Preparedness

HOW CAN I PREPARE FOR A DISASTER?*

Step 1: Make a Plan

- Designate a relative or friend as an out-of-area contact with whom family members can relay information.
- Involve your children in the planning process.
- Review and update your emergency supply kit periodically.
- Learn alternate ways out of your neighborhood, in case the usual way becomes blocked.
- Plan how to transport your pets. Click for information on evacuating horses to the Del Mar Fairgrounds. If you have horses, pre-fill out this mandatory evacuation form.

Step 2: Prepare an Emergency Supply Kit

- Your kit should consist of supplies stored in easy-to-carry containers such as backpacks or plastic crates.
- Your kit should include the following items (at minimum):
  - A three-day supply of water (one gallon/person/day) and food for people and pets.
  - Change of apparel plus blankets/sleeping bags.
  - First aid kit, prescriptions, toiletries and specialty items for infants, elderly and disabled.
  - An extra set of car keys, flashlight/batteries and battery-powered radio.
  - Important documents such as copies of insurance policies, identification and bank accounts.
- Review FEMA's list of how to obtain replacements for important documents.
- Obtain more emergency supply kit information at Ready San Diego.

Step 3: Stay or Go?

- During an emergency, you may be required to evacuate or to stay where you are.
- Sign up for Alert San Diego to receive information sent directly to your mobile device and email.
- Listen to your radio/TV (KOGO-AM 600 and Encinitas 1500AM) to stay informed of potential evacuations.

- Follow recommended evacuation routes. Do not take any shortcuts as they may be blocked.
- Click for information on tsunami and wildland fire evacuation plans.

Step 4: Stay Informed and Share Information

- Avoid non-essential cell phone use.
- Text rather than call during an emergency. Messaging is more resilient in a disaster than voice communication.
- Let loved ones know you're safe. After a disaster, register yourself at the American Red Cross' Safe and Well website so family and friends know you are okay.
- Visit the City of Encinitas website and San Diego County emergency site for up-to-date information.
- Follow the Encinitas Fire Department on Facebook and Twitter.
- Check the CA Department of Transportation website for road conditions and closures.
- Download the San Diego County Emergency App to receive real-time information during a disaster.
- Take advantage of additional emergency preparedness resources listed below.

*For a more in-depth review of identifying hazards and preparing for, responding to, and recovering from a disaster, please explore the following pages:

- Identify Hazards
- Prepare
- Respond
- Recover

Additional preparedness information and classes are available to residents upon request. Please send us an email by clicking here or call 633-2815 if you would like further information or would like to schedule a class or presentation for your group.

Identified Hazards

Together with the County of San Diego, the City of Encinitas has identified the hazards below as the top six, based on their probability and potential impact.

To mitigate the impact of these potential hazards, the County has created the Multi-Jurisdictional Hazard Mitigation Plan (Plan). The Plan is updated every five years. In

2014, community input from the entire County was solicited to update and improve the 2017 Plan Update. The update can be found here.

The process to revise the 2017 Plan has begun. A vital part of the revision process is receiving public input regarding the threats facing our region and potential actions to reduce the impact of those hazards. Your input is very important. It will help guide the revision process by identifying your concerns and potential solutions, allowing us to incorporate them into the planning process and the plan itself. Please take the time to complete an on-line survey.

Earthquake

On November 22, 1800, a 6.5 magnitude occurred on the Rose Canyon fault offshore from Oceanside. It cracked adobe walls at the missions of San Diego de Alcala and San Juan Capistrano. Other notable local earthquakes include a magnitude 6.0 earthquake centered on the Rose Canyon or Coronado Band faults on May 27, 1862, and a magnitude 5.4 earthquake centered off the coast of Oceanside on the Coronado Bank Fault on July 13, 1986. The geographic extent of this hazard is citywide. A greater percentage of the city's population is potentially exposed to this hazard relative to other hazards, and potential losses from an earthquake would be comparatively larger in most cases.

The Rose Canyon Fault lies offshore (2.5 miles west of the city at its closest point) and is capable of generating a magnitude 6.2 to 7.2 earthquake that could potentially damage dwellings and infrastructure throughout the city. A magnitude 6.9 earthquake on the Rose Canyon Fault could potentially result in a peak ground acceleration of .40 within downtown Encinitas and the Coast Highway 101 corridor. These areas of the city are more likely to suffer heavier damage and greater human losses than other parts of the city because of the presence of older buildings (including 19 unreinforced masonry buildings and several multi-unit buildings constructed prior to 1973), a relatively higher population density and softer soils susceptible to liquefaction, lurch cracking, lateral spreading and local subsidence.

Wildfire

A significant number of Encinitas residents live within the wildland-urban interface. The geographic extent of this hazard includes the following areas of the city, for the most part: 1) Saxony Canyon; 2) South El Camino Real/Crest Drive; and 3) Olivenhain. Properties in these and other smaller areas are susceptible to wildfire because they are situated near open space and canyons containing heavy fuel loads. Reoccurring periods of low precipitation have increased the risk of wildfires in the region. A greater percentage of the population is potentially exposed to wildfires. Potential losses from this hazard are comparatively larger than those associated with a dam failure, flooding, coastal bluff failures or hazardous material incidents. Recent wildfire events in Encinitas include a wildfire in the central part of the city in 1970 and three wildfires in the community of Olivenhain in 1943, 1980 and 1996. The 1996 Harmony Grove Fire resulted in the loss of three homes and the evacuation and sheltering of hundreds of residents.

Dam Failure

Geologists estimate that a magnitude 7.5 earthquake from the Elsinore Fault, located 11 miles east of Lake Wohlford, could result in a failure of its hydraulic fill dam. The geographic extent of this hazard is limited to the persons and properties within the inundation path surrounding Escondido Creek and San Elijo Lagoon. The dam inundation path is larger than the Escondido Creek 100-year floodway and a greater number of persons and properties are exposed to this hazard compared to coastal bluff failures and flooding. Major arterials within the inundation path include El Camino Del Norte, Rancho Santa Fe Road, Manchester Avenue and Coast Highway 101. The failure of Wohlford Dam (1895) and Dixon Reservoir Dam (1970) could possibly threaten city facilities and infrastructure (including the San Elijo Water Reclamation Facility, Cardiff and Olivenhain sewer pump stations and the San Dieguito Water District 36” high pressure supply line) and educational facilities (Mira Costa College) located in and adjacent to the inundation path. Although exposure to loss of property is significant, the potential for loss of life is limited because of the length of time before flood wave arrival (approximately 1 ½ hours) allowing for aggressive warning and evacuation measures to be initiated by the city.

The Olivenhain Dam (2003) is a concrete gravity dam located on a tributary of Escondido Creek, just west of Lake Hodges, holding 24,000 acre feet. Stanley Mahr Reservoir (1981) is a small, earth-filled embankment dam located on a tributary of Encinitas Creek in San Marcos with a capacity of approximately 200 acre feet. A failure of Mahr Reservoir in Carlsbad would produce flooding along Encinitas Creek (which flows into Batiquitos Lagoon) in the northern portion of the city. Emergency Action Plans have been developed for these dams. The risk of failure of both dams is relatively low due to their age and construction and existing surveillance and inspection measures.

Coastal Bluff Failures

Geographic extent of the hazard is limited primarily to the Encinitas coastal sandstone bluffs. After the El Niño storms of 1982-1983, Encinitas beaches were stripped of vertical sand up to 20 feet deep, putting the coastal bluffs and homes in jeopardy of collapsing into the sea. Furthermore, the shoreline segments at Moonlight Beach and Cardiff-by-the-Sea are extremely vulnerable to coastal inundation from potential future sea level rise. In 2000, unstable cliffs at Beacon’s Beach in Encinitas caused a landslide that killed a woman sitting on the beach. The recreational bicycle path along the seaside of Highway 101 was undermined in 2010.

Erosion studies have been conducted for Encinitas, Solana Beach and Del Mar. Various degrees of coastal bluff erosion occur annually and coastal bluff failures have resulted in limited loss of life. As a result, negotiations with the California Coastal Commission are underway to develop a comprehensive coastal bluff policy towards coastal bluff top development. A smaller percentage of the population is exposed to this hazard relative to earthquakes, wildfires and dam failures and the potential for losses is comparatively less.

Flooding

The geographic extent of this hazard is limited to 1) Encinitas coastline, particularly "Restaurant Row" in Cardiff (south of San Elijo State Beach Campgrounds); 2) Escondido, Encinitas and Cottonwood Creeks; and 3) low-lying areas of Leucadia and Old Encinitas. The city has experienced some property-related losses resulting from localized flooding in Leucadia and coastal flooding in Cardiff, but not loss of life. Winter storms in 1997, 2005-2006 and 2010-2011 resulted in significant damage and required emergency protective measures, debris removal and reconstruction of infrastructure. The associated recovery costs (FEMA public assistance) for the 2005-06 event were over $500,000. Recovery costs for the 2010-2011 event were approximately $30,000.

What You Can Do During the Disaster

Dealing with a disaster involves more than just preparing for one. How you respond is equally important. The best thing you can do is remain calm and stay informed. Staying informed includes knowing when to evacuate and where to find shelter. Avoid becoming the victim during a disaster by learning how to respond, whether it be for your family or community. Find details about information outlets, evacuation routes, and ways to prepare to be response-ready during a disaster in the sections that follow.

- Stay Informed
- Evacuate and Seek Shelter
- For Local Businesses

What Is The City's Role During An Emergency?

In a typical year the Federal Emergency Management Agency (FEMA) pays about $2 billion to help people and local governments recover from disasters. That cost, and the corresponding unquantifiable costs in human suffering, can be significantly reduced if every community, no matter how small, has in place a plan or process for responding to these potential disasters.

The Disaster Preparedness Division of the Fire Department develops emergency procedures, activities, and disaster operation plans to be implemented in the event of a natural or man-made emergency. It is also responsible for instituting measures that mitigate the impact of disasters, and manage emergency response and recovery activities during and after an emergency or disaster.

In an emergency or disaster the City's Emergency Operations Center is activated. The mission of the Encinitas Emergency Operations Center (EOC) is to respond to catastrophic events by providing centralized management of the City's emergency response personnel, resources, facilities, and mutual aid assistance given the city. The EOC Director will direct the strategic allocation and deployment of its resources and coordinate emergency response information, planning and operational priorities. When managing a disaster or emergency, staff within the EOC are involved in five major functions: Management (or Command), Operations, Planning, Logistics, and Finance. In a nutshell, management sets the City's mission during a disaster; Operations carries out the mission; Planning plans and documents the mission; Logistics supports the mission; and Finance pays for the mission. These functions come together to form the basis of the City's emergency response organization.

Evacuate and Seek Shelter

Evacuate and Find Shelter

The City has an emergency plan that includes standard operating procedures for initiating an evacuation. Where you would go during an evacuation depends on the location and type of the disaster.

Local Evacuation Routes:
Tsunami
Wildland Fire

If you must evacuate:

A wholesale evacuation of the county's 3 million residents is not contemplated under the most extreme disasters analyzed for San Diego County. However, selected evacuations could be necessary in certain hard-hit areas, as was necessary in the 2003 wildfires. Circumstances would dictate how to coordinate traffic flow out of an affected area, but here are a few general guidelines:

Unless there is immediate danger, stay at home, work, school or elsewhere, until officials signal where it is safe to go. Keep any driving to a minimum to make room for emergency vehicles and other necessary travel.

If an evacuation is ordered, the sheriff's office or other law enforcement agencies will announce details, what routes to take, where to go for shelter and care and how long the emergency and the evacuation may last.

Freeways: Although strengthened to withstand most earthquakes, freeways, off ramps and bridges could become unstable. Traffic managers recommend stopping as soon as possible to make sure it's safe to proceed. Be wary when driving. Changes to directional flow on freeways and other roads could be made.

Keep your vehicle's fuel tank full. Depending on the type of emergency, gasoline may not be available.

Mass transit: Transit agencies, school bus fleets, vans and ambulances stand by to assist in relocating people unable to leave on their own. Nursing homes, prisons, hospitals and other institutional facilities are required to prepare their own plans for possible evacuation or relocation. Details on accessing emergency transit would be broadcast to the public along with a phone number to request special assistance.

Emergency Shelter

Once deemed safe, a list of places will be broadcast:

The American Red Cross is officially designated by federal, state and local authorities to run emergency shelters. If the agency is not able to respond, the county's Health and Human Services Agency or individual cities would take over.

Locations: The Red Cross has identified more than 600 potential emergency shelters, such as schools, but does not make the list known in advance of a disaster because it doesn't want the public to go to a shelter until the site has been deemed to be safe. Qualcomm Stadium, Petco Park and the San Diego Convention Center have not been designated as potential shelter locations.

Notification: Shelter locations would be broadcast via the county's Emergency Alert System (on KOGO/AM 600) and other public information outlets. A toll-free number to find shelter sites is (866) 438-4636.

Services: The Red Cross will handle food, first-aid treatment, crisis counseling and individual services, such as supplying clothes, arranging temporary housing and assisting with shelter costs, medication and occupational supplies. Caches of supplies have been pre-positioned at local fire stations and other locations around the county.

Minors: The County's Child Protective Services office is responsible for caring for unaccompanied minors. Call the hotline at (800) 344-6000.

Prepare to 'shelter in place'

In the event of a terrorist attack or other emergency where hazardous materials have been released into the atmosphere, there are additional steps you should be familiar with.

Actions described elsewhere in this section such as creating a family emergency plan, stocking a disaster kit and gathering important documents remain vital preparation measures for such emergencies.

During some emergencies, you may be asked to “shelter in place” – meaning you should stay indoors at your home, place of work or at school to protect yourself from chemical, radiological or biological threats.

To 'shelter in place'

- Bring pets inside.
- Turn on your TV or portable radio for official information.
- Close and lock windows and exterior doors.
- Turn off fans, heating and air-conditioning systems.
- Close fireplace dampers, vents and other openings.
- Find refuge in an interior room without windows, or a room with the fewest number of openings to the outside. If there is a chemical peril, a room above ground level is preferable. For sheltering against radiation dispersed by a “dirty bomb” or from radioactive fallout after a nuclear explosion, shelter in a basement or lower level room.
- Move your 72-hour disaster kit to an easily accessible location.
- In the room you have chosen for refuge, seal openings or cracks around the door, any windows and vents leading into the room with heavy tape, plastic sheeting or wet towels.
- Prepare to evacuate quickly if ordered to do so.

Remember that instructions to “shelter in place” are usually provided for durations of a few hours, not days or weeks. There is little danger that the room in which you are taking shelter will run out of oxygen and suffocate you.

If your home is damaged, you may be forced to go elsewhere. The Red Cross has identified more than 600 potential emergency shelters locally, but it does not announce locations before disasters occur. Recreational vehicles or camping tents may be useful as backups.

Stay Informed

Stay informed through various media

outlets.

Call: 2-1-1

Listen: KOGO-AM 600 and Encinitas 1500AM

Consider purchasing a NOAA weather radio.

http://www.nws.noaa.gov/nwr/

Having a NOAA Weather Radio or portable radio with batteries will allow you to receive important emergency information from the Emergency Alert System (EAS). Also, help keep the phones working by using your phone as little as possible. Do not use the phone to get news or information. Naturally, when disaster strikes, people want to call to reassure each other but when everyone tries to call at the same time, the phone system is strained to capacity.

Visit: www.encinitasca.gov/

www.sdcountyemergency.com/

The Emergency Digital Information Service (EDIS) delivers official information about emergencies and disasters to the public and the news media in California. To receive alerts from the Emergency Digital Information Service http://www.calalerts.org/

Follow:	Twitter	Facebook
	@EncinitasFire	City of Encinitas
	@EncinitasGov	County of San Diego
	@SanDiegoCounty	Ready San Diego

Download: Lantern Live

The U.S. Department of Energy has recently launched a new App called "Lantern Live." According to the website, it "allows users to report the operational status of local gas stations, find fuel, and look up power outage maps from local utilities, while also accessing useful tips and guidelines."

Free County Emergency App Now Available for Download

The Encinitas Fire Department urges you to use your Smartphone to stay connected before, during, and after a disaster.

Visit the San Diego County website for information and to download the free county emergency app.

Volunteer: Become a CERT member

In 95% of all emergencies, bystanders or victims themselves are the first to provide emergency assistance or perform a rescue. One way to help first responders, yourself and your neighbors is to participate in the Citizens Corps program and become part of a Community Emergency Response Team, or CERT. The CERT program trains people in basic disaster response skills, such as fire suppression, urban search and rescue and medical operations, and helps them take a more active role in emergency preparedness.

2-1-1 San Diego
American Red Cross
Disaster Relief Opportunities through VolunteerMatch.org

For Local Businesses

An important part of the City's disaster preparedness program involves developing a partnership with local businesses to prepare and effectively respond to disasters.

During a disaster, businesses and non-profit organizations may be able to provide our firefighters, local law enforcement personnel and emergency management staff with desperately needed goods and services. To facilitate the delivery of these resources to those in need, the Encinitas Fire Department maintains an Emergency Resource Directory, which can be used to quickly identify vendors should there be a need to purchase essential goods and services after a disaster strikes.

If you are willing to provide crucial assistance during a disaster and would like to be included within this Directory, please download this questionnaire and return it to us by e-mail, fax at (760) 633-2818, or mail to the following address: Encinitas Fire Department, 505 South Vulcan Avenue, Encinitas, CA 92024. The information you provide will be kept confidential and will only be used in emergencies by authorized City of Encinitas personnel.

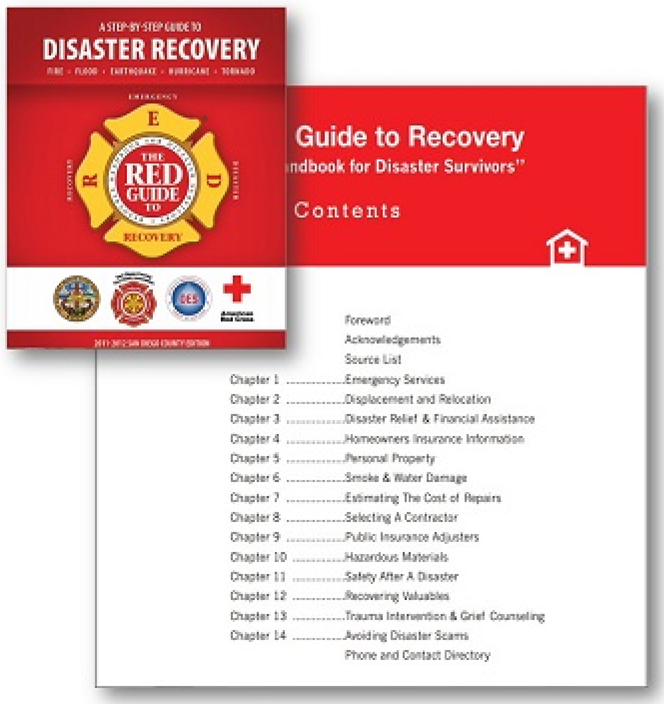
Examples of services, supplies or commodities that may be needed in a disaster:

Meals, Beverages & Water
Lodging
Retail/Office Space for Emergency Operations
Office Supplies
Fuel
Vehicles
Vehicle Maintenance
Medical Equipment & Supplies
Construction Materials (i.e. Lumber, Concrete)
Heavy Construction Equipment
General Contractual Services
Protective Clothing
Communications Equipment
Information Technology (i.e. Computers, Phones, Printers)
Portable or Modular Buildings/ Trailers
Porta Potties
Traffic Signs & Barricades
Blankets & Cots
Portable Generators
Electrical
Engineering Services
Building Inspection Services
Tree Trimming
Hardware/ Small Tools
Portable Lighting
Sand & Sand Bags
Portable Pumps
Bulk Manpower
Canopies

R e c o v e r

After a Disaster:

Click here for a condensed version of the "Red Guide to Recovery: A Resource Handbook for Disaster Survivors."



This handbook is specific to the San Diego region and was written with support by the County of San Diego, the San Diego Fire Chief's Association, the County of San Diego's Office of Emergency Services, and American Red Cross. Save it on to your laptop and tablet for easy access in a disaster.

After the Immediate Threat Passes

- Perform a safety check of your living quarters, wearing sturdy shoes, gloves and a dust mask or wet handkerchief if damage is extensive.
- Some chimneys may collapse and others may be weakened and should be approached with caution. Do not use a damaged chimney.
- If you find damaged electrical wiring, shut off the power at the control box. Do not touch downed power lines. If the power is out, unplug sensitive electronic

equipment, such as computers, to protect them from a power surge. Leave a table light on so you will know when power is restored. There is generally no need to turn off the main power switch if there is no damage. To shut off electricity, turn off all small breakers and then shut off the main circuit breaker. For a home equipped with a fuse box, remove all small fuses and then turn off the main using a knife switch handle.
- Beware of items that may fall out of a cupboard or closet or from shelves.
- Do not eat or drink anything from open containers near shattered glass. If the power is out, first eat foods that will spoil quickly, such as those in the refrigerator and freezer. Generally, they're safe to eat as long as they're refrigerator-cool. Freezer items may be refrozen if ice chips are still evident. When in doubt, throw it out.
- Operate portable generators outdoors only. Use only with appliances that can connect directly to the generator by extension cords and do not plug a generator into a household outlet. That could send electricity back into the main utility system and cause possible injury.
- For leaks and spills, check water lines in the kitchen, bathrooms, laundry room and the landscaping system. Check the main line connection at the street and house. Turn off the valves as needed. Immediately clean up any spilled medicines, drugs and hazardous materials, such as gasoline or bleach.
- Check that each telephone is on its receiver. Phones that are off the hook tie up the phone network. Cordless phones may not work if power is out, so have a manual traditional phone available to plug into the wall. Cell phones may not work if towers have been destroyed or the system is disrupted.
- If you smell natural gas or hear a gas leak, turn off the main valve, using a 10-to 12-inch wrench. Report the leak to SDG&E from a telephone outside your home and request a company technician or a licensed contractor to check for leaks and turn on the gas. Do not turn the gas back on yourself and do not turn on electrical switches until you are sure there is no leak. There is no need to turn off the gas if you do not detect any leaks. When checking your house, use only flashlights, not lanterns, candles or other flammable light sources, which could ignite a gas leak.

Pick Up the Pieces Safely

- Cleaning homes and yards after a disaster can be a big job. Let professionals handle complicated and dangerous repair work, such as a cracked foundation, downed power lines or gas leaks.
- Be careful upon entering your home. A sticky door could signal a ceiling ready to fall. If you need to use force, wait a few seconds after opening a door in case debris falls.
- Wear safety goggles, gloves and hard-sole shoes at all times.

- Remove water quickly from inside a home with a mop or squeegee to prevent mold and mildew. Floodwaters can contain dangerous oil-based and other hazardous materials, requiring interiors to be disinfected.
- In sorting through belongings, keep this in mind: When in doubt, throw it out.

In addition, see the Steps to Recovery from American Red Cross below for more information.

Staying Safe in the Immediate Aftermath
Checking Utilities and Major Systems
Checking Your Home: Structural Elements
Recovering Emotionally
Recovering Financially

ATTACHMENT "C" – BEHAVE FIRE MODELING

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:27:25 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description		ESCONDIDO CREEK CENTRAL
Fuel/Vegetation, Surface/Understory		
Fuel Model		sh5
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	30
Wind Adjustment Factor		.5
Air Temperature	oF	85
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	78
Ridge-to-Valley Elevation Difference	ft	609
Ridge-to-Valley Horizontal Distance	mi	0.12
Spotting Source Location		MW
Fire		
Elapsed Time	h	1

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].
Calculations are only for the direction of maximum spread [SURFACE].
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].
Wind is blowing upslope [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]
Heat per Unit Area (Btu/ft2) [SURFACE]
(continued on next page)

NORTH ESCONDIDO CREEK BEHAVE FIRE MODELING
SANTA ANA WIND EVENT
FUEL MODEL SH-5 DRY CLIMATE HIGH LOAD SHRUB
2003 CEDAR FIRE BURNING CONDITIONS
HARMONY GROVE ROAD

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:27:25 Pag

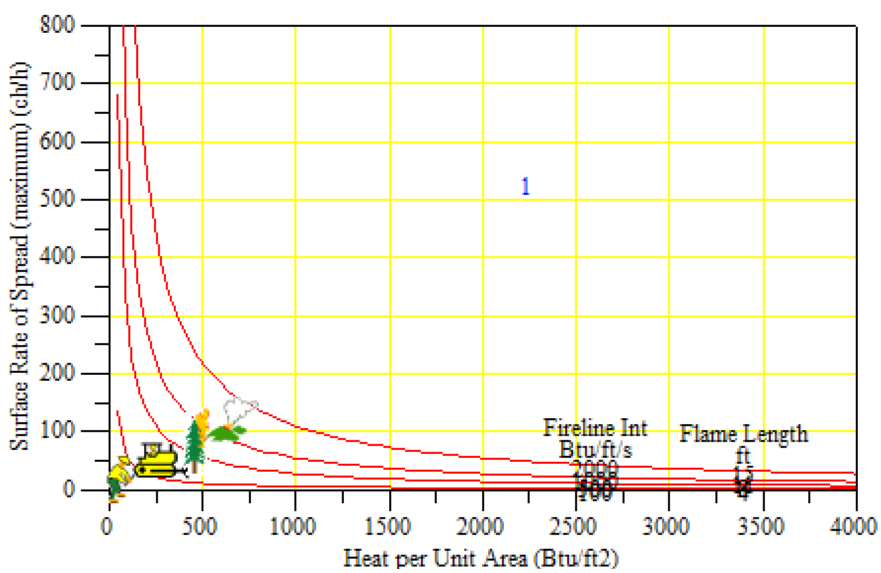
ESCONDIDO CREEK CENTRAL

Surface Rate of Spread (maximum)	532.2	ch/h
Heat per Unit Area	2235	Btu/ft2
Fireline Intensity	21803	Btu/ft/s
Flame Length	44.6	ft
Reaction Intensity	7284	Btu/ft2/min
Area	4167.0	ac
Perimeter	1120	ch
Spot Dist from a Wind Driven Surface Fire	1.7	mi
Probability of Ignition from a Firebrand	100	%

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:27:25 Page 4

ESCONDIDO CREEK CENTRAL

Fire Characteristics Chart



BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:35:01 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description: ESCONDIDO CREEK CENTRAL

Fuel/Vegetation, Surface/Understory		
Fuel Model		sh7
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	30
Wind Adjustment Factor		.5
Air Temperature	oF	85
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	78
Ridge-to-Valley Elevation Difference	ft	609
Ridge-to-Valley Horizontal Distance	mi	0.12
Spotting Source Location		MW
Fire		
Elapsed Time	h	1

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].
Calculations are only for the direction of maximum spread [SURFACE].
Fireline intensity, flame length, and spread distance are always
for the direction of the spread calculations [SURFACE].
Wind is blowing upslope [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]
Heat per Unit Area (Btu/ft2) [SURFACE]

(continued on next page)

NORTH ESCONDIDO CREEK BEHAVE FIRE MODELING, SANTA ANA WIND EVENT
FUEL MODEL SH-7 DRY CLIMATE VERY HIGH LOAD SHRUB
2003 CEDAR FIRE BURNING CONDITIONS
HARMONY GROVE ROAD

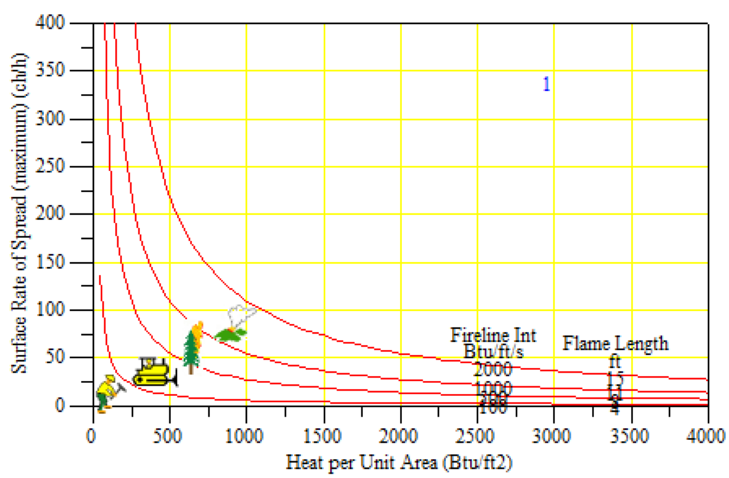
BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:59:46 Page 3

ESCONDIDO CREEK CENTRAL

Surface Rate of Spread (maximum)	340.4	ch/h
Heat per Unit Area	2955	Btu/ft2
Fireline Intensity	18441	Btu/ft/s
Flame Length	41.3	ft
Reaction Intensity	9488	Btu/ft2/min
Area	1683.4	ac
Perimeter	716	ch
Spot Dist from a Wind Driven Surface Fire	1.6	mi
Probability of Ignition from a Firebrand	100	%

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:35:01 Page 4

ESCONDIDO CREEK CENTRAL
Fire Characteristics Chart



BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:39:34 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description: ESCONDIDO CREEK CENTRAL

Fuel/Vegetation, Surface/Understory		
Fuel Model		4
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	30
Wind Adjustment Factor		.5
Air Temperature	oF	85
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	78
Ridge-to-Valley Elevation Difference	ft	609
Ridge-to-Valley Horizontal Distance	mi	0.12
Spotting Source Location		MW
Fire		
Elapsed Time	h	1

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind is blowing upslope [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]

Heat per Unit Area (Btu/ft2) [SURFACE]

(continued on next page)

NORTH ESCONDIDO CREEK BEHAVE FIRE MODELING – SANTA ANA WIND EVENT
FUEL MODEL 4 CHAPARRAL
2003 CEDAR FIRE BURNING CONDITIONS

HARMONY GROVE ROAD

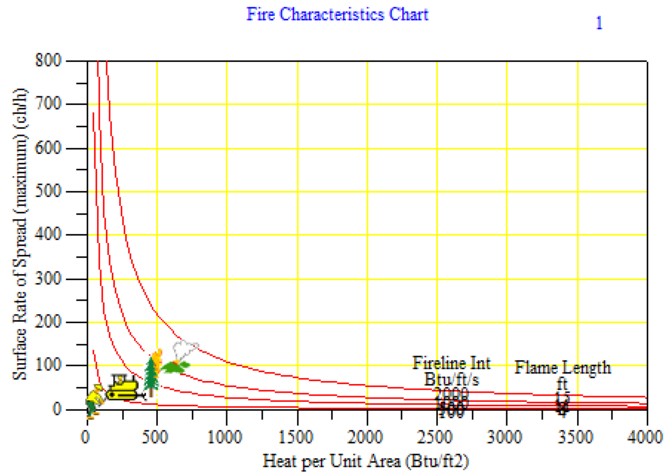
BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:39:34 Page 3

ESCONDIDO CREEK CENTRAL

Surface Rate of Spread (maximum)	895.8	ch/h
Heat per Unit Area	3667	Btu/ft2
Fireline Intensity	60230	Btu/ft/s
Flame Length	71.1	ft
Reaction Intensity	16610	Btu/ft2/min
Area	12155.4	ac
Perimeter	1891	ch
Spot Dist from a Wind Driven Surface Fire	2.4	mi
Probability of Ignition from a Firebrand	100	%

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 16:39:34 Page 4

ESCONDIDO CREEK CENTRAL
Fire Characteristics Chart



BehavePlus 5.0.5 Sun, Dec 22, 2019 at 17:14:37 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description: ESCCKWWHOLLOW

Fuel/Vegetation, Surface/Understory		
Fuel Model		sh5
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	30
Wind Adjustment Factor		.5
Air Temperature	oF	85
Fuel Shading from the Sun	%	09
Terrain		
Slope Steepness	%	37
Ridge-to-Valley Elevation Difference	ft	300
Ridge-to-Valley Horizontal Distance	mi	0.15
Spotting Source Location		MW
Fire		
Elapsed Time	h	1

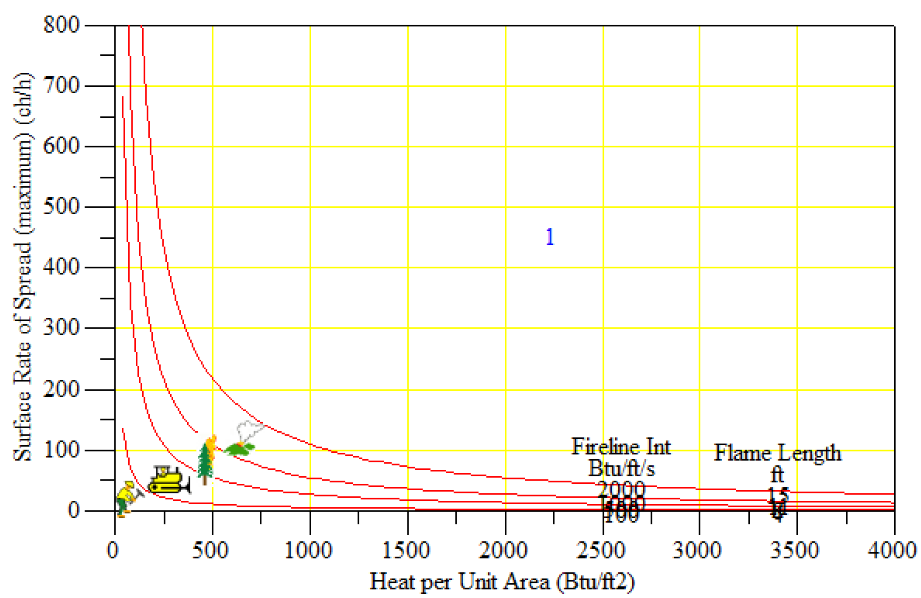
NORTH ESCONDIDO CREEK BEHAVE FIRE MODELING – SANTA ANA WIND EVENT
FUEL MODEL SH-5 DRY CLIMATE HIGH LOAD SHRUB
2003 CEDAR FIRE BURNING CONDITIONS
WILD WILLOW HOLLOW ROAD

ESCCKWWHOLLOW

Surface Rate of Spread (maximum)	458.7	ch/h
Heat per Unit Area	2235	Btu/ft2
Fireline Intensity	18792	Btu/ft/s
Flame Length	41.6	ft
Reaction Intensity	7284	Btu/ft2/min
Area	3440.4	ac
Perimeter	975	ch
Spot Dist from a Wind Driven Surface Fire	1.6	mi
Probability of Ignition from a Firebrand	100	%

ESCCKWWHOLLOW

Fire Characteristics Chart



BehavePlus 5.0.5 Sun, Dec 22, 2019 at 17:18:35 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description: ESCCKWWHOLLOW

Fuel/Vegetation, Surface/Understory		
Fuel Model		sh7
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	30
Wind Adjustment Factor		.5
Air Temperature	oF	85
Fuel Shading from the Sun	%	09
Terrain		
Slope Steepness	%	37
Ridge-to-Valley Elevation Difference	ft	300
Ridge-to-Valley Horizontal Distance	mi	0.15
Spotting Source Location		MW
Fire		
Elapsed Time	h	1

NORTH ESCONDIDO CREEK BEHAVE FIRE MODELING – SANTA ANA WIND EVENT
FUEL MODEL SH-7 DRY CLIMATE VERY HIGH LOAD SHRUB
2003 CEDAR FIRE BURNING CONDITIONS
WILD WILLOW HOLLOW ROAD

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 17:18:35 Page 3

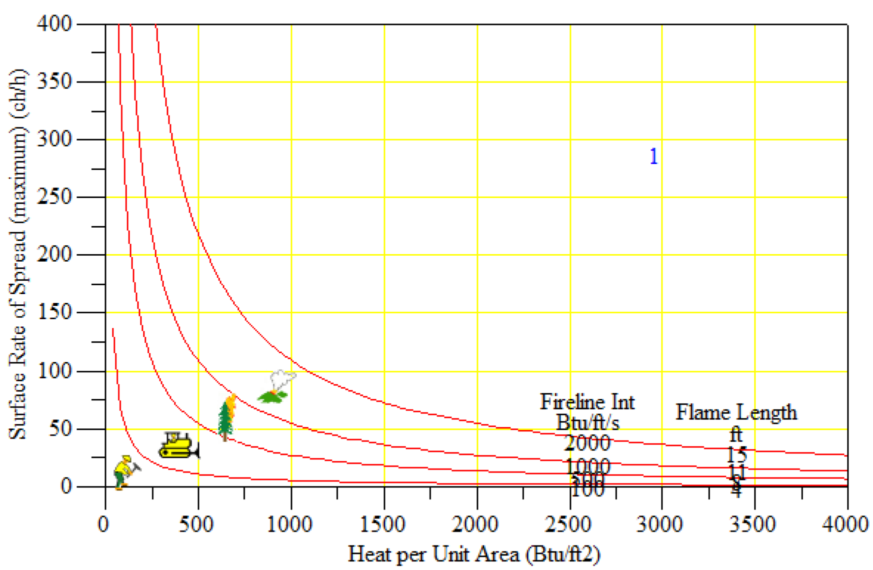
ESCCKWWHOLLOW

Surface Rate of Spread (maximum)	290.1	ch/h
Heat per Unit Area	2955	Btu/ft2
Fireline Intensity	15716	Btu/ft/s
Flame Length	38.3	ft
Reaction Intensity	9488	Btu/ft2/min
Area	1371.8	ac
Perimeter	616	ch
Spot Dist from a Wind Driven Surface Fire	1.5	mi
Probability of Ignition from a Firebrand	100	%

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 17:18:35 Page 4

ESCCKWWHOLLOW

Fire Characteristics Chart



BehavePlus 5.0.5 Sun, Dec 22, 2019 at 17:29:59 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description		ESCCKWWHOLLOW
Fuel/Vegetation, Surface/Understory		
Fuel Model		4
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	30
Wind Adjustment Factor		.5
Air Temperature	oF	85
Fuel Shading from the Sun	%	09
Terrain		
Slope Steepness	%	37
Ridge-to-Valley Elevation Difference	ft	300
Ridge-to-Valley Horizontal Distance	mi	0.15
Spotting Source Location		MW
Fire		
Elapsed Time	h	1

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind is blowing upslope [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]

Heat per Unit Area (Btu/ft2) [SURFACE]

(continued on next page)

NORTH ESCONDIDO CREEK BEHAVE FIRE MODELING – SANTA ANA WIND EVENT
FUEL MODEL SH-7 DRY CLIMATE VERY HIGH LOAD SHRUB
2003 CEDAR FIRE BURNING CONDITIONS

WILD WILLOW HOLLOW ROAD

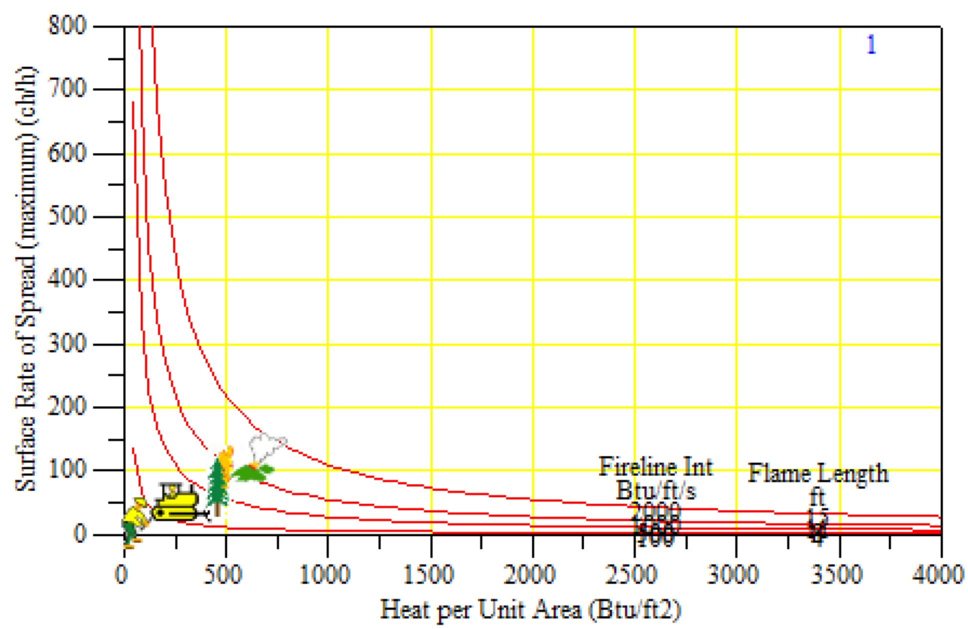
BehavePlus 5.0.5 Sun, Dec 22, 2019 at 17:29:59 Page 3

ESCCKWWHOLLOW

Surface Rate of Spread (maximum)	778.1	ch/h
Heat per Unit Area	3667	Btu/ft2
Fireline Intensity	52313	Btu/ft/s
Flame Length	66.6	ft
Reaction Intensity	16610	Btu/ft2/min
Area	9971.3	ac
Perimeter	1655	ch
Spot Dist from a Wind Driven Surface Fire	2.3	mi
Probability of Ignition from a Firebrand	100	%

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 17:29:59 Page 4

ESCCKWWHOLLOW
Fire Characteristics Chart



Inputs: SURFACE, SIZE, SPOT, IGNITE

Description		ESCCKNE

Fuel/Vegetation, Surface/Understory

Fuel Model		4

Fuel/Vegetation, Overstory

Downwind Canopy Height	ft	4

Fuel Moisture

1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50

Weather

20-ft Wind Speed (upslope)	mi/h	21
Wind Adjustment Factor		.5
Air Temperature	oF	100
Fuel Shading from the Sun	%	09

Terrain

Slope Steepness	%	79
Ridge-to-Valley Elevation Difference	ft	462
Ridge-to-Valley Horizontal Distance	mi	0.08
Spotting Source Location		MW

Fire

Elapsed Time	h	1

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind is blowing upslope [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]

Heat per Unit Area (Btu/ft2) [SURFACE]

(continued on next page)

NORTH ESCONDIDO CREEK BEHAVE FIRE MODELING – SANTA ANA WIND EVENT FUEL MODEL 4 CHAPARRAL
2014 COCOS FIRE WEATHER/FUEL CONDITIONS
HARMONY GROVE ROAD

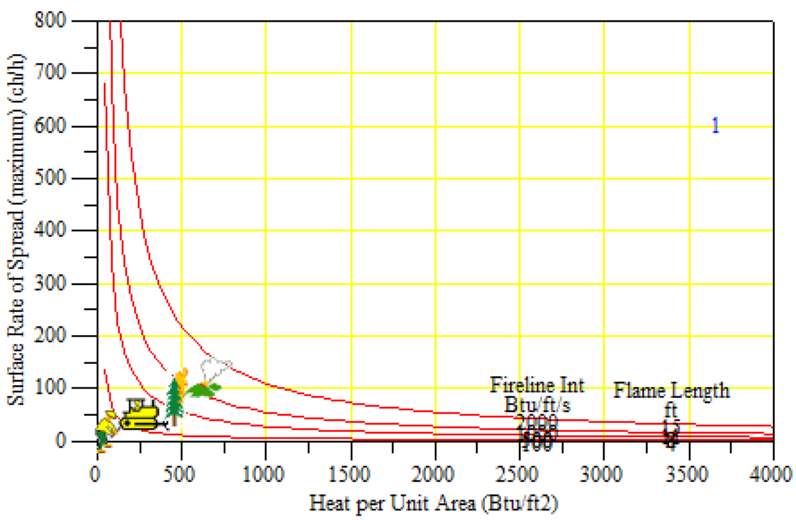
BehavePlus 5.0.5 Sun, Dec 22, 2019 at 20:55:10 Page 3

ESCCKNE

Surface Rate of Spread (maximum)	607.7	ch/h
Heat per Unit Area	3667	Btu/ft2
Fireline Intensity	40859	Btu/ft/s
Flame Length	59.5	ft
Reaction Intensity	16610	Btu/ft2/min
Area	7027.9	ac
Perimeter	1314	ch
Spot Dist from a Wind Driven Surface Fire	1.7	mi
Probability of Ignition from a Firebrand	100	%

BehavePlus 5.0.5 Sun, Dec 22, 2019 at 20:55:10 Page 4

ESCCKNE
Fire Characteristics Chart



BehavePlus 5.0.5 Tue, Mar 09, 2021 at 17:58:09 Page 1

Inputs: SURFACE, SAFETY, SIZE, SPOT, IGNITE

Description		ENCINITAS SOUTH ESCONDIDO CRk
Fuel/Vegetation, Surface/Understory		
Fuel Model		GR9
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	20
Wind Adjustment Factor		.5
Air Temperature	oF	70
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	0
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	0
Spotting Source Location		VB
Fire		
Elapsed Time	h	1
Suppression		
Number of Personnel		50
Area per Person	ft2	25
Number of Heavy Equipment		0

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ENCINITAS SOUTH ESCONDIDO CRk

Surface Rate of Spread (maximum)	1003.2	ch/h
Heat per Unit Area	4242	Btu/ft2
Fireline Intensity	78018	Btu/ft/s
Flame Length	80.1	ft
Reaction Intensity	17808	Btu/ft2/min
Safety Zone Separation Distance	320	ft
Safety Zone Size	8.35	ac
Area	23556.6	ac
Perimeter	2232	ch
Spot Dist from a Wind Driven Surface Fire	2.0	mi
Probability of Ignition from a Firebrand	100	%

SOUTH ENCINITAS CREEK – MANCHESTER AVENUE
FUEL MODEL GR-9 VERY HIGH LOAD HUMID LOAD GRASS (ARRUNDO/GIANT REED TYPE)
LATE SUMMER AFTERNOON FIRE BEHAVIOR

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 18:08:46 Page 1

Inputs: SURFACE, CROWN, SIZE, SPOT, IGNITE

Description		SOUTH ESCONDIDO CREEK MANCHESTER
Fuel/Vegetation, Surface/Understory		
Fuel Model		tu5
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	50
Canopy Base Height	ft	50
Canopy Bulk Density	lb/ft3	.062
Fuel Moisture		
1-h Moisture	%	3
10-h Moisture	%	5
100-h Moisture	%	7
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Foliar Moisture	%	35
Weather		
20-ft Wind Speed (upslope)	mi/h	20
Wind Adjustment Factor		.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	0
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	0
Spotting Source Location		VB
Fire		
Elapsed Time	h	1

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SOUTH ESCONDIDO CREEK MANCHESTER

Surface Rate of Spread (maximum)	31.0	ch/h
Heat per Unit Area	3034	Btu/ft2
Fireline Intensity	1725	Btu/ft/s
Flame Length	13.9	ft
Reaction Intensity	9666	Btu/ft2/min
Surface Spread Distance	31.0	ch
Critical Surface Intensity	858	Btu/ft/s
Transition Ratio	2.01	
Transition to Crown Fire ?	Yes	
Crown ROS	93.4	ch/h
Critical Crown ROS	9.0	ch/h
Active Ratio	10.37	
Active Crown Fire?	Yes	
Fire Type	Crowning	
Area	22.5	ac
Perimeter	69	ch
Spot Dist from a Wind Driven Surface Fire	0.4	mi
Probability of Ignition from a Firebrand	85	%

SOUTH ENCINITAS CREEK – MANCHESTER AVENUE
FUEL MODEL TU-5 EUCALYPTUS
LATE SUMMER AFTERNOON FIRE BEHAVIOR

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 18:23:42 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description: SOUTH ESCONDIDO CREEK MANCHESTER

Fuel/Vegetation, Surface/Understory		
Fuel Model		gs2
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	3
10-h Moisture	%	5
100-h Moisture	%	7
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	20
Wind Adjustment Factor		.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	0
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	0
Spotting Source Location		VB
Fire		
Elapsed Time	h	1

South Escondido Creek Manchester

Surface Rate of Spread (maximum)	138.9	ch/h
Heat per Unit Area	666	Btu/ft2
Fireline Intensity	1696	Btu/ft/s
Flame Length	13.8	ft
Reaction Intensity	3170	Btu/ft2/min
Area	451.4	ac
Perimeter	309	ch
Spot Dist from a Wind Driven Surface Fire	0.6	mi
Probability of Ignition from a Firebrand	100	%

SOUTH ENCINITAS CREEK – MANCHESTER AVENUE
FUEL MODEL GS-2 MODERATE LOAD DRY CLIMATE GRASS-SHRUB
LATE SUMMER AFTERNOON FIRE BEHAVIOR

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 18:28:23 Page 1

Inputs: SURFACE, SIZE, SPOT, IGNITE

Description		SOUTH ESCONDIDO CREEK MANCHESTER
Fuel/Vegetation, Surface/Understory		
Fuel Model		sh5
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	3
10-h Moisture	%	5
100-h Moisture	%	7
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	20
Wind Adjustment Factor		.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	0
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	0
Spotting Source Location		VB
Fire		
Elapsed Time	h	1

BehavePlus 5.0.5 Wed, Mar 10, 2021 at 19:23:01 Page 3

South Escondido Creek Manchester

Surface Rate of Spread (maximum)	271.8	ch/h
Heat per Unit Area	2235	Btu/ft2
Fireline Intensity	11137	Btu/ft/s
Flame Length	32.7	ft
Reaction Intensity	7284	Btu/ft2/min
Area	1729.6	ac
Perimeter	605	ch
Spot Dist from a Wind Driven Surface Fire	1.1	mi
Probability of Ignition from a Firebrand	100	%

SOUTH ENCINITAS CREEK – MANCHESTER AVENUE
FUEL MODEL SH-5 HIGH LOAD DRY CLIMATE SHRUB
LATE SUMMER AFTERNOON FIRE BEHAVIOR

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 19:20:47 Page 1

Inputs: SURFACE, CROWN, SAFETY, SIZE, SPOT, IGNITE

Description		OLIVENHAIN TOWN CENTER
Fuel/Vegetation, Surface/Understory		
Fuel Model		tu5
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	50
Canopy Base Height	ft	50
Canopy Bulk Density	lb/ft3	.062
Fuel Moisture		
1-h Moisture	%	3
10-h Moisture	%	5
100-h Moisture	%	7
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Foliar Moisture	%	35
Weather		
20-ft Wind Speed (upslope)	mi/h	20
Wind Adjustment Factor		.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	0
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	0
Spotting Source Location		VB
Fire		
Elapsed Time	h	1

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 18:00:43 Page 3

ENCINITAS SOUTH ESCONDIDO CRk

Surface Rate of Spread (maximum)	1003.2	ch/h
Heat per Unit Area	4242	Btu/ft2
Fireline Intensity	78018	Btu/ft/s
Flame Length	80.1	ft
Reaction Intensity	17808	Btu/ft2/min
Safety Zone Separation Distance	320	ft
Safety Zone Size	8.35	ac
Area	23556.6	ac
Perimeter	2232	ch
Spot Dist from a Wind Driven Surface Fire	2.0	mi
Probability of Ignition from a Firebrand	100	%

OLIVENHAIN TOWN CENTER
FUEL MODE TU-5 EUCALYPTUS
2003 WITCH INCIDENT FIRE BEHAVIOR

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 19:35:30 Page 1

Inputs: SURFACE, CROWN, SAFETY, SIZE, SPOT, IGNITE

Description		LITTLE OAKS PARK
Fuel/Vegetation, Surface/Understory		
Fuel Model		tu5
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	50
Canopy Base Height	ft	50
Canopy Bulk Density	lb/ft3	.062
Fuel Moisture		
1-h Moisture	%	3
10-h Moisture	%	5
100-h Moisture	%	7
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Foliar Moisture	%	35
Weather		
20-ft Wind Speed (upslope)	mi/h	20
Wind Adjustment Factor		.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	0
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	0
Spotting Source Location		VB
Fire		
Elapsed Time	h	1

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 19:37:03

LITTLE OAKS PARK

Surface Rate of Spread (maximum)	31.0	ch/h
Heat per Unit Area	3034	Btu/ft2
Fireline Intensity	1725	Btu/ft/s
Flame Length	13.9	ft
Reaction Intensity	9666	Btu/ft2/min
Surface Spread Distance	31.0	ch
Critical Surface Intensity	858	Btu/ft/s
Critical Surface Flame Length	10.1	ft
Transition Ratio	2.01	
Transition to Crown Fire ?	Yes	
Crown ROS	93.4	ch/h
Critical Crown ROS	9.0	ch/h
Active Ratio	10.37	
Active Crown Fire?	Yes	
Fire Type	Crowning	
Crown Spread Distance	93.4	ch
Safety Zone Separation Distance	55	ft
Safety Zone Size	0.41	ac
Area	22.5	ac
Perimeter	69	ch
Spot Dist from a Wind Driven Surface Fire	0.4	mi
Probability of Ignition from a Firebrand	85	%

LITTLE OAKS PARK
FUEL MODE TU-5 WETLANDS HABITAT TREES
2003 WITCH INCIDENT FIRE BEHAVIOR

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 19:31:50 Page 1

Inputs: SURFACE, SAFETY, SIZE, SPOT, IGNITE

Description		LITTLE OAKS PARK
Fuel/Vegetation, Surface/Understory		
Fuel Model		gs2
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	3
10-h Moisture	%	5
100-h Moisture	%	7
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	20
Wind Adjustment Factor		.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	0
Ridge-to-Valley Elevation Difference	ft	0
Ridge-to-Valley Horizontal Distance	mi	0
Spotting Source Location		VB
Fire		
Elapsed Time	h	1

BehavePlus 5.0.5 Tue, Mar 09, 2021 at 19:30:58 Page 3

LITTLE OAKS PARK

Surface Rate of Spread (maximum)	116.4	ch/h
Heat per Unit Area	571	Btu/ft2
Fireline Intensity	1220	Btu/ft/s
Flame Length	11.8	ft
Reaction Intensity	2720	Btu/ft2/min
Surface Spread Distance	116.4	ch
Safety Zone Separation Distance	47	ft
Safety Zone Size	0.33	ac
Area	317.2	ac
Perimeter	259	ch
Spot Dist from a Wind Driven Surface Fire	0.5	mi
Probability of Ignition from a Firebrand	85	%

LITTLE OAKS PARK
FUEL MODE GS-2 MODERATE LOAD DRY CLIMATE GRASS-SHRUB
2003 WITCH INCIDENT FIRE BEHAVIOR

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