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PRELIMINARY FIRE PROTECTION ANALYSIS REPORT

Del Mar Heights Elementary School
13555 Boquita Drive
Del Mar, CA 92014

This Preliminary Fire Protection Analysis Report is submitted at the request of a Citizen's Action Group with concerns regarding the fire and life safety conditions of a proposed addition to the Del Mar Heights Elementary School, located at 13555 Boquita Drive, Del Mar, CA.

The Analysis Report analyzed the proposed school upgrades from two (2) perspectives:

- From the viewpoint of a Fire Authority (FAHJ) reviewing the Plan and its contents for acceptability and approval of a Fire Protection Plan, as required by Chapter 49 of the 2016 and 2019 Editions of the California Fire Code
- From the perspective of a neutral third party consultant with extensive fire plan review, fire protection plan review, governmental project conditioning of major sub-division developments and schools, and FAHJ experience.

This Report reflects a preliminary review of existing conditions and potential adverse environmental effects that the proposed additions to the School site will be impacted by during a wildland fire event.

PROJECT DESCRIPTION

The Project proposes a major addition to the school site, in the form of a single classroom building along the eastern boundary of the established site.

The original campus and its buildings were, according to the school's official website, developed in 1959. The earliest historical aerial photographs available from Google Earth are from 1994 and exhibit a completed residential development around the campus at that time.

The existing portable classrooms currently located in the north central area of the school grounds along the eastern property line will be relocated elsewhere on the site.

The proposed new building, when compared to and measured from aerial photography, appears to have a proposed length of approximately 415 feet and a maximum width of 90 feet. Approximately 36 classrooms and other interior spaces are proposed. The building will have a center hallway combined with collaboration spaces and a central entry and collaboration lobby. The main lobby has eight standard 36” outward swinging doors and there a minimal number of direct exits out of the building along the perimeter of the north and south wings.

The lands paralleling the eastern property line of the campus will be graded and a three-lane access road will be provided. Staff parking will be provided along the extreme eastern side of the access road; the existing native combustible vegetation will remain between the parking lot, the campus property line and the right-of-way corridor of Mira Montana Drive, which is immediately off-site of the school grounds.

The end of the access road will be provided with a cul-de-sac roundabout for northbound traffic exiting from the eastern side of the campus.

Aerial View of Existing Development of Del Mar Height School

Proposed Re-development Plan for Del Mar Heights School

1. ENVIRONMENTAL SETTING

1.1 Location:

The school is located at 13555 Boquita Drive, and is within the jurisdictional boundaries of the incorporated city of San Diego, County of San Diego, California. It is approximately three-quarters of one mile east of the Pacific Ocean and thirty miles not of the United States-Mexico international border.

The campus is surrounded on the south, west and northwest sides by the North Torrey Pines Natural Reserve, a dedicated biological Open Space. The north and east sides of the campus are adjacent to an established single-family residential development.

The Torrey Pines Nature Preserve covers 1500 acres of land with biological importance including endangered vegetation habitats. The Reserve is a protected area targeted for conservation.

As a dedicated biological open space preserve, the vegetation habitats within the Reserve are subject to limited management for fire and life safety impacts resulting from wild fire events. As an example, Government Code 51184 clearly indicates that Government Code Section 51182 standard defensible space requirements for all buildings do not apply on lands used for habitat for endangered or threatened animal or vegetation and for dedicated open space reserves.

1.2 Topography:

The Del Mar Heights School campus rests on a relatively flat graded surface.

The North Torrey Pines Reserve lands south of the school grounds can be generally described as having moderately to very steep sided slopes with expansive mesas, with many areas bisected by significant major topographical drainages.

The southwest corner of the campus is immediately adjacent to a major drainage. The drainage has a southwest to northeast configuration, rising from an elevation of 192 feet ASL (above sea level) at its base to 380 feet ASL immediately adjacent to the athletic fields of the school site. Over a run of 3065 feet, this drainage has an average gradient of 6.1% but actual slopes are much steeper.

1.3 Flammable Vegetation:

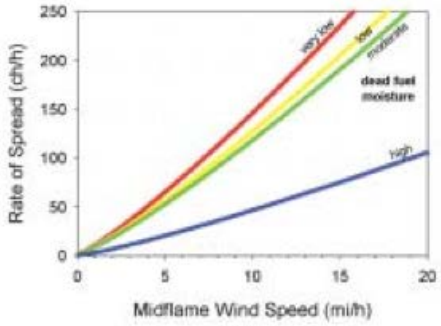
According to the most recent edition of *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model,*

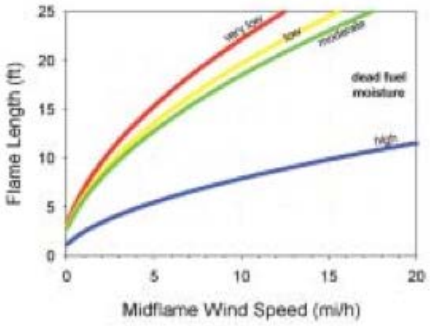
most of the native vegetative fuels currently (2019) growing on Preserve lands can be classified as SH-5 Heavy Load, Dry Climate Shrub, SH-7 Very High Load Dry Climate Shrub or Fuel Model 4, Chaparral vegetation species.

1.3.1 Shrub-Type Fuels

SH-5 Heavy Load, Dry Climate Shrubs

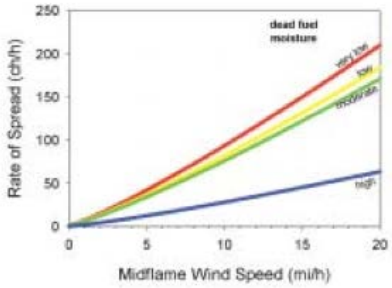
The primary carrier of fire in SH-5 is woody shrubs and shrub litter. There will be a heavy concentration of fuel loading of 6.5 tons or more. Vegetation will have relatively uninterrupted canopies with depths between four (4') to six (6') feet deep and across. The Rate of Spread and Flames Lengths will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

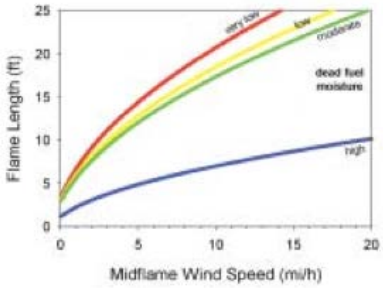




SH-7 Very Heavy Load, Dry Climate Shrubs

The primary carrier of fire in SH7 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

Photo 9. Mixed chaparral of southern California; note dead fuel component in branchwood.

Chaparral composed of manzanita and chamise near the Inaja Fire Memorial, Calif.

The vegetation is generally considered as California Coastal Sage habitat, which occur on steep slopes with shallow alluvial or colluvial soils, at elevations between sea level and 1200 meters.

This shrub land alliance has a medium fire return interval of 20 to 100+ years. Fires will generally occur in late summer through fall, with fires completely burning the habitat stand with moderate to high fire intensity and high to very high fire severity.

2. Climate:

Like most of Southern California, San Diego County and the project site 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 elevations where the project site is located.

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.

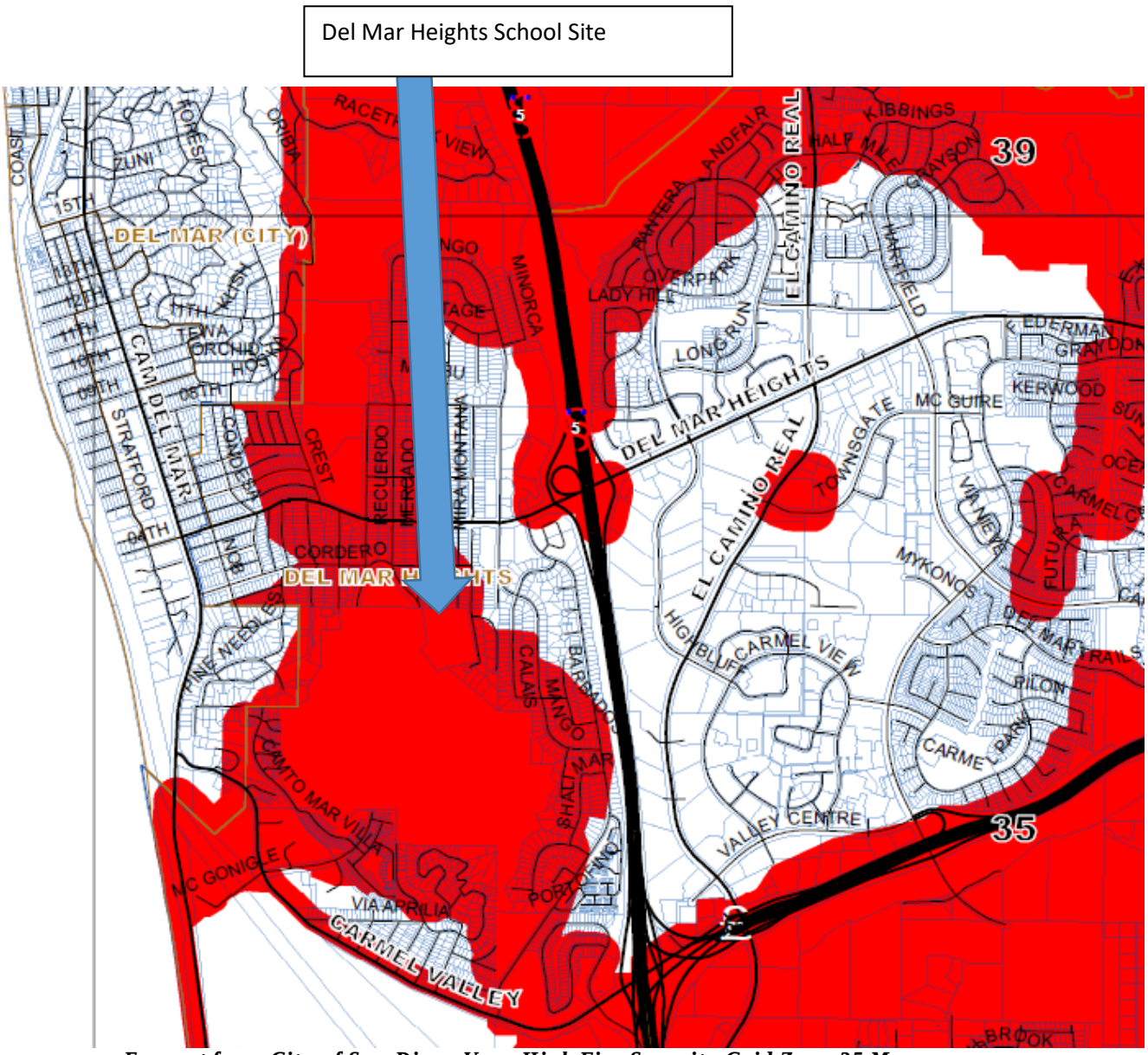
The U.S. Forest Service Weather Information Management System provides information about weather patterns in San Diego County. Daily afternoon weather observations in San Diego County were analyzed for forty-four years (1961-2005) at selected fire stations. San Diego County is divided into five climate 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.

Worst Case Weather and Burning Conditions, Coastal 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	-

3. Fire Severity Area

The school and surrounding neighborhood have been built in a City of San Diego designated Very High Fire Severity Area.



Excerpt from City of San Diego Very High Fire Severity Grid Zone 35 Map

NOTE: All City of San Diego VHFSA grid maps indicate that properties within the designated VHFSA lands must have a 300-foot wide brush buffer.

2. PROJECT EXPOSURE TO WILDLAND FIRES

2.1 Water Supply:

The plans provided to the Consultant did not have any information related to water distribution infrastructure for the proposed Project.

Depending on the building construction type, required flows for the proposed size of the new classroom building range between 2000 to 5250 gallons per minute and require 2 to 5 fire hydrants, spaced so that an engine company does not have to travel more than 300 feet to reach a building.

2.2. Fire Access Roads

2.2. 1 Location.

The campus currently has one fire access point from Boquito Drive.

Boquito Drive is a publicly owned and maintained residential street with an approximate width of 40 feet (as measured by aerial photography). Boquito Drive, between Cordero Road and the entrance to the school grounds is 535 feet long.

Typical Road Conditions on Boquito Drive, Looking South at School Entrance

To access Boquito Drive, fire department vehicles must proceed southbound on Mercado Drive from its intersection with Del Mar Heights Road to the intersection of Mercado Drive and Cordero Road, a distance of approximately 575 feet. At Cordero Road, apparatus turn eastbound (left) and proceed an additional 350 feet to Boquita Drive, where a southbound (right) turn is made.

Total access route from Del Mar Heights Road to the school is approximately 1460 feet, or a little over one-quarter (1320') feet.

The surface of all three access roads to the school site is asphaltic concrete, also known as macadam paving or asphalt paving. The road surface appears to be in relatively good condition at the time of this report.

2.2.2 Evacuation Route Analysis

It is unknown if the process of evacuating of students from the school during a wildfire event has been analyzed. This analysis must also take into consideration the evacuation of residents from the surrounding single-family residential developments around the school campus.

Evacuation routes from the neighborhood are limited to residential streets with one lane of egress flow out of the development. While Boquita Drive and Mira Montana Drive to the east of the school have a south to north configuration north of Cordero Road, both

streets terminate in cul-de-sac bulbs before a connection to Del Mar Heights Road can be established. Both cul-de-sac bulbs are elevated above Del Mar Heights Road with a significant change of elevation, preempting a future connection.

Northern Cul-de-sac Bulb of Boquito Drive, Looking South from Del Mar Heights Road

The evacuation route for the area east of Mercado Drive serves the school and an estimated 95 single-family dwellings. The existing school serves 500 students; with the new addition, another 100 students can be accommodated on the school grounds.

For evacuation purposes, nine school buses are required to evacuate 600 students from the site if each bus can safely accommodate 70 students.

Finding: *The local School District does not provide busing services to students; no buses for emergency evacuation purposes are available.*

The proposed school parking lot accommodates 80 parking spaces.

For evacuation of the residential properties, for a liberal analysis, a minimum of 95 vehicles (one vehicle per residence) is added to the evacuation equation.

A total number of 175 vehicles will be evacuating from the eastern portion of the residential development and the school grounds through the established access route.

The San Diego County Operations Plan, Annex Q – Evacuations, provides an Evacuation Time formula for estimating vehicle egress times during disaster conditions:

Evacuation Time = (Evacuation Population/Average Vehicle Occupancy) / Roadway Capacity

Cordero Road, as a Single Family Sub-Collector street has an Average Daily Traffic (ADT) flow of 2200 vehicle trips or 92 trips per hour.

Number of vehicles outbound impacting traffic flow:

- 95 vehicles for residences east of Mercado Drive
- 80 parking spaces in new school staff/parent parking lot
- Total 175 vehicles

ET = (175) /91 vehicles per hour = **1.92 hours (115 minutes) evacuation time**

The above evacuation calculation does not consider the number of parental vehicles attempting to enter the area in an effort to retrieve their children from the school grounds in the event of a major emergency. With a student occupant load of 600 children, a conservative estimate of an additional 300 vehicles (600 students x .5 or 2 students per vehicle) could be anticipated trying to reach the school over a narrow and congested roadway system.

ET = 475 vehicles /91 vehicles per hour = **5.2 hours (1662.4 minutes) evacuation time.**

West of Mercado Drive, the south shoulder of the Cordero Road right-of-way corridor, at its intersection with Recuerdo Drive, is immediately adjacent to a major topographical drainage/canyon that is part of the North Torrey Pines Reserve. This drainage is also abuts the western sides of the school campus.

Fires entering this south-to-north configured canyon, with typical south and southwest winds prevalent during daylight hours, will extend in a northerly direction with flame lengths ranging between 20 and 65 feet.

As measured by aerial photography, Cordero Drive has an estimated paved width of 40 feet. A fire front extending out of the canyon will substantially cross over the roadway, blocking incoming and outgoing traffic flow and, further, exposing vehicle occupants and buildings on the north side of Cordero Drive to high levels of radiant heat energy and direct flame impingement.

NOTE: *This preliminary evaluation does not consider the impact of other evacuating residents from the western area of the residential development or from other Del Mar communities using Del Mar Heights road as an evacuation route. The preliminary evacuation evaluation also does not take into consideration a traffic incident that could obstruct the evacuation routes.*

NOTE: *Fires starting in the North Torrey Pines Preserve, based on BEHAVE Fire Modeling, can reach the school in as little as three minutes, precluding an over-the-road evacuation and requiring a shelter-in-place strategy in fire hardened school buildings away from the southern property line of the campus.*

Finding: *The existing evacuation route for the school and surrounding residential neighborhood does not allow for an effective simultaneous evacuation and ingress of emergency vehicles due to narrow, congested streets.*

Finding: *Developments with inadequate access significantly contribute to the inability to effectively residents during a disaster while simultaneously providing the necessary emergency access for fire, ambulance or law enforcement personnel.*

Finding: *Inadequate emergency access* ***is*** *a Significant Adverse Impact/Effect according to Appendix G, XVI Transportion/Traffic of the California Environmental Quality Act (CEQA) and* ***must*** *be mitigated in the Project planning documents and process.*

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2. 3. Building Construction:

No information for the proposed building construction type or materials was provided to the Consultant at the time this initial evaluation report was requested.

It can be reasonably presumed that all structures and buildings shall comply with the Wildland-Urban-Interface ignition-resistive construction requirements specified in Chapter 7A of the California Building Code.

2.4 Fire Protection Systems:

All habitable school buildings require of the installation of National Fire Protection Association 13 compliant automatic residential fire sprinklers California Code of Regulations Title 19 and the California Fire and Building Codes.

Installation of automatic fire sprinklers allows a prescriptive reduction of the fire flow requirements for the building.

Installation of automatic fire sprinklers are a specific City of San Diego mitigation alternative building design when defensible space provisions cannot be achieved due to property or building constraints.

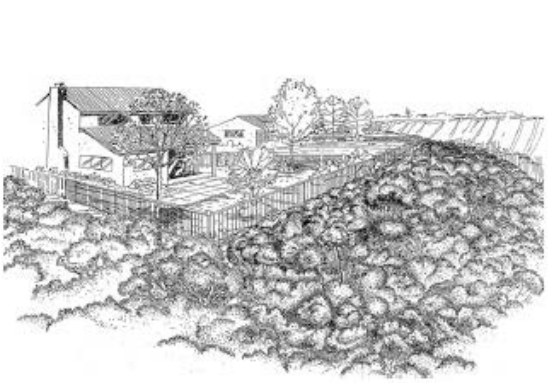
2.5 Defensible Space and Vegetation Management

For non-Very High Fire Severity Area lands, the City of San Diego requires a minimum 100-foot (or to the property line, whichever is closer) Fuel Management Zone must be established and maintained around all buildings or structures over 250 square feet in size.

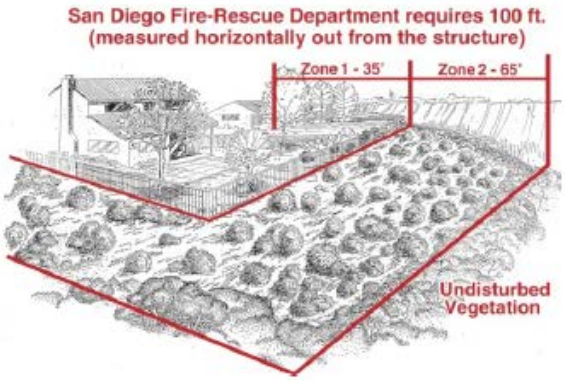
Fuel Management Zones, also known as Defensible Space or Fuel Modification Zones, are further divided into two sub-areas:

FMZ-1 begins at the exterior wall of a building and extends laterally outward for a minimum distance of 35 feet. All combustible vegetation within FMZ-1 are removed and replanted with irrigated and approved landscaping, preferably species that are fire- and/or drought resistant.

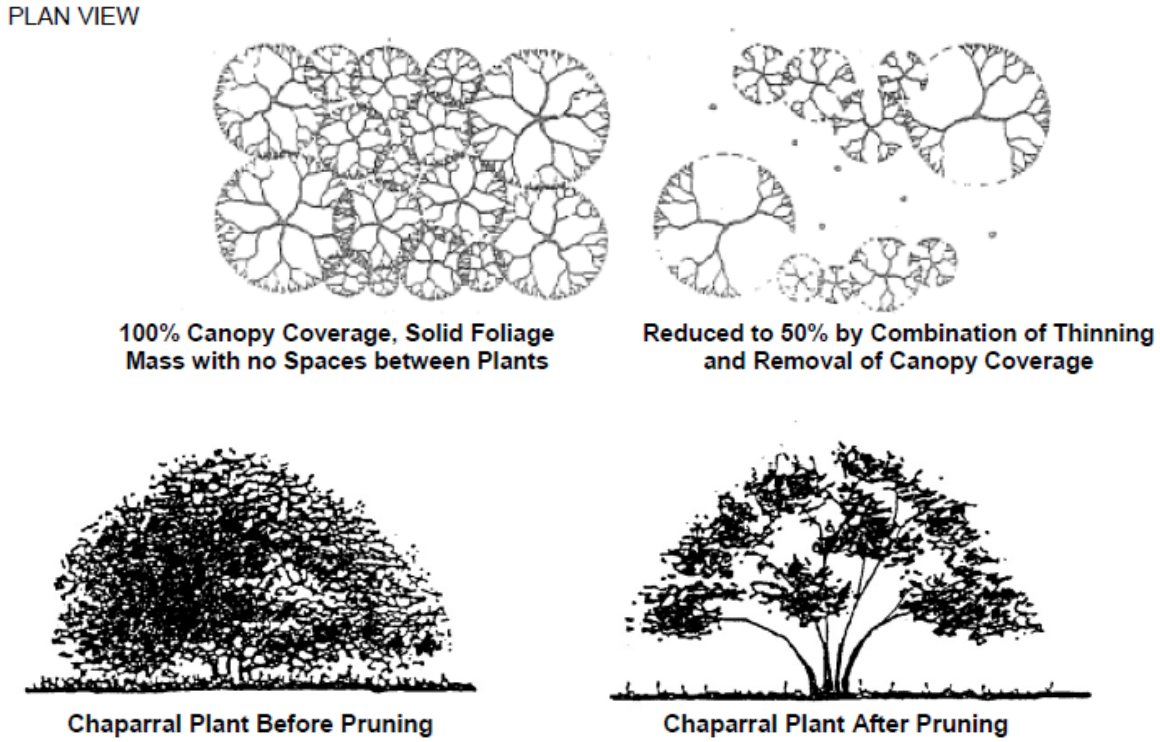
FMZ-2 begins at the outer perimeter of FMZ-1 and extends outward laterally for a distance of an additional 65 feet. Native vegetation is allowed to remain within FMZ-2 if 50% of all existing plants over 24 inches tall are cut and cleared to a height of 6 inches. The remaining 50% of plants must have their vegetative canopies reduced in height by 50% and thinned/pruned to reduce fuel loading.



Before Brush Management



After Thinning and Pruning



Section 142.0412 (a) of the City of San Diego Municipal Code allows brush management activity in environmentally sensitive lands located within 100 feet of a building or structure. Sub-section (d), however, prohibits brush management activities in coastal sage scrub, maritime succulent scrub and coastal sage-chaparral habitats between March through August 15th except when documentation indicates that thinning is consistent with conditions of species coverage described in the City's Multi-Species Conservation Plan's subarea Plan.

While the City's Municipal Code allows brush management in environmentally sensitive habitats, Government Code Section 51184 excludes local control over lands dedicated for endangered habitat or threatened species; lands kept in a predominantly natural state as habitat for wildlife, plant or animal communities; open space lands that are environmentally sensitive parklands; and other lands having scenic values as declared by a local agency or by state or Federal law.

Finding: *The North Torrey Pines Preserve meets all of the exemption criteria indicated by Government Code 51184.*

Finding: *Government Code 51182 is the basis for mandatory provision of defensible space around buildings throughout California in areas designated as Very High Fire Severity Areas.*

Finding: *Government Code 51184 specifically states that Section 51182 shall* ***not*** *apply to any land used for the four criteria designated within its prescribed text.*

Finding*: While the City's Municipal Code allows brush management in environmentally sensitive lands, legislated California law takes precedence over locally enacted regulations that cover the same matter, forbidding brush management practices in protected habitats and open spaces.*

Determination: *Brush management, for the purpose of mitigating wildfire exposure to the school grounds, cannot be implemented along the northern boundary of the North Torrey Pines Reserve, which is immediately adjacent to the southern walls of the proposed new building.*

The southern wall of the existing permanent classroom in the center of the campus is approximately 375 feet north of the unmanaged combustible vegetation in the North Torrey Pines Reserve lands. As built, it complies with the City of San Diego 300-foot wide brush buffer for buildings constructed on designated Very High Fire Severity Area lands.

The southwestern corner of the southern-most temporary classroom is approximately 330 feet from the closest combustible native vegetation in the North Torrey Pines Reserve lands. As placed on the campus, it complies with the City of San Diego 300-foot wide brush buffer for buildings constructed on designated Very High Fire Severity Area lands.

The southern end of the proposed building appears to be approximately 30 to 35 feet from the campus property line and 70 feet from the closest combustible native vegetation in the North Torrey Pines Reserve. As proposed, it does ***not*** comply with the City of San Diego 300-foot wide brush buffer for buildings constructed on designated Very High Fire Severity Area lands *or* with standard required 100 feet of defensible space requirements for new buildings.

NOTE: *The Consultant was not provided with detailed building plans for the Project. The separation distance is an approximation made by comparing a proposed design plan without measurements to aerial photography of the site and existing conditions.*

Brush Management Separation Distances
Red Arrow – 375 feet from Vegetation to Building Yellow Line – 330 feet to building

Brush Management Separation Distances
Red Arrow – 30-35 feet from Building to PL; Yellow Arrow – 70 feet from Building

2.6 **Fire Behavior Computer Modeling and Anticipated Fire Behavior**

Wildland fire behavior calculations have been projected for the hazardous vegetative fuels on the undeveloped North Torrey Pines Reserve bordering the school. These projections are based on "worst case" fire scenarios that could impact the school campus.

The computer-based BEHAVE-Plus modeling program can be used to develop fire behavior assessments impacting development projects.

The BEHAVE Fire Behavior analysis can display the expected Rate of Fire Spread (expressed in feet per minute), Fire Line Intensity (Btu/ft./sec), Flame Length (feet) and anticipated downwind ember/firebrand deposits for native vegetative fuels expected in a project's climate zone. Variable inputs are slope, projected wind speed, and the anticipated weather. The analysis can also include calculation inputs obtained from project site observations and fuel levels typically observed during the local fire season.

The fuel model sets currently used by fire scientists, fire behavior analysts and Fire Protection Plan consultants do not have the ability to simulate fire behavior changes created by various fuel treatments. Fuel Models are based on fully cured vegetation at or near their seasonal extinction moistures and, concurrently, at the worst part of the annual fire season. This tends to produce over-prediction of fire spread rates and other fire behavior parameters, especially in annual grass and chaparral type fuels.

The Consultant performed an independent Behave-Plus fire modeling simulation, using the FPP input parameters and input parameters typical of those recommended for use by San Diego County Fire Protection Consultants.

In San Diego County, fire protection modeling is based on worst case burning conditions, using weather input parameters recorded during the 2003 Cedar Fire Santa Ana wind event incident.

The Consultant used four scenarios using 2003 Cedar Fire-Santa Ana wind event input factors but with different fuel model types:

- Fuel Models SH-5 and FM-4
- Fuel Moistures
    - 1-hour, annual grasses – 1%
    - 10-hour fuels – 3%
    - 100-hour fuels – 5%
    - Live Herbaceous Moisture – 30%
    - Live Woody Moisture – 50%
- 20 foot Wind Speed –
    - 8 mph (typical late summer afternoon)
    - 30 mph, Santa Ana wind events

- Wind Adjustment Factor – 0.5

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.

Use of Fire Model Inputs – Caveats

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 Model 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 identified in this report only because it is the model currently used by most fire consultants.

Fuel Model	**Flame Length**	**Spread Rate**	**Spotting Distance**	**Size of Safety Separation Zone**
SH-5 – Late Summer Burning Conditions	**20.3 feet**	105.7 ft./min	0.4 miles	**81 feet**
FM-4 Chaparral, Late Summer Burning Conditions	**20.6 feet**	136.29 ft./min	0.5 miles	**115 feet**
SH-5 Santa Ana	**40.8 feet**	482 ft./min.	1.6 miles	**163 feet**

FM-4 Santa Ana	**65.4 feet**	821.04 ft./min.	2.2 miles	**262 feet**

BEHAVE-Plus Fire Modeling Analysis Results

Rate of Spread calculations for a fire beginning at the base of the prominent draw near the southwest corner of the school campus indicates that a wildfire will impact the school with the following time lines:

- Fuel Model SH-5, Late Summer fires – 28 minutes
- Fuel Model 4, Late Summer fires – 22 minutes
- Fuel Model SH-5, Santa Ana Conditions – 6 minutes
- Fuel Model 4, Santa Ana Conditions – 3.73 minutes

The Size of the Safety Separation Zones are the *minimum* distances that *firefighters*, with full protection equipment, can safely withdraw from fires burning under extreme conditions, and survive without injuries, before re-engaging in fire suppression operations. These safety zone distances do *not* apply to residents or students occupying the school grounds.

3. WILD FIRE CEQA DEFICIENCIES NOTED

3.1 Defensible Space

As proposed, the new classroom building does not comply with the City of San Diego's Brush Management Policies and Ordinances (City Municipal Code).

The proposed building will be constructed with its southern wall approximately 30 to 35 feet from the southern boundary of the school campus.

This may or may not provide adequate FMZ-1 defensible space depth at the southeast corner of the campus, which, by prescriptive regulation, has a minimum depth of 35 feet. It does not provide the minimum 75 feet of FMZ-2 defensible space required by the City's Municipal Code regulations and the SDFD Brush Management Directives.

Regardless of defensible space depth, the existing and proposed landscaping of the site does not provide mitigations for combustible natural growth vegetation along the school's eastern border and paralleling the right-of-way corridor of Mira Montana Drive. Several combustible plant species form a south-to-north vegetation corridor in this space, as shown in the accompanying photos below. The proposed building design document indicates that these plants will not be removed during or after construction of the new classroom building.

Mira Montana Drive, Looking South Opposite Most Northern Temporary Building

Mira Montana Drive, Looking North from Vicinity Opposite of Southernmost Temporary Building

Cul-de-Sac Bulb at Southern End of Mira Montana Drive, Looking North

The eastern wall of the temporary buildings is approximately 11 to 12 feet. Flame lengths for fires in the unmanaged combustible vegetation is 20.3 feet, indicating that there will be direct flame contact on the exposed wooden exterior walls.

The redevelopment of the campus will provide three lanes of asphalt paving, and designated parking spaces, between the buildings and the unmanaged natural and combustible vegetation along the eastern property line. The paved surfaces are considered to be non-combustible surfaces, have a width of approximately 45 feet and is considered, by most Fire Authorities in San Diego County, to have equivalency of FMZ-1 defensible space ***if*** roadside fuel modifications zones, installed to FMZ-1 defensible space criteria, are also provided. A FMZ-1 compliant roadside defensible space is not provided along the eastern edge of parking spaces. Vehicles parked in the parking lot will be subject to radiant and convective heat and direct flame exposures from the adjacent combustible vegetation when burning. Multiple ignitions of parked vehicles in this lot are a foreseeable event.

The southwest corner of the new classroom building is approximately 70 to 75 feet away from unmanaged combustible natural vegetation located along the southern property line of the school. The school grounds itself, by means of irrigated lawn and landscaping along the southern edges of the site, provides 70 feet of FMZ-1 compliant defensible space. This provides for the required 35 feet of FMZ-1 defensible space and an additional mitigation distance of FMZ-1 defensible space to the property line boundary.

While 70 feet of FMZ-1 defensible space is acceptable, the fuel modification zone width does not address the issue of radiant and convective heat exposures necessitating an 81-foot wide safety zone for firefighter safety during extreme weather event incidents where fire is burning upslope into the Campus from the Reserve under typical late summer afternoon conditions.

Discussion:

Due to the severity of impacts from the improper management of wild land areas, the existing laws are stringent and regulate all aspects of wild land fire including building standards, fuel modification, water availability/flow, and access.

All new buildings and structures erected on the project site will be required to meet the CBC Building Code Chapter 7-A requirements for Wildland Urban Interface Areas.

A CEQA and California Fire Code Chapter 49 required Fire Protection Plan was not provided to the Consultant for review. The building standards proposed by Fire Protection Plans should provide a reasonable degree of ignition resistant buildings at the project site and reduce the Significant Impact caused by less resistive construction standards.

Fire behavior, under most proposed FPP mitigations strategies, should be expected to significantly diminish when a wildfire encroaches into Fuel Modification Zones on property lines exposed to off-site unmanaged vegetative fuels**.**

Vegetation management beyond a structure's immediate vicinity has little effect on building ignitions unless a minimal break of continuous surface fuels is maintained around the perimeter of the building. For this reason, site protection includes eliminating continuous ground fuels that lead from wild land fuel beds to the building. This can be accomplished with rock landscaping, cement sidewalk, green grass or by removing dried vegetation and tree needles (Jack Cohen, USFS).

In 1997, Cohen conducted a full-scale experiments that revealed that a typical Type V-B combustible wall thirty-three feet from a crown fire in 43 foot (13 meter) tall Black Spruce trees. These fires produced flame heights of 20 meters or 65.616 feet. A 100-megawatt fire produces twenty-meter long flame heights. The walls on the test site only ignited when actually touched by flames.

These full-scale fire tests are the basis for the 100-foot wide Fuel Modification Zones mandated by the City of San Diego.

The off-site Coastal Sage shrub and chaparral environments south of the school will produce a minimum 3.5502631035 megawatt fire. This heat energy release rate is approximately 3% of the energy produced by Cohen's full-scale test fires.

The BEHAVE Fire Modeling calculation for the campus indicate that a wild fire moving through Fuel Model 1-GR-1 native and invasive species annual grasses will produce a Fire Line Intensity of 115 BTU/foot/second (Consultant's fire modeling output results).

This value can be anecdotally applied to irrigated lawns and used to determine ignition times for residential construction materials by using various formulas and tables.

For example, using the formula:

$$t_{ig} = \pi \text{ kpc } (T_{ig} - T_o) \ / \ 2q_e$$ (National Fire Academy *Fire Dynamics* pg. 5-3)

where:

t_{ig} = time to ignition, seconds
kpc = thermal inertia of material
T_{ig} = temperature of ignition source
T_o = surface temperature of exposed material
q_e = incident heat flux to the material

The ignition time of solid materials can be estimated.

Exposure to Fuel Model SH-5 Heavy Load Dry Climate Shrub Fire Front

For a gypsum based one hour fire resistive or non-combustible stucco plaster wall (as required by Chapter 7A of the County and California Building Codes) with a surface temperature of 100 degrees (solar exposure), having a kpc of 5.8×10^5 q_e (*Fire Dynamics*, pg. 2-15), exposed to radiative heat from a 1400 degree flame front thirty feet (30') away producing 2955 BTUs, ignition time would be 40016.176. seconds or ***116.67116 minutes (2.51468474 hours)***.

Exposure to Fuel Model FM-4 Heavy Load Chaparral Fire Front

For a gypsum based one hour fire resistive or non-combustible stucco plaster wall (as required by Chapter 7A of the County and California Building Codes) with a surface temperature of 100 degrees (solar exposure), having a kpc of 5.8×10^5 q_e (*Fire Dynamics*, pg. 2-15), exposed to radiative heat from a 1400 degree flame front thirty feet (30') away

producing 3677 BTUs, ignition time would be 337543.5953 seconds or ***93.762 minutes (1.56 hours)***.

Finding: *The above exposure-ignition times are calculated using a worst-case flame temperature of 1400 degrees C, which is a determination based on small, well-mixed diffusion flames with higher temperatures than typical large, poorly mixed flames typical of hydrocarbon involved fires (950-1100 degrees C).*

Finding: *Ignition times elicited in the Northwest Territory Forest experiments were for wood-sided buildings, with piloted ignition occurring at approximately* ***twenty-seven (27) minutes*** *of radiant and convective heat exposure.*

Finding: *The duration of the high intensity flame fronts elicited by the Northwest Territory Forest experiments and being 96% greater than the anticipated heat release rate of chaparral and shrub vegetation, lasted less than one minute.*

Finding: *No ignitions or significant charring of wood sided walls beyond a separation distance of twenty meters (20m or 66 feet)*

Finding: S*ome wall surfaces at 10 meters (10m or 33 feet) charred but did not ignite during the full scale flame front experiments. Wall surfaces that did ignite could not sustain flame production once the crown fires burned out after one minute.*

The BEHAVE Fire Modeling Calculation indicates that non-irrigated Fuel Model 1/GR-1 light fuels under worst case 2003 Cedar Fire Event burning conditions will produce 2868 BTUs, equivalent to 840.324 watts or **.840324 kilowatts**.

Fuel Model SH-5 Scrub vegetation produces a heat release rate of 2235 BTUs or 2235 watts (2.235 kilowatts).

Fuel Model SH-7 Scrub Fuels produce a heat release rate of 2955 BTUS or 2955 watts (2.955 kW)

Fuel Model 4 chaparral vegetation produce a heat release rate of 3677 BTUs or 3677 watts (3.677 kW)

Referring to *Fire Dynamics* Figure 2-5 *Damage Caused by Radiation* below, the calculated fire crossing into the Preserve from adjacent properties will not produce sufficient radiant heat to cause significant damage of any proposed new recreational or auxiliary buildings.

Damage Description	**Heat Flux – kW/m²**

Skin burns	4.7 to 5.0
Pain threshold	1.5
Pain at one minute	2.1
Plastic melts	12.0
Cable insulation degrades	18.0 to 20.0
Piloted ignition occurs:	
Wood	**14.6**
Painted Wood	**16.7**
Wood spontaneously ignites	**33.5**

Type of Heat Exposure	**Heat Flux Value**
Flame Radiation	0-200 kW/m²
Flame Convection	10-20 kW/m²
Hot Gas Convection	0-10 kW/m²
Hot Gas Radiation	0-150 kW/m²

Table 5.5 Heat Flux **Direct Contact** *Values, NFA* Fire Dynamics

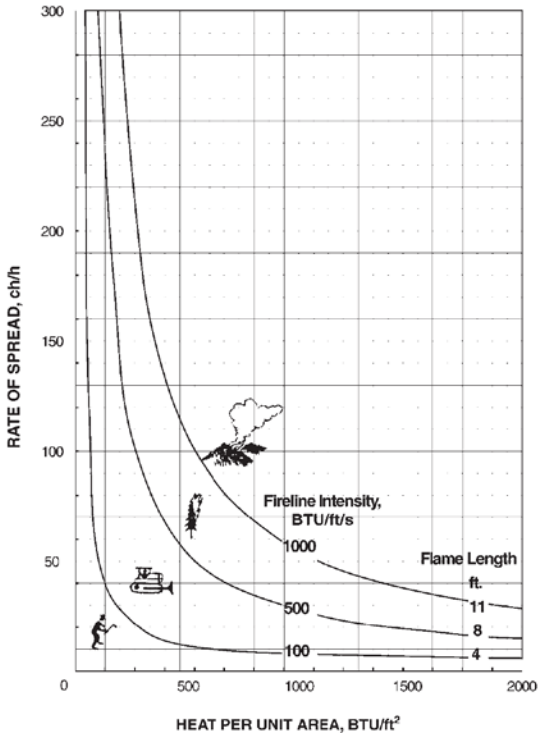
Irrigated lawns or other fire resistant plant species, if proposed as part of the defensible space guidelines for buildings on the Preserve, will have fuel moisture contents of at least 120%.

Fuel moisture contents of 120% result in green, non-cured vegetation, with all herbaceous materials remaining in the "live" fuel categories.

As a result, irrigated grassy fuels, for example, with high fuel moistures will produce a flame length of one (1') foot or less and have a rate of spread of approximately five chains (330 feet) per hour when exposed to a 20 M.P.H. mid-flame wind.

The fire behavior characteristics of irrigated landscaping vegetation is well within the capabilities of fire suppression forces using non-mechanized firefighting tools to control fires in this vegetation type.

The change of burning characteristics and intensity as fire moves across the irrigated landscaping fuels will provide more opportunities for responding resources to take defensive suppression action at the established Fuel Modification Zones around the Preserve recreational and auxiliary buildings (see the Fire Behavior Characteristics Chart below).



The current landscaping design for the Del Mar Heights School includes irrigated athletic and baseball fields with a minimum depth of approximately 330 feet between unmanaged combustible vegetation and ignitable portable buildings with Type V non-rated construction.

Finding: *The existing 330 feet of irrigated landscaping between the most vulnerable buildings erected on the school grounds complies with the City of San Diego VHFSA required 300 feet of brush buffers.*

Finding: *The proposed layout of the new classroom buildings is within 75 feet of combustible unmanaged fuels and does* ***not*** *comply with the City of San Diego VHFSA 300 feet depth for brush buffer requirements.*

According to most recent edition of *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, irrigated landscaping, such as athletic fields, are categorized as Fuel Model Non-Burnable NB-3, Agricultural Lands or NB-1, Urban Developed Lands.

Non-Burnable Fuel Types do not have combustible fuel loading – wildland fires will not spread across these landscapes.

NB-3 Agricultural Lands is maintained in a non-burnable condition by irrigation of plants and landscaping. If not kept in a non-burnable condition, another fuel model must be used to classify the landscape.

NB-1 Urban Developed Lands are covered by urban and suburban development. To be called NB-1, the area under consideration must not support wildland fire spread. However, areas mapped as NB-1 may experience structural losses during wildfire incidents. These may be by building-to-building ignitions or ignitions through downwind fire brand depositions, neither of which is directly modeled using fire behavior models. If sufficient vegetative fuel surrounds buildings that makes wildfire spread possible, another fuel model appropriate for the wildland vegetation is used instead of Fuel Model NB-1.

Finding: *The original irrigated condition and maintenance of the athletic fields qualifies these areas as Fuel Model NB-1 and NB-3 for the southwest, south, west and northern portions of the school campus.*

Finding: *The southeast side and eastern property line, with vegetation immediately adjacent to buildings, does not qualify as Fuel Model NB1 or NB-3 non-burnable lands. There is a near-continuous south-to-north hedgerow of Fuel Model SH-5 Dry Climate Heavy Load natural combustible fuels extending out of the North Torrey Pines Reserve fuel bed.*

Finding: *To the best of the Consultants knowledge, and after analyzing the presented documents, there are no obvious mitigations (other than mandatory automatic fire sprinkler systems inside the new classrooms) proposed to safeguard the proposed new school building against exposure to radiant and convective heat originating from the south-to-north hedgerow of combustible vegetative fuels.*

Finding: *The original configuration of the athletic fields, with a minimum of 330 feet of non-burnable Fuel Model NB-3 irrigated grass and landscaping, provides*

significantly more fire and life safety protection and mitigations than those proposed by the new field and building layouts.

Finding: *The original layout of the classroom buildings and athletic fields provides a minimum of 330 feet of non-burnable irrigated landscaping. This provides a heat exposure buffer ranging between 40 and 249 feet for students evacuated to the northern portions of the campus when an effective evacuation cannot be instituted before the southern edges of the campus are impacted by wildfires in the North Torrey Pines Reserve.*

Finding: *The proposed configuration of the new classroom building places it approximately 70 to 75 feet of the unmanaged vegetation in the North Torrey Pines Reserve. The minimum safety zone for Campus buildings for firefighting operations is 81 feet, or an operational deficit of 6 feet.*

3.2 Access and Evacuation Routes

The access route analysis indicates that a minimum of RSET factor of 1.7 hours is needed before all evacuating vehicles will clear the existing road system.

BEHAVE-Plus fire modeling indicates that fires originating in the canyons south of the campus may reach the school's southern property line in as little as 3 minutes and, more likely during a late summer afternoon fire, 28 minutes.

Evaluating these circumstances, there is a 99-minute deficit between ASET and RSET values in a Santa Ana wind event and a 74-minute deficit during typical summer time burning conditions.

Finding: *With an inadequate evacuation route, students and staff will need to shelter-in-place at the northern end of the campus until fire conditions stabilize.*

Finding: *The proposed layout of the new classroom building does not provide adequate setback distances between the building and unmanaged vegetative fuels, which allow for effective heat exposure safety buffers for students and staff.*

Shelter-in-Place Discussion

The Shelter-in-Place strategy is one of many protection actions taken to reduce the impact of a wildfire emergency on a threatened population. It is less common than evacuations and is used ***only*** when evacuation routes can be potentially overrun by the wildfire flame front.

Evacuation is the process of removing people from a threatened area and is the most common method used because it offers a relatively high level of life protection if there is

Sheltering-in-place takes less time than evacuations, ***but*** its effectiveness changes according to the protective qualities offered by the selected shelter.

Shelter-in-place offers protection against the direct effects of fire. Shelter-in-place has a range of approaches including harboring in buildings, safety areas or bodies of water.

Shelter in Place can be sub-divided into two basic aspects: a) refuge shelters and b) in-house shelters. Refuge shelters do not require an active defense for the occupants and often involves a short trip to a refuge site in either a vehicle or on foot.

Using the BEHAVE-Plus fire modeling program, and attempt was made to determine the size of a shelter-in-place outdoor facility where students and staff could safely survive a fire event without additional protection. The program's input parameters have a maximum occupant load in a safety zone of 200 people. Thus, two additional safety zones would need to be provided on the campus.

Finding: For 200 students, using the fire modeling parameters for Fuel Model SH-5, a minimum 2-acre safety zone is required.

For 600 students, a six-acre safety zone is needed.

Finding: *No single protection active represents a universal solution to eliminating casualties in fire-prone areas. Each protection action has circumstances that may outweighs the benefits of other forms of protection.*

Finding: *In general, evacuation and shelter-in-place protective actions have all resulted in successful and unsuccessful outcomes in protecting people in wildfires.*

Finding: *The original layout of the athletic grounds in comparison to campus buildings may provide an effective safety buffering area from heat and direct flame exposures when staff and students use a shelter-in-place strategy, instead of a general time-consuming evacuation.*

Finding: *The information provided to the Consultant does not indicate that a shelter-in-place strategy has been considered as a mitigation against adverse impacts on CEQA required evacuation routes.*

Finding: *For an effective sheltering in place strategy, the original configuration of the athletic fields, which provide the City of San Diego VHFSA brush buffer area and a heat dissipation zone, would need to be retained and augmented by specially fire-hardened buildings at the north side of the campus.*

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4. CONCLUSIONS

The Preliminary Fire Protection Report indicates that there are serious deficiencies in the proposed building configurations and mitigations related to CEQA Significant Impacts related to wild fire safety as required for new projects and residential developments.

These deficiencies encompass several categories:

- Non-c0mpliance with prescriptive requirements from State and local codes, ordinances and policies
- Minimization of vegetation management and defensible space requirements and implementations
- Failure to recognize that the Del Mar Heights School is located in a Wildland Urban Interface area and that entire site is in a designated Very High Fire Severity Area
- Ineffective primary and secondary access roadway systems
- Proposed roadway systems cannot effectively provide satisfactory evacuations during major fast-moving and dynamic wild fire incidents
- Evacuation times exceeding the potential time frames from fires occurring during extreme Santa Ana-Northeast wind events will reach and potentially reach and overrun the combined communities and established egress routes

Given that major CEQA Wildfire Significant Impacts have not been effectively mitigated, Fire Protection and Evacuation Plans for Del Mar Heights School project requires additional development before the Fire Authority Having Jurisdiction can be reasonably assured that the planned changes to the campus can provide an acceptable level of fire and life safety.

Respectfully submitted,

J. Charles Weber, CFPS # 3414

Fire and Life Safety Consultant

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Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model, General Technical Report RMRS-GTR-153. June 2005. Joe H. Scott, Robert E. Burgan, United States Department of Agriculture - Forest Service, Rocky Mountain Research Station, Missoula, Montana.

BEHAVE PLUS: Fire Modeling System Version 5.0.3 April 5, 2010. Patricia L. Andrews, United States Department of Agriculture - Forest Service, Rocky Mountain Research Station – Fire Sciences Lab, Missoula, Montana and Collin D. Bevins, System for Environmental Management, PO Box 8868, Missoula, Montana, 59807. Web site: http://fire.org/

National Wildfire Coordinating Group - *S-290 Intermediate Fire Behavior* Manual

National Wildfire Coordinating Group – *S-390 Introduction to Wildfire Calculations* Manual

Aids to Determining Fuel Models for Estimating Fire Behavior, Hal E. Anderson,

United States Department of Agriculture Forest Service Intermountain Forest and Range Experiment Station General Technical Report INT-122, April 1982

Physics-Based Modeling for WUI Fire Spread – Simplified Model Algorithm for Ignition of Structures by Burning Vegetation, USDA Fire Research Division, NISTIR 7179

NFPA Publications:

National Fire Protection Association - NFPA 1144 *Standard for Reducing Structure Ignition Hazards from Wildfire* (2008).

National Fire Protection Association Pamphlet 299 *Protection of Life and Property from Wildfire*

National Fire Protection Association *Assessing Structure Ignition Potential from Wildfire*

State of California Regulatory Documents

California Code of Regulations, Title 14, Natural Resources, SRA Requirements

California Public Resources Codes sections 4201 through 4204

California Government Code, sections 51175 through 51189.

2016 California Fire Code, CCR Title 24 Part 9, including Local Amendments and Appendices

2019 California Fire Code, CCR Title 24, Part 9

2016 California Building Code, CCR Title 24, Part 2

2019 California Building Code, CCR Title 24, Part 2

The California State and Local Responsibility Area Fire Hazard Severity Zone Map.

Local Codes, Ordinances and Policies

City of San Diego Municipal Code, Chapter 5, Article 5: Fire Protection and Prevention

San Diego Fire Dept. Fire Prevention Policy Bureau (FPB) A-00-9 *Access Roadways, Modified Roadway Surfaces*

SDFD FPB A-14-1 *Fire Apparatus Access Roadways*

SDFD FPB A-14-10 *Fire Access Roadways, Existing Streets*

SDFD FPB K-15-2 – *Knox Product Requirements and Ordering Procedures*

SDFD FPB B-08-01 *Brush Management Regulations*

SDFD FPB B-18-01 *Mitigations for Reduced Brush Management Zones*

City of San Diego Municipal Code, Article 2, Landscaping Regulations

City of San Diego Street Design Manual, March 2017 Edition

SDFD Designated Very High Fire Severity Area Maps

2017 San Diego County Consolidated Fire Code

County of San Diego *Guidelines for Determining Significance and Report Format and Contents Requirements*, San Diego County DPLU Land Use and Environment Group, Second Revision, August 31, 2010

San Diego County General Plan, Chapter 7 – Safety Element

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ATTACHMENT 1 – BEHAVE-Plus Fire Modeling Analysis

BehavePlus 5.0.5 - [unnamed01.bpr]

File Calculate View Configure Pages Windows Tools Help

BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:09:01 Page 1

Inputs: SURFACE, SAFETY, SPOT

Description		N TORREY PINES RESERVE
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	8
Wind Adjustment Factor		.5
Terrain		
Slope Steepness	%	10
Ridge-to-Valley Elevation Difference	ft	188
Ridge-to-Valley Horizontal Distance	mi	0.59
Spotting Source Location		MW

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].

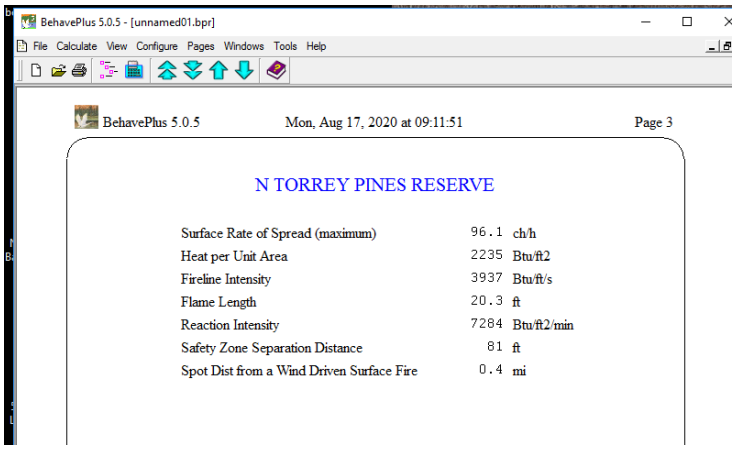
Safety zone calculations are based on the flame length in the direction of maximum spread [SAFETY].

Flame length is used as a worst-case estimate of flame height [SAFETY].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]

Heat per Unit Area (Btu/ft2) [SURFACE]



BehavePlus 5.0.5 - [unnamed01.bpr]

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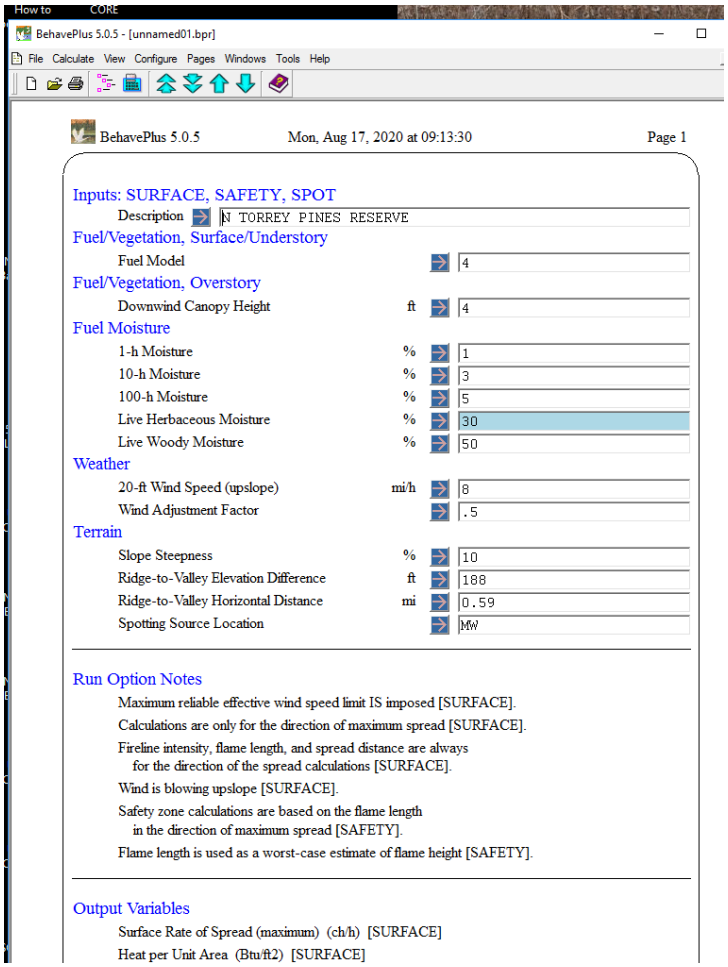
BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:11:51 Page 3

N TORREY PINES RESERVE

Surface Rate of Spread (maximum)	96.1	ch/h
Heat per Unit Area	2235	Btu/ft2
Fireline Intensity	3937	Btu/ft/s
Flame Length	20.3	ft
Reaction Intensity	7284	Btu/ft2/min
Safety Zone Separation Distance	81	ft
Spot Dist from a Wind Driven Surface Fire	0.4	mi

Summer Afternoon Fires – Fuel Model SH-5



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BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:13:30 Page 1

Inputs: SURFACE, SAFETY, SPOT

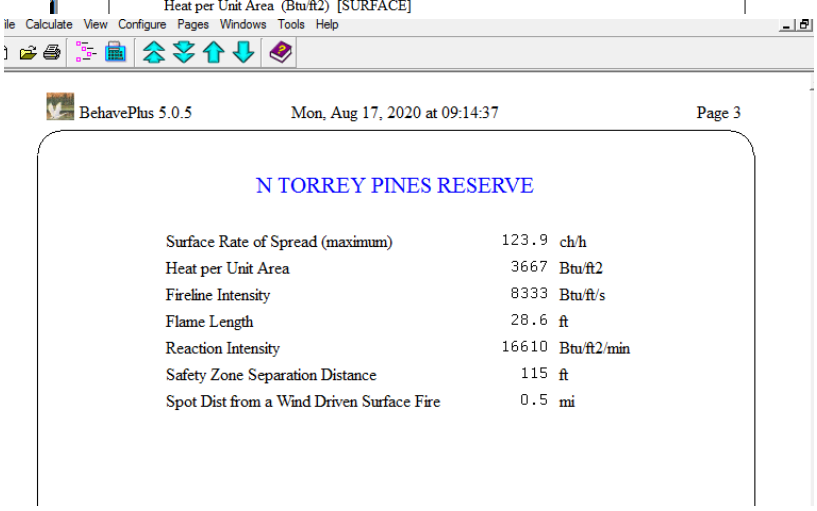
Description		N TORREY PINES RESERVE
Fuel/Vegetation, Surface/Understory		
Fuel Model		4
Fuel/Vegetation, Overstory		
Downwind Canopy Height	ft	4
Fuel Moisture		
1-h Moisture	%	1
10-h Moisture	%	3
100-h Moisture	%	5
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	50
Weather		
20-ft Wind Speed (upslope)	mi/h	8
Wind Adjustment Factor		.5
Terrain		
Slope Steepness	%	10
Ridge-to-Valley Elevation Difference	ft	188
Ridge-to-Valley Horizontal Distance	mi	0.59
Spotting Source Location		MW

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].
Safety zone calculations are based on the flame length in the direction of maximum spread [SAFETY].
Flame length is used as a worst-case estimate of flame height [SAFETY].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]
Heat per Unit Area (Btu/ft2) [SURFACE]



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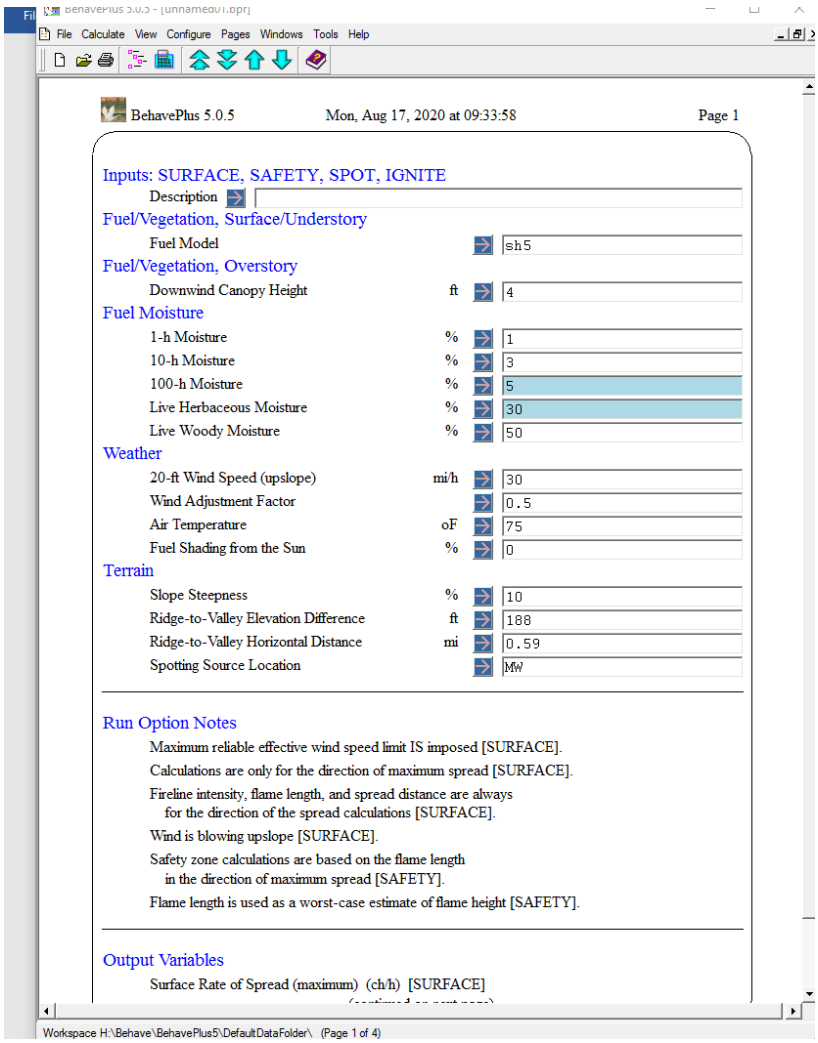
BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:14:37 Page 3

N TORREY PINES RESERVE

Surface Rate of Spread (maximum)	123.9	ch/h
Heat per Unit Area	3667	Btu/ft2
Fireline Intensity	8333	Btu/ft/s
Flame Length	28.6	ft
Reaction Intensity	16610	Btu/ft2/min
Safety Zone Separation Distance	115	ft
Spot Dist from a Wind Driven Surface Fire	0.5	mi

Summer Afternoon Fires – Fuel Model FM-4 Chaparral



BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:33:58 Page 1

Inputs: SURFACE, SAFETY, SPOT, IGNITE

Description		
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		0.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	10
Ridge-to-Valley Elevation Difference	ft	188
Ridge-to-Valley Horizontal Distance	mi	0.59
Spotting Source Location		MW

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].
Safety zone calculations are based on the flame length in the direction of maximum spread [SAFETY].
Flame length is used as a worst-case estimate of flame height [SAFETY].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]

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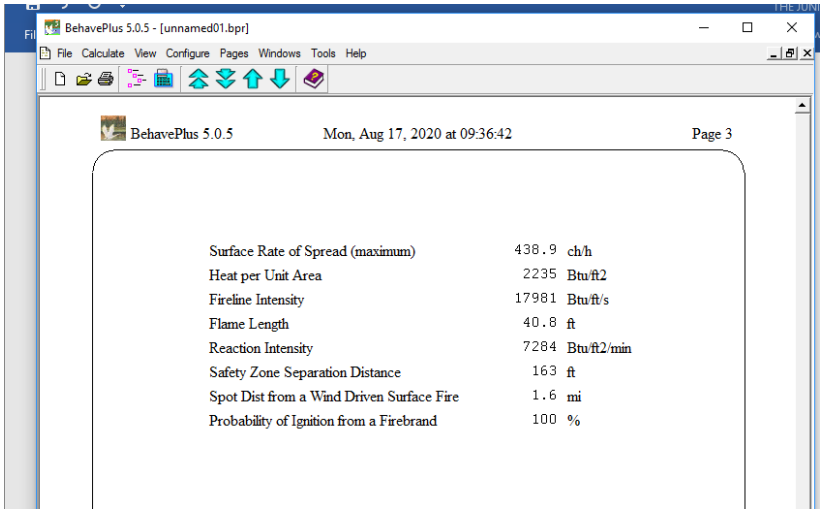
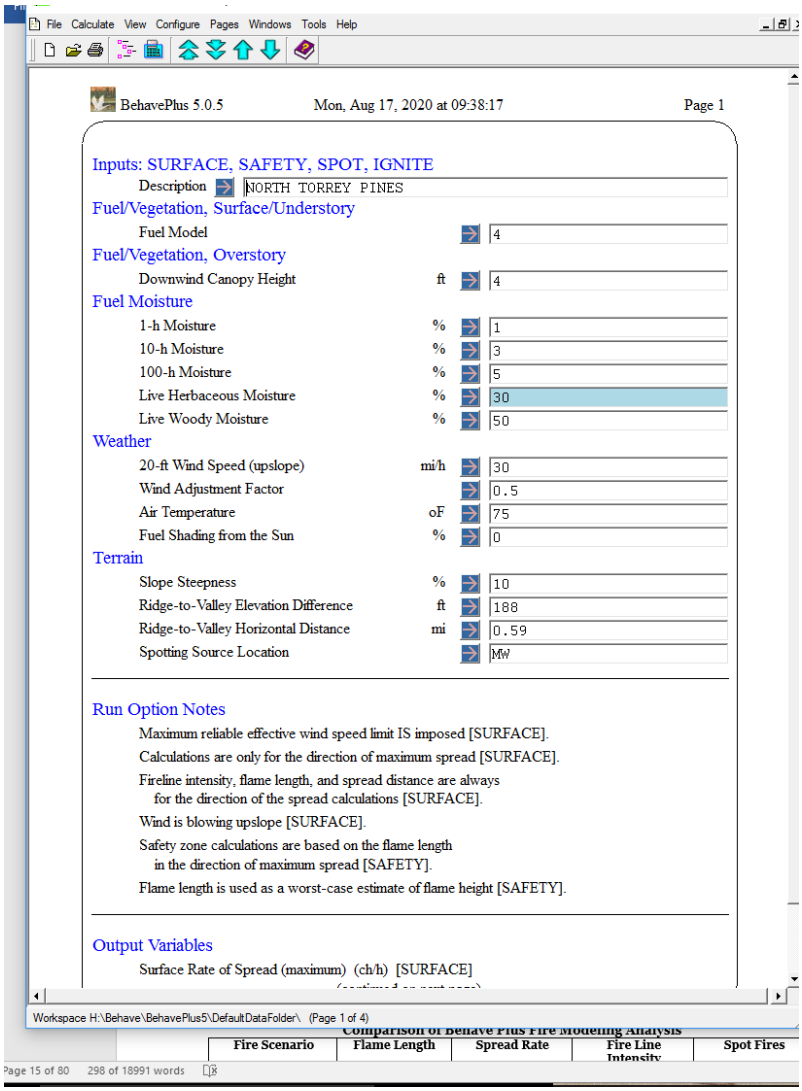


BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:36:42 Page 3

Surface Rate of Spread (maximum)	438.9	ch/h
Heat per Unit Area	2235	Btu/ft2
Fireline Intensity	17981	Btu/ft/s
Flame Length	40.8	ft
Reaction Intensity	7284	Btu/ft2/min
Safety Zone Separation Distance	163	ft
Spot Dist from a Wind Driven Surface Fire	1.6	mi
Probability of Ignition from a Firebrand	100	%

Santa Ana Wind Event, FM SH-5



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BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:38:17 Page 1

Inputs: SURFACE, SAFETY, SPOT, IGNITE

Description		NORTH TORREY PINES
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		0.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	10
Ridge-to-Valley Elevation Difference	ft	188
Ridge-to-Valley Horizontal Distance	mi	0.59
Spotting Source Location		MW

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].
Safety zone calculations are based on the flame length in the direction of maximum spread [SAFETY].
Flame length is used as a worst-case estimate of flame height [SAFETY].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]

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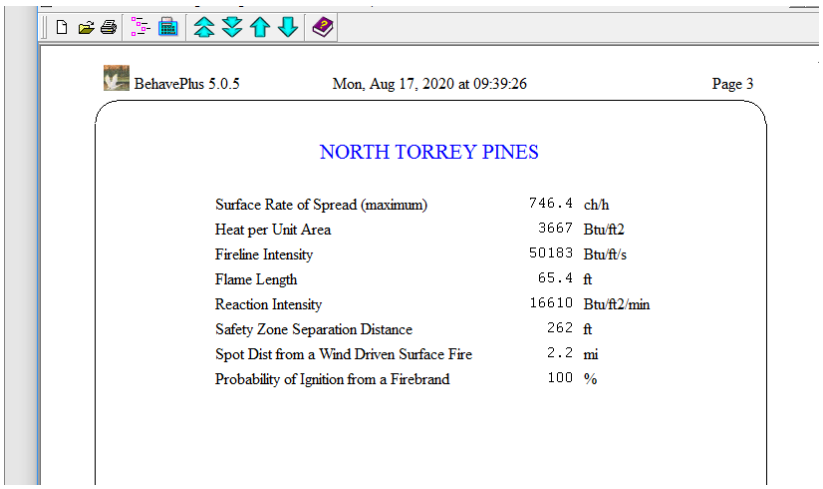
Comparison of Behave Plus Fire Modeling Analysis

Fire Scenario	Flame Length	Spread Rate	Fire Line Intensity	Spot Fires

Page 15 of 80 298 of 18991 words



BehavePlus 5.0.5 Mon, Aug 17, 2020 at 09:39:26 Page 3

NORTH TORREY PINES

Surface Rate of Spread (maximum)	746.4	ch/h
Heat per Unit Area	3667	Btu/ft2
Fireline Intensity	50183	Btu/ft/s
Flame Length	65.4	ft
Reaction Intensity	16610	Btu/ft2/min
Safety Zone Separation Distance	262	ft
Spot Dist from a Wind Driven Surface Fire	2.2	mi
Probability of Ignition from a Firebrand	100	%

Santa Ana Wind Event, Fuel Model FM-4 Chaparral

ATTACHMENT 2

CALIFORNIA GOVERNMENT CODE 51182 & 51184

CHAPTER 6.8. Very High Fire Hazard Severity Zones [51175 - 51189]
(Chapter 6.8 added by Stats. 1992, Ch. 1188, Sec. 1.)

51182.
(a) A person who owns, leases, controls, operates, or maintains an occupied dwelling or occupied structure in, upon, or adjoining a mountainous area, forest-covered land, brush-covered land, grass-covered land, or land that is covered with flammable material, which area or land is within a very high fire hazard severity zone designated by the local agency pursuant to Section 51179, shall at all times do all of the following:

(1) Maintain defensible space of 100 feet from each side and from the front and rear of the structure, but not beyond the property line except as provided in paragraph (2). The amount of fuel modification necessary shall take into account the flammability of the structure as affected by building material, building standards, location, and type of vegetation. Fuels shall be maintained in a condition so that a wildfire burning under average weather conditions would be unlikely to ignite the structure. This paragraph does not apply to single specimens of trees or other vegetation that are well-pruned and maintained so as to effectively manage fuels and not form a means of rapidly transmitting fire from other nearby vegetation to a structure or from a structure to other nearby vegetation. The intensity of fuels management may vary within the 100-foot perimeter of the structure, the most intense being within the first 30 feet around the structure. Consistent with fuels management objectives, steps should be taken to minimize erosion.

(2) A greater distance than that required under paragraph (1) may be required by state law, local ordinance, rule, or regulation. Clearance beyond the property line may only be required if the state law, local ordinance, rule, or regulation includes findings that the clearing is necessary to significantly reduce the risk of transmission of flame or heat sufficient to ignite the structure, and there is no other feasible mitigation measure possible to reduce the risk of ignition or spread of wildfire to the structure. Clearance on adjacent property shall only be conducted following written consent by the adjacent landowner.

(3) An insurance company that insures an occupied dwelling or occupied structure may require a greater distance than that required under paragraph (1) if a fire expert, designated by the fire chief or fire official from the authority having jurisdiction, provides findings that the clearing is necessary to significantly reduce the risk of transmission of flame or heat sufficient to ignite the structure, and there is no other feasible mitigation measure possible to reduce the risk of ignition or spread of wildfire to the structure. The greater distance may not be beyond the property line unless allowed by state law, local ordinance, rule, or regulation.

(4) Remove that portion of a tree that extends within 10 feet of the outlet of a chimney or stovepipe.

(5) Maintain a tree, shrub, or other plant adjacent to or overhanging a building free of dead or dying wood.

(6) Maintain the roof of a structure free of leaves, needles, or other vegetative materials.

(7) Prior to constructing a new dwelling or structure that will be occupied or rebuilding an occupied dwelling or occupied structure damaged by a fire in that zone, the construction or rebuilding of which requires a building permit, the owner shall obtain a certification from the local building official that the dwelling or structure, as proposed to be built, complies with all applicable state and local building standards, including those described in subdivision (b) of Section 51189, and shall provide a copy of the certification, upon request, to the insurer providing course of construction insurance coverage for the building or structure. Upon completion of the construction or rebuilding, the owner shall obtain from the local building official, a copy of the final inspection report that demonstrates that the dwelling or structure was constructed in compliance with all applicable state and local building standards, including those described in subdivision (b) of Section 51189, and shall provide a copy of the report, upon request, to the property insurance carrier that insures the dwelling or structure.

(b) A person is not required under this section to manage fuels on land if that person does not have the legal right to manage fuels, nor is a person required to enter upon or to alter property that is owned by any other person without the consent of the owner of the property.

(c) The Department of Forestry and Fire Protection shall develop, periodically update, and post on its Internet Web site a guidance document on fuels management pursuant to this chapter. Guidance shall include, but not be limited to, regionally appropriate vegetation management suggestions that preserve and restore native species, minimize erosion, minimize water consumption, and permit trees near homes for shade, aesthetics, and habitat; and suggestions to minimize or eliminate the risk of flammability of nonvegetative sources of combustion such as woodpiles, propane tanks, decks, and outdoor lawn furniture.

CHAPTER 6.8. Very High Fire Hazard Severity Zones [51175 - 51189]
(Chapter 6.8 added by Stats. 1992, Ch. 1188, Sec. 1.)

51184.
(a) Section 51182 shall not apply to any land or water area acquired or managed for one or more of the following purposes or uses:

(1) Habitat for endangered or threatened species, or any species that is a candidate for listing as an endangered or threatened species by the state or federal government.

(2) Lands kept in a predominantly natural state as habitat for wildlife, plant, or animal communities.

(3) Open space lands that are environmentally sensitive parklands.

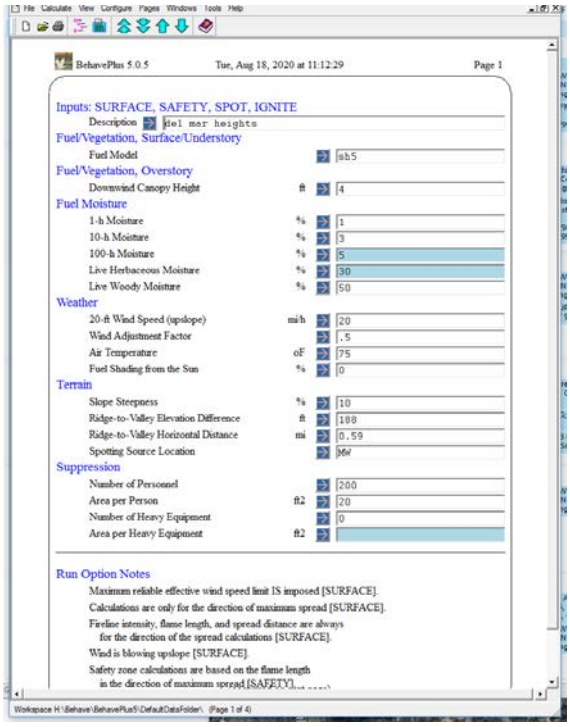
(4) Other lands having scenic values, as declared by the local agency, or by state or federal law.

(b) This exemption applies whether the land or water area is held in fee title or any lesser interest. This exemption applies to any public agency, any private entity that has dedicated the land or water areas to one or more of those purposes or uses, or any combination of public agencies and private entities making that dedication.

(c) This section shall not be construed to prohibit the use of properly authorized prescribed burning to improve the biological function of land or to assist in the restoration of desired vegetation.

(d) In the event that any lands adjacent to any land or water area described in subdivision (a) are improved such that they are subject to Section 51182, the obligation to comply with Section 51182 shall be with the person owning, leasing, controlling, operating, or maintaining the occupied dwelling or occupied structure on the improved lands. All maintenance activities and other fire prevention measures required by Section 51182 shall be required only for the improved lands, not the land and water areas described in subdivision (a).

ATTACHMENT 3 – SAFETY ZONE CALCULATION



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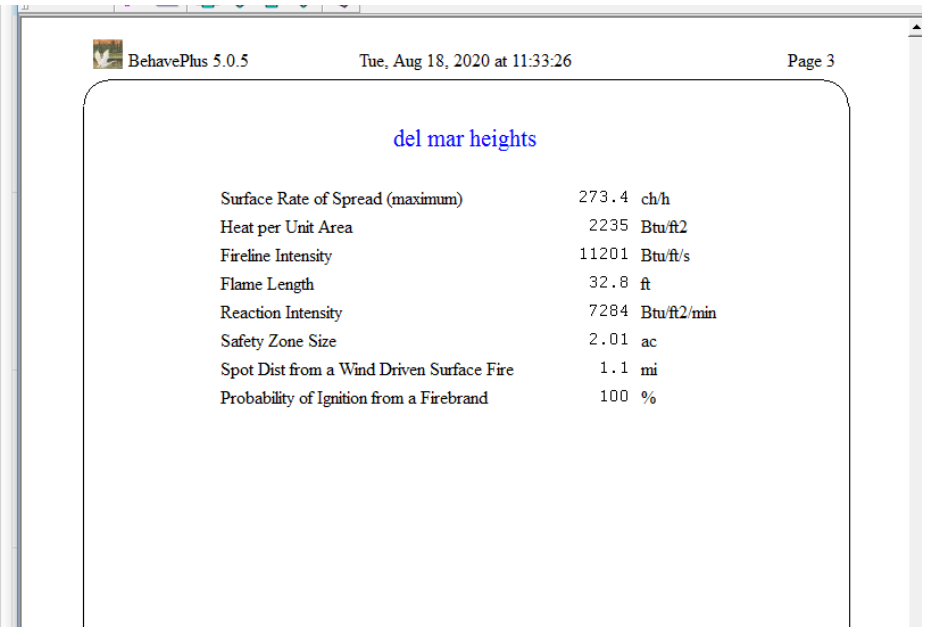
Inputs: SURFACE, SAFETY, SPOT, IGNITE

Description		del mar heights
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	20
Wind Adjustment Factor		.5
Air Temperature	oF	75
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	10
Ridge-to-Valley Elevation Difference	ft	100
Ridge-to-Valley Horizontal Distance	mi	0.59
Spotting Source Location		MW
Suppression		
Number of Personnel		200
Area per Person	ft2	20
Number of Heavy Equipment		0
Area per Heavy Equipment	ft2	

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].
Safety zone calculations are based on the flame length in the direction of maximum spread [SAFETY].



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del mar heights

Surface Rate of Spread (maximum)	273.4	ch/h
Heat per Unit Area	2235	Btu/ft2
Fireline Intensity	11201	Btu/ft/s
Flame Length	32.8	ft
Reaction Intensity	7284	Btu/ft2/min
Safety Zone Size	2.01	ac
Spot Dist from a Wind Driven Surface Fire	1.1	mi
Probability of Ignition from a Firebrand	100	%