FINAL

Stoneridge Preserve
Vegetation Management Plan

Prepared for:

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AA	airtactical aircraft
amsl	above mean sea level
AFPD	Alpine Fire Protection District
APN	Assessor's Parcel Number
ASMD	Area Specific Management Directives
BLM	Bureau of Land Management
BMP	Best Management Practices
CAL FIRE	California Department of Forestry and Fire Protection
Cal-IPC	California Invasive Plant Council
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CRHR	California Register of Historic Places
CRPR	California Rare Plant Rank
DPR	County of San Diego Department of Parks and Recreation
FRAP	Fire and Resource Assessment Program
GIS	Geographic Information System
LFPD	Lakeside Fire Protection District
mph	miles per hour
MSCP	Multiple Species Conservation Program
MSDS	Material Safety Data Sheets
NRHP	National Register of Historic Places
RMP	Resource Management Plan
RPO	Resource Protection Ordinance
SAP	Subarea Plan
SDRFPD	San Diego Rural Fire Protection District
SMFPD	San Miguel Fire Protection District
SRA	State Responsibility Area
USGS	U.S. Geological Survey
VCM	Vegetation Classification Manual
VMP	Vegetation Management Plan
VMU	Vegetation Management Unit
WUI	Wildland–Urban Interface

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1.0 INTRODUCTION

The approximately 246-acre Stoneridge Preserve (Preserve) is located within Harbison Canyon, east of the City of El Cajon, in central San Diego County (County). Specifically, the Preserve is bounded to the northwest by Mountain View Road and to the southeast by Harbison Canyon Road. The Preserve is owned by the County of San Diego Department of Parks and Recreation (DPR) and management for the Preserve will be under the direction of a Resource Management Plan (RMP), including Area-Specific Management Directives (ASMDs), pursuant to the requirements of the County of San Diego Multiple Species Conservation Program Subarea Plan (MSCP SAP). The Preserve is included in the MSCP SAP preserve system and contains valuable native habitats that are relatively undisturbed.

The Preserve is adjacent to residential areas primarily to the south and southeast. In a few discrete locations, human disturbance, likely related to brush management, has resulted in unvegetated areas, which are subject to erosion; these areas can be utilized for fuel management/defensible space purposes and have been incorporated into a Vegetation Management Unit designated for this purpose. The majority of the Preserve most recently burned during the 2003 Cedar Fire, and the entirety of the Preserve has burned during the recorded fire history period (1878-2011), some areas having burned over five times.

Despite repeated fires and some human disturbance, the majority of the Preserve supports high quality native vegetation communities. Invasive non-native plant species are generally at low frequencies, and tend to be concentrated within riparian areas of the Preserve. Aside from invasive nonnative plant species control, there are no areas of the Preserve in need of restoration. However, DPR should evaluate disturbance related to brush management on the southern and southeastern perimeters of the Preserve, and coordinate with adjacent land owners on brush management activities to ensure that it occurs in accordance with County guidelines.

1.1 Purpose and Need

The purpose of this Vegetation Management Plan (VMP) is to describe current conditions within the Preserve and provide recommendations for vegetation management including: 1) invasive nonnative plant species management, 2) habitat restoration, and 3) fire management. While this VMP is intended to be a stand-alone document, the information and recommendations presented will be used by DPR to develop additional ASMDs to augment the existing Preserve RMP. In addition, the VMP provides fire response personnel with critical site information for emergency fire response within and immediately adjacent to the Preserve boundaries and identifies targeted fuel management actions that can be implemented as preventative measures.

The Invasive Species Management section of this VMP lists the invasive non-native plant species mapped in the Preserve, identifies and prioritizes target species for removal, and outlines standard removal methods. The Habitat Restoration section of this VMP evaluates potential restoration opportunities within the Preserve and outlines standard restoration methods. The Fire Management section of this VMP outlines a framework to address wildfire risk and enables environmental documentation of strategic fuels management that may be needed. The framework includes discussion of fire prevention, suppression, and post-suppression fire-control activities within and adjacent to the Preserve.

The goals and objectives as well as the recommendations in this VMP are consistent with the County's MSCP and the County of San Diego Vegetation Management Report (County of San Diego 2009), which addresses vegetation management criteria for wildland and urban areas of unincorporated San Diego County. It is anticipated that this VMP will be revised once every 5 years, as needed, in conjunction with anticipated Preserve RMP updates.

1.2 Site Location and Description

The Preserve is located east of the City of El Cajon, in central San Diego County. The Preserve is bounded to the northwest by Mountain View Road and to the southeast by Harbison Canyon Road, within unincorporated San Diego County (Figure 1). The Preserve is mapped within the U.S. Geological Survey (USGS) 7.5-minute Alpine quadrangle: Township 15 South, Range 1 East, Sections 35 and 36, and Township 16 South, Range 1 East, Sections 1 and 2 (Figure 2).

The Preserve is composed of the following Assessor's Parcel Numbers (APNs): 399-030-06, 399-030-18, 399-030-19, 399-030-20, 399-030-021, 399-290-04, 401-101-10, 401-101-11, 401-101-12, 401-101-13, and a portion of 399-030-16.

The Preserve is bordered by low density, rural residential development to the south and southeast, Mountain View Road to the north and east, and undeveloped land to the west. Conserved lands in the vicinity are owned and managed by the U.S. Fish and Wildlife Service, California Department of Fish and Game (CDFG), and private homeowners associations.

The Preserve does not have any facilities, official access roads, or designated trails. There are no on-site DPR staff; however, DPR staff from the nearby Flinn Springs District manage the Preserve and provide periodic patrols.

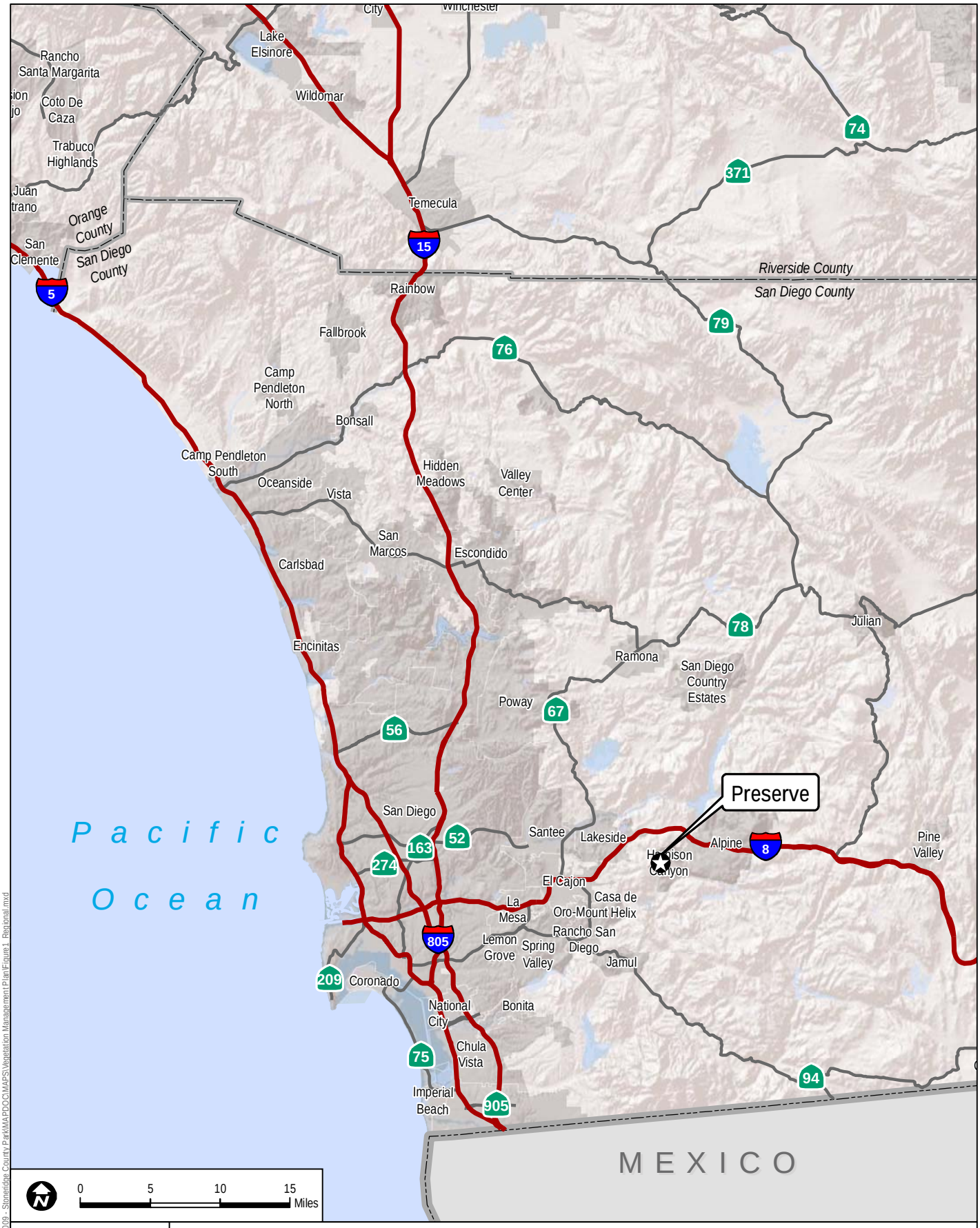

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FIGURE 1

Regional Map

Stoneridge Preserve - Vegetation Management Plan

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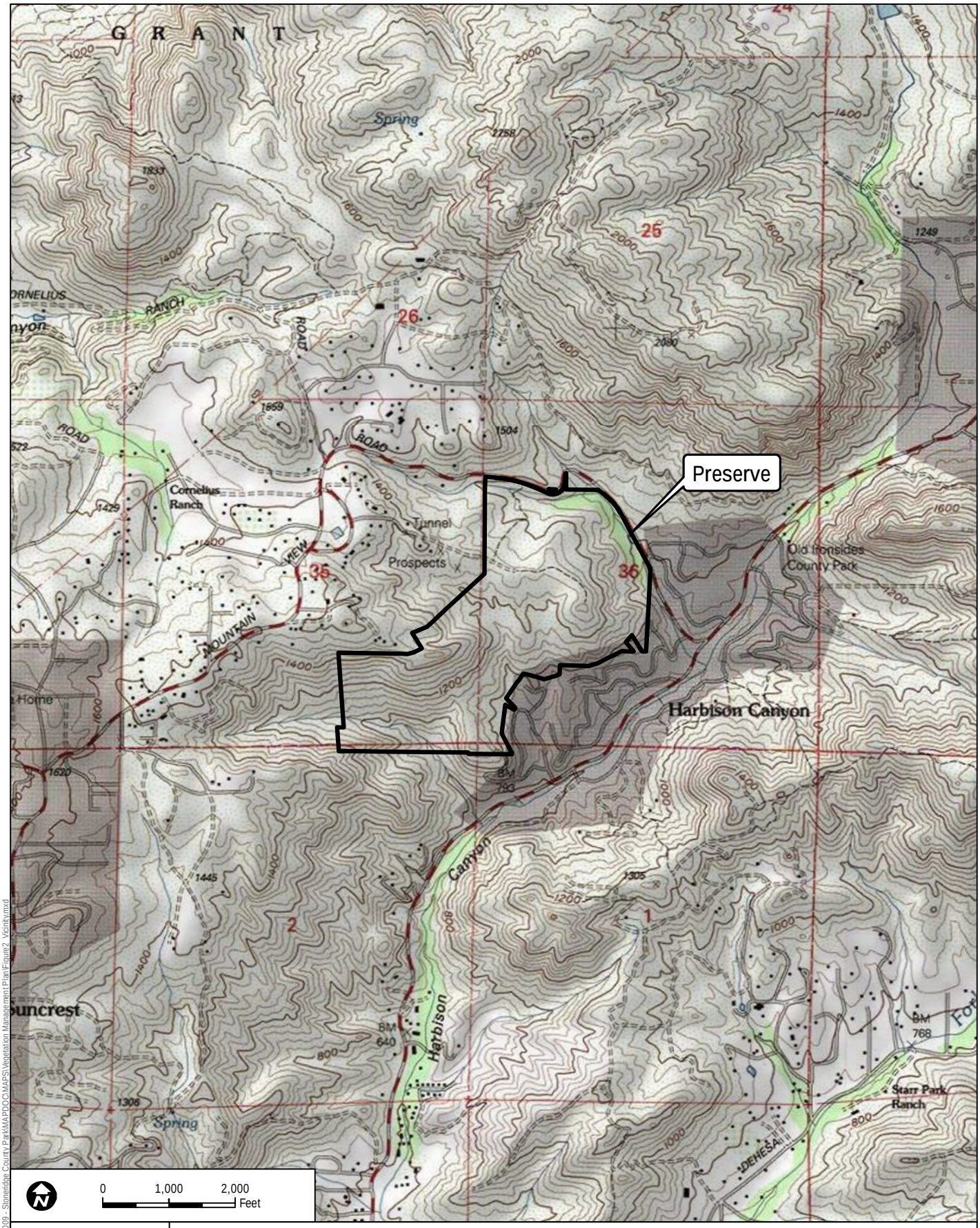

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SOURCE: USGS topo 7.5-Minute Series Quadrangle

FIGURE 2

Vicinity Map

Stoneridge Preserve - Vegetation Management Plan

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The Preserve is classified as a Very High Fire Hazard Severity Zone by the California Department of Forestry and Fire Protection (CAL FIRE) (FRAP 2012). The entirety of the Preserve is designated a state responsibility area (SRA). Therefore, the Preserve lies within the service area of CAL FIRE.

The Preserve is located in the coastal foothills of the Peninsular Ranges of Southern California and is composed of hilly terrain, ranging in elevation from 264 meters (867 feet) above mean sea level (amsl) in the southeast region to approximately 405 meters (1,300 feet) amsl in the west-central region of the Preserve.

1.3 Vegetation Management Goals and Objectives

This VMP aims to develop management strategies consistent with the County's MSCP and the County of San Diego Vegetation Management Report (County of San Diego 2009), which addresses vegetation management criteria for wildland and urban areas of unincorporated San Diego County. To that end, the vegetation management goals for the Preserve are focused on environmental resource preservation and enhancement of existing native habitat. The vegetation management goals for the Preserve include the following:

- Ensure the long-term viability and sustainability of native ecosystem function and natural processes;
- Manage invasive non-native plant species to ensure native vegetation community and resource preservation;
- Restore and/or enhance the quality of degraded vegetation communities in a manner consistent with overall species or habitat preservation goals; and
- Develop fuel-load reduction methods that are consistent with overall Preserve management goals.

To achieve these long-term vegetation management goals for the Preserve, the following objectives have been formulated to achieve desired levels of resource protection and public and firefighter safety:

1. Maximize the extent of appropriate habitat for native target species by the removal or control of invasive nonnative plant species:

    - Maximize native vegetation community quality through invasive non-native plant species management;

- Identify and prioritize removal/control of invasive non-native plant species in the Preserve;
- Provide methods for removal/control of invasive non-native plant species.

2. Provide a framework for the restoration of disturbed areas within the Preserve:

- Avoid or minimize adverse impacts to sensitive and high-value habitats;
- Identify and address current and long-term vegetation community restoration needs;
- Monitor restoration success and follow-up to ensure target restoration goals are achieved.

3. Provide a fire management strategy that will include planning for wildland fires:

- Utilize available fuel and invasive non-native plant reduction techniques, such as mowing, herbicide application, and prescribed fire, consistent with Preserve goals for habitat preservation, enhancement, and restoration, and cultural resource protection;
- Provide site information about fire behavior to local fire agencies, including CAL FIRE San Diego Unit, San Diego Rural Fire Protection District, and San Miguel Fire Protection District, for inclusion in wildland pre-response plans;
- Establish vegetation management units (VMUs) based on topography or other clearly discernible landscape boundaries to facilitate fire management;
- Minimize likelihood of Preserve-wide, catastrophic wildfires by limiting ignition potential, reducing fuel loads in key areas, limiting illegal access, and increasing public awareness;
- Identify wildland–urban interface (WUI) areas and associated fuel management goals with a dual role of preventing wildfire from impacting urban areas, as well as protecting Preserve lands from fire originating in urban areas;
- Provide local fire agencies maps of sensitive biological and cultural resources to be avoided to the maximum extent possible;
- Prepare Preserve maps depicting relevant fire management data, including property boundaries, topography, vegetation and fuel types, and access;
- Prepare fire restoration management guidelines for each VMU including discussion of prevention, suppression, and post-suppression activities; and
- Provide appropriate contact information to responding fire personnel in the event fire management activities may affect priority resources.

2.0 ENVIRONMENTAL RESOURCES

Baseline biological surveys of the Preserve were conducted in 2012 (Dudek 2012a). Field studies included vegetation communities mapping, rare plant surveys, invasive non-native plant species mapping, butterfly surveys and habitat assessment for Quino checkerspot (*Euphydryas editha quino*) and Hermes Copper (*Lycaena hermes*) butterflies, herpetological pitfall trap surveys, diurnal and nocturnal avian point count surveys, passive bat surveys, small mammal trapping, and large and medium mammal surveys using remote camera stations. Brief descriptions of the existing vegetation communities, sensitive plant and wildlife species, and cultural resources documented in the Preserve during the baseline surveys are provided in the following sections.

2.1 Biological Resources

2.1.1 Vegetation Communities

Vegetation community classification was based on two separate systems, including the Vegetation Classification Manual for Western San Diego County (VCM) (SANDAG 2011) and the Holland (1986) (as modified by Oberbauer et al. 2008) classification system. The field mapping was conducted according to the VCM and then cross-walked to the Holland/Oberbauer classification system. The predominant vegetation community within the Preserve is San Diego Sunflower–California Sagebrush–California Buckwheat Association; however, six other plant alliances, associations, or semi-natural stands have been mapped within the Preserve including Coast Live Oak Woodland Alliance, Chamise Chaparral–Coastal Sage Scrub Association, Chamise Chaparral–Mission Manzanita Alliance, California Sagebrush–California Buckwheat–Laurel Sumac Association, Woolly-leaved Ceanothus Association, and Annual Brome Grasslands Semi-natural Stands (Table 1; Figure 3a). Unvegetated habitat was also mapped in the Preserve, including disturbed habitat and urban/developed land. Vegetation communities according to the Holland/Oberbauer classification system are included as Figure 3b.

Table 1
Vegetation Communities and Land Covers

VCM code	VCM Alliance/ Association	VCM Common Name	Holland Code	Holland Classification	Acres on Site[1]
Riparian Forests and Woodlands					
3.6	*Quercus agrifolia* Alliance	Coast Live Oak Woodland Alliance	71160	Coast Live Oak Woodland	15.98
Riparian Forests and Woodlands Total					15.98

Table 1
Vegetation Communities and Land Covers

VCM code	VCM Alliance/ Association	VCM Common Name	Holland Code	Holland Classification	Acres on Site[1]
Drought-Deciduous Shrublands					
4.1.2	*Adenostoma fasciculatum–(Eriogonum fasciculatum Artemisia californica, Salvia mellifera)* Association	Chamise Chaparral–Coastal Sage Scrub Association	37G00	Coastal Sage-Chaparral Transition	46.51
4.2	*Adenostoma fasciculatum–Xylococcus bicolor* Alliance	Chamise Chaparral–Mission Manzanita Alliance	37120	Southern Mixed Chaparral	23.40
4.7.1	*Artemisia californica–Eriogonum fasciculatum–Malosma laurina* Association	California Sagebrush–California Buckwheat–Laurel Sumac Association	32500	Diegan Coastal Sage Scrub	50.81
4.13.1	*Bahiopsis laciniata–Artemisia californica–Eriogonum fasciculatum* Association	San Diego Sunflower–California Sagebrush–California Buckwheat Association	32500	Diegan Coastal Sage Scrub	89.47
4.18.1	*Ceanothus tomentosus* Association	Woollyleaf Ceanothus Association	37120	Southern Mixed Chaparral	17.04
				Drought-Deciduous Shrublands Total	227.23
Upland Herbaceous Vegetation					
5.8	*Bromus (diandrus, hordeaceus)–Brachypodium distachyon* Semi-Natural Stand	Annual Brome Grasslands Semi-Natural Stands	42200	Non-Native Grassland	0.04
				Upland Herbaceous Vegetation Total	0.04
Unvegetated					
N/A	*N/A*	N/A	11300	Disturbed Habitat	3.12
N/A	*N/A*	N/A	12000	Urban/Developed	0.35
				Unvegetated Total	3.47
				Grand Total	**246.72**

[1] Does not include 100-foot buffer acreage

2.1.2 Sensitive Plant Species

Four special-status plant species have been documented within the Preserve (Dudek 2012a). Table 2 presents the sensitive plant species identified in the Preserve. Sensitive plant species locations are presented in Figure 4.

Table 2
Sensitive Plant Species Known to Occur in the Preserve

Common Name	Scientific Name	Status[1]
Engelmann oak	*Quercus engelmannii*	CRPR 4.2, County List D
Rush-like bristleweed	*Xanthisma junceum*	CRPR 4.3, County List D
San Diego County viguiera	*Bahiopsis [=Viguiera] laciniata*	CRPR 4.2, County List A
San Diego sagewort	*Artemisia palmeri*	CRPR 4.2, County List D

[1] **CRPR (California Rare Plant Rank):**
1A Plants Presumed Extinct in California
1B Plants Rare, Threatened, or Endangered in California and Elsewhere
2 Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere
3 Plants About Which We Need More Information - A Review List
4 Plants of Limited Distribution - A Watch List

Threat Ranks:
0.1 Seriously threatened in California
0.2 Fairly threatened in California
0.3 Not very threatened in California

County Designations:
County List A Plants rare, threatened, or endangered in California and elsewhere
County List B Plants rare, threatened, or endangered in California but common elsewhere
County List C Plants which may be rare, but need more information to determine their true rarity status
County List D Plants of limited distribution and are uncommon, but not presently rare or endangered

2.1.3 Sensitive Animal Species

Overall, 25 special-status wildlife species were observed or detected within the Preserve (Dudek 2012a). Table 3 presents the sensitive animal species observed in the Preserve. Sensitive animal species locations are also presented on Figure 5.

Table 3
Sensitive Wildlife Species Known to Occur in the Preserve

Common Name	Scientific Name	Status (Federal/State/County, MSCP)[1]
Herpetofauna		
Coast horned lizard	*Phrynosoma blainvillei ssp. coronatum*	None/CSC/Group 2, MSCP
Coastal western whiptail	*Aspidoscelis tigris stejnegeri*	None/None/Group 2
Orange-throated whiptail	*Aspidoscelis hyperythra beldingi*	None/CSC/Group 2, MSCP
San Diego banded gecko	*Coleonyx variegatus*	None/None/Group 1
Coast patch-nosed snake	*Salvadora hexalepis virgultea*	None/CSC/Group 2
Northern red diamond rattlesnake	*Crotalus ruber ruber*	None/CSC/Group 2
Birds		
Barn owl	*Tyto alba*	None/None/Group 2
Coastal California gnatcatcher	*Polioptila californica californica*	FT/CSC/Group 1, MSCP
Cooper's hawk	*Accipiter cooperii*	None/WL/Group 1, MSCP

Table 3
Sensitive Wildlife Species Known to Occur in the Preserve

Common Name	Scientific Name	Status (Federal/State/County, MSCP)[1]
Red-shouldered hawk	*Buteo lineatus*	None/None/Group 1
Southern California rufous-crowned sparrow	*Aimophila ruficeps canescens*	None/WL/Group 1, MSCP
Turkey vulture	*Cathartes aura*	None/None/Group 1
Western bluebird	*Sialia mexicana*	None/None/Group 2, MSCP
White-tailed kite	*Elanus leucurus*	None/ FP/Group 1
Mammals		
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	None/ CSC/Group 2
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	None/CSC/Group 2
San Diego desert woodrat	*Neotoma lepida intermedia*	None/CSC/Group 2
Pallid bat	*Antrozous pallidus*	None/CSC/Group 2
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	None/CSC/Group 2
Western mastiff bat	*Eumops perotis californicus*	None/CSC/Group 2
Western red bat	*Lasiurus blossevillii*	None/CSC/Group 2
Western small-footed myotis	*Myotis ciliolabrum*	None/None/Group 2
Western yellow bat	*Lasiurus xanthinus*	None/CSC/None
Yuma myotis	*Myotis yumanensis*	None/None/Group 2
Mule deer	*Odocoileus hemionus*	None/None/Group 2, MSCP

[1] **Federal Designations:**
FT: Federally Threatened
State Designations:
CSC: California Species of Special Concern (CDFG)
FP: State Fully Protected
WL: State Watch List
County Designations:
Group 1: Animals of high sensitivity (listed or specific natural history requirements)
Group 2: Animals declining, but not in immediate threat of extinction or extirpation
MSCP: Covered under the MSCP

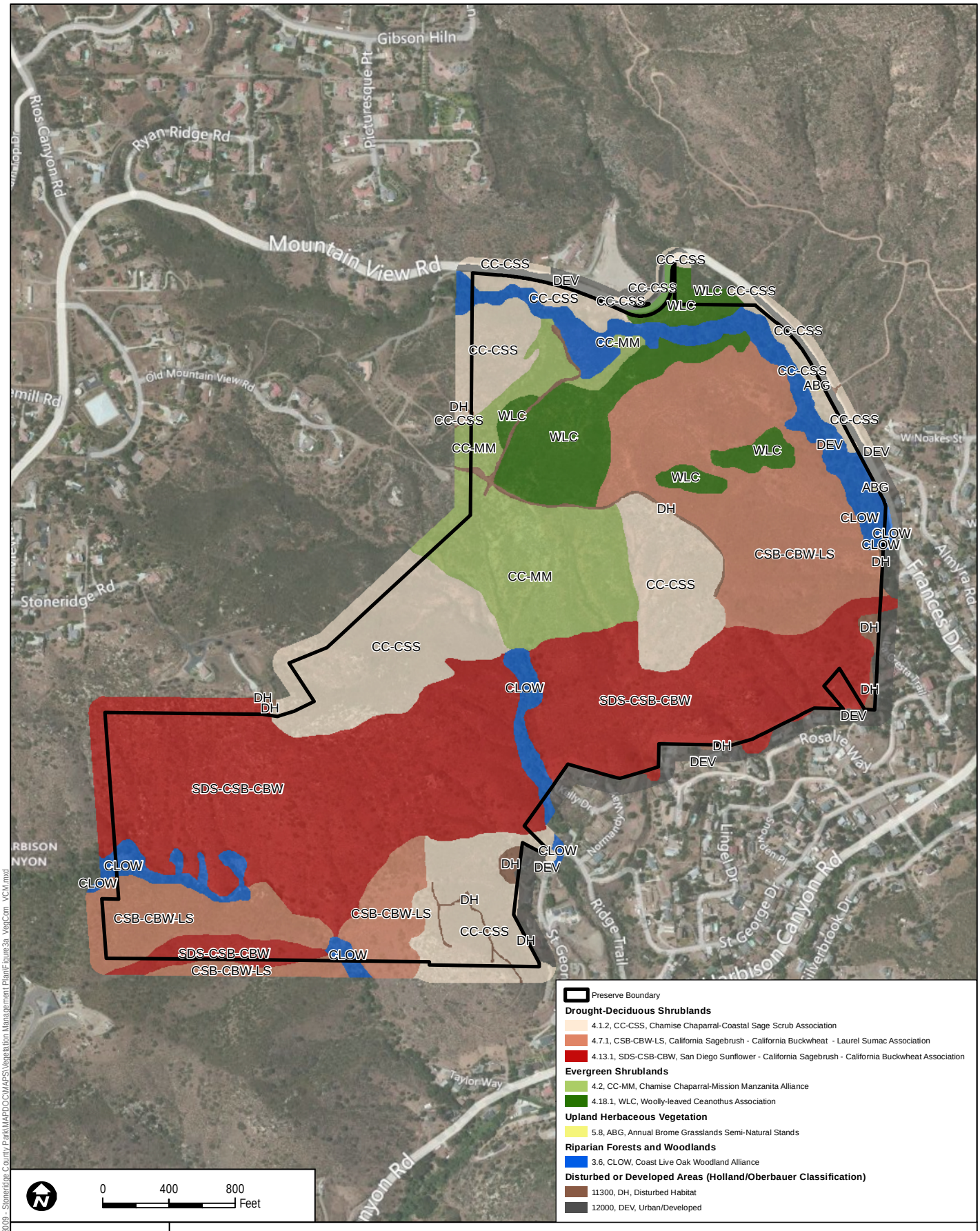

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FIGURE 3a

Vegetation Communities and Land Cover Types (VCM)

Stoneridge Preserve - Vegetation Management Plan

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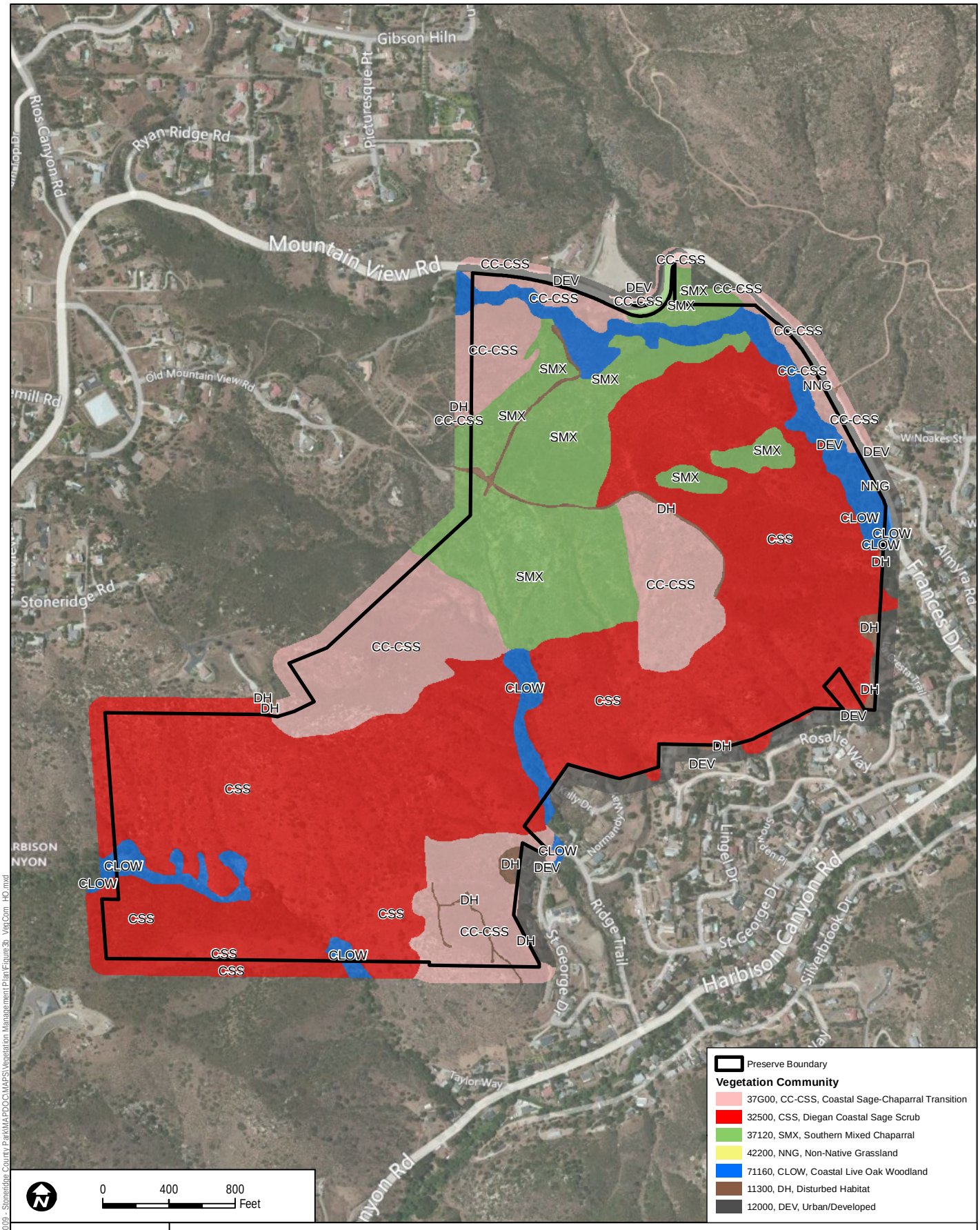

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FIGURE 3b

Vegetation Communities and Land Cover Types (Holland)

Stoneridge Preserve - Vegetation Management Plan

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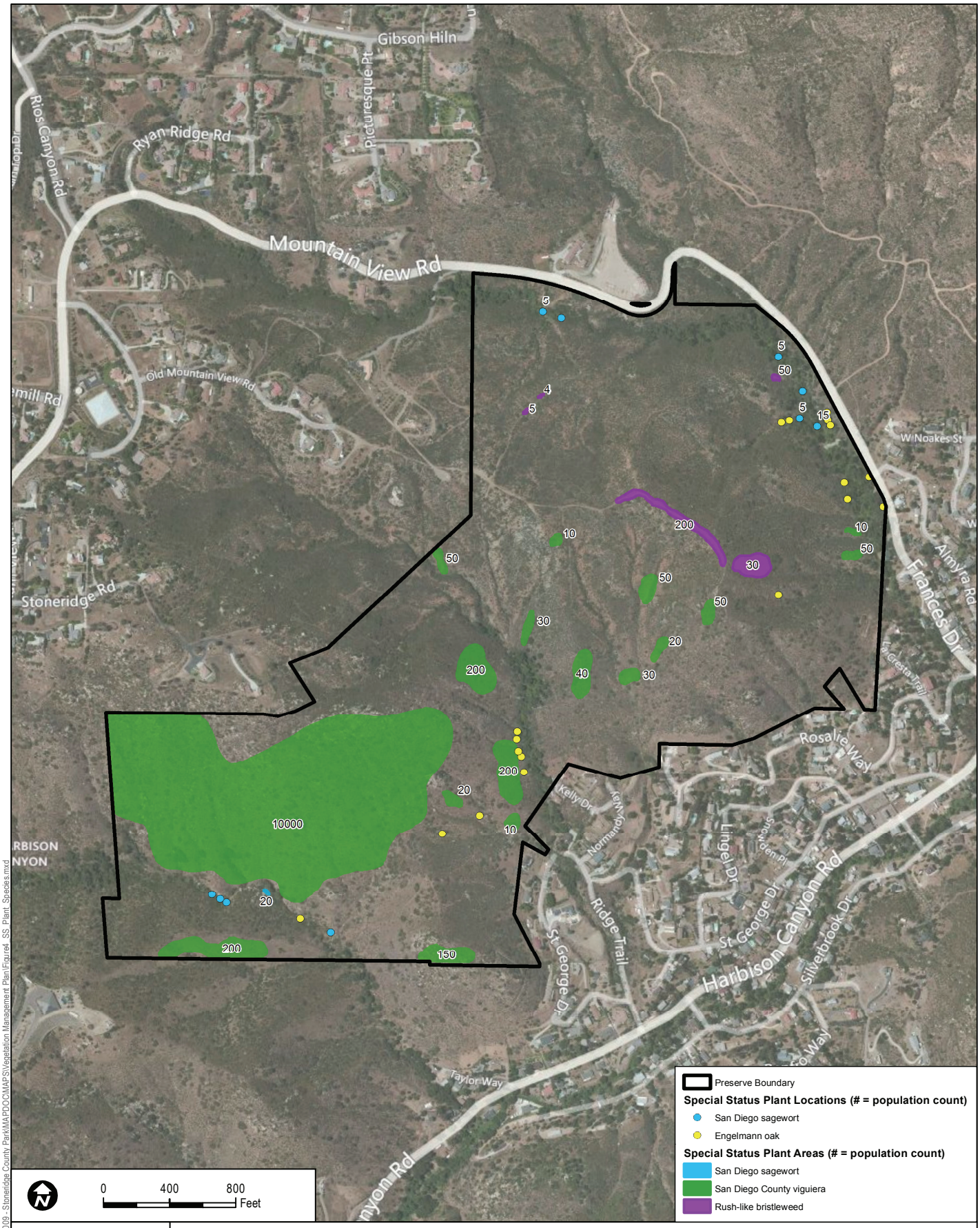

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FIGURE 4

Special Status Plant Locations

Stoneridge Preserve - Vegetation Management Plan

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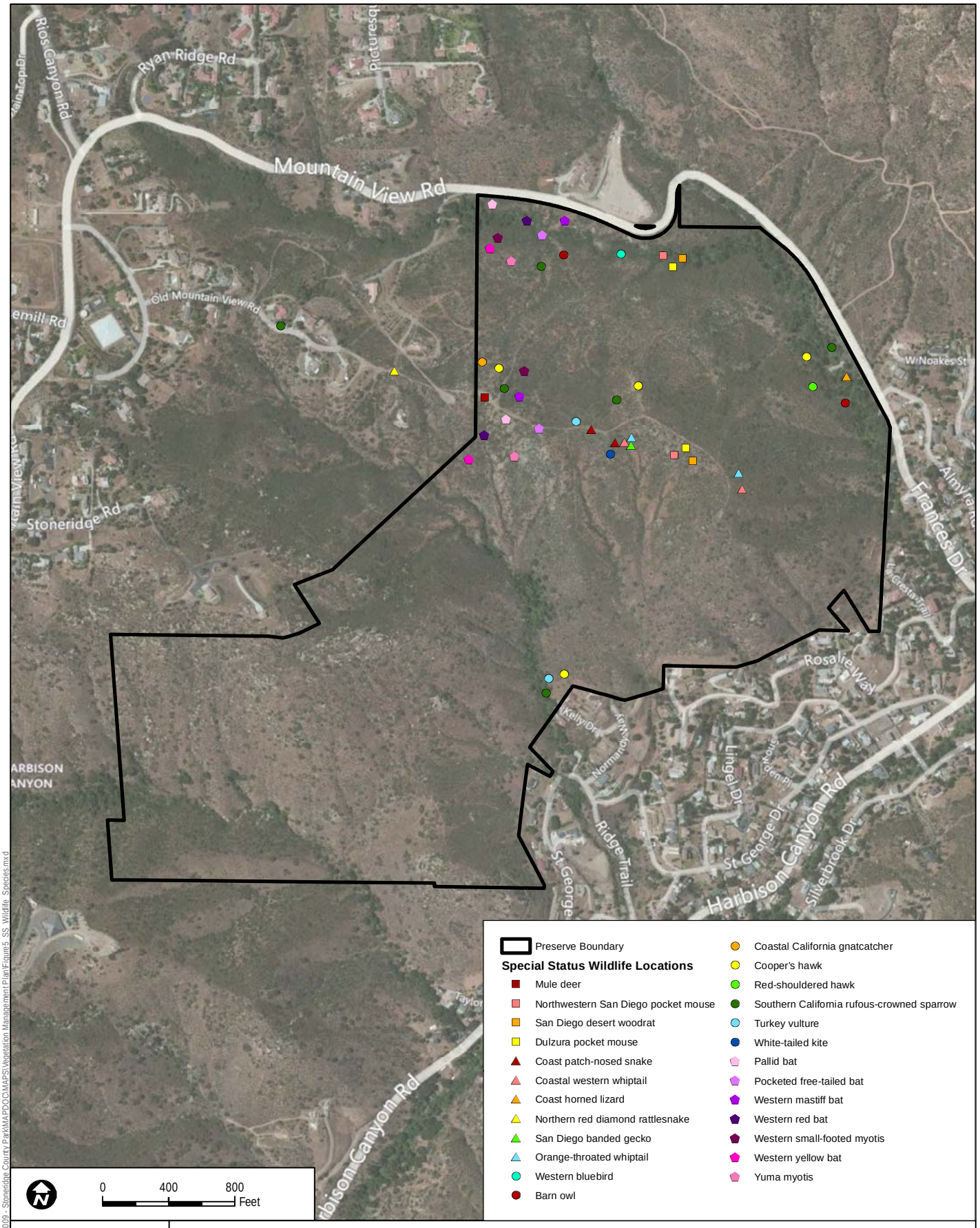

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FIGURE 5

Special Status Wildlife Locations

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Stoneridge Preserve - Vegetation Management Plan

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2.2 Cultural Resources

One cultural site was recorded during the 2012 survey of the Preserve (ASM 2012; Table 4). This resource consists of a concrete dam and associated metal pipes and drains. ASM determined that the date of construction was between 1968 and 1971, and therefore the dam does not meet significance thresholds for age under the National Register of Historic Places (NRHP) and the California Register of Historic Places (CRHR). This structure also does not meet thresholds for significance based on historical or architectural importance. This cultural resource is discussed in greater detail in the Archaeological Survey Report for the Stoneridge Preserve, San Diego County, California (ASM 2012) including the location.

Table 4
Preserve Cultural Sites

Primary or Trinomial Site No.	Description	Significance Evaluation
CA-SDI-20,695 (P-37-032657)	Concrete dam, and associated metal pipes, drains	Important resource under County guidelines. Not eligible to the California Register of Historical Resources (CRHR) or Local Register. Not significant under County Resource Protection Ordinance (RPO).

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3.0 INVASIVE SPECIES MANAGEMENT

In 2012 invasive non-native plant species were surveyed and mapped within the Preserve (Dudek 2012a). Because invasive non-native plant species can have significant impacts on native plant associations, ecosystem processes, and biodiversity, special management measures are needed for their removal and control. Invasive non-native plants have few ecological controls on their population sizes, and they tend to thrive under disturbed conditions. They often exhibit aggressive growth, out-compete or otherwise harm sensitive species, and can alter natural fire regimes by increasing the frequency and intensity of wildfire (Bell 2009).

During the mapping efforts in 2012, the focus was to map species with the greatest potential to invade native habitats, such as those listed on the California Invasive Plant Council's (Cal-IPC) California Invasive Plant Inventory (2012a) with a rating of moderate or high (e.g., crimson fountaingrass (*Pennisetum setaceum*)), or species that may not be rated as moderate or high, but are considered to have a localized potential for habitat invasion (e.g., river red gum (*Eucalyptus camaldulensis*)). An attempt was made to count or estimate the quantity of individuals at each location to facilitate control efforts. However, populations of many of the mapped invasive plant species, particularly annual species, can fluctuate dramatically from season to season depending on rainfall. Therefore, the mapped quantities of invasive plants should only be considered an indication of the presence and relative abundance of the species.

Ubiquitous species scattered across the Preserve that pose limited potential for invasion into established habitats and that would be impractical to control on an individual basis (e.g., brome grasses (*Bromus* spp.), filaree (*Erodium* spp.)) were not mapped as individual occurrences; however, their presence was noted as components of non-native grasslands or disturbed habitats. Non-native grasslands are considered sensitive under the County's MSCP due to their ability to provide raptor foraging habitat, as well as the potential to support special status native plant species. However, some of the species often associated with the non-native grasslands on site (e.g., Maltese star thistle), were noted for control where they were particularly abundant, or in areas where they are invading into native coastal scrub and chaparral communities and are not directly associated with non-native grasslands.

Of the non-native plant species identified during botanical surveys (Dudek 2012b), 18 invasive non-native plant species were mapped and targeted for control, including both perennial and annual species. Table 5 lists the mapped invasive non-native plant species and their associated Cal-IPC Inventory rating; locations are shown on Figure 6.

Table 5
Invasive Non-native Plant Species Mapped at Stoneridge Preserve

Common Name[1]	Scientific Name	Cal-IPC Rating[2]
Rose Natal grass	*Melinis repens* ssp. *repens*	None
Red river gum	*Eucalyptus camaldulensis*	Limited
Canary Island date palm	*Phoenix canariensis*	Limited
Peruvian peppertree	*Schinus molle*	Limited
Silver wattle	*Acacia dealbata*	Moderate
Tree of heaven	*Ailanthus altissima*	Moderate
Slender oat	*Avena barbata*	Moderate
Black mustard	*Brassica nigra*	Moderate
Italian plumeless thistle	*Carduus pycnocephalus* ssp. *pycnocephalus*	Moderate
Maltese star thistle	*Centaurea melitensis*	Moderate
Bull thistle	*Cirsium vulgare*	Moderate
Crown daisy	*Glebionis* [=*Chrysanthemum*] *coronaria*	Moderate
Shortpod mustard	*Hirschfeldia incana*	Moderate
Tree tobacco	*Nicotiana glauca*	Moderate
Crimson fountaingrass	*Pennisetum setaceum*	Moderate
Washington fan palm	*Washingtonia robusta*	Moderate
Pampas grass	*Cortaderia selloana*	High
Saltcedar	*Tamarix ramosissima*	High

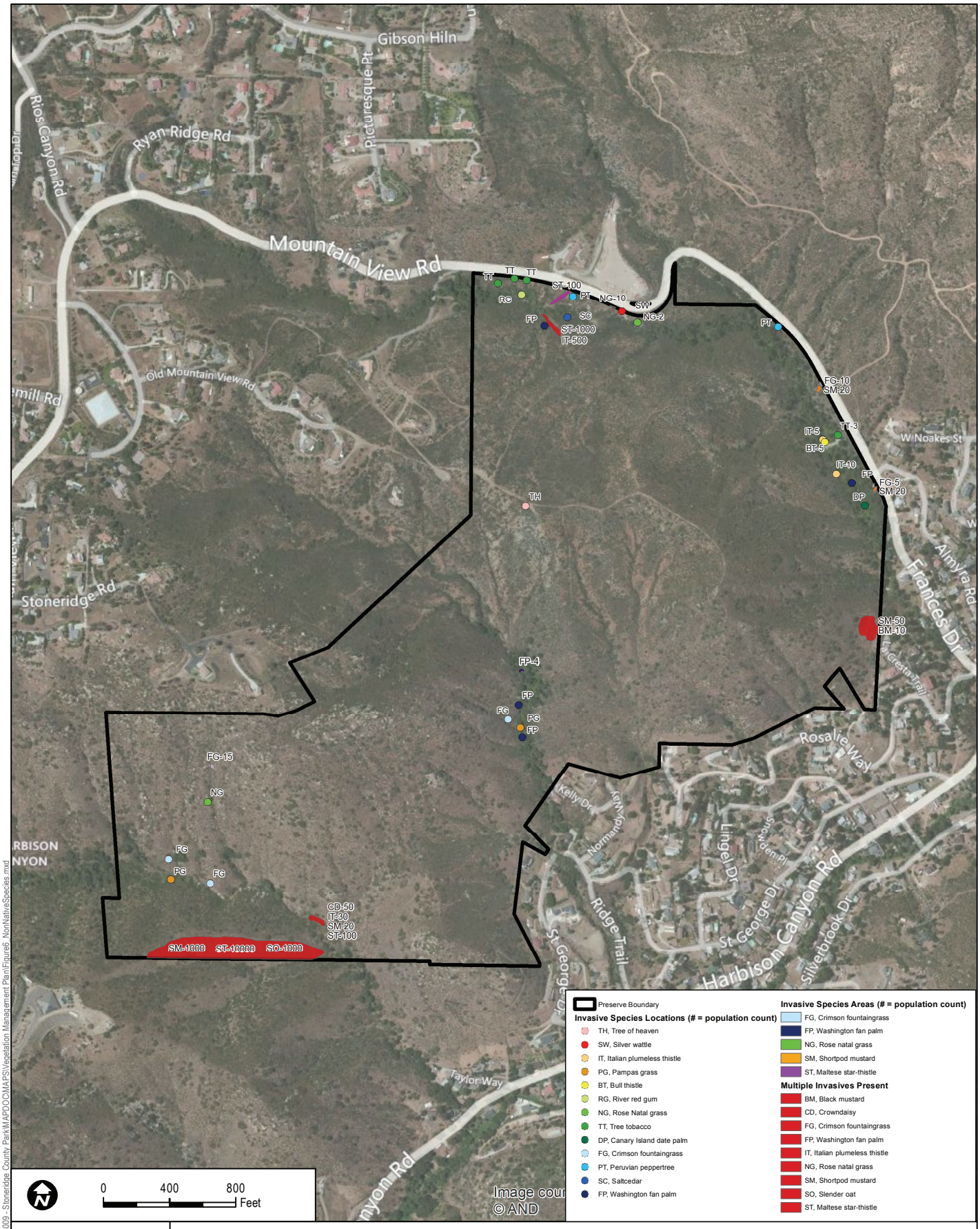
[1]**Source:** Cal-IPC Database, updated April 2012. Overall rating listed for southwest region, factoring impact, invasiveness, distribution, and documentation level.

Cal-IPC Rating Categories

High: Species have severe ecological impacts, are conducive to moderate to high rates of dispersal/establishment, and most are widely spread.

Moderate: Species have substantial and apparent, but generally not severe, ecological impacts, are conducive to moderate to high rates of dispersal, although establishment is generally dependent on ecological disturbance, and distribution may range from limited to widespread.

Limited: Species are invasive, but their ecological impacts are minor on a statewide level (or there was not enough information to justify a higher score); they have low to moderate rates of invasiveness and are generally limited, but may be locally persistent and problematic.



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SOURCE: Bing

FIGURE 6

Invasive Plant Species Locations

Stoneridge Preserve - Vegetation Management Plan

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3.1 Target Invasive Non-native Plant Species

Twenty-nine invasive non-native plant species were identified within the Preserve and 18 of those species have been identified and mapped as target species in need of treatment (Table 6). Species ranked as high priority are recommended for control as soon as possible; species ranked as moderate priority are recommended for control as soon as high-priority species are under control; and species ranked as low priority are recommended for control after high and moderate priority species are under control.

Table 6
Removal Priority of Target Invasive Non-native Plant Species

Common Name	Scientific Name	Removal Priority
Pampas grass	*Cortaderia selloana*	High
Red river gum	*Eucalyptus camaldulensis*	High
Canary Island date palm	*Phoenix canariensis*	High
Saltcedar	*Tamarix ramosissima*	High
Washington fan palm	*Washingtonia robusta*	High
Tree of heaven	*Ailanthus altissima*	Moderate
Rose Natal grass	*Melinis repens* ssp. *repens*	Moderate
Tree tobacco	*Nicotiana glauca*	Moderate
Crimson fountain grass	*Pennisetum setaceum*	Moderate
Peruvian peppertree	*Schinus molle*	Moderate
Silver wattle	*Acacia dealbata*	Low
Slender oat	*Avena barbata*	Low
Black mustard	*Brassica nigra*	Low
Italian plumeless thistle	*Carduus pycnocephalus* ssp. *pycnocephalus*	Low
Maltese star thistle	*Centaurea melitensis*	Low
Bull thistle	*Cirsium vulgare*	Low
Crown daisy	*Glebionis [=Chrysanthemum] coronaria*	Low
Shortpod mustard	*Hirschfeldia incana*	Low

Species with a high priority for removal are those species generally found within the riparian corridors of the Preserve, including pampas grass, red river gum (eucalyptus), Canary Island date palm, Washington fan palm, and saltcedar. Descriptions of these high priority species and suggested treatment options are discussed below. Species ranked as moderate and low priority for removal are discussed in Appendix B.

Remaining invasive non-native plant species, such as bromes or filaree, are not prioritized for removal, but should be included as species to monitor and control as components of general habitat management. These species are generally spread throughout the Preserve and

management for these species would most likely not be cost-effective or successful. However, some methods, such as periodic controlled burns (e.g., every 10–20 years) (Ainsworth and Alan 1995), may help control invasive non-native plant species and make habitat more suitable for sensitive plant and animal species.

3.1.1 High Priority Species for Removal

Pampas Grass (*Cortaderia selloana*)

Pampas grass is a large, clumping grass, about 6–8 feet (1.8–2.4 meters) tall. It is an aggressive spreading, ornamental species that produces significant amounts of biomass, which is extremely flammable, thus increasing the potential for fire ignition and/or spread. This species produces an abundance of seed, which is light, and can be windblown into the surrounding areas (CalIPC 2012a). The Cal-IPC inventory categorizes pampas grass as having an overall rating of "high," and it is ranked as a high priority for removal/control within the Preserve because of its ability to spread rapidly and contribute to the spread of wildfire. Two individuals were mapped within the central and southern riparian corridors (Figure 6). Removal of pampas grass involves either hand digging or pulling/winching plants out of the ground. If complete removal of the plant is not feasible, it may treated with an herbicide to control. Herbicide application can occur as a foliar application, or the plants can be cut to near the ground surface and treated with an appropriate systemic herbicide (e.g., glyphosate). Treatment is recommended to occur prior to seed-set (blooms September to March), and if viable seed is present at the time of treatment, plumes should be carefully cut and bagged to prevent seed spread. Fall applications of herbicide for treatment results in better control compared to summer applications (Bossard 2000).

River Red Gum (*Eucalyptus camaldulensis*)

The Cal-IPC inventory categorizes river red gum eucalyptus species as having an overall rating of "limited." One individual was mapped within the riparian corridor on the northern boundary of the Preserve (Figure 6). Eucalyptus is ranked as a high priority for removal/control in the Preserve because of its tendency to displace native vegetation communities and spread into new areas, particularly along riparian corridors. In addition, this species is of concern for fire hazard since its physical characteristics (resin content) can increase fire intensity, transition ground fire to crown fires, and propagate spot fires through the dislodging of canopy material during windy conditions. The best treatment for eucalyptus control is through mechanical removal and herbicidal treatments (Bossard 2000). Treatment can occur any time of year, but best results have been achieved when cutting occurs in fall (Bossard 2000). Eucalyptus trees may be cut and treated with the appropriate systemic herbicide (e.g., triclopyr, imazapyr or Glyphosate), or trees may be removed with the use of girdling and herbicidal treatment. Herbicides should be applied

to the cambium layer within the first 1 to 2 minutes following cutting. Follow-up herbicidal treatment may be necessary since sucker growth may occur. Small saplings or seedlings can be removed by manually removing from the soil by hand pulling.

Canary Island Date Palm (*Phoenix canariensis*)

Canary Island date palm is a species of palm tree commonly used for landscaping in Southern California which has the potential to establish in riparian areas and displace native trees. It is slow growing, and establishes exclusively from seed. The Cal-IPC inventory categorizes Canary Island date palm as having an overall rating of "limited." This species is ranked as a high priority for removal/control within the Preserve because of its tendency to spread in riparian areas and displace native vegetation. Within the Preserve, one individual was mapped within the riparian corridor along the eastern border (Figure 6). Control for this species can occur any time of year and may include mechanical removal and treatment of the stump with an appropriate systemic herbicide. Alternatively, the palm may be drilled, injected with an appropriate systemic herbicide (e.g., glyphosate), and left in place to die if physical removal is not desired. Complete mechanical removal would be preferable from a fire management perspective, as this would reduce the available deadwood fuel load present.

Saltcedar (*Tamarix ramosissima*)

Saltcedar is a shrub or tree typically found along waterways, drainages, and riparian areas. It is associated with dramatic changes in geomorphology, groundwater availability, soil chemistry, fire frequency, plant community composition, and native wildlife diversity. Saltcedar presents the greatest risk of reducing habitat quality within riparian areas and vegetated ephemeral drainages, which are limited in presence within the Preserve (CalIPC 2012a). Within the Preserve, one individual was mapped within the northern riparian corridor (Figure 6). The Cal-IPC inventory categorizes saltcedar as having an overall rating of "high." It is ranked as high priority for control due to its ability to spread rapidly and displace native habitat. Because saltcedar can become a large shrub or tree, it can be difficult to control manually. Therefore, large shrubs or trees may need to be removed mechanically. Within the Preserve, all individuals observed were small shrubs. Application of an appropriate systemic herbicide (e.g., triclopyr or glyphosate) is recommended to control the species since root fragments can regenerate. Cut and daub treatment is likely the most effective means of control. Foliar applications of herbicide achieve the best results when applied in late spring to early fall (Bossard 2000).

Washington Fan Palm (*Washingtonia robusta*)

Washington fan palm is a species of palm tree commonly used for landscaping, which has become invasive in riparian areas, orchards, and landscaped areas. It is known to create monotypic stands in riparian areas, and dead fronds of the tree can create a fire hazard. It can spread into native vegetation communities through seeds being washed downstream in drainages or birds dispersing seeds into areas with sufficient soil moisture for the palm to germinate and establish. The Cal-IPC inventory categorizes Washington fan palm as having an overall rating of "moderate" and designates it as an Alert species, indicating it has significant potential to invade new ecosystems. This species is ranked as high priority for removal/control within the Preserve due to its potential for additional colonization within the riparian corridor. Four individuals of this species were mapped in the northern and central riparian corridors within the Preserve (Figure 6). Control for this tree species can occur any time of year, and may include mechanical removal of the tree and treatment of the stump with an appropriate systemic herbicide (e.g., glyphosate). Alternatively, the palms may be drilled, injected with an appropriate systemic herbicide, and left in place to die if removal is not desired. Complete removal of the trees would be preferable from a fire management perspective since this would reduce the available deadwood fuel load present.

3.2 Removal Methods

The selection of the appropriate removal methodology should be determined with consideration of many variables, including the time of year, severity of infestation, the presence of sensitive plants and wildlife, the degree of intermixing of invasive species with sensitive native habitats, access, and proximity to surface water. General recommendations for the Preserve are provided below.

3.2.1 Manual Removal

Manual vegetation removal (e.g., hand pulling, grubbing, and hoeing) is a low-impact method of controlling invasive non-native plant species within a focused area. Due to the perennial nature of many of the target invasive plant species, their large size, and/or difficulty of control, manual vegetation control is primarily applicable to the smaller, annual species within the Preserve. Appropriate applications for manual removal are for small occurrences of annual weeds and seedlings of perennial species when complete removal of the root system is possible. More mature perennial plants will limit the ability for manual removal based on their size and root mass. Manual removal should be incorporated where herbicide application alone is inadequate, or where proximity of sensitive plant species prevents safe application (e.g., overspray or drifting of herbicides). All removed invasive non-native plant material that is feasible (portions of trees may be too large to remove without significant effort or impact) should be disposed of in a

manner that does not promote spread or infestation of the species into new areas of the Preserve. If the plant material cannot be contained on site to decompose without regenerating, it should be disposed of outside of the Preserve at a green waste facility or landfill.

3.2.2 Mechanical Removal

Mechanical removal may be necessary for control of some larger target invasive non-native plant species, such as eucalyptus, pampas grass, and saltcedar, and is recommended to be combined with herbicide application. Cutting and removal of the aboveground plant material can be conducted with chainsaws and/or hand saws. The resulting material should be chipped and hauled off site. Subsequent application of herbicides should follow product guidelines for safe transport, storage, and application. Stumps remaining on site after cutting and herbicide application are not recommended for removal or grinding, but should be left to decompose in place.

3.2.3 Herbicides

The application of herbicides to control target invasive non-native plant species may be used on its own or as a secondary treatment following manual or mechanical removal for controlling sprout growth and regeneration. Herbicide application is recommended following removal of all target invasive tree species and other perennial species with the ability to regenerate from root fragments when removal of all plant material is not feasible. Herbicide use should be limited to localized applications rather than foliar applications to eliminate the possibility of drift and impacts to neighboring desirable species. A wide range of herbicides are available for such types of treatment. Systemic herbicides (as opposed to contact herbicides) are likely the most effective for control of invasive non-native plant species due to their ability to spread via translocation into root tissue. Herbicide labels and material safety data sheets (MSDS) list susceptible target plant species and provide proper direction in the use and handling of the products. Herbicides should be applied in accordance with state and federal laws.

3.2.4 Cut and Daub

Cut and daub treatment is recommended for larger invasive plants to control regrowth and kill the portion of the plant remaining belowground. Cut and daub involves the cutting of invasive plant stalks or trunks and then the direct application of an appropriate systemic herbicide directly to the cambium layer of the freshly cut stump. Other related methods include drill and fill where holes are drilled into the trunk of a tree and herbicide is injected. It is critical that the herbicide treatment occur immediately after the plants are severed so that the herbicide is carried into the plant tissue. If enough time elapses to allow the cut surface of the severed plant to dry out, a fresh cut should be made prior to herbicide application.

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4.0 HABITAT RESTORATION

The goal of habitat restoration is to reestablish or enhance the biological functions and values of vegetation communities that have been degraded by either human or natural causes. Restoration methods range from active revegetation (involving soil preparation and planting), to passive management (involving weed control and allowing time for natural recruitment to occur). Active restoration may assist the recovery of an area that has been disturbed and is showing difficulty in recovering. Any proposed restoration activity should utilize current, accepted techniques, avoid/minimize impacts to sensitive species or native vegetation communities, and should use only local native species. The purpose of restoration is to reclaim native vegetation community acreage lost or compromised due to human or other induced disturbance involving the clearing or grading of native vegetation. Restoring disturbed areas will provide an overall increase of acreage of native vegetation, connectivity of existing native vegetation, and erosion control in areas of disturbance. Restoration of degraded areas is important to the integrity of the surrounding vegetation communities, as cleared areas can provide opportunity for non-native species to colonize (many non-native annuals are flashy fuels that can increase fire danger), provide opportunity for erosion by exposing the soil surface, reduce acreage of native vegetation communities, and sever connectivity among vegetation communities.

4.1 Proposed Restoration Areas

The Preserve is composed of high-quality native vegetation communities. No specific habitat restoration opportunities were identified within the Preserve. There are a few areas where invasive non-native plant species are abundant, and control efforts could be coupled with passive or active restoration. However, disturbance is minimal in the Preserve, and invasive non-native plant species control could be conducted without the need to implement a targeted restoration effort. The native plant components of the identified areas supporting substantial components of non-native species will benefit from control efforts, and planting and seeding would not be necessary. However, if habitat restoration opportunities arise as a result of future disturbance or as accompanied by invasive non-native plant species control, general guidelines are provided herein.

4.2 Restoration Methods

Two methods of restoration are available when habitat restoration opportunities arise within the Preserve: (1) passive restoration, and (2) active restoration. These methods are described in greater detail below.

4.2.1 Passive Restoration

Passive restoration involves performing weed control in disturbed areas where natural recruitment of native plant species is actively occurring. The weed control activities may be

accompanied by some erosion control efforts, but directed planting and seeding is not necessary because the areas would be expected to reestablish naturally over time. Passive restoration would be appropriate for areas where invasive non-native plant control is targeted within the Preserve. Passive restoration areas may require multiple years of weed control to minimize competition from weeds and encourage reestablishment of the native community. Should natural recruitment slow or stop over time, and it appears that the area will not recover without intervention, seed application and/or container plants could be incorporated, as described in the following section.

4.2.2 Active Restoration

Active restoration involves soil preparation and planting of disturbed or degraded areas where native vegetation recruitment is not actively occurring, and/or significant soil/vegetation disturbance is required in preparation for revegetation (such as extensive invasive non-native plant control or grading). These areas may have been previously cleared and are not showing significant natural recruitment of native plant species, and/or may be degraded from erosion. These areas may require site preparation prior to planting by recontouring to approximate the natural gradient expected at the site. In general, unless the topsoil has been removed from the site, fertilizer is not recommended since this can favor establishment of faster growing, annual non-native weeds. Appropriate erosion-control measures should be installed after site preparation activities to limit erosion and soil loss during the establishment period.

Upon completion of site-preparation activities, native seed and container plants could be installed. Plant materials should be native species from San Diego County and planting palettes should be composed of species that are representative of the target vegetation community. Plant quantities, rates, and composition should be determined on an individual basis, based on the existing plant composition around the restoration sites.

Because of the limited access into the Preserve and the steep and rugged terrain, it is unlikely that a temporary irrigation system would be practical. Therefore, restoration should prioritize seed application over container plant installation. Seed application should occur prior to the onset of the winter rainy season to take advantage of the full growing season. An example of an effective seed application technique would be to clear weedy vegetation and thatch from the soil surface, hand broadcast seed, rake seed into the soil, and cover with a fine mulch seed topper at approximately 1/4-inch depth. The fine mulch seed topper will help protect the seed from getting eaten by birds and rodents, and also helps keep the soil moist during the rainy season.

Weed control should be performed regularly for the first few years to allow new to establish and transition the area to its intended native vegetation community.

5.0 FIRE MANAGEMENT

5.1 Current Fire Management Practices

There are no current fire management practices in place for the Preserve. Based on the location and terrain of the Preserve, vehicular access is limited primarily to public roads adjacent to portions of the Preserve perimeter. Vehicular access is very limited within the interior of the Preserve, except a dirt road extending eastward from the end of Old Mountain View Road.

5.2 Fire Environment

Several factors comprise the fire environment. Fires can occur in any environment where conditions are conducive to ignition and fire movement. The three major components of fire environment are climate, topography, and vegetation/fuels. The state of each of these components and their interaction with each other determine the potential characteristics and behavior of a fire at any given moment. Understanding these existing conditions is necessary to understanding the potential for fire within and around the Preserve.

Wildfires are a regular and natural occurrence in most of Southern California. However, increasing numbers of fires and acres burned annually has been experienced over the last decade. These wildfires are mostly human-caused, suggesting that the historic fire interval has been artificially affected across large areas. In addition, wildfire suppression efforts over the last several decades may have aided in the accumulation of fuels in some natural communities (Minnich 1983; Minnich and Chou 1997) resulting in larger and more intense wildfires. Large wildfires have had, and will continue to have, a substantial and recurring role in native California landscapes (Keeley and Fotheringham 2003), in part because (1) native landscapes become highly flammable each fall, (2) the climate in the region has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with Santa Ana winds occurring during autumn after a 6-month drought period each year, and (3) ignitions via anthropogenic sources have increased or are increasing in many wildland or WUI areas.

Based on available information and an understanding of the fire environment of the region, it is expected that large wildfires will occur again and will burn within the Preserve. In addition, the Preserve is located within a Very High Fire Hazard Severity Zone (FRAP 2012). This is the most dangerous rating. The Very High Fire Hazard rating is based on a combination of relevant factors of fuel/vegetation, terrain and climate/weather. The Fire Hazard Severity Zones were created by the Fire and Range Assessment program of CAL FIRE (CAL FIRE 2011) per State of California Public Resources Code, Sections 4201-4204.

5.2.1 Climate

As with most of Southern California, the regional climate in the vicinity of the Preserve is influenced by the Pacific Ocean and is frequently under the influence of a seasonal, migratory, subtropical high-pressure cell known as the Pacific High (WRCC 2012a). Wet winters and dry summers with mild seasonal changes generally characterize the Southern California climate. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, easterly Santa Ana winds (WRCC 2012a).

Additionally, the local vegetation and the seasonal drying produce climatic conditions that result in fuel-driven wildfires and fire-associated climatic changes. This type of condition is referred to as a plume-dominated wildfire. Plume-dominated wildfires are fires where the energy produced by the fire in conjunction with atmospheric instability creates significant convective forces and increased winds. Such fires are extremely unpredictable, spread in various directions simultaneously, and exhibit extreme fire behavior. These fires are extremely dangerous and are often large in size.

However, there is some local variance in the typical Southern California climate. The influence of the Pacific Ocean is lessened due to the inland location of the Preserve. As such, temperatures are subject to much more variability on a daily and seasonal basis. The average high temperature calculated from October 1952 to June 2012 for the surrounding Alpine area is approximately 76.4º Fahrenheit (F), with higher temperatures in summer and early fall (June through September) reaching up to an average of 88°F (WRCC 2012b). Average minimum cooler temperatures for the same time period is approximately 42°F for winter months. The mean annual precipitation for the area is 16.15 inches, with the most rainfall concentrated in the months of January (2.91 inches), February (3.18 inches), and March (2.97 inches) (WRCC 2012b). Less rainfall occurs during summer months, and is typically less than one inch (WRCC 2012b). In Alpine, the 2011–2012 season (July through June) cataloged 16.29 inches of rain while the 2010–2011 season cataloged 22.86 inches of rain (WRCC 2012b).

The prevailing wind pattern is from the west, but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are typically from the west–southwest (sea), and at night, winds are from the northeast (land). During the summer season, the diurnal winds can be slightly stronger than the winds during the winter season due to greater pressure gradient forces. Surface winds can also be influenced locally by topography and slope variations. On the Preserve, the varied topography may affect wind velocity and patterns. The highest wind velocities are typically associated with downslope, canyon, and Santa Ana winds.

The fire season in Southern California typically starts in June, as vegetation begins to dry out after winter and spring rains, and typically ends in October, although fire weather may be present year-round (Schroeder and Buck 1970). The highest fire danger for this area coincides with the Santa Ana winds. Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis during late summer and early fall. They are dry, warm winds that flow from the higher desert elevations in the north through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors.

General weather conditions for the region were derived from the Poway Valley weather station[1]. Additional weather variables were analyzed to determine extreme fire weather conditions, as outlined in the guidelines and standards presented by the County of San Diego, Department of Planning and Development Services. Specifically, Peak and Summer wind and fuel moisture conditions were evaluated and used in the fire behavior modeling efforts conducted for the Preserve.

5.2.2 Topography

The topography of the Preserve includes moderate to steep slopes with elevation ranges from approximately 870 to 1,515 feet amsl. Two primary peaks characterize the Preserve, one located in the northeast portion and the other in the southwest portion. Several drainages are also present on the Preserve and include one at the southern edge, one in the central portion, and one along the northern edge. Each of these drainages flow eastward toward Harbison Canyon, which is situated outside of the Preserve to the southeast. The drainages on the Preserve contain slopes with gradients reaching up to 75% (approximately 35°) in some areas. Topographic features that may present a fire spread facilitator are the narrow drainages and sub-drainages which may serve to funnel winds, thus increasing their velocity and potential for influencing extreme fire behavior. From a regional perspective, the alignment of adjacent Harbison Canyon to the southeast is conducive to channeling and funneling wind, thereby increasing the potential for more extreme wildfire behavior in the region.

5.2.3 Watershed Description

The Preserve is entirely within the Sweetwater Watershed. The northern region of the Preserve generally drains southwest through a riparian corridor along the northern and northeastern border. The central region of the Preserve drains through a smaller canyon, and the southwest region of the Preserve drains through a third canyon. These three drainages converge at Harbison Canyon and flow into the Sweetwater River. The Sweetwater River flows southwest from the Preserve to the San Diego Bay in Chula Vista, California

[1] The Poway Valley station is located in Poway, approximately 7.5 miles north of the Preserve. The following summarizes the location and available data ranges for the Poway Valley weather station: Latitude 33.017, Longitude –117.033, Elevation: 650 feet, Data years 1893 to 2012.

5.2.4 Fire History

Fire history is an important component in understanding fire frequency, fire type, significant ignition sources, and vulnerable areas. The topography, vegetation, and climatic conditions associated with the Preserve combine to create a unique situation capable of supporting large-scale, high-intensity wildfires, such as the Cedar Fire in 2003. The history of wildfires on the Preserve is graphically portrayed in Figure 7.

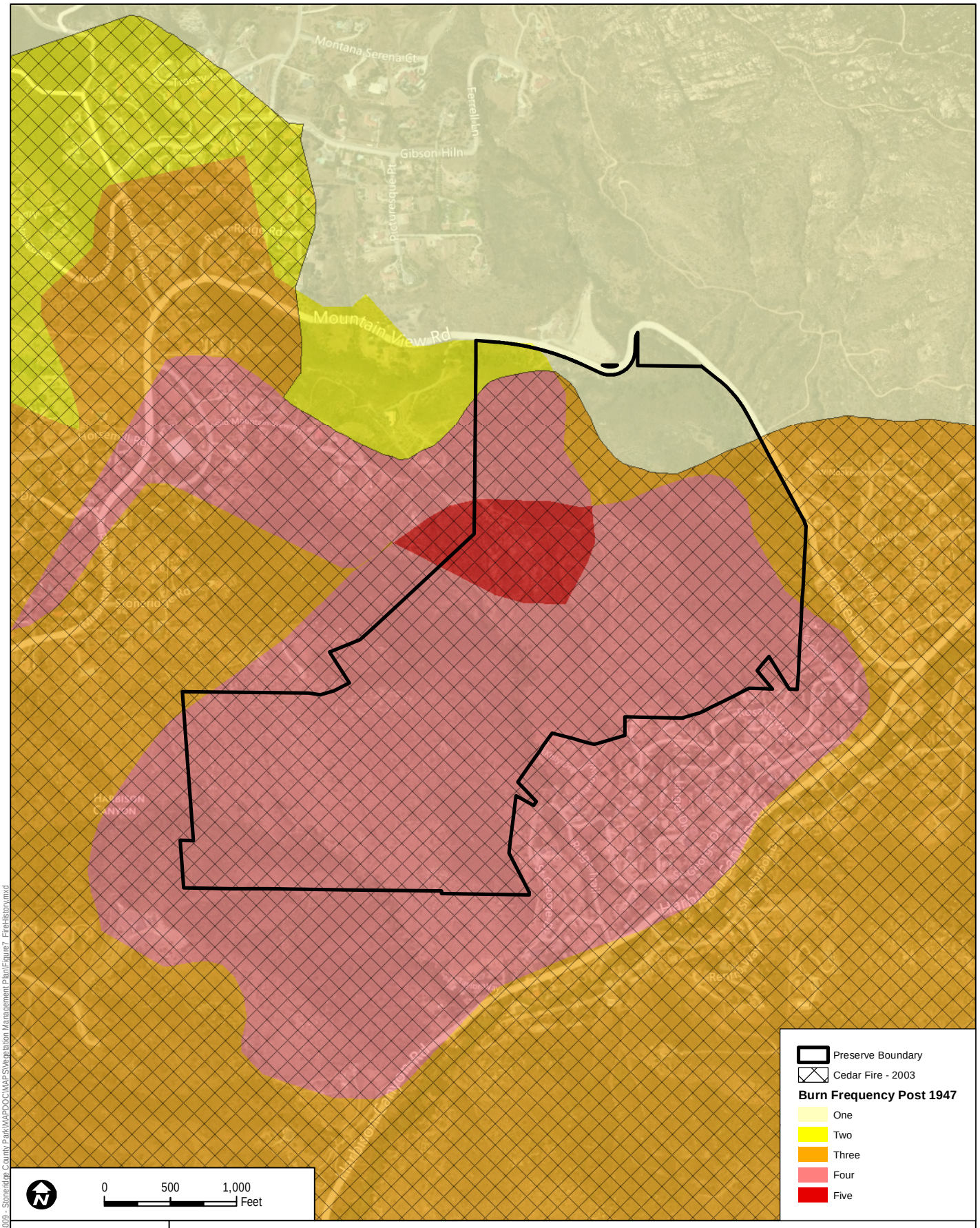
Based on historical fire perimeter data (FRAP 2012)[2], all of the Preserve has burned at least once during the recorded data period, with fires occurring in 1947, 1965, 1967, 1970, and 2003. Some areas of the Preserve have burned as many as five times over the course of the recorded fire history. Table 7 presents the quantity of times the Preserve has burned by land area (acreage).

Table 7
Quantity of Times Burned for the Stoneridge Preserve

Quantity of Times Burned	Acreage	Percentage
1	19.66	8.0%
2	2.95	1.2%
3	16.33	6.6%
4	192.27	77.9%
5	15.52	6.3%
Total	**246.73**	**100.0%**

Source: FRAP 2012

[2] Based on polygon geographic information system (GIS) data from CAL FIRE's Fire and Resource Assessment Program (FRAP), which includes data from CAL FIRE, U.S. Department of Agriculture Forest Service Region 5, Bureau of Land Management (BLM), National Park Service, contract counties and other agencies. The data set is a comprehensive fire perimeter GIS layer for public and private lands throughout the state and covers fires 10 acres and greater between 1878 and 2011.



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SOURCE: Bing, SanGIS 2012

FIGURE 7

Fire History

Stoneridge Preserve - Vegetation Management Plan

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Based on an analysis of this fire history data set, specifically the years in which the fires burned, the average interval between wildfires on the Preserve was calculated at 14 years with intervals ranging between 2 and 33 years. Based on this analysis, it is expected that the Stoneridge Preserve would be subject to wildfire occurrence every 14 years, with the realistic possibility of shorter interval occurrences. Table 8 presents fire history and fire return interval data for the Preserve.

Table 8
Fire History and Return Intervals for the Stoneridge Preserve

Fire Year	Fire Name	Interval (years)	Acreage Burned on Preserve	Percent of Preserve Burned*
1947	Unnamed Fire	N/A	224.11	90.8%
1965	Suncrest Fire	18	34.21	13.9%
1967	Harbison Canyon Fire	2	192.05	77.9%
1970	Laguna Fire	3	246.73	100.0%
2003	Cedar Fire	33	224.11	90.8%

Source: FRAP 2012
*Based on total Preserve acreage of 246.44

Based on an analysis of the fire history, vegetation age classes on the Preserve are fairly consistent across the site due to the extent of burning in 2003. Specifically, nearly 91% of the vegetation on the Preserve is 9 years old, recovering from burning during the Cedar Fire in 2003. The remaining vegetation (approximately 23 acres), located in the northernmost portion of the Preserve, last burned in the 1970 Laguna Fire, resulting in 42-year-old vegetation. While younger vegetation is generally considered less susceptible to fire than the older vegetation, all vegetation is capable of igniting and carrying fire, especially during extreme weather (Red Flag Warning Conditions), and over time, the younger age vegetation will become more susceptible to fire ignition and spread.

5.2.5 Vegetation Dynamics and Fuel Loads

Utilizing site vegetation maps, field evaluations were conducted to evaluate fuel loading and classify vegetation types into fuel models (Anderson 1982; Scott and Burgan 2005; Weise and Regelbrugge 1997). Fuel model assignments are presented in Table 9 by vegetation type and are graphically presented in Figure 8. Certain vegetation types increase fire hazard based on plant physiology (resin content), biological function (flowering, retention of dead plant material), and/or physical structure (leaf size, branching patterns). Chaparral and sage scrub communities typically contain plant species which exhibit these attributes.

In addition, invasive non-native plants can increase the frequency of fires by providing more continuous fuels that are more easily ignited (Brooks et al. 2004). Invasive plants also present hazards when located adjacent to neighboring structures or within fuel modification zones that

are meant to provide defensible space. Non-native invasive plant species of the greatest concern within the Preserve include saltcedar, pampas grass, Canary Island Date Palm, Washington Fan Palm and river red gum (eucalyptus) (Figure 6).

Table 9
Vegetation Communities and Associated Fuel Models for Stoneridge Preserve

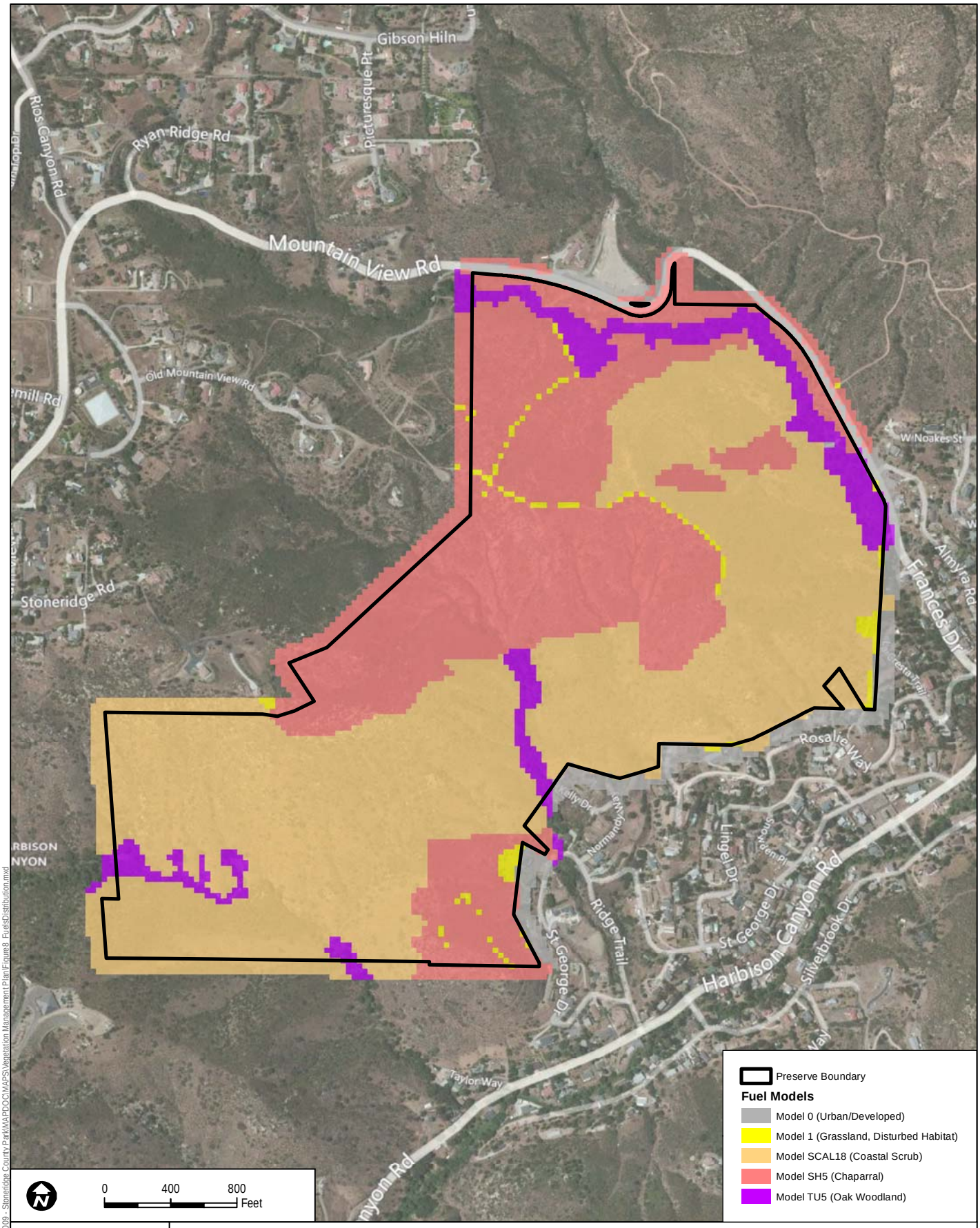
Vegetation Community/Land Cover[1]	Fuel Model	Acres	Percentage
Coast Live Oak Woodland	TU5	15.98	6.5%
Coastal Sage–Chaparral Transition	SH5	46.51	18.9%
Southern Mixed Chaparral	SH5	40.44	16.4%
Diegan Coastal Sage Scrub	SCAL18	140.28	56.9%
Non-Native Grassland	1	0.04	0.0%
Disturbed Habitat	1	3.12	1.3%
Urban/Developed	0	0.35	0.1%
	Total	**246.73**	**100.0%**

[1] Holland Code

Vegetation Dynamics

Vegetation plays a significant role in fire behavior and is an important component of the fire behavior models discussed in this report. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes affect plant community succession, or the natural sequential replacement of vegetation types over time. Succession of plant communities, most notably the gradual conversion of shrublands to grasslands in areas with high fire frequencies and short intervals between fires, and grasslands to shrublands in areas with fire exclusion or long fire-free periods, is highly dependent on fire characteristics, including intensity, duration, and return interval. Additionally, encroachment of invasive non-native plant species from residential landscaping and Mountain View Road into wildland areas is already occurring and is expected to continue based on the proximity of ornamental landscaping to open space. Consequently, establishment and maintenance of fuel treatment areas, is needed to maintain reduced hazard conditions.

Biomass and associated fuel loading will increase over time, assuming that disturbance or fuel reduction efforts are not realized. Depending on factors such as fire exclusion activities, mechanical treatments, and prescribed burning, among others, the current vegetation composition and density will continue to change, either through increased volume and the establishment of non-native species or the continued degradation of scrublands and persistence of annual grasses.



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SOURCE: Bing, SanGIS 2012

FIGURE 8

Fuel Distribution

Stoneridge Preserve - Vegetation Management Plan

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The Preserve is dominated by sage scrub (approximately 57%) and chaparral vegetation communities (approximately 16%), including a coastal sage-chaparral transition community (approximately 19%). Woodland habitat is present on site at lower elevations and concentrated within the three drainages on site. Grassland habitat is minimal on site (> 0.1 acre) and is found in the northeast corner of the Preserve. It should be noted that chaparral and sage are not susceptible to annual burning, but grass cover can burn yearly (Minnich and Scott 2005). Lack of disturbance such as fire will, over time, allow shrub cover to establish in areas currently dominated by grass cover. Shrub cover, although less likely to burn in the first 20 years during typical weather conditions, will burn under extreme fire events (Moritz 2003). Once established, the shrub cover will increase in volume, and following approximately 20 years, the hazard will increase corresponding with fuel age (Keeley 2005; Moritz et al. 2004). Additionally, as previously mentioned, encroachment of invasive non-native plants into open space areas is likely based on the proximity of ornamental landscaping to undeveloped open space land, in many cases increasing the fuel load and likelihood for higher intensity fire.

Changes in the chaparral, scrub, and woodland types will also occur with the lack of disturbance. Chaparral and sage scrub stands will continue to accumulate biomass and volume, often retaining dead plant material within individual component shrubs. Oak woodland cover types tend to limit ground fuel accumulation with age. Canopy closure serves to "shade-out" understory plants, resulting in mature oak woodland characterized by a dense canopy layer and an understory consisting primarily of leaf and twig litter. Hardwood stands vary in species composition with disturbance, but maintain typically consistent shrub and tree cover with associated ladder fuels allowing the potential for canopy fire spread.

Sage Scrub Fire Effects

Sage scrub occupies the majority of the Preserve (140.3 acres). Following fire, typical sage scrub succession includes a predominance of annual herbs during the first year. Non-native species may dominate a landscape after wildfire due to their success in establishing quickly and out competing many native species. Non-native species tend to decline in subsequent years without fire or other disturbances as shrubs establish and attain greater cover. Perennial herb understory species, which may grow from resprouts, show low recruitment from the soil seed bank. Unlike herbaceous annuals, the overall diversity of perennial understory herbs remains constant the first few years following fire. New species continue to become established in recovering sage scrub, reaching a peak at 5 to 10 years after a fire. After the peak in species diversity, there is a general decline in perennial understory herb species, possibly attributable to shading effects from dominant shrubs (Wills 2000; Keeley and Keeley 1984).

Lack of fire will allow shrub cover to return to burned areas over time. Recovering shrub cover is less likely to burn in the first 20 years during typical weather conditions, but it will burn under extreme fire events (Moritz 2003). The Preserve's vegetation age is almost entirely consistent, with nearly 91% of vegetation being 9 years old at the time of this report. Shrub cover will continue to increase in volume, and within approximately 11 years, the fire hazard will increase corresponding with fuel age (Keeley 2005). Changes in land use will also affect the vegetation distribution pattern. For example, the encroachment of non-native plants is likely based on the proximity of residential development and transportation corridors to the Preserve.

Chaparral Fire Effects

Chaparral communities are also dominant on site (including the coastal sage–chaparral transition community), covering 86.7 acres. This vegetation type typically ranges from 1 to 3 meters (3 to 10 feet) in height with little herbaceous understory in mature stands. Chaparral vegetation communities have developed post-fire reproductive strategies intended to survive stand-replacing wildfires. Specifically, component plant species can be classified as obligate sprouters, obligate seeders, or facultative seeders. Obligate sprouters reproduce via root systems that survive after a fire (e.g., toyon (*Heteromeles arbutifolia*)), while obligate seeders rely solely on seedling establishment for survival (e.g., ceanothus (*Ceanothus* spp.), manzanita (*Arctostaphylos* spp.)) (Conrad 1987). Facultative seeders are those chaparral species that stump sprout and regenerate via seed following fire (e.g., chamise (*Adenostoma* ssp.)) (Conrad 1987).

Current fire frequency in chaparral communities averages between 20 and 30 years (Keeley and Keeley 1988), although historic fire frequency is likely in the range of 50 to100+ years (Conard and Weise 1998). The shortening of fire-free periods in chaparral has been affected by increases in ignition sources due to the proximity of chaparral communities to developed/urban areas. Fires in chaparral typically consume all aboveground vegetation. In the first year following fire, there is typically abundant herbaceous vegetative growth, although by the fifth post-fire year, shrub cover dominates the site (Keeley and Keeley 1988). In general, vegetation/fuel volume in chaparral will increase in the years following fire, with the rate of biomass increase leveling out between 20 and 40 years, depending on numerous site-specific variables (Conard and Weise 1998).

Live Oak Woodland Effects

Coast live oak woodland covers nearly 16 acres of the Preserve. Coast live oak trees are very fire resistant, with fire adaptations including evergreen leaves, thick bark, and post-fire sprouting from surviving tissue. Fire intensity affects individual tree survival, with the amount and extent of trunk char and canopy consumption playing a critical role in survival and response (Plumb and Gomez 1983). Following burning, coast live oaks sprout from the main trunk and upper

crown even after severe burning (Plumb and McDonald 1981). Post-fire recovery of coast live oak woodlands is dependent on fire intensity, and fall fire damage is typically more severe than that occurring earlier in the year (Plumb and Gomez 1983). While the thick bark of mature coast live oak trees minimizes the effects of heat exposure from wildfire, seedlings and acorns are much more susceptible to mortality, even following low-intensity fires (Lawson, Zedler, and Sieger 1997). Recovery of coast live oaks may take up to 3 years, so post-fire cutting of affected trees should be postponed to verify whether resprouting will occur (Plumb and Gomez 1983).

As with coastal sage and chaparral, decreases in fire frequency in coast live oak woodlands and forests favors woodland/forest expansion into neighboring communities (Callaway and Davis 1993). Fire behavior in oak woodlands and forests is typically much less intense than wildfires burning in chaparral and sage scrub communities. Low, compacted leaf litter understory, canopy shading of ground fuels, and wind velocity reduction resulting from tree canopies significantly reduce the intensity and spread rates of surface fires in oak woodland and forest vegetation types. Transition from ground to canopy fire increases fire intensity, spotting, and tree mortality potential.

Fire Behavior

Fire behavior modeling provides reasonably accurate representations of how wildfire would move through available fuels in high-fire hazard areas. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. Current and accepted fire research data from several programs that specialize in the study of wildland fire were utilized for the completion of this analysis for the Preserve. To objectively predict flame lengths and intensities, the FlamMap fire behavior fuel modeling system was applied using predominant fuel characteristics from representative fuel models observed on the Preserve. In addition to fuels data, topographic and weather data were utilized in developing fire behavior models for two separate weather conditions: Summer (onshore flow) and Peak (offshore flow with Santa Ana condition). Results of fire behavior modeling efforts for the Preserve are presented in Appendix D.

5.3 Fuel Management Methods

Successful fire management requires preplanning and utilization of fire prevention techniques and strategies. As the majority of the Preserve has been fire-free for 9 years (91%), management of fuels is an important component of overall Preserve management. To that end, Vegetation Management Units (VMUs), based on topography or other clearly discernible landscape boundaries, have been delineated on the Preserve to assist with fuel management planning. Figure 9 illustrates the VMU boundaries. VMU specific fuel management recommendations are provided in Section 6.3. A list of general fuel management methods and their suitability for use in the Preserve are discussed as follows.

5.3.1 Grazing

Grazing is an effective fuel reduction method and can be compatible with Preserve management goals. Focused grazing is a feasible alternative on this Preserve, but it would need to be highly managed to avoid introducing and spreading non-native species, overgrazing, or escape grazing. Currently there is no pressing need to introduce grazing. However, the method should remain in the management toolbox for specific applications adjacent to highly sensitive habitats, adjacent roadways, and potentially in areas that are considered fuel modification zones.

5.3.2 Mowing/Line Trimming

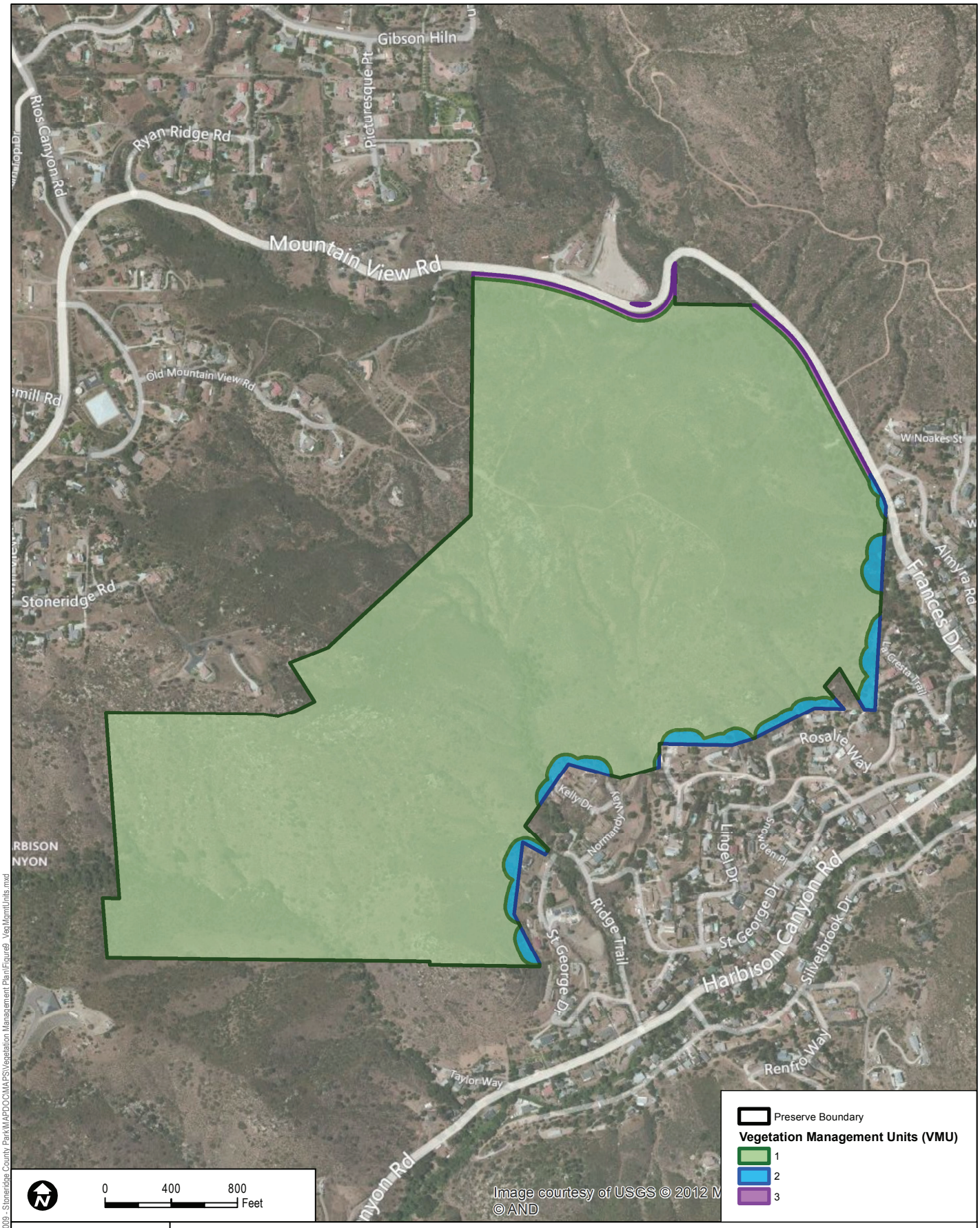
Mowing and line trimming are two of the most common and successful methods for reducing fuel loads and are compatible with Preserve management goals, but they are of limited use in rocky and rugged terrain. Line trimming is a feasible option for the Preserve to meet fuel modification goals. However, annual mowing/trimming may convert shrub-dominated areas to grasslands over time. Therefore, mowing/trimming should be conducted in late spring after weedy annuals have stopped growing, but have not yet produced viable seed (Bell 2009).

5.3.3 Herbicides

Chemical means to control fuels/non-native plants are an effective method, but one that has a negative connotation, potential toxicity for humans and wildlife, and can affect water quality. Focused chemical selection and application minimizes the detrimental effects and makes the use of chemicals, such as glyphosate and other selective chemicals, a feasible alternative.

5.3.4 Prescribed Fire

Prescribed fire occurs in two forms: (1) natural fire, occurring primarily through lightning strikes that are then allowed to burn, and (2) intentional, managed fires. Natural fires are rare in San Diego County due to a general lack of lightning. However, natural fires may occur, and if allowed to burn as part of a fire plan, would then be considered a prescribed fire. Although considered unlikely, if natural fire occurs on the Preserve and the fire is determined to pose no threat to life or high-value resources, the fire may be allowed to burn if it meets fire authority objectives. If unsafe conditions exist (e.g., high winds, low humidity, high temperature) and, without suppression, it has a high likelihood of burning into areas of fire exclusion or is threatening valuable resources on or off site, then assertive suppression would be pursued.



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SOURCE: Bing, SanGIS 2012

FIGURE 9

Vegetation Management Units

Stoneridge Preserve - Vegetation Management Plan

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Intentionally managed fires are planned ignitions for purposes of reducing fuels primarily for public safety or habitat improvement, are regulated by all applicable laws, and are managed by CAL FIRE's Vegetation Management Program. Where prescribed burning is feasible, it shall be conducted under permit from CAL FIRE or under contract with CAL FIRE under the statewide Vegetation Management Program.

Prescribed fire on the Preserve is not currently considered a high priority for fuel management in respect to the other treatment options included in this VMP. However, future conditions may warrant the use of prescribed fire as a fire hazard reduction or habitat modification technique. Prescribed fire can only be implemented by CAL FIRE, or a similar fire authority with experience and certifications to conduct burns, and requires the preparation and approval of a prescribed burn plan prior to implementation. Burning objectives shall adhere to those included in the 2009 County of San Diego Vegetation Management Report (County of San Diego 2009), specifically:

> Prescribed burns will generally be utilized in strategic locations when the surrounding land has few residences or a fire can be easily controlled because of topographic or other features. Again, the use of fire as a management tool will be considered specific to ecosystem management objectives. Strategic fuels treatments would be located to provide the most effective potential for reducing catastrophic fire. The potential for promoting vegetation health could be factored into decisions on locating strategic fuel treatments.

5.3.5 Hand Tool or Mechanical Equipment Thinning

Thinning can reduce fuel continuity and loading by selective removal of dead and dying, overly dense, horizontal and vertical bunches and non-natives. This type of fuel reduction is most useful in urban interface and intermix areas and/or around high-value resources, such as cultural sites. Adjacent residences would have to maintain their own defensible space off site, but on-site extensions would be located within the Preserve to provide additional clearance for the County required 100-feet of defensible space from the edge of the structure (VMU 2). Thinning is recommended to occur on an annual basis prior to June for fuel modification zones associated with adjacent residences. Thinning is appropriate anywhere in the Preserve where insect or disease outbreaks and frost or drought kill occurs, resulting in dense, dead vegetation.

5.3.6 Fuel Breaks

Fuel breaks provide areas of removed fuels that play an important role in helping contain wildfires. The local fire departments and CAL FIRE attempt to minimize impacts to sensitive resources when fighting fires in wildlands, when possible; and where feasible, fires are allowed to run to natural breaks including trails and roads. These locations then serve as a defensive

position for fighting the fire. Due to terrain and accessibility, no fuel breaks are proposed for the Preserve. The dirt road extending onto the Preserve from the end of Old Mountain View Road could be modified to create a fuel break should it be necessary during an emergency.

5.4 Fire Response Plan

The San Diego Rural Fire Protection District (SDRFPD) would be the primary responders to a wildfire in the Preserve. It is expected that SDRFPD and CAL FIRE would be the primary agencies involved in wildland fire suppression on the Preserve. Other nearby agencies that may assist via mutual aid agreements include; the San Miguel Fire Protection District (SMFPD), the Lakeside Fire Protection District (LFPD), and the Alpine Fire Protection District (AFPD).

CAL FIRE provides response to wildfires in the SRA, including the Preserve. CAL FIRE has a vast arsenal of firefighting personnel and apparatus throughout the County that can be called upon for responding to wildfires within or in the vicinity of the Preserve, including:

- Air tankers
- Helicopters
- Airtactical aircraft (AA)
- Various engine types
- Crew transports
- Bulldozers
- Communications centers.

CAL FIRE utilizes three levels of dispatch and response based upon weather conditions and time of year. The three levels are:

- Low—includes two engines with three personnel each;
- Medium—includes three engines (type III) with three personnel each, one battalion chief, one mid-sized bulldozer, one type III helicopter, and one 16-person hand crew; and
- High—includes five engines with three personnel each, one battalion chief, two medium bulldozers, one AA, two air tankers, and one type III helicopter.

Dispatch levels are based on weather conditions. Low dispatch occurs during the winter months from November through May. Medium and high dispatch occurs during the normally declared fire season, June through October. There is some variation in the timing of the dispatch levels, based entirely on weather.

SDRFPD currently employs the following firefighting apparatus with associated firefighting personnel:

- Structure protection type I pumpers
- Type III brush engines
- Water tender
- Command vehicles.

Fire Response

This VMP stresses the need for firefighting response to minimize impacts to natural resources, when possible, by using preplanned fire suppression tactics and actions within the boundary of the Preserve. Fire suppression is considered the top priority across the Preserve due to the proximity of structures and the shortened fire return interval realized over the last 20 to 25 years.

Fire suppression air support with fire retardant drops may be a component of responses to the entire Preserve for achieving goals and objectives, especially under conditions that would accelerate wildfire spread. Under extreme conditions, or at night, air support may not be available, and in these situations, response categories may become secondary to public safety. Fires occurring within open space areas have demonstrated the potential to move through the preserve into urban areas, consequently overwhelming available fire resources.

Response to a fire within the Preserve will likely be limited to peripheral roads for firefighting personnel, type I engines (limited to paved roadways), type III engines, fire crews, air attack and fire retardant, helicopters, and air tankers. Fire suppression actions may include one or more of the following: direct attack with engines, fire crews, helicopters, and firing operations. Line construction activities within the Preserve would be best carried out by hand crews. Dozers/road graders may be activated but should not be put into operation on the Preserve itself unless necessary for improving existing roads for engine access or constructing a line or secondary line for preservation of high-value resources, including plant and animal species, habitats, people, or property.

There is an existing access road/trail (top of Old Mountain View Road) that may be utilized for fire containment efforts by fire agency personnel including using the road as a fuel break or as an anchor point from which to conduct operations. However, this road is not wide enough to provide acceptable fire spread slowing during wind driven wildfires. While it may slow fire spread under moderate conditions, it is not currently maintained and is inaccessible for firefighting equipment.

5.4.1 Fire Hazard and Current Fire Management Practices Evaluation

Based on site-specific data analysis, discussions with fire agencies responsible for fire suppression, and fire behavior modeling results, the Preserve includes an ongoing fire hazard that can result in significant fire intensity and spread during extreme weather events. This section presents a discussion of fire hazard situations for the Preserve. This information was collected during initial site analysis and reviews of project data, fire behavior modeling results, and high-resolution aerial imagery and was integrated into the preparation of this document and associated recommendations.

1. Based on topography, vegetation, and fire history of the region, a large conflagration during Santa Ana wind conditions will likely enter the Preserve from the east, traveling down Harbison Canyon through undeveloped wildland areas to the east and northeast, as seen in the 2003 Cedar Fire. Fires during typical onshore wind patterns are likely to enter the site from either the adjacent developed areas or roadways, or from open space areas south or west of the Preserve.
2. A WUI threat exists along the southeastern and northwestern boundaries of the Preserve. Residential development is most dense along the southeastern boundary, with lower density rural-residential development along the northwestern boundary.
3. Potential ignitions include a variety of residential-related sources including structure fire, hot works, and yard machines, among others. Ignition sources not associated with residential development include vehicular associated ignitions (e.g., car fire, catalytic converter, tossed cigarette) along adjacent roads, including Mountain View Road and Harbison Canyon Road, and other human-caused ignitions resulting from authorized or unauthorized access to the Preserve.
4. Wildfires fueled by Santa Ana winds may move rapidly across the Preserve. Sage scrub and chaparral fuels will be the predominant carriers of fire across the site with flame lengths exceeding 20 feet. Steep slopes with even steeper walled drainages typify the topography of the Preserve. Fires in chaparral or sage scrub fuels will produce heat output in excess of 5,000 British thermal units.
5. A fire originating in a structure within approximately a 1-mile radius of the Preserve could result in burning embers landing within the Preserve before they decay to the point of being unable to ignite fuels, potentially resulting in vegetation ignition if there is a receptive fuel bed.

Based on accessibility, firefighting may be difficult on the Preserve as the only potential access road is narrow and not maintained. In addition, this road is a dead end, has limited turnaround capability, and not designed to accommodate typical responding fire apparatus. Consequently, air attack will be an important component but may not be available or usable, depending on the extent of the fire event and/or the time of day and weather conditions.

The catastrophic wildfire threat for the Preserve is extreme when severe fire weather occurs, which will coincide with Red Flag Warning periods. Red Flag Warnings are declared by the National Weather Service. The Preserve is located in Fire Weather Zone 250, San Diego County Inland Valleys. Accordingly, Red Flag Warnings are issued when humidity is 15% or lower (for at least 6 hours) and sustained winds are 25 miles per hour (mph) (with gusts greater than or equal to 35 mph) (National Weather Service 2012).

Beyond these provisions, fire management practices are restricted to response and tactical suppression efforts associated with wildfires originating on or burning onto the Preserve. No active fire or fuels management plans are currently employed on site.

5.4.2 Primary Actions and Contacts for Wildfire Emergency

The following persons/agencies should be contacted in the event of a wildfire on the Preserve or for information regarding fire management activities.

CAL FIRE
San Diego Unit
Emergency: 911
Non-Emergency—Unit Chief, El Cajon: 619.590.3100
Website: http://www.fire.ca.gov/

San Diego Rural Fire Protection District (SDRFPD)
Emergency: 911
Non-Emergency: 619.669.1188
Website: http://www.sdruralfire.org/

5.4.3 Roads/Access

Access in the Preserve is limited only to an unimproved, unmaintained dirt road that extends eastward from the end of Old Mountain View Road. As mentioned, this road is not recommended for fire apparatus, but may serve as a fuel break during a fire emergency. No formal hiking trails are found in the Preserve.

Access to the Preserve is limited to the following:

- The dirt road extending from the end of Old Mountain View Road
- Roadside access from Mountain View Road along the northern boundary of the Preserve
- The end of La Cresta Trail, Rosalie Way, Kelly Drive, and St. George Drive.

From a fire suppression perspective, access is limited to these locations. As mentioned, fire apparatus access to the central portion of the Preserve is not recommended due to terrain, one-way access, and the condition of the Old Mountain View Road extension. Preserve access is presented in Appendix C.

5.4.4 Fuel Breaks

No fuel breaks currently exist on the Preserve. Based on the topography of the Preserve and the potential for related impacts, it is not recommended that additional breaks be created at this time. However, the need for fuel breaks is dependent on the specific conditions of a fire. If new fire breaks are required, the location should be coordinated with the Incident Command team where possible. The Incident Command team includes the DPR District Manager and fire agency staff with access to location information on sensitive biological and cultural resources that should be avoided, if possible.

5.4.5 Emergency Staging Areas

Due to the terrain and fuels, it is not anticipated that fire response staging areas will be situated on the Preserve. Staging areas, important for incident command and to organize, plan, and implement firefighting strategies, typically cause higher ground disturbance from personnel, vehicles, and equipment in confined areas. Staging areas for fires that affect the Preserve will likely occur off site in well-defended, lower hazard areas.

5.4.6 Fire Hydrants

No fire hydrants are located on the Preserve. Fire hydrants are located within the adjacent community of Harbison Canyon. Fire hydrant locations are not consistent in the surrounding semirural area. Wildland fire response to the Preserve would have to include a water tender as the primary water supply. Fire hydrants may be utilized during a fire event to refill engines, as necessary.

5.4.7 Other Water Sources

Other water sources which may be available during a wildfire event within the Preserve include the following:

- Loveland Reservoir, approximately 4.25 miles from the furthest reaches of the Preserve, would provide helicopter dipping access.
- El Capitan Reservoir, approximately 5.0 miles from the furthest reaches of the Preserve, would provide helicopter dipping access.
- Lake Jennings, approximately 4.0 miles from the furthest reaches of the Preserve, would provide helicopter dipping access.

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6.0 MANAGEMENT DIRECTIVES

This section provides recommendations for vegetation management within the Preserve, including management directives specifically related to invasive non-native plant species management, habitat restoration, and fire management.

6.1 Invasive Species Removal

The following short-term management directives address high priority invasive non-native plant species removal while longer-term management directives consider invasive non-native plant species for their risk of reducing vegetation community quality over time.

Management Directive Invasive 1—Remove and Control High Priority Invasive Non-native Plant Species. Control high priority invasive non-native plant species and those with a high fire hazard within the Preserve, including saltcedar, pampas grass, eucalyptus, and palm trees as soon as possible.

Management Directive Invasive 2—Identify and Pursue Funding for Long-Term Invasive Non-native Plant Control. Coordinate with other agencies, non-profit organizations, and/or volunteer groups in order to seek funding and implement invasive, non-native plant control projects for moderate and low priority non-native species within the Preserve.

Management Directive Invasive 3—Conduct Invasive Non-native Plant Species Monitoring. Continue to monitor for new locations of invasive non-native plant species within the Preserve to determine whether additional removal efforts are necessary in order to maintain and/or improve the quality of the existing native vegetation communities on site.

Management Directive Invasive 4—Educational Outreach. Prepare and implement an invasive non-native plant species educational outreach program/materials for adjacent property owners in order to discourage introduction of invasive non-native plants into the Preserve.

6.2 Restoration

The primary management directives for native vegetation community restoration include:

Management Directive Restoration 1—Restore Native Vegetation Community Quality and Function. No specific habitat restoration opportunities were identified within the Preserve. However, the Preserve contains invasive non-native plant species that should be controlled. Invasive non-native species control efforts could be a

component of a passive restoration approach, as identified in Section 6.1 above. If additional habitat restoration opportunities arise in the future, this management objective is to restore degraded areas to reestablish and/or enhance the biological functions and values of native vegetation communities.

> **1A–Passive Restoration**. Perform weed and erosion control as needed in disturbed areas where natural recruitment of native plant species is actively occurring, as described in Section 4.2.1.
>
> **1B–Active Restoration**. Conduct soil preparation and seeding of disturbed or degraded areas where native vegetation recruitment is not actively occurring, as described in Section 4.2.2.

Management Directive Restoration 2—Address Long-Term Restoration Needs. Restoration activities should occur following landscape-changing disturbances that remove, damage, degrade, or alter the existing native vegetation communities. Restoration methods will be customized to the Preserve, based on the type of disturbance, and may require preparation and implementation of a restoration plan. Restoration may incorporate a variety of general restoration techniques, including:

- Native vegetation community establishment/creation;
- Native vegetation community enhancement;
- Removal of invasive plants when they are young;
- Native seed application
- Erosion control; and
- Application of supplemental irrigation if needed.

Management Directive Restoration 3—Monitor Invasive Non-native Plant Removal Sites. Continue to monitor invasive non-native plant species removal sites to ensure that passive natural recruitment is successfully occurring in these areas.

Management Directive Restoration 4—Monitor Native Vegetation Community Quality. Continue to monitor the quality of native vegetation communities throughout the Preserve using comparative vegetation mapping over time and evaluation of potential type conversions.

Management Directive Restoration 5—Monitor Pests and Disease. Monitor the presence of disease or pest levels to determine outbreaks and prescribe an active treatment, as appropriate.

6.3 Fire Management

The long-term strategic fire management plan considers strategic fire prevention activities, fire suppression with regard to fire effects on habitat, and post-fire monitoring and rehabilitation. The long-term strategic fire plan for the Preserve must prioritize public safety while meeting habitat management goals. Management directives are as follows.

Management Directive Fire 1—Fire Suppression: Fire suppression, in combination with other management methods in targeted Preserve habitat management areas, is the priority for the Preserve. Lengthening the fire return cycle to an optimal frequency will require fuel reduction experiments, research, monitoring, and analysis as part of the overall management approach. It may be difficult to achieve longer fire return intervals given the current and projected ignition sources that may affect the Preserve. However, results of site data analysis will more firmly establish the optimal return intervals to meet habitat goals, or if additional steps need to be implemented, to lengthen the return of fire.

Management Directive Fire 2—Maintain Required Fuel Modification Zones. Annually maintain, and extend/abandon where necessary, the fuel modification zones along the Preserve boundaries that are extensions of off-site residential structure fuel modification zones (Figure 9; VMU 2) within the Preserve, as identified in Table 10. Figure 10 provides a focused view of existing fuel modification areas compared with proposed fuel modification areas, consistent with the boundary of VMU 2. Fuel modification zones are measured at 100 horizontal feet from the edge of structures. **Management Directive Fire 3—Delineate Fuel Modification Areas**. Install and maintain inconspicuous fuel modification extent markers for all fuel modification zones (Figure 10; VMU 2) within the Preserve to minimize additional thinning outside intended area.

Management Directive Fire 4—Create Roadside Fuel Treatment Areas. Annually maintain a 30-foot wide fuel treatment area along the southern edge of Mountain View Road. Maintenance should focus on flashy fuel trimming/removal (grasses) and removal of dead plant material. This effort will minimize roadside ignitions in the Preserve (Figure 9; VMU 3).

Management Directive Fire 5—Control Illegal Access. Restrict illegal access (e.g., off-highway vehicles, public) utilizing fencing, gates, or signage and by establishing a high profile presence of DPR staff. Installation of a gate and Knox lock is recommended at the Preserve boundary where it intersects the dirt road extension of Old Mountain View Road.

Management Directive Fire 6—Access Data Sharing. Data regarding site access should be provided to the appropriate local fire agency. Gates and locks installed to

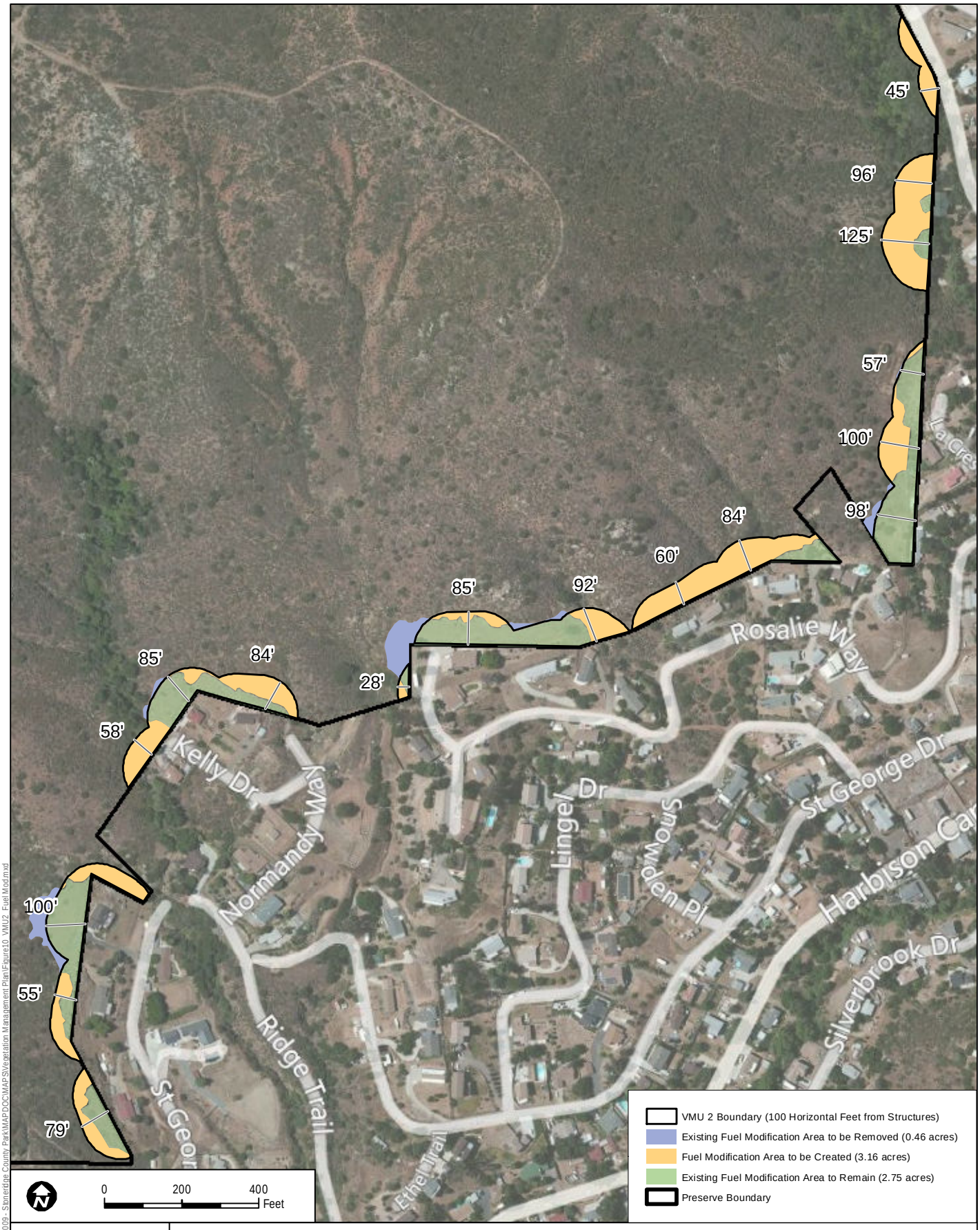
control access (as identified in Management Directive Fire 5 above) should be maintained and should include a Knox lock. Gate and lock locations should be communicated to the local fire agency to assist first responders. This information will be included in their wildland pre-response plans, resulting in more efficient responses. Information readily accessible by responders not familiar with the area, such as out of County or out of state responders, will improve firefighter safety.

Management Directive Fire 7—Educational Outreach. Private property owners in the interface or intermix (located adjacent to the Preserve) should be encouraged to play an active role in reducing the potential fire hazard. It will also be beneficial if the public understands the management actions occurring on the Preserve as applicable. As such, this VMP recommends a concerted effort to reach property owners who are situated in locations that may be affected by wildfire on the Preserve or whose properties and actions may serve as Preserve ignition sources. Educational material can be customized for these homeowners to include discussion of the importance of the Preserve. Standard measures for implementing a 100-foot fuel modification/defensible space zone can be provided from materials available from CAL FIRE and from the County of San Diego Department of Planning and Development Services (County of San Diego 2010)[3]. As part of the public education program, private property owners should be encouraged to participate as "eyes on the Preserve" to help curb illegal access and report potential problems.

Management Directive Fire 8—Reduce Adjacent Ignition Sources: Ignition sources are present adjacent to the Preserve including Mountain View Road and Harbison Canyon Road, adjacent residences, and unauthorized recreational users, among many others. As such, it is not possible to remove all sources of ignition. Rather, reducing the potential spread of wildfire onto or throughout the Preserve is recommended. Fuel modification and roadside buffers on the Preserve edges near adjacent homes and roadways will need to be maintained.

Management Directive Fire 9—Post-fire Management and Erosion Control. Provide controls following fire events to stabilize soils in the burn area and minimize potential for erosion. Erosion control best management practices (BMPs), such as mechanical rehabilitation treatments, including straw mulch, hay bales, and jute rolls, should be in place as soon as possible after a fire and prior to the onset of the winter rainy season. Care should be taken to select and inspect these materials so they are not a source of invasive non-native plants. The use of certified weed-free hay should be followed (Bell 2009).

[3] Available online at http://www.fire.ca.gov/cdfbofdb/pdfs/4291finalguidelines2_23_06.pdf and http://www.sdcounty.ca.gov/dplu/fire_resistant.html.



DUDEK

6680-09

SOURCE: Bing, SanGIS 2012

FIGURE 10

Focused Fuel Modification Areas in VMU 2

Stoneridge Preserve - Vegetation Management Plan

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Table 10
Fuel Management Activities by VMU

VMU	Sensitive Resources	Fuel Reduction Practice
1	Sensitive Animal Species: Barn owl Belding's orange-throated whiptail California gnatcatcher Coast horned lizard Coast patch-nosed snake Coastal western whiptail Cooper's hawk Dulzura pocket mouse Mule deer Northwestern San Diego pocket mouse Pallid bat Pocketed free-tailed bat Red-shouldered hawk Southern California rufous-crowned sparrow San Diego banded gecko San Diego desert woodrat Turkey vulture Western bluebird Western mastiff bat Western red bat Western small-footed myotis Western yellow bat White-tailed kite Yuma myotis Sensitive Plant Species: San Diego County viguiera Engelmann oak Rush-like bristleweed San Diego sagewort <u>Cultural Sites:</u> CA-SDI-20695	VMU 1 consists of the majority of the Preserve. Vegetation is predominantly 9 years in age, while the oak woodland/riparian area along the northern edge is 40 + years old. Access to VMU 1 is limited. Primary access to this area is at the end of Old Mountain View Road and along the southern edge of Mountain View Road. Steep terrain in this VMU also limits access and the amount of thinning that would be possible. Consequently, fuel treatment in VMU 1 should be limited to invasive non-native plant species removal. Strategic understory shrub thinning/crown raising may be implemented along the sage scrub or chaparral-oak woodland interface to minimize the potential for crown fire occurrence in the oak woodland/riparian zone. Thinning/vegetation reduction may be necessary to reduce potential for catastrophic fire near sensitive species locations. Sensitive species locations should be flagged and avoided to the maximum extent possible. Vegetation should be removed via manual methods in these areas.
2 (WUI Fuel Modification Zones)	Residences <u>Sensitive Animal Species:</u> Cooper's hawk <u>Sensitive Plant Species:</u> San Diego County viguiera	Residential development is adjacent to this VMU along the eastern and southeastern edges of the Preserve. Fuel modification zones shall be created or extended within this VMU to accommodate the required 100-foot buffer around adjacent residences. Fuel reduction by manual thinning, mowing, and invasive non-native plant removal should be conducted routinely to minimize fire spread and ignition potential from residential

Table 10
Fuel Management Activities by VMU

VMU	Sensitive Resources	Fuel Reduction Practice
		development. Thinning/vegetation reduction may be necessary near sensitive species locations. Sensitive species locations should be flagged and avoided to the maximum extent possible. No cultural sites have been identified in this VMU.
3 (Mountain View Road Roadside Buffer)	Sensitive Plant Species: Engelmann oak	This zone exists along the northern and northeastern edges of the Preserve and consists of a 30-foot-wide fuel treatment area adjacent to Mountain View Road. Fuel reduction by manual thinning, mowing, and invasive non-native plant removal should be conducted routinely to minimize fire spread and ignition potential from Mountain View Road. No cultural sites have been identified in this VMU.

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APPENDIX A

Glossary of Terms

APPENDIX A
Glossary of Terms

TERMS

BehavePlus: Fire behavior prediction and fuel modeling computer program designed to model fire behavior characteristics based on fuel, weather, and topographic inputs. Model outputs include flame length values, fire spotting potential, and rate of fire spread.

Brush: A collective term that refers to stands of vegetation dominated by shrubby, woody plants or low-growing trees; usually of a vegetation type undesirable for livestock or timber management.

Brush Fire: A fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.

Burning Conditions: The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

Canopy: The stratum containing the crowns of the tallest vegetation present (living or dead), usually above 20 feet.

Closure: Legal restriction, but not necessarily elimination, of specified activities such as smoking, camping, or entry that might cause fires in a given area.

Combustible: Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

Conflagration: A raging, destructive fire. Often used to describe a fire burning under extreme fire weather. The term is also used when a wildland fire burns into a WUI, destroying structures.

Crown Fire: A fire that advances from top-to-top of trees or shrubs more or less independent of a surface fire.

Defensible Space: An area either natural or man-made where material capable of allowing a fire to spread unchecked has been treated, cleared, or modified to slow the rate and intensity of advancing wildfire. This will create an area for housing increased emergency fire equipment, for evacuating or sheltering civilians in place, and a point for fire suppression to occur.

Duff**:** The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles and leaves and immediately above the mineral soil.

Exposure: (1) Property that may be endangered by a fire burning in another structure or by a wildfire; (2) direction in which a slope faces, usually with respect to cardinal directions; (3) the general surroundings of a site with special reference to its openness to winds.

Extreme Fire: A level of fire behavior characteristics that ordinarily precludes methods of direct control. One or more of the following is usually involved: high rates of spread, prolific crowning and/or spotting, presence of fire whirls, a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environments and behave erratically, sometimes dangerously.

Fine Fuels: Fast-drying dead fuels that are less than 0.025-inch in diameter and are generally characterized by a comparatively high surface area to volume ratio. These fuels (grass, leaves, needles, etc.) ignite readily and are consumed rapidly by fire when dry.

Fire Behavior: The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Department: Any regularly organized fire department, fire protection district or fire company regularly charged with the responsibility of providing fire protection to the jurisdiction.

Fire Front: That part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, it is assumed to be the leading edge of the fire perimeter.

Fire Hazard: A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.

Fire Hydrant: A valved connection on a piped water supply system having one or more outlets that is used to supply hose and fire department pumpers with water.

Fire Prevention: Activities, including education, engineering, enforcement, and administration that are directed at reducing the number of wildfires, the costs of suppression, and fire-caused damage to resources and property.

Fire Protection: The actions taken to limit the adverse environmental, social, political, and economic effects of fire. Protection is relative, not absolute.

Fire Regime*:* Periodicity and pattern of naturally occurring fires in a particular area or vegetative type, described in terms of frequency, biological severity, and area of extent.

Fire Retardant: Any substance, except plain water, that by chemical or physical action reduces flammability of fuels or slows their rate of combustion.

Fire Season: (1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities; (2) a legally enacted time during which burning activities are regulated by state or local authority.

Fire Storm: Violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts, near and beyond the perimeter, and sometimes by tornado-like whirls.

Fire Triangle: Instructional aid in which the sides of a triangle are used to represent the three factors (oxygen, heat, fuel) necessary for combustion and flame production; removal of any of the three factors causes flame production to cease.

Fire Weather: Weather conditions which influence fire starts, fire behavior, or fire suppression.

Fire Whirl: Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than 1 foot to over 500 feet in diameter. Large fire whirls have the intensity of a small tornado.

Firebrand: Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or gravity into unburned fuels. Examples include leaves, pine cones, glowing charcoal, and sparks.

Firebreak: A natural or constructed barrier used to stop or check fires that may occur or to provide a control line from which to work.

Firefighter: A person who is trained and proficient in the components of structural or wildland fire.

Flame: A mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.

Flammability: The relative ease with which fuels ignite and burn regardless of the quantity of the fuels.

Fuel Break: An area, strategically located for fighting anticipated fires, where the native vegetation has been permanently modified or replaced so that fires burning into it can be more easily controlled. Fuel breaks divide fire-prone areas into smaller areas for easier fire control and to provide access for firefighting.

Fuel Loading: The volume of fuel in a given area generally expressed in tons per acre.

Fuel Model: Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

Fuel Modification: Any manipulation or removal of fuels to reduce the likelihood of ignition or the resistance to fire control.

Fuel Modification Zone: A strip of land, typically 100 feet wide or more, between an improved property and wildlands, where combustible vegetation has been removed, thinned, or modified and may be partially or totally replaced with approved drought-tolerant, fire-resistant, and/or irrigated plants to provide an acceptable level of risk from vegetation fires. Fuel modification reduces radiant and convective heat, thereby reducing the amount of heat exposure on the roadway or structure and providing fire suppression forces a safer area in which to take action.

Fuels: All combustible material within the WUI or intermix, including vegetation and structures.

Hazard: The degree of flammability of the fuels once a fire starts. This includes the fuel (type, arrangement, volume, and condition), topography, and weather.

High Value Resource: High Value Resources are natural or man-made resources, including plant and animal species, cultural resources, and residences that form the basis for fire management planning on the Preserve.

Ignition Time: Time between application of an ignition source and self-sustained combustion of fuel.

Invasive Plant Species: A plant species that is not native to the region and has demonstrated the ability to aggressively outcompete native plant species that would normally colonize a given area.

Ladder Fuels: Fuels that provide vertical continuity allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

Overstory: That portion of the trees in a forest that forms the upper or uppermost layer.

Peak Fire Season: That period of the year during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damages at an unacceptable level.

Prescribed Burning: Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions, which allows the fire to be confined to a predetermined area, and to produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

Prescribed Fire: A fire burning within prescription. This fire may result from either planned or unplanned ignitions.

Red Flag Warning Conditions: A **Red Flag Warning** is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds that may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk.

Responsibility Area: That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the fire protection agent. Several agencies or entities may have some basic responsibilities without being known as the fire organization having direct protection responsibility.

Restoration **(of native vegetation communities):** The act of restoring ecological functions and values of vegetation communities that have been adversely affected by human- or nature-induced impacts, causing decrease in ecological functions and values.

Sensitive Species: A plant or animal species with a special status listing from federal, state, or local regulatory agencies.

Slope: The variation of terrain from the horizontal; the number of feet rise or fall per 100 feet measured horizontally, expressed as a percentage.

Smoke: (1) The visible products of combustion rising above a fire; (2) term used when reporting a fire or probable fire in its initial stages.

Spotting: The ignition of unburned fuels ahead of the fire front as a result of ignition by firebrands. Spotting enhances the spread of wildfires.

Structure Fire: Fire originating in and burning any part of all of any building, shelter, or other structure.

Suppression: The most aggressive fire protection strategy, it leads to the total extinguishment of a fire.

Surface Fuel: Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

Tree Crown: The primary and secondary branches growing out from the main stem, together with twigs and foliage.

Uncontrolled Fire: Any fire that threatens to destroy life, property, or natural resources and that (a) is not burning within the confines of firebreaks or (b) is burning with such intensity that it could not be readily extinguished with ordinary, commonly available tools.

Understory: Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.

Urban Interface: Any area where wildland fuels threaten to ignite combustible homes and structures.

Vegetation Management Unit: Delineated Preserve unit based on topography, vegetation or other features used for internal invasive species, restoration, and fire management planning.

Weed: A plant species that interferes with a desired management objective. This term does not denote the native or non-native status of a plant species. Both native and non-native plants have the ability to interfere, depending on the objective (i.e., native cattails can be considered a weed for flood control management objectives).

Wildfire: An unplanned and uncontrolled fire spreading through vegetative fuels, at times involving structures.

Wildland: An area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildland Fire: Any fire occurring on the wildlands, regardless of ignition source, damages or benefits.

Wildland–Urban Interface (WUI): The area where structures and other human developments meet or intermingle with undeveloped wildland (as defined in the County Fire Code, County Consolidated Fire Code, and County Building Code).

Sources: www.firewise.org and County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements, Wildland Fire and Fire Protection (2010).

APPENDIX B

Moderate and Low Priority Invasive Non-Native Plant Species for Control

APPENDIX B
Moderate and Low Priority
Invasive Non-Native Plant Species for Control

Moderate Priority Species for Control

Tree of Heaven (*Ailanthus altissima*)

Tree of heaven is a tree in the Simaroubaceae family that was introduced into California as a landscape ornamental. It is widely distributed in somewhat disturbed lands throughout California and is commonly found in coastal areas throughout the Sierra foothills (CalIPC 2012a). This species has a Moderate Cal-IPC Inventory Ranking (CalIPC 2012a). It can reproduce by either seeds or creeping roots. One individual was mapped along the ridgeline trail in the central region of the Preserve (Figure 6). In riparian settings, this species can spread rapidly and displace native habitat. However, within the Preserve, this species is growing in upland habitat. Therefore, it is ranked as a moderate priority for removal/control within the Preserve due to its moderate invasive potential, but limited ability to spread in upland habitats. Young seedlings can be hand-pulled or dug out. However, due to this species ability to re-sprout from base, or reproduce from creeping roots, herbicide application is likely the most effective. Girdling or cut-stump treatment in association with a systemic herbicide application (e.g., glyphosate or triclopyr) is effective at controlling this species if the herbicide is applied immediately following cutting to the cambium layer. Herbicide applications should be most effective in spring (Bossard 2000).

Rose Natal Grass (*Melinis repens* ssp. *repens*)

Rose Natal grass is a perennial grass in the Poaceae family that is native to South Africa but has now been introduced to North and South America (Invaders 2012). In the United States, this species now occurs in states along the Gulf of Mexico, and southwestern states including Southern California. This species possesses a low ability to displace well-established native upland vegetation communities and will primarily colonize disturbed areas along roads or trails, or areas of naturally occurring sparse vegetation, such as sandy/rocky outcroppings on south-facing slopes. Approximately 16 individuals were mapped within two locations in both the southern and northern areas of the Preserve (Figure 6).

Rose Natal grass is not rated by the Cal-IPC (CalIPC 2012a). However, in the Preserve, this species is nearly as abundant as fountain grass, and colonizes the same types of environments. Therefore, it is ranked as a moderate priority for removal/control within the Preserve due to its ability to easily colonize, but limited ability to displace established habitats. Recommended control for this species includes treatment with an appropriate systemic herbicide (e.g., glyphosate) prior to the development of mature seed heads (generally blooms spring through fall, but can bloom year-round). Should control not occur prior to maturation of seed, it is recommended that the seed heads be removed, bagged, and disposed of off site, with the

remaining grass bunch receiving an herbicide treatment. Since the majority of the rose Natal grass stands occurring in the Preserve are located on steep, sparsely vegetated slopes, herbicide treatment would be preferable to hand-pulling due to soil disturbance.

Tree Tobacco (*Nicotiana glauca*)

Tree tobacco is an invasive tree/shrub that was first introduced in California as an ornamental, but has escaped and frequently colonizes areas of soil disturbance in a variety of upland habitats. It is a prolific seed producer and has a high rate of spread. The Cal-IPC inventory categorizes tree tobacco as having an overall rating of "moderate," and it is ranked as a moderate priority for removal/control within the Preserve because of the species tendency to establish in disturbed areas and its limited presence in established habitat. Six individuals were mapped in the riparian corridor along the northern and eastern region of the Preserve (Figure 6). Mechanical removal is recommended, with an appropriate systemic herbicide applied immediately to remaining stump and plant parts. Treatment can occur any time of year, although good results have been documented when herbicide application occurs the fall (Cal-IPC 2012b). Follow-up treatments may be necessary.

Crimson Fountain Grass (*Pennisetum setaceum*)

Crimson fountain grass is a smaller clumping grass that has spread in large part due to its popularity as an ornamental plant. This species possesses a low ability to displace well-established native upland vegetation communities and will primarily colonize disturbed areas or areas of naturally occurring sparse vegetation, such as sandy/rocky outcroppings on slopes. Crimson fountain grass is well-adapted to fire and can increase in density following a burn. Crimson fountaingrass is mapped primarily in three regions of the Preserve: adjacent to the southern riparian corridor, adjacent to the central riparian corridor, and along Mountain View Road (Figure 6). There were 33 individuals mapped in the Preserve. The Cal-IPC inventory categorizes Crimson fountain grass as having an overall rating of "moderate." It is ranked as a moderate priority for removal/control within the Preserve due to its high abundance within portions of the Preserve, but limited ability to displace established habitats. Small infestations can be removed by uprooting. However, the most effective control for this species is treatment with an appropriate systemic herbicide (e.g., hexazinone or glyphosate) (Bossard 2000) prior to the development of mature seed heads (species blooms March to December). Should control not occur prior to maturation of seed, it is recommended that the seed heads be removed, bagged, and disposed of off site, with the remaining grass bunch receiving an herbicide treatment. Herbicide treatment is recommended for fountain grass stands occurring on steep, sparsely vegetated slopes to minimize soil disturbance.

Peruvian Peppertree (*Schinus molle*)

Peruvian peppertree is an ornamental tree that can invade into natural areas with suitable soil moisture through shoot sprout or seed dispersal by birds or stream flows in drainages. Two individuals were mapped within the riparian corridor along the northern border (Figure 6). The Cal-IPC inventory categorizes Peruvian peppertree as having an overall rating of "limited." It is ranked as a moderate priority for removal/control within the Preserve due to its potential to colonize into surrounding areas, but limited abundance in the Preserve. Recommended control methods include mechanical removal and application of an appropriate systemic herbicide (e.g., triclopyr, hexazinone or glyphosate) to remaining stump and plant parts. The species can be controlled any time of year. Follow-up herbicide control may be required.

Low Priority Species for Control

Silver Wattle (*Acacia dealbata*)

Silver wattle is a tree in the Fabaceae family commonly found in disturbed areas adjacent to coastal prairies, riparian areas, and coniferous forests (Cal-IPC 2012a). This species fixes nitrogen in the soil, thereby altering soil chemistry. Fallen leaves may have allelopathic effects, thereby restricting growth of native plants that would otherwise grow in these habitats (CalIPC 2012a). This species has a Moderate Cal-IPC Inventory Ranking (CalIPC 2012a). One individual was mapped within the northern part of the Preserve, adjacent to Mountain View Road (Figure 6). It is ranked as a low priority for removal/control within the Preserve due to its low abundance and limited potential to displace native habitat. The species can be controlled year-round by mechanical removal accompanied by an appropriate systemic herbicide application (e.g., glyphosate).

Slender Oat (*Avena barbata*)

Slender oat is found throughout grasslands in California and is particularly prolific in sandy or low nutrient soils. It is commonly found along road edges or other disturbed areas (CalIPC 2012a). This species has a Moderate Cal-IPC Inventory Ranking (CalIPC 2012a). Approximately 1,000 individuals were mapped along the southwestern border of the Preserve, in conjunction with two other non-native species, Maltese star thistle and shortpod mustard (Figure 6). This species was not targeted during field mapping due to its ubiquitous presence in non-native grasslands and disturbed areas, but was mapped at this location within the Preserve because of its high abundance. It is ranked as a low priority for removal/control within the Preserve due to the difficulty in effective control and limited potential to displace native habitat. Slender oat can be controlled by manual removal, mechanical removal, or herbicide treatment. Control efforts should occur prior to seed set (species blooms March to June).

Black Mustard (*Brassica nigra*)

Black mustard is a winter annual herb/forb which can form monotypic stands. Due to the relative flammability of dead/dried stalks, it can spread fire rapidly and over time can contribute to the transition of native communities to annual grasslands (CalIPC 2012a). Within the preserve it exists as a component of annual grasslands, but is also observed invading into native non-grassland vegetation communities. Ten individuals were mapped on the eastern border of the Preserve, along with 50 individual shortpod mustard plants (Figure 6). The Cal-IPC inventory categorizes black mustard as having an overall rating of "moderate." It is ranked as a low priority species for removal/control within the Preserve due to its limited distribution. Control of this species could include manual removal, mechanical control, or herbicide treatment. The species produces abundant seed, and therefore control should be focused during the winter and early spring months before the species develops seed (species blooms April to September). Young plants can be pulled, cut or treated with an appropriate herbicide (e.g., glyphosate) to control.

Italian Plumeless Thistle (*Carduus pycnocephalus*)

Italian plumeless thistle is an annual forb found in disturbed or open areas throughout California, including road edges, annual grasslands, and pastures (CalIPC 2012a). This species has a "moderate" Cal-IPC Inventory Ranking. It is rated as a low priority for control within the Preserve due to its isolated occurrences and limited ability to displace native habitat. Approximately 545 individuals of this species are scattered throughout riparian corridors in the Preserve, and it is most abundant in the northern region (Figure 6). Control of this species could include manual removal, mechanical control, or herbicide treatment. The species produces abundant, wind-blown seed, and therefore control should be focused during the winter and early spring months before the species develops seed. Young plants can be pulled, cut, or treated with an appropriate herbicide (e.g., glyphosate) to control.

Maltese Star Thistle (*Centaurea melitensis*)

Maltese star thistle is widespread in open or disturbed areas in the western United States. This species will occupy grasslands, open woodlands, roadsides, and agricultural fields (CalIPC 2012a). This species has more invasive potential in Southern California and has been designated with a "moderate" Cal-IPC Inventory Ranking. The species is rated as "low" priority for control within the Preserve due to its difficulty for effective control and limited ability to displace established coastal scrub and chaparral communities. Maltese star thistle is a common component of many communities, but was mapped herein for control where its presence was particularly abundant. A total of 11,200 individuals were mapped within the northern and southern regions of the Preserve (Figure 6), but additional scattered individuals are likely present. Control of this species could include manual removal, mechanical control, or herbicide

treatment. Control should be focused during the winter and early spring months before the species develops seed. Young plants can be pulled, cut, or treated with an appropriate herbicide (e.g., glyphosate) to control.

Bull Thistle (*Cirsium vulgare*)

Bull thistle is common in coastal grassland, marsh, and forest habitats, although it is of particular management concern in areas that are repeatedly disturbed, including overgrazed pastures or areas of recent burns. Bull thistle outcompetes native species for limited resources, such as water, nutrients, and space (CalIPC 2012a). This species has a "moderate" Cal-IPC Inventory Ranking. It is rated as a "low" priority for control within the Preserve due to its limited distribution and limited ability to displace established coastal scrub and chaparral communities. Within the Preserve, five individuals were mapped in the riparian corridor within the eastern region of the Preserve (Figure 6). Control of this species could include manual removal, mechanical control, or herbicide treatment. Control should be focused during the winter and early spring months before the species develops seed. Young plants can be pulled, cut, or treated with an appropriate herbicide (e.g., glyphosate) to control.

Crown Daisy (*Glebionis [=Chrysanthemum] coronaria*)

Crown daisy is a flowering annual in the Asteraceae family. It is an escaped ornamental species that inhabits coastal environments and easily invades disturbed areas. In disturbed environments, this species can form large, dense stands that may exclude native vegetation (CalIPC 2012a). Crown daisy has a "moderate" Cal-IPC Inventory Ranking (CalIPC 2012a). Approximately 50 individuals were mapped within the southern riparian corridor (Figure 6). It is rated as a "low" priority for control within the Preserve due to its limited distribution and limited ability to displace established coastal scrub and chaparral communities. Control of this species could include manual removal, mechanical control, or herbicide treatment. Control should be focused during the winter and early spring months before the species develops seed. Young plants can be pulled, cut, or treated with an appropriate herbicide (e.g., glyphosate) to control.

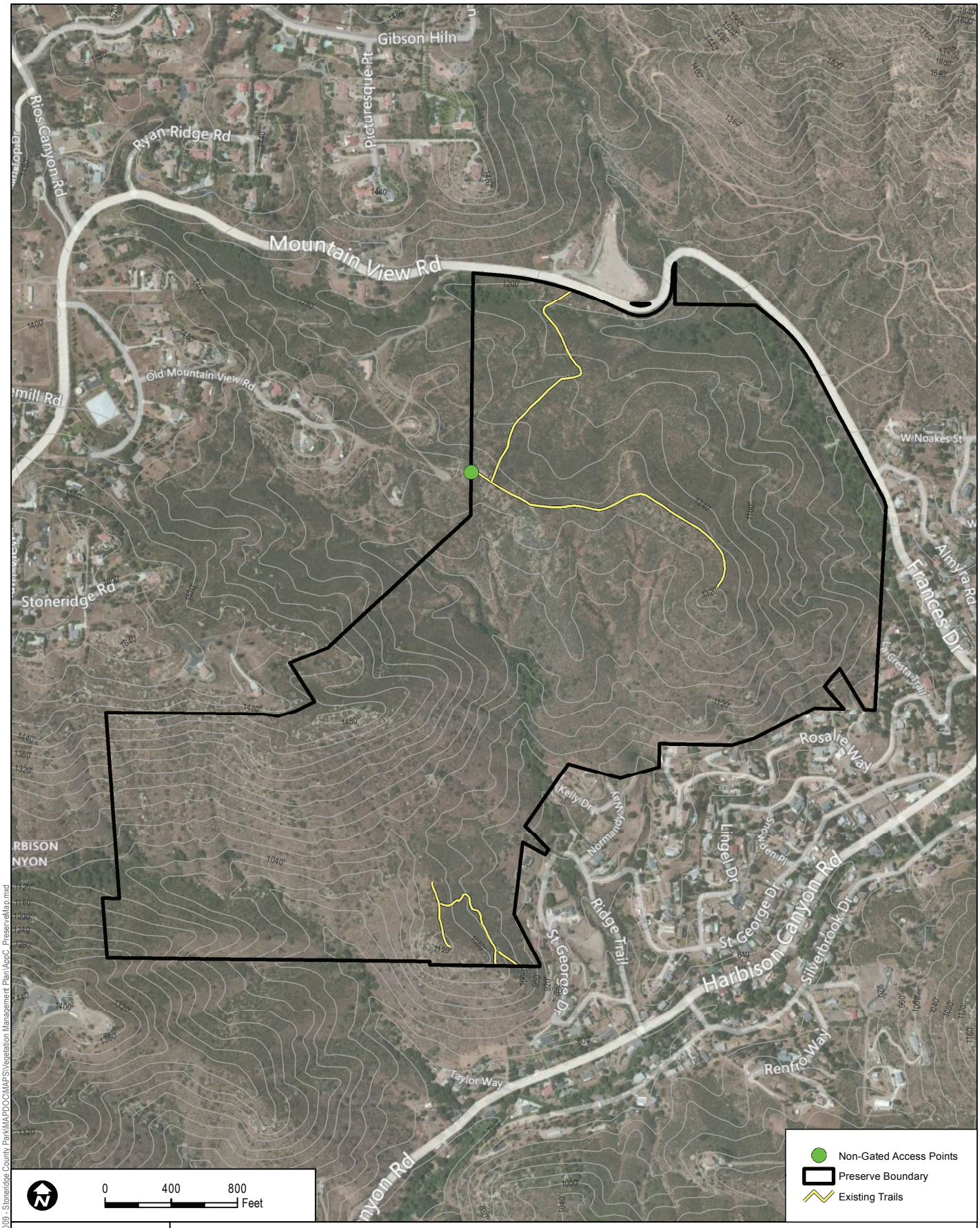
Shortpod Mustard (*Hirschfeldia incana*)

Shortpod mustard is a biennial, or occasionally a short-lived perennial, forb found in coastal scrub and grassland habitats (CalIPC 2012a). This species has a "moderate" Cal-IPC Inventory Ranking (CalIPC 2012a). Shortpod mustard was mapped throughout the Preserve, including a population of 1,110 individuals in the southern region of the Preserve (Figure 6). The species was ranked as low priority for control within the Preserve due to its limited ability to displace coastal scrub and chaparral communities. However, the species has the ability to spread and reestablish quickly in disturbed areas and should be controlled as feasible. Control of this species

could include either mechanical or herbicide treatment. The species produces abundant seed. Thus, removal of plant material that has seed present is important. Control should be focused during the winter and early spring months before the species develops seed. Young plants can be pulled, cut, or treated with an appropriate herbicide (e.g., glyphosate) to control.

APPENDIX C

Preserve Map with Access Points and Vegetation Management Units



DUDEK

6680-09

SOURCE: Bing, SanGIS 2012

APPENDIX C

Preserve Map with Access Points

Stoneridge Preserve - Vegetation Management Plan

Path: Z:\Projects\6680009\668009 - Stoneridge County Park\MAPDOC\MAPS\Vegetation Management Plan\AppC_PreserveMap.mxd

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APPENDIX D

Fire Behavior Modeling Results

APPENDIX D
Fire Behavior Modeling Results

FUELS CLASSIFICATION

Reliable estimates of fire behavior must consider the relationship of fuels to the fire environment and the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content and chemical properties.

All vegetation is considered fuel. All vegetation will burn; however, some species require more heat in order to ignite and propagate flame. The moisture content of vegetation is an important component; dry vegetation will ignite more rapidly, whereas green vegetation must lose its moisture before it will ignite. Consequently, shrubland vegetation with high oil content (above 6%) will burn more quickly and hotter than vegetation with high leaf moisture levels and low oil content levels. More than 90% of the flaming front of a wildfire is composed of fuel less than 0.5 inch in diameter and is consumed in minutes. Fuels larger than 1 inch in diameter are termed "residual" fuel and may require several hours to burn out. This larger fuel does not contribute to the forward rate of spread of the fire. The following factors describe the relationship between vegetation characteristics that affect fire behavior:

Fuel loading is defined as the oven dry weight of fuels in a given area, usually expressed in tons per acre. Natural fuel loading varies greatly by vegetative or fuel types in addition to the different size classes of fuel particles. Vegetation types can be rated as light, moderate, or heavy. Each rating is an estimate of the dead or live surface fuels that are less than 3 inches in diameter. Although specific measurements were not taken, based on the vegetation types identified in the cursory survey of the Stoneridge Preserve (Preserve), the different vegetation types can generally be assigned a moderate to high rating.

> Measuring the intensity, force, and destructive potential of wildfire is accomplished by observing flame lengths produced by burning vegetation. A direct relationship exists between the amount of energy released during burning (per second) and the length of flame generated. The standard for measuring energy release in the United States is the British Thermal Unit (BTU). One BTU is defined as the amount of energy required to increase the temperature of 1 pound of water 1°F (a standard kitchen match or candle flame is approximately one BTU).

Size and shape affect the surface area to volume ratio of fuels. Small fuels have a greater surface area to volume ratio than larger fuels. Dead fuels are separated into four size classes: (1) grasses, litter, or duff less than 0.25 inch diameter; (2) twigs and small stems 0.25– to 1-inch diameter; (3) branches 1- to 3-inch diameter; and (4) large stems and branches greater than 3-inch diameter. The fine fuels less than 0.25-inch diameter are most important for fire behavior analysis because their ignition time is less, and their fuel moisture content changes rapidly. This characteristic is typical for the grasses that were identified within and adjacent to the Preserve.

> The arrangement, size, and surface area of vegetative fuels play an important role in fire behavior and spread potential. Dense, concentrated biomass may burn evenly; however, when overall size decreases and surface area increases (as seen in native shrub stands), burning patterns change, resulting in faster ignition and spread. Live shrubland and grassland vegetation generally exhibit high surface to volume ratios. Standing grass, coastal sage scrub, and chaparral have high surface area to volume ratios, whereas forest litter and chipped or cut biomass exhibit very low surface to volume ratios.

Compactness, or spacing between fuel particles, affects the rate of combustion. For example, fuel particles that are closely compacted have less surface area exposed and less air circulation between particles and thus are slower to combust. The thick duff layer found underneath a mixed forest is an example of a tightly compacted fuel, whereas the open, dead branches on sagebrush or chaparral are considered a loosely compacted fuel. With the exception of the on-site oak woodlands, the fuels on the Preserve are loosely spaced with adequate air circulation required to carry a fire.

Horizontal continuity is the extent of horizontal distribution of fuels at various levels or planes. The vegetative types within various portions of the Preserve were analyzed for horizontal continuity and vertical arrangement. Fuels are either rated as uniform or patchy. Uniform fuels are evenly distributed and occur in a continuous, non-interrupted cover across the landscape. Patchy fuels are not continuous.

Vertical arrangement is defined as the relative heights of fuels above the ground, as well as their vertical continuity. Both of these vegetation characteristics influence the ability of fire to reach various fuel levels or strata. Vegetation of various heights that can transport fire from the low-level brush to tree canopies is called a fuel ladder and may create what is called a "crown fire." When tall grasses and shrubs grow around trees with low hanging branches, the result is a fuel ladder. When a ground fire climbs the fuel ladder into the crowns of trees, it can spread canopy to canopy, creating higher fire intensity and firebrands.

Fuel moisture content is defined as the amount of water in fuels. The moisture content of plant materials plays a major role in the ignition, development, and spread of fires. Fuel moisture controls the current flammability of fuels both living and dead. During the most active growing periods of spring, the moisture content of plant foliage may be quite high. As the season progresses, a plant's moisture content declines until late summer or early fall when the plant becomes dormant or completely dies. Fine fuels, less than 0.25 inch thick, are most responsible for the spread of fire and have highly variable fuel moisture contents depending on the relative humidity of the air. Live fuel moisture content during the peak fire season (October through December) is estimated to be 60% to 80% in the drier open areas. This can potentially drop to less than 60% under extreme, dry wildfire conditions.

> There are two types of fuel moisture values to consider: (1) dead fuel moisture, with measurements of 1-, 10-, 100-, and 1,000-hour time-lag; and (2) live fuel moisture.

Dead fuel moisture percentages are determined by temperature, aspect, time of day, relative humidity, and time of year. One-hour time-lag fuel is less than 0.5 inch thick, 10-hour time-lag fuel is between 0.5 inch and 1 inch thick, 100-hour time-lag fuel is between 1 and 3 inches thick, and 1,000-hour time-lag fuel is greater than 3 inches thick. One-hour time-lag fuel can reach equilibrium with the surrounding atmosphere in 1 hour, or within minutes when air temperature exceeds 80°F and relative humidity is below 25%. One-hour time-lag fuel moisture may be calculated using a set of tables that reference time of day, month, aspect, slope, temperature, and relative humidity. Ten-hour, 100-hour, and 1,000-hour time-lag fuel can take up to 10 hours, 100 hours, or 1,000 hours to reach equilibrium with the surrounding atmosphere, respectively. In Southern California, 1-hour, 10-hour, and 100-hour time-lag fuels are usually given equal value. One thousand hour time-lag fuel, which occurs in more heavily wooded environments (i.e., timber), is generally used in measuring drought effects. Forests are considered "critical" when 1,000-hour fuel measurements are less than 15% (as a frame of references, kiln-dried wood moisture averages 22%).

> Despite variations in the topography and disturbance history of the Preserve, vegetative cover is classified into four main types: grass, chaparral, coastal sage scrub, and woodland. Frequent fires have created low-volume fuel beds throughout much of the Preserve. Although most fuels occur in the 1-hour size class, pockets of 10- and 100-hour fuels can be found, primarily in the woodland vegetation types on site.

Live fuel moisture is described as the moisture in leaves and woody portions of a plant. Field measurements of live fuel moistures are calculated by cutting small branches (less than 3 inches in diameter), weighing the branch, placing it in a low- temperature oven for 12 hours, removing the branch, and weighing it again. The difference in weight is the loss of moisture in the leaves

and woody portion of the branch. Consequently, live fuel moisture may exceed 100% of the dry weight of the plant. Live fuel moisture is the highest in the spring and early summer, and the lowest in late summer, fall, and early winter. This measurement is a valuable tool in predicting wildfire potential for a general area.

> Chaparral and coastal sage scrub are common Southern California vegetation types found in many upland locations and generally have reduced fuel moisture levels. Conversely, riparian vegetation, including willow (*Salix* spp.), coast live oak (*Quercus agrifolia*), and mulefat (*Baccharis salicifolia*), has higher leaf moisture values than vegetation growing in drier, more xeric sites. The importance of fuel moisture in examining fire hazard is that higher moisture levels ultimately require higher BTU output to ignite or sustain ignition. Consequently, fuel arrangement, along with fuel chemical/moisture content, plays an important role in wildfire combustion, spread, and heat output. Fuel moisture is a significant component, as vegetation requires external heat and energy to reduce moisture levels before it will ignite. High winds, low relative humidity, and/or high temperatures begin the process of removing fuel moisture, thus allowing vegetation to ignite and burn more rapidly. Consequently, lower fuel moisture values, including both dead and live fuel moistures, result in increased fire intensity. Moisture-laden fuels inhibit complete combustion while simultaneously producing excessive smoke output.

Fuel chemical properties include the presence of volatile substances such as oils, resins, wax, and pitch. These also affect the rate of combustion. Chaparral and sage scrub vegetation have high amounts of these volatile substances that contribute to rapid rates of spread and high fire intensities.

> Oil and moisture contents vary between fuels and fluctuate depending on the time of year. For example, black sage may have an oil content approaching 20% of its weight in dry summer or autumn months, but, in the spring, when sufficient groundwater is available, moisture content values can exceed 300%. When stressed during extreme dry weather conditions, numerous chaparral and coastal sage scrub species may react explosively when moisture falls below 60%, whereas larger shrubs may require higher energy to sustain ignition.

FUEL MODELS

All nine fuels characteristics are descriptors that help define the 13 standard fuel models (Anderson 1982), the more recently developed 40 fuel models (Scott and Burgan 2005), and five custom fuel models developed for Southern California (Weise and Regelbrugge 1997). Four fuel models (models 1, SCAL 18, SH5, and TU5) were used in the FlamMap analysis for the Preserve and are required inputs for the mathematical fire spread computations. Additionally, one non-burnable model (model 0) was utilized to represent non-fuel areas (e.g., roads)). Table 1 provides details of the four fuel models used in the analysis conducted for Preserve.

Table 1
Fuel Model Characteristics

Fuel Model	Description	Tons/acre; Btu/lb	Fuel Bed Depth (Feet)
1	Short grass	0.7 tons/acre; 8,000 Btu/lb	1.0
SCAL18	Sage/buckwheat	9.7 tons/acre; 9,200 Btu/lb	3.0
SH5	High load dry scrub	8.6 tons/acre; 8,000 Btu/lb	6.0
TU5	Very high load, dry climate timber-shrub	14.0 tons/acre; 8,000 Btu/lb	1.0

WILDLAND FIRE BEHAVIOR MODELING

Fire behavior was analyzed for the Preserve site using FlamMap fire behavior modeling software and local topographic, fuels, and weather data. The FlamMap output data provide an indication of how vegetative fuels will burn under specific fuel, weather, and topographical conditions. The FlamMap (version 5.0) fire behavior software package (Finney et al. 2012) is a geographic information system (GIS)-driven computer program that incorporates fuels, weather, and topography data in generating static fire behavior outputs, including values associated with flame length, rate of spread, and fireline intensity. It is a flexible system that can be adapted to a variety of specific wildland fire planning and management needs.

The calculations that result from FlamMap are based on the BehavePlus Fire Modeling System algorithms but result in a geographically distinct data set based on GIS inputs. FlamMap model outputs allow wildland resource managers to predict rate of spread, fireline intensity, and flame length, which provide important insights about the characteristics of wildfire spread within and adjacent to high-value areas, whether residential structures or preserved sensitive habitats. Each of the input variables used in FlamMap remain constant at each location, meaning that the input variables are applied consistently to each grid cell and the fire behavior at one grid cell does not impact that at a neighboring grid cell. Essentially, the model presents a "snapshot" in time and does not account for temporal changes in fire behavior or the movement of fire across the landscape. As such, the results of the models contained herein should be utilized as valuable information sources and tools to prioritize fuel treatment options rather than an exact representation of how a fire would behave on the Preserve.

The basic assumptions and limitations of FlamMap are:

- The fire model output describes fire behavior only in the flaming front. The primary driving forces in the predictive calculations are the dead fuels less than 0.25 inch in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect to carry fire, and fuels greater than 3 inches in diameter have no effect.
- The model bases calculations and descriptions on a wildfire spreading through surface fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.
- The software assumes that fuel moisture conditions are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel must be carefully considered to obtain useful predictions.
- WindNinja software (v. 2.1.0), which is incorporated into FlamMap, allows for the generation and incorporation of gridded wind data in the FlamMap simulation.
- The FlamMap fire behavior computer modeling system provides the average length of the flames, which is a key element for determining defensible space distances for minimizing structure ignition.

Fuel models used in the FlamMap analysis are classified into four groups based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Fuel model classifications were made during field analysis and in conjunction with available vegetation maps of the Preserve. The following list of fuel types describes the classification of fuel models based on vegetation type:

- Grasses Fuel, Models 1 through 3. These models represent the fast moving, light, flashy fuels found in grassland landscapes.
- Brush Fuel, Models 4 through 7, SCAL 14 through 18. These models are designed to represent the higher-intensity chaparral and sage scrub dominated landscapes.
- Timber Fuel, Models 8 through 10. Timber models are selected to represent the riparian woodland or ornamental forested landscapes.
- Logging Slash, Fuel Models 11 through 13. These models are used to represent slash; none were utilized for the Preserve.

FLAMMAP FUEL MODEL INPUTS

FlamMap software requires a minimum of 5 input files that represent field conditions in the study area, including elevation, slope, aspect, fuel model, and canopy cover. Each of these files was created as a raster geographic information system (GIS) file in ArcGIS 10.0 software, exported as an ASCII grid file, then utilized in creating a FARSITE Landscape file that served as the base for the FlamMap runs. The resolution of each grid file and associated ASCII file that was used in the models described herein is 10 meters, based on available digital elevation models (DEMs). In addition to the Landscape file, wind and weather data are incorporated into the model inputs. The output files chosen for each of the modeling runs included flame length (feet) and fireline intensity (BTU/ft/sec). Figures C-1 through C-4 depict the results of each of the four modeling runs and exhibit each of these output variables.

The following provides a description of the input and output variables used in processing the FlamMap models. In addition, data sources are cited and any assumptions made during the modeling process are described.

1. ***Elevation.*** Elevation data were derived from a 10 meter resolution Digital Elevation Model (DEM) acquired from the San Diego Association of Governments (SANDAG). This data set was utilized to create an elevation grid file, using units of feet above mean sea level. The elevation data are a necessary input file for FlamMap runs and are necessary for adiabatic (i.e., a process that happens without loss or gain of heat) adjustment of temperature and humidity and for conversion of fire spread between horizontal and slope distances (Finney et al. 2012).
2. ***Slope.*** Using Spatial Analyst tools, a slope grid file was generated from the elevation grid file. Slope measurements are represented in percent of inclination from horizontal. The slope input file is necessary for computing slope effects on fire spread and solar radiance (Finney et al. 2012).
3. ***Aspect.*** Using Spatial Analyst tools, an aspect grid file was generated from the elevation grid. Aspect values are presented in azimuth degrees and are important in determining solar exposure.
4. ***Fuel Model.*** Vegetation coverage data in the form of a GIS shapefile were used in this analysis to create a fuel model file. Derived from Dudek's vegetation mapping data, the vegetation types were classified according to existing National Forest Fire Laboratory (NFFL) and BehavePlus fuel models, and the data file was converted to a grid file for inclusion in FlamMap modeling. Table 2 presents the vegetation and associated fuel type classifications for the Preserve.

5. ***Canopy Cover.*** Canopy cover is a required file for FlamMap operations. It is necessary for computing shading and wind reduction factors for all fuel models. Canopy cover is the horizontal percentage of the ground surface that is covered by tree crowns. Canopy cover is measured as the horizontal fraction of the ground that is covered directly overhead by tree canopy. Crown closure refers to the ecological condition of relative tree crown density. Stands can be said to be "closed" to recruitment of canopy trees but still only have 40% or 50% canopy cover (Finney et al. 2012). Coverage units can be categories (0–4) or percentage values (0–100). Table 2 presents canopy cover assignments for each vegetation type/fuel model.

Table 2
Fuel Models and Associated Canopy Cover Values

Vegetation Community/Land Cover	Fuel Model	Canopy Cover Value
Coast Live Oak Woodland	TU5	3
Coastal Sage-Chaparral Transition	SH5	0
Southern Mixed Chaparral	SH5	0
Diegan Coastal Sage Scrub	SCAL18	0
Southern Mixed Chaparral	SH5	0
Non-Native Grassland	1	0
Disturbed Habitat	1	0
Urban/Developed	0	0

Weather

Weather and fuel moisture inputs incorporated into fire behavior modeling for the site were determined by utilizing the guidelines and standards presented by the County of San Diego, Department of Planning and Land Use. These guidelines identify acceptable fire weather inputs for extreme fire conditions during summer months and Santa Ana fire weather patterns. The County analyzed and processed fire weather from Remote Automated Weather Stations (RAWS) between April 15 to December 31 in order to represent the general limits of the fire season. Data provided by the County's analysis included temperature, relative humidity, and sustained wind speed and is categorized by weather zone, including Maritime, Coastal, Transitional, Interior, and Desert.

To determine fuel moisture values for the analysis area, Dudek utilized the Fine Dead Fuel Moisture tool within the BehavePlus (v. 5.0.5) fire behavior modeling software package. The temperature, relative humidity, and wind speed data for the Transitional weather zone were utilized for this analysis based on the Preserve location. Reference fuel moistures were calculated in BehavePlus for two weather scenarios (Summer and Peak) and were based on site-specific topographic data inputs. Table 3 summarizes the fuel moisture calculations utilized for this analysis.

Table 3
Fine Dead Fuel Moisture Calculation

Variable	Summer Weather	Peak Weather
Dry Bulb Temperature	90 -109 deg. F	90 -109 deg. F
Relative Humidity	10 - 14 %	5 - 9 %
Reference Fuel Moisture	2 %	1 %
Month	May June July	Feb Mar Apr Aug Sept Oct
Time of Day	14:00 - 15:59	14:00 - 15:59
Elevation Difference	Level (within 1,000 ft.)	Level (within 1,000 ft.)
Slope	30+ %	31+ %
Aspect	South	South
Fuel Shading	Exposed (< 50% shading)	Exposed (< 50% shading)
Fuel Moisture Correction	1 %	1 %
Fine Dead Fuel Moisture	3 %	2 %

The fine dead fuel moisture values were incorporated into the Initial Fuel Moisture file used as an input in FlamMap. Initial wind direction and wind speed values for the two FlamMap runs were manually entered during the data input phase. WindNinja software (v. 2.1.0), which is incorporated into FlamMap, allows for the generation and incorporation of gridded wind data in the FlamMap simulation. The input wind speed and direction is roughly an average surface wind at 20 feet above the vegetation over the analysis area. The WindNinja-generated wind data was included in the modeling effort and provides a more detailed data set for modeling the effect of wind speed and direction on fire behavior across the modeling area. Table 4 presents the weather and fuel moisture input variables used for fire behavior modeling efforts.

Table 4
FlamMap Weather Input Variables

Model Variable	Summer Weather	Peak Weather
1 h fuel moisture	3%	2%
10 h fuel moisture	4%	3%
100 h fuel moisture	6%	5%
Live herbaceous moisture	60%	30%
Live woody moisture	90%	60%
20 ft wind speed (mph)	19 mph	41 mph
Wind direction	225 degrees	45 degrees
Slope steepness	Variable by location	Variable by location

mph = miles per hour

FlamMap Fuel Model Outputs

Two output grid files were generated for each of the two FlamMap runs, and include representations of flame length (feet) and fireline intensity (BTU/feet/second), as shown in Figures C-1 through C-4. The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews and Bevins 2009). It is a somewhat subjective and non-scientific measure of fire behavior, but is extremely important to fireline personnel in evaluating fireline intensity and is worth considering as an important fire variable (Rothermel 1991). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire and is another important variable in initial attack and fire suppression efforts. The information in Table 5 presents an interpretation of these fire behavior variables as related to fire suppression efforts.

Table 5
Fire Suppression Interpretation

Flame Length (feet)	Fireline Intensity (Btu/ft/s)	Interpretations
Under 4	Under 100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 to 8	100 to 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. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 to 11	500 to 1000	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11	Over 1000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Source: BehavePlus 5.0.5 fire behavior modeling program (Andrews and Bevins 2009)

The fire behavior analysis results for the Preserve vary depending on fuel type. As FlamMap utilizes site-specific digital terrain data (including slope, vegetation, aspect, and elevation data) slight variations in predicted flame length and fireline intensity values can be observed based on fluctuations of these attributes across the landscape. As presented, wildfire behavior in each of the fuel types varies depending on weather conditions. Given the climatic, vegetation, and topographic characteristics along with the fire history and fire behavior modeling results discussed in this VMP, the Preserve is determined to be vulnerable to wildfire starting in, burning onto, or spotting onto the site. Based on this information, adjacent residential development, and the fire history of the area, it is expected that wildfires will occur on the Preserve in the future.

Under Peak weather conditions, fire can move rapidly through the site's fuels. Worst-case flame lengths were calculated at approximately 42 feet in chaparral vegetation types and approximately 40 feet in sage scrub vegetation on slopes exceeding 50% throughout the Preserve. Spread rates on site may exceed 8 miles per hour in dry flashy fuels (grasses and scrub) under extreme weather and slope conditions. Finally, under extreme weather and wind conditions, fireline intensity values may exceed 18,000 Btu/feet/second limiting the options for fire response personnel and emphasizing the importance of fuel modification and defensible space for adjacent residences.

It should be noted that the modeling results depict values based on inputs to the FlamMap system. Variations in weather or pockets of different fuel types are not accounted for in this analysis. Additionally, the scale of analysis (10 square meters) limits fine-scale analysis and interpretation. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns that could not be obtained for this analysis.

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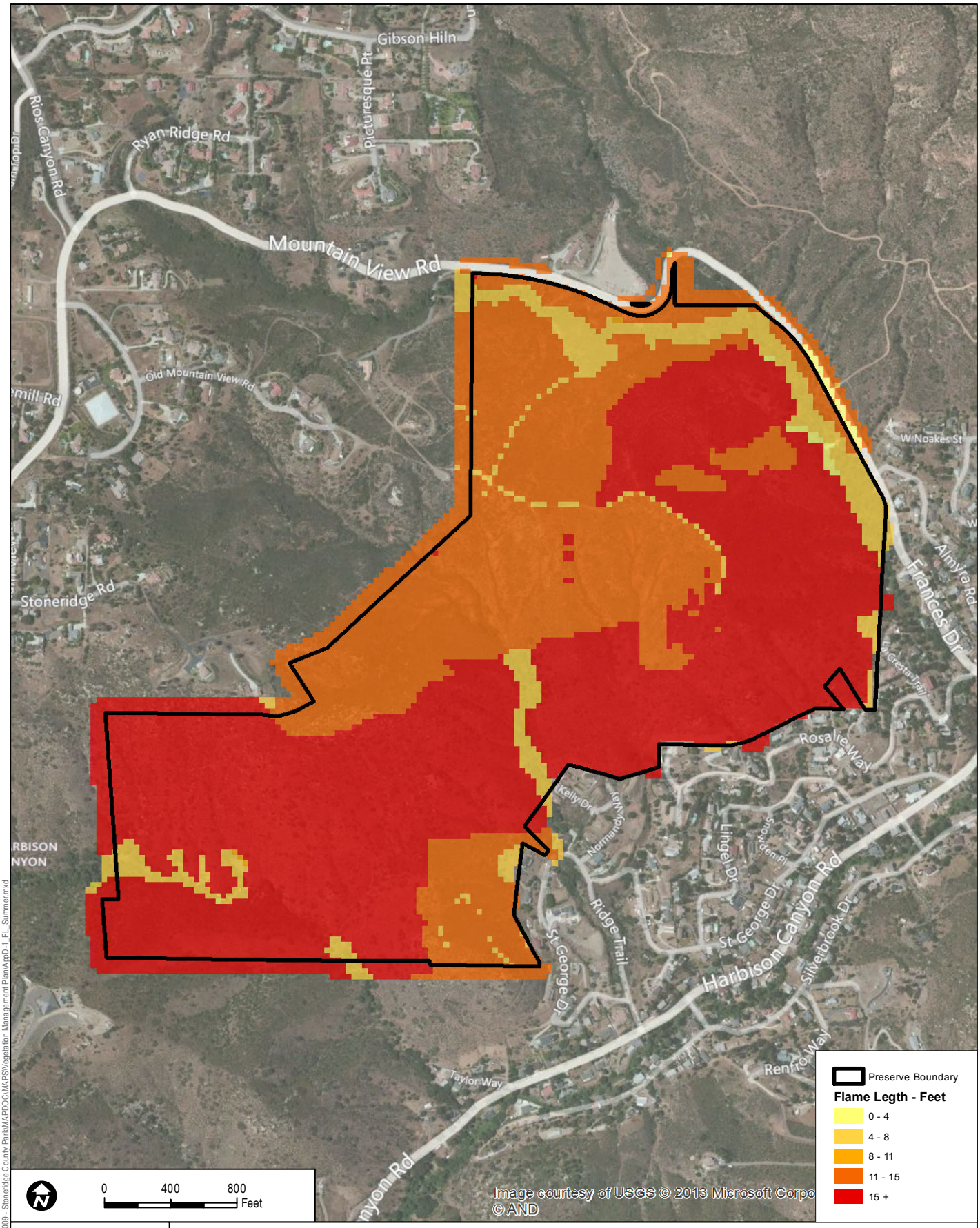

DUDEK

6680-09

SOURCE: Bing

APPENDIX D-1

Flame Length, Summer Fire

Stoneridge Preserve - Vegetation Management Plan

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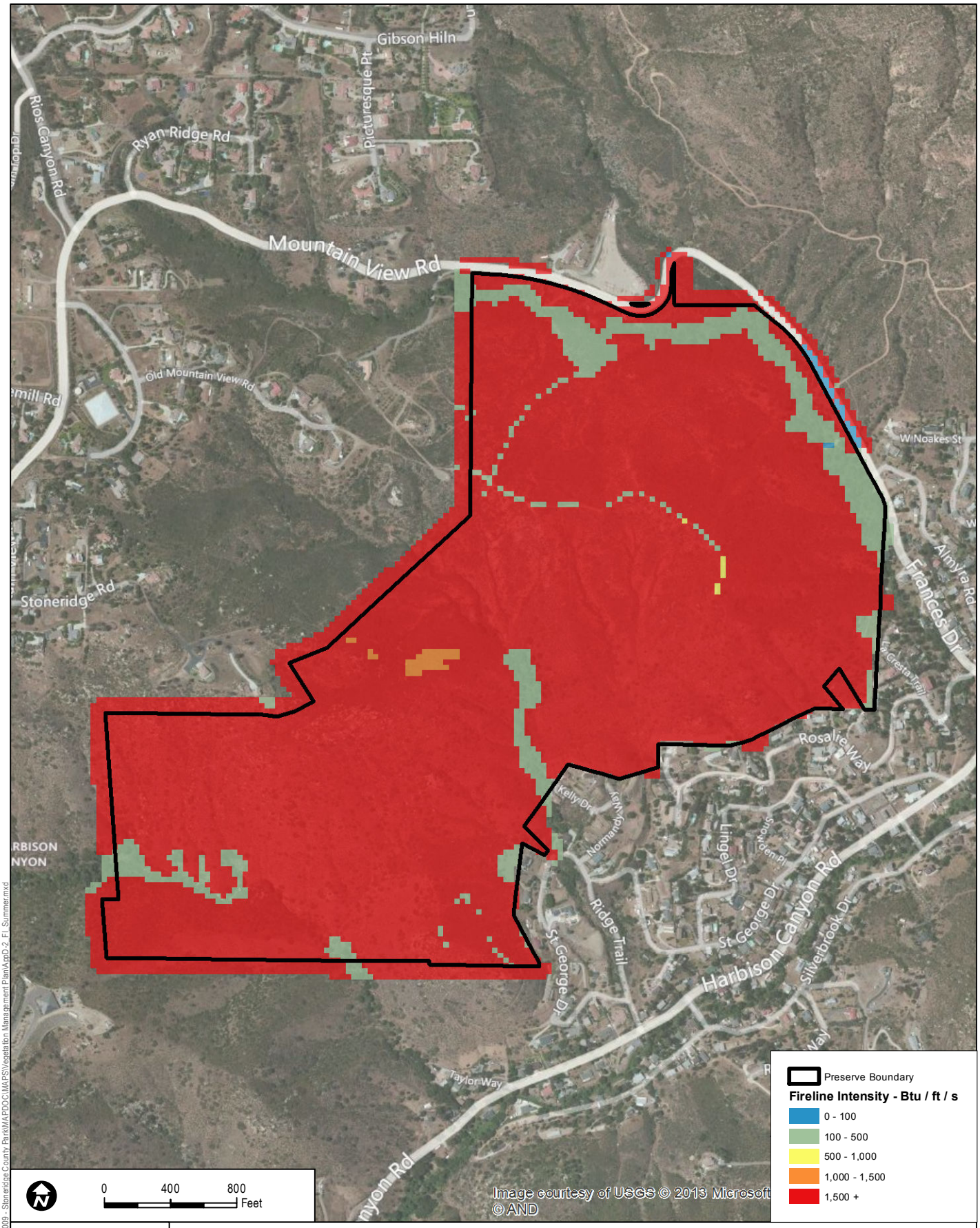

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SOURCE: Bing

APPENDIX D-2

Fireline Intensity, Summer Fire

Stoneridge Preserve - Vegetation Management Plan

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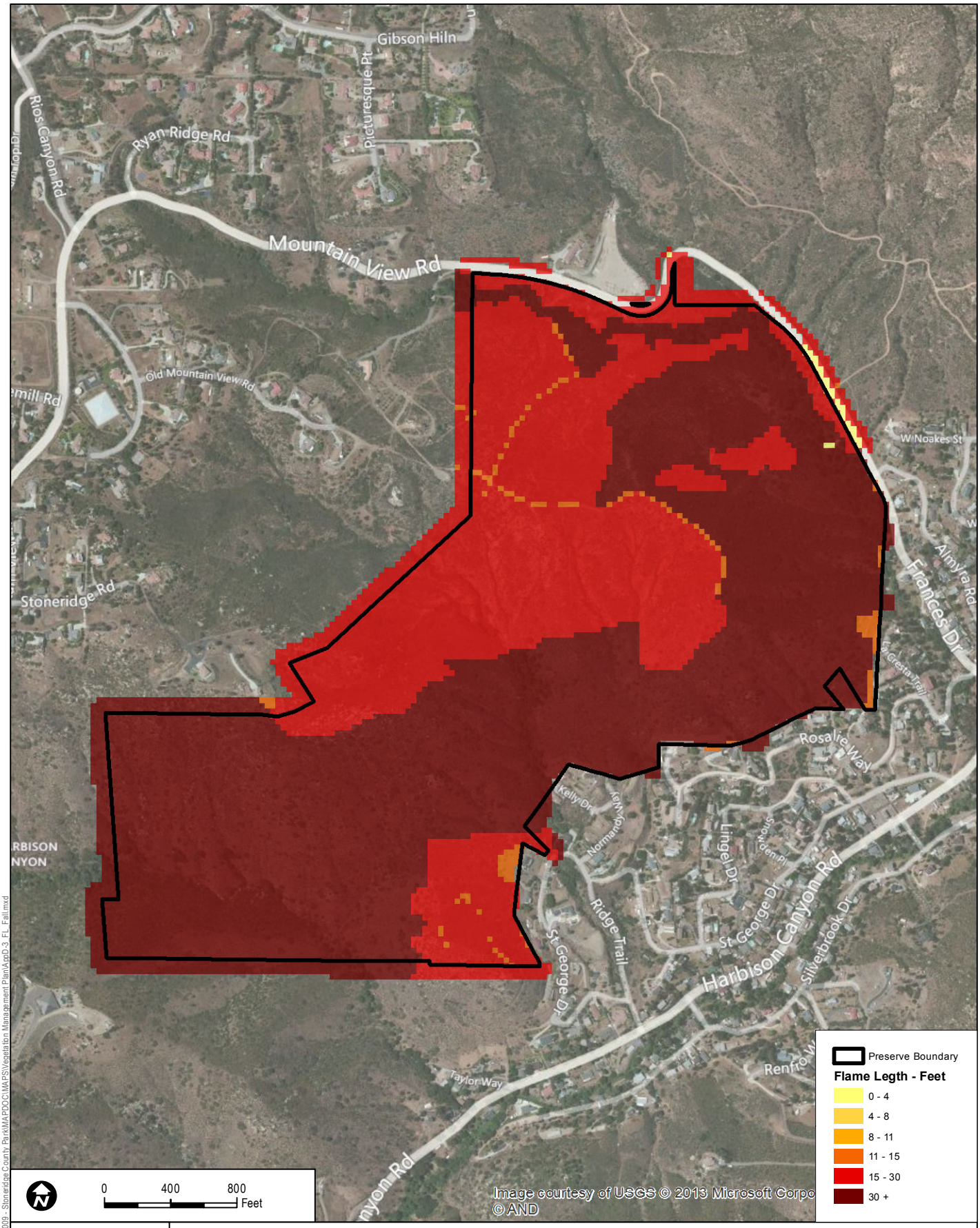

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SOURCE: Bing

APPENDIX D-3

Flame Length, Fall Fire

Stoneridge Preserve - Vegetation Management Plan

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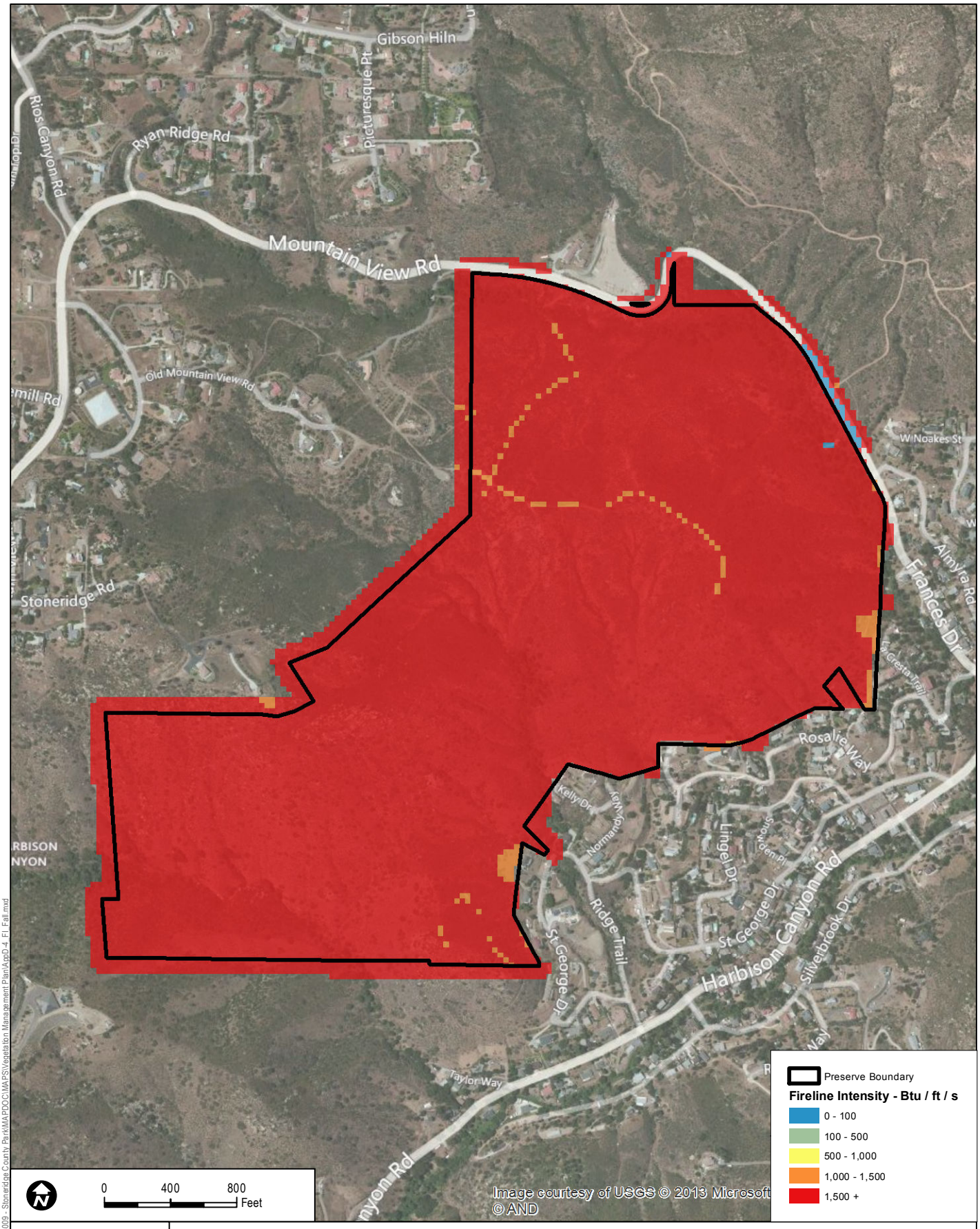

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SOURCE: Bing

APPENDIX D-4

Fireline Intensity, Fall Fire

Stoneridge Preserve - Vegetation Management Plan

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