Santa Margarita Preserve
Vegetation Management Plan







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A Current California Herbicides Approved For Water Use

B Fire Modeling

Glossary of Terms & Acronyms

AMSL	above mean sea level
Aquamaster®	DuPont trade name for its brand of glyphosate herbicide. Aquamaster is approved for use in aquatic systems
Cal Fire	California Department of Forestry and Fire Protection
Cal-IPC	California Invasive Plant Council
CDFA	California Department of Food and Agriculture
CNPS	California Native Plant Society
CRC	Cooperative Research Centre for Weed Management Systems
CWPP	Community Wildfire Protection Plan
DPR	Department of Parks & Recreation
Exotics	Invasive species
FRMP	Framework Resource Management Plan
ft	feet
I-15	Interstate 15
Invasive [Species]	A species that is not native to the Preserve, and as such has unwanted impacts of native species
M	meter
Preserve	Santa Margarita Preserve
SR-76	State Route 76
SRA	State Responsibility Area
USGS	U.S. Geological Survey
VMP	Vegetation Management Plan

Chapter 1
Introduction

1.1 Purpose and Need

The purpose of this Vegetation Management Plan (VMP) is to provide guidance for the management of the vegetative resources of the County of San Diego's Department of Parks and Recreation (DPR) Santa Margarita Preserve (Preserve) through specific and adaptive management practices. The three main components of vegetation management for the Preserve include: invasive species management, habitat restoration, and fire management. This information is needed to ensure vegetation communities that provide wildlife habitat for shelter and breeding, movement corridors and foraging opportunities are managed for preservation and function.

While this VMP is intended to be a standalone document, the information and recommendations presented will be used by DPR to develop Area Specific Management Directives (ASMDs) as part of the Resource Management Plan (RMP) being prepared for the Preserve. 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 non-native invasive plant species observed on the Preserve, identifies and prioritizes target species for removal, and outlines standard removal methods. The Habitat Restoration section of this VMP identifies 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 five years, as needed, in conjunction with anticipated Preserve RMP updates. The VMP may be revised on a shorter timescale if there is a change in circumstance, for example, acquisition of additional Preserve land or a wildfire event on-site.

1.2 Site Location and Description

The Preserve is located in northern San Diego County approximately 5.5 miles west of Interstate 15 (I-15), approximately nine (9) miles north of State Route 76 (SR-76), and approximately two (2) miles northwest of downtown Fallbrook, California (Figure 1). Specifically the Preserve is located directly west of Sandia Creek Road, just east of the northeastern portion of Camp Pendleton Marine Corps Base and the southern portion of the Preserve is bisected by De Luz Road.



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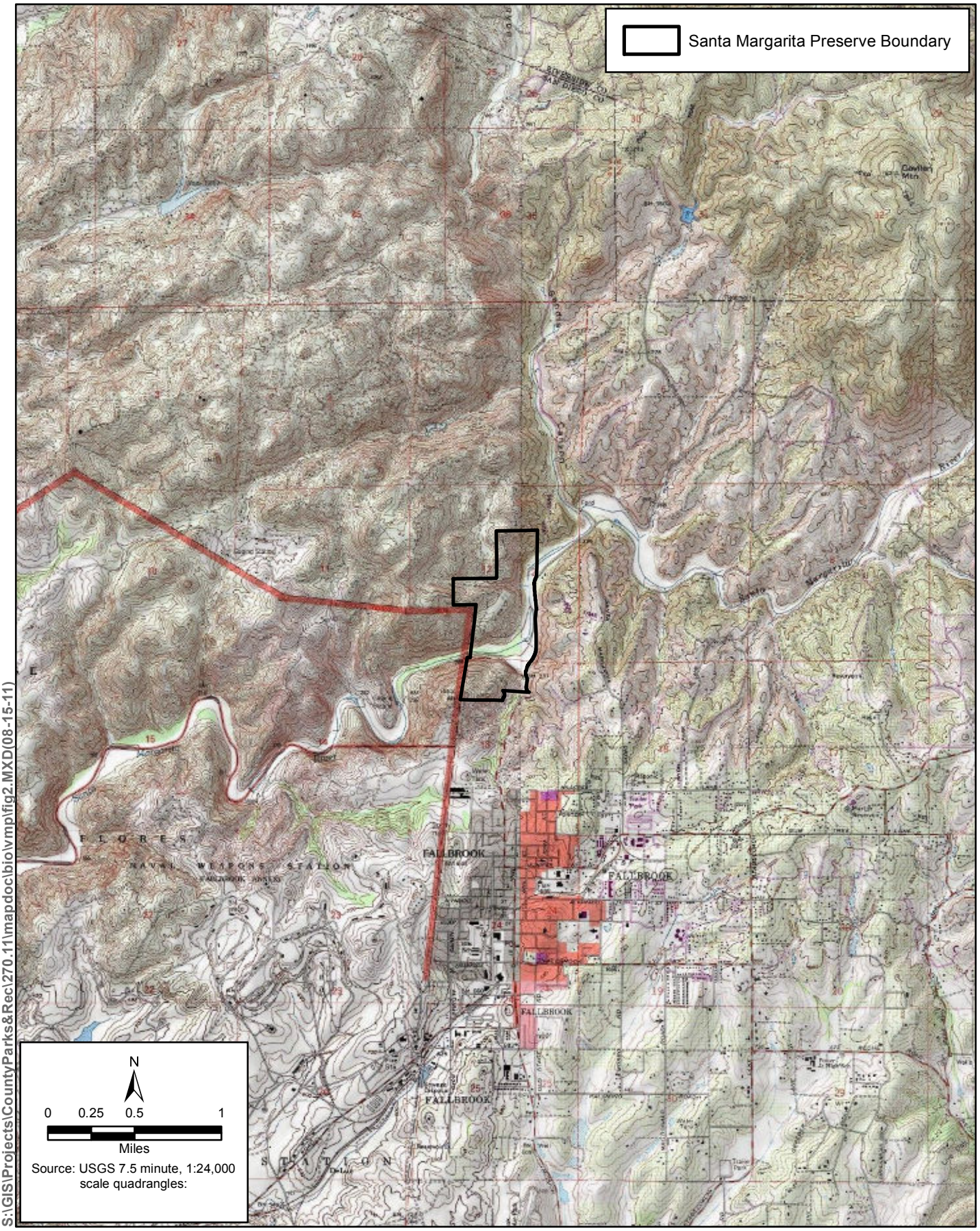
Figure 1
Regional Location
Santa Margarita Preserve

The Preserve is located in the upper Santa Margarita River Valley, which consists of a deep basin surrounded by steep hills and rocky rises ranging in elevation from approximately 90 meters (m) (300 feet [ft]) above mean sea level (AMSL) along the valley floor, to over 275 m (900 ft) AMSL in the hills north and south of the river bottom (Figure 2).

1.3 Goals & Objectives

Specifically, the goals and objectives of this VMP are to provide management guidelines for the following:

1. Maximize the extent of appropriate habitat for native target species by the removal or control of non-native species:
    - Identify invasive species and their locations
    - Investigate and report on control techniques
    - Develop management objectives
2. Provide a framework for the restoration of disturbed areas within the Preserve:
    - Identify closed trails, roads and other areas of potential restoration
    - Identify appropriate restoration goals for each of these sites (i.e., appropriate habitat)
    - Investigate and report on restoration techniques
    - Develop management objectives for the restoration areas
3. Provide a fire management strategy that will include planning for wildland fires:
    - Investigate and report on current fire management practices
    - Provide a description of the fire environment
    - Provide a discussion on fire management methods
    - Develop management objectives through a fire response plan



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Figure 2
Preserve Vicinity Map
Santa Margarita Preserve

Chapter 2
Environmental Resources

Baseline biological surveys of the Preserve were conducted between April and October 2011 (ICF 2011). Field studies included vegetation mapping (including mapping invasive non-native plants), rare plant surveys, butterfly surveys, pitfall arrays, amphibian surveys, avian point counts, bat surveys, small mammal trapping, and medium and large mammal tracking and camera stations. Brief descriptions of the existing vegetation communities, sensitive biological and cultural resources documented within the Preserve during the baseline surveys are provided below.

2.1 Biological Resources

2.1.1 Vegetation Communities

The Preserve consists of 13 plant alliances or associations (Table 1; Figure 3). These vegetation community types are described below and organized as they are in the classification key by functional group (e.g., drought deciduous shrublands, riparian shrublands, and riparian woodlands\forest and woodlands). Currently the VCM classification system does not include unvegetated habitat (e.g. disturbed habitat, urban/developed, and non-vegetated channel) and agricultural lands; therefore, these landcover types are described using the Oberbauer-modified Holland classification system (Oberbauer et al. 2008, Holland 1986).

Mapped according to the Vegetation Classification Manual for Western San Diego County (SANDAG 2011)

- 3.4.2 Western Sycamore-Cottonwood-Arroyo Willow Association (3.1 ac)
- 3.4.3 Western Sycamore-Coast Live Oak Association (4.3 ac)
- 3.6.1 Coast Live Oak-California Sagebrush Association (2.9 ac)
- 3.6.2 Coast Live Oak-Scrub Oak Association (3.9 ac)
- 3.6.3 Coast Live Oak-Arroyo Willow Association (1.2 ac)
- 3.6.4 Coast Live Oak-Poison Oak-Grass Association (6.9 ac)
- 3.9.1 Red Willow Association (35.4 ac)
- 4.1.2 Chamise-Buckwheat-California Sage Brush Association (26.7 ac)
- 4.2.1 Chamise-Mission Manzanita-Scrub Oak Association (9.3 ac)
- 4.7.1 California Sagebrush-Buckwheat-Laurel Sumac Association (21.8 ac)
- 4.11.1 Mule Fat Association (0.8 ac)
- 4.38 Scrub Oak-Chamise Alliance (42.7 ac)
- 4.43.2 White Sage-California Sage Brush Association (44.0 ac)
- 5.5 Wild Oat Semi-Natural Stand (within the mapping buffer only)

Unvegetated Areas & Agriculture (Holland Classification)

- 64200 Non Vegetated Channel (2.4 ac) (NVC)
- 12000 Developed lands (6.5 ac) (DEV)
- 11000 Disturbed Habitat (6.6 ac) (DH)
- 18100 Agriculture (0.1 ac) (AG)
- Santa Margarita Preserve Boundary

0 100 200 400
Feet

N

Figure 3
Vegetation Communities
Vegetation Classification Manual for Western San Diego County
Santa Margarita Preserve

Table 1. Vegetation Communities

VCM Code	Vegetation Community Type				Acres
	VCM Alliance/Association	VCM Common Name	Holland Code	Holland Classification	
Drought Deciduous Shrublands					
4.1.2	*Adenostoma fasciculatum-Eriogonomum fasciculatum-Artemisia californica* Association	Chamise-Buckwheat-California Sagebrush Association	37G00	Coastal Sage-Chaparral Transition	26.7
4.2.1	*Ademostoma fasciculatum – Xyloccocus bicolor – Quercus berberidifolia* Association	Chamise-Mission Manzanita-Scrub Oak Association	37903	Scrub Oak Chaparral	9.3
4.38	*Quercus berberidifolia – Adenostoma fasciculatum* Alliance	Scrub Oak-Chamise Alliance	37903	Scrub Oak Chaparral	42.7
4.43.2	*Salvia apiana – Artemisia californica* Association	White Sage-California Sagebrush Association	32501	Diegan Coastal Sage Scrub	44.0
4.7.1	*Artemisia californica – Eriogonum fasciculatum – Malosma laurina* Association	California Sagebrush-Buckwheat-Laurel Sumac Association	32501	Diegan Coastal Sage Scrub	21.8
	Total Drought Deciduous Shrublands				***144.5***
Riparian Shrublands					
4.11.1	*Baccharis sarothroides* Association	Mule Fat Association		Mule Fat Scrub	0.8
	Total Riparian Shrublands				***0.8***
Riparian Woodland/Forest					
3.4.2	*Platanus racemosa – Populus fremontii – Salix lasiolepis* Association	Western Sycamore-Cottonwood-Arroyo Willow Association	62500	Southern Riparian Woodland	3.1
3.4.3	*Platanus racemosa – Quercus agrifolia* Association	Western Sycamore-Coast Live Oak Association	61300	Southern Riparian Forest	4.3
3.6.3	*Quercus agrifolia – Salix lasiolepis* Association	Coast Live Oak-Arroyo Willow Association	61310	Southern Coast Live Oak Riparian Forest	1.2
3.9.1	*Salix laevigata* Association	Red Willow Association	63720	Southern Willow Scrub	35.4
	Total Riparian Woodland/Forest				44.0
Woodland					
3.6.1	*Quercus agrifolia – Artemisia californica* Association	Coast Live Oak-California	71160	Coast Live Oak Woodland	3.0

VCM Code	Vegetation Community Type				Acres
	VCM Alliance/Association	VCM Common Name	Holland Code	Holland Classification	
		Sagebrush Association			
3.6.2	*Quercus agrifolia – Quercus (berberidifolia x acutidens)* Association	Coast Live Oak-Scrub Oak Association	71160	Coast Live Oak Woodland	3.5
3.6.4	*Quercus agrifolia – Toxicodendrum diversilobum* Association	Coast Live Oak-Poison Oak-Association	71160	Coast Live Oak Woodland	6.9
	Total Woodland				***13.4***
Unvegetated[1]					
N/A	N/A	N/A	18100	Agriculture	0.1
N/A	N/A	N/A	11300	Disturbed Habitat	3.2
N/A	N/A	N/A	12000	Urban/Developed	1.9
N/A	N/A	N/A	64200	Non-Vegetated Channel	2.4
	Total Unvegetated				***7.6***
		TOTAL LAND COVER			**210.3**

[1] The Vegetation Classification Manual does not classify unvegetated habitats and agricultural lands such as that found in the Oberbauer-modified Holland classification system.

2.1.2 Sensitive Plant Species

Two special status plants were detected during baseline surveys of the Preserve in 2011 (Table 2). Figure 4). A complete discussion of special status plant species detected within the Preserve may be found in the Baseline biological Survey Report for the Santa Margarita Preserve (ICF 2011).

Table 2. Special Status Plant Species

Species	Status
Rainbow Manzanita (*Arctostaphylos rainbowensis*)	CRPR List 1B, County A, MSCP
Engelmann Oak (*Quercus engelmannii*)	CRPR List 4, County D, MSCP

CRPR = California Rare Plant Rank

County List A = Plants rare, threatened or endangered in California and elsewhere; County List D = Plants of limited distribution and are uncommon, but not presently rare or endangered.

MSCP = North County MSCP Covered Species



Figure 4
Special Status Plant Species
Santa Margarita Preserve

2.1.3 Sensitive Animal Species

In total, 20 special-status wildlife species were detected during the 2011 survey at the Preserve (Table 3; Figure 5). A complete discussion of each of these special status wildlife species may be found in the Baseline Biological Survey Report for the Preserve (ICF 2011).

Table 3. Special Status Wildlife Species

Species	Status
Monarch Butterfly (*Danaus plexippus*)	County Group II, MSCP
Arroyo Toad (*Anaxyrus (Bufo) californicus*)	FE, CSC, County Group I, MSCP
Orange-throated Whiptail (*Aspidoscelis hyperythra*)	CSC, County Group II, MSCP
Western Whiptail (*Aspidoscelis tigris*)	County Group II
Red Diamond Rattlesnake (*Crotalus ruber*)	CSC, County Group II, MSCP
Great Blue Heron (*Ardea herodias*)	County Group II
Turkey Vulture (*Cathartes aura*)	County Group I
Cooper's Hawk (*Accipiter cooperii*)	County Group I
Barn Owl (*Tyto alba*)	County Group II
Least Bell's Vireo (*Vireo bellii pusillus*)	FE, SE, County Group I, MSCP
Yellow Warbler (*Dendroica petechial brewsteri)*	CSC, County Group II
Yellow-breasted Chat (*Ictera virens*)	CSC, County Group I, MSCP
Southern California Rufous-crowned Sparrow (*Aimophila ruficeps canescens*)	County Group I, MSCP
Small-footed Myotis (*Myotis cilioblabrum*)	County Group II
Yuma Myotis (*Myotis yumanensis*)	County Group II
Dulzura Pocket Mouse (*Chaetodipus californicus femoralis*)	CSC, County Group II
Northwestern San Diego pocket mouse (*Chaetodipus fallax fallax*)	CSC, County Group II
San Diego Desert Woodrat (*Neotoma lepida intermidia*)	CSC, County Group II
Mountain Lion (*Puma concolor)*	County Group II, MSCP
Southern Mule Deer (*Odocoileus hemionus fuliginata*)	County Group II

Status:

Federal

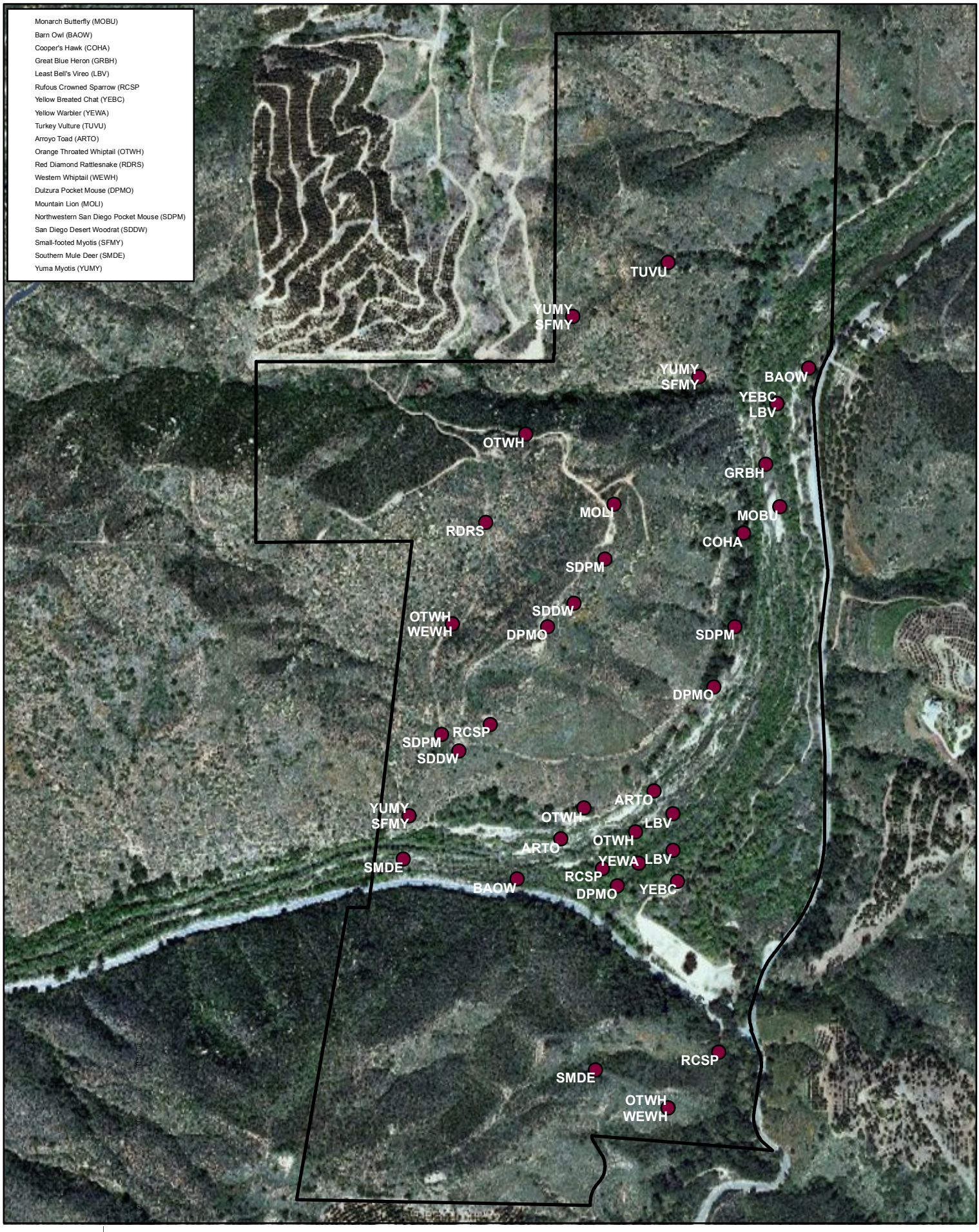
FE - Listed as endangered under the federal Endangered Species Act.

State

SE - Listed as endangered under the California Endangered Species Act.
CSC – Species of Special Concern

San Diego County Group –
I = includes animal species that have a very high level of sensitivity, either because they are listed as threatened or endangered or because they have very specific natural history requirements that must be met.
II = includes animal species that are becoming less common, but are not yet so rare that extirpation or extinction is imminent without immediate action. These species tend to be prolific within their suitable habitat types.

MSCP = North County MSCP Covered Species



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Figure 5
Special Status Wildlife
Santa Margarita Preserve

2.2 Cultural Resources

Results of the 2011 Phase I cultural inventory indicated that one historic period resource, a residential building, has been previously recorded within the Preserve. One other historic period resource has been previously recorded within close proximity to the Preserve. During the current survey, three new resources were identified, a prehistoric milling feature, an iron bridge, and modified concrete structure, possibly associated with the Fallbrook Station of the Atchison, Topeka and Santa Fe Branch Railroad (Table 4). The previously recorded residential structure is now almost completely deteriorated, with only the lower portions of DPR 523 forms were completed for the four resources.

With only a single prehistoric resource identified in the Preserve, the conclusions that can be drawn are limited. However, a few comments are appropriate. Given the nature of the terrain, it seems possible that much of the Preserve area may constitute a possible transit route between habitation sites elsewhere along the Santa Margarita River valley, and between the coast and interior valleys more generally. The near absence of the sites within the area of the Preserve may be significantly influenced by natural factors such as the limited presence of bedrock suitable for use as milling tools, and the absence of cobbles suitable for use as flaked stone tools. Table 2 details the resource number, description and potential significance of each site documented during the 2011 Phase I cultural inventory.

Table 4. Cultural Resources within the Preserve

Resources #	Resources Description	Potential Significance
P-37-013739	Collapsed cobble walls and debris from residential building	Low
CA-SDI-20440/P-37-032250	Bedrock milling station with degraded milling slick	Low
P-37-032251	Iron bridge	Low
P-37-032252	Modified, concrete water storage structure associated with the Fallbrook Station	Low

Chapter 3
Invasive Species Management

The introduction of foreign invasive species into native habitats is becoming more common and further expansion of human activities into areas away from urban and suburban centers will amplify this effect. Today, it is almost impossible to find any lowland areas in California that do not support a collection of plant species brought from elsewhere.

The general effect of invasive species is that they out compete native species. This can occur directly through the taking up of space that was formerly occupied by native plants, but can also occur from a variety of indirect, competitive effects of the presence of invasives. Competition can be keen between invasives and native species for scarce water resources, soil nutrients, or even sunlight. Other species may use chemical warfare (i.e., allelopathy) to prevent germination of native plants. With a decrease in native plant diversity, there is an associated decrease in native animal diversity. Thus it becomes important to control or eliminate non-native invasive plant species from natural areas to maintain natural biodiversity, and the support systems for native fauna.

Table 3 lists all non-native species found during the current surveys of the Preserve. During initial surveys of the Preserve a total of 50 non-native species were detected. With the exception of poison hemlock (*Conium maculatum*), most of these species appear as isolated individuals or small patches of individuals. Regardless, each of those species listed below in Table 3 should be removed from the Preserve whenever encountered.

Based on their current extent, their highly invasive nature and the ability to reproduce quickly, and their potential effects on the environment, seven species have been determined to be “target species”; those for which a concerted effort should be made to monitor and control/eliminate them. These target species are discussed below in Section 3.1. . It should be noted that Table 5 details the presence of three additional Cal-IPC High rated invasive plants but these species are not targeted for removal\control because either they are naturalized (red-brome) or do not currently present a significant risk to the biological resources within the Preserve (i.e. sweet fennel and six-petal water pimpernel).

Table 5. Invasive Non-Native Invasive Plant Species Known to Occur in the Preserve

Scientific Name	Common Name	Cal-IPC Rating
Anagallis arvensis	Scarlet Pimpernel	N/A
Apium graveolens	Common Celery	N/A
Avena fatua	Wild Oat	Moderate
Bromus diandrus	Ripgut Grass	Moderate
Bromus hordeaceus	Soft Chess	Limited
Bromus madritensis ssp. rubens	Red Brome	High
Carduus pycnocephalus	Italian Thistle	Moderate
Centaurea melitensis	Tocalote	Moderate
Chenopodium album	Lamb's Quarters	N/A
Chenopodium murale	Nettle-Leaf Goosefoot	N/A
Conium maculatum	Poison Hemlock	Moderate

Scientific Name	Common Name	Cal-IPC Rating
Convolvulus arvensis	Field Bindweed	N/A
Cynodon dactylon	Bermuda Grass	Moderate
Cyperus involucratus	Umbrella Plant	N/A
Erodium botrys	Long-Beak Filaree	N/A
Erodium cicutarium	Red-Stemmed Filaree	Limited
Euphorbia peplus	Petty Spurge	N/A
Foeniculum vulgare	Sweet Fennel	High
Hirschfeldia incana	Short-Podded Mustard	Moderate
Hordeum murinum	Foxtail Barley	N/A
Hypochaeris glabra	Smooth Cat's Ear	Limited
Lactuca serriola	Prickly Lettuce	N/A
Lepidium latifolium	Perennial Pepperweed	High
Ludwigia hexapetala	Six-Petal Water-Primrose	High
Lythrum hyssopifolia	Grass-Poly	Limited
Medicago polymorpha	California Burclover	Limited
Melilotus indicus	Annual Yellow Sweetclover	N/A
Nicotiana glauca	Tree Tobacco	Moderate
Opuntia ficus-indica	Mission Prickly-Pear	N/A
Piptatherum miliaceum	Smilo Grass	Limited
Plantago lanceolata	English Plantain	Limited
Polypogon interruptus	Ditch Beard Grass	N/A
Polypogon monspeliensis	Annual Beard Grass	Limited
Raphanus sativus	Wild Radish	Limited
Ricinis communis	Castor Bean	Limited
Rumex conglomerus	Whorled Dock	N/A
Rumex crispus	Curly Dock	Limited
Schismus barbatus	Common Mediterranean Grass	Limited
Senecio vulgare	Common Groundsel	N/A
Silene gallica	Common Catchfly	N/A
Sisymbrium orientale	Hare's-ear Cabbage	N/A
Sonchus asper	Spiny Sow-Thistle	N/A
Spergularia bocconii	Boccone's Sand Spurry	N/A
Stellaria media	Common Chickweed	N/A
Tamarix ramosissima	Tamarisk	High
Torilis arvensis	Hedge Parsley	N/A
Urtica urens	Dwarf Nettle	N/A
Verbascum virgatum	Wand Mullein	N/A
Veronica anagallis-aquatica	Water Speedwell	N/A
Vinca major	Greater Periwinkle	Moderate
Vulpia myuros var. hirsuta	Hairy Rat-tail Fescue	Moderate

3.1 Target Invasive Species

Presented below is a discussion of the most prominent of the non-native invasive plants which have been documented in the Preserve. These should be considered principle target species for monitoring, control or elimination because of their widespread nature, their ability to compete with native species, and/or their effects on the general health of the environment:

- Italian thistle
- Tocalote
- Poison hemlock
- Short-podded mustard
- Perennial pepperweed
- Tamarisk
- Castor bean

With the exception of poison hemlock, generally speaking, these species are currently represented by a few individuals or patches of individuals, and therefore it should be considered a high priority to quickly eradicate these species from the Preserve before they can reproduce further, making control harder later. Efforts to control hemlock will be more substantial as described below.

Figure 6 shows the location of these seven (7) target species within the Preserve. The additional species listed above in Table 5 should be monitored periodically to determine if they pose a significant threat to the biological resources at the Preserve.

3.1.1 Italian Thistle (Carduus pycnocephalus)



Italian thistle is a winter annual which varies in height from 1 to 6 feet. A native of the Mediterranean area and the Middle East, it is now widespread worldwide. It reproduces strictly from two types of seeds: brown seeds which stay with the plant inflorescences and silver seeds which are spread primarily by wind. Seeds can remain viable in the soil for up to 10 years.

Italian thistle forms dense stands and outcompetes native plants for nutrients, space and sunlight. It grows best on disturbed soils, and is generally not eaten by livestock.

Italian thistle was observed during 2011 surveys in the northern area of the Preserve within the river streambed and south of De Luz Road (Figure 6). Italian thistle should be quickly eradicated within the Preserve. Spraying should be done as the plants begin to grow and before they flower (March-April). . Herbicides known to be effective against Italian thistle include glyphosate, clopyralid, and picloram. Following eradication, early winter surveys of the previously known location(s) each year should be performed to determine if Italian thistle is still present.

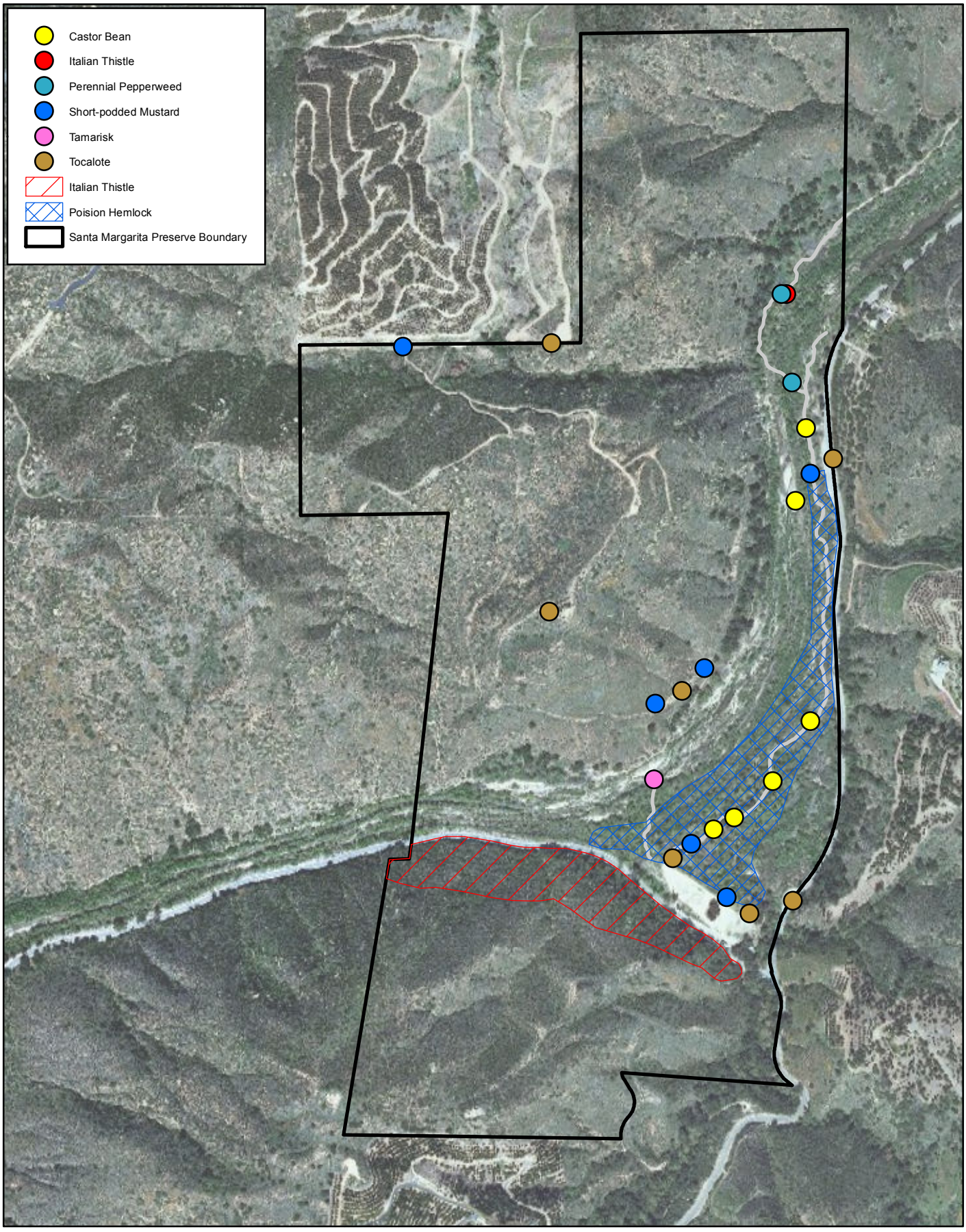


Figure 6
Invasive Plant Locations
Santa Margarita Preserve

3.1.2 Tocalote (Centaurea melitensis)



Tocalote, or Maltese starthistle, is a winter annual which varies from about 1 to 3 feet in height. Resembling yellow starthistle (*C. solsitalis*), it is sometimes mistaken for it, but blooms about a month ahead of it. It reproduces from seeds which germinate following fall rains, and forms basal rosettes until sending up inflorescences in the early spring. Flowering occurs during the late spring and early summer. As with many thistle-like invasive plants, tocalote takes valuable resources that would otherwise be available to native species.

Tocalote is widely scattered in the Preserve with concentration occurring along old trails/roads that are primarily vegetated with native species (Figure 6). When encountered it is recommended to quickly eradicate tocalote from on the Preserve. There have been no systematic studies on how to control tocalote, but it is likely that techniques used for yellow starthistle will also work on tocalote (UC Press 2000). Chemical treatments using 2,4-D, triclopyr, dicamba, or glyphosate are likely to control tocalote. To be most effective, each of these herbicides has its own "window" of best effectiveness [for yellow starthistle] (UN 2002). For instance, 2,4-D is most effective when treating the rosette stage, while triclopyr is most effective at the seedling or large plant stage. Care must be taken when using glyphosate since it is a non-selective treatment and could impact native species as well. After treatment, monitor the treatment areas each year during the late winter or early spring. If more individuals are observed, they should be sprayed before they have a chance to flower (early spring).

3.1.3 Poison Hemlock (*Conium maculatum*)



Poison hemlock, also known as poison parsley, is a common, introduced biennial herbaceous shrub. Native to Europe, Africa and Asia, during the 1800s this attractive plant was introduced into America as a garden plant (UN 2007). It is most often found growing in disturbed sites, usually with moist soils. The plant's main energy reserves are stored in its taproot. As the name implies, poison hemlock is highly poisonous to humans and livestock, and is famous as the agent used for the execution of Socrates (Parsons & Cuthbertson 1992 *from* UC Press 2000).

Hemlock reproduces by seeds, with inflorescences forming in early to mid-spring, and seeds becoming mature in early summer (UC Press 2000). Seeds remain viable in the soil for up to three years (Baskin & Baskin 1990 *from* UC Press 2000).

Poison hemlock is the most common invasive species at the Preserve. Found along the banks of Santa Margarita River, two large areas support substantial stands (Figure 6). As with many non-native invasive plants, the primary impact from hemlock is the usurpation of native habitat, and the altering of native competitive relationships. It is also toxic to wildlife.

Efforts should begin as soon as possible to eradicate poison hemlock on the Preserve. It is recommended that the current populations be sprayed, and follow up treatments be conducted each spring during the initial growth phase of the species. Because of the ability of the seeds to remain viable in the soil for years, repeated treatments are likely. Herbicides known to be effective on poison hemlock include glyphosate, and 2,4-D. Each of these herbicides are approved for use within or adjacent to water (Appendix A.). Eradication efforts should be done in early March and will be timed to not directly impact nesting birds (including the federally endangered least Bell's vireo).

3.1.4 Short-Podded Mustard (*Hirschfeldia incana*)



Short-podded mustard, also known as summer mustard, Mediterranean mustard or Buchan weed, is an herbaceous biennial or perennial weed. It has become widespread in sunny, disturbed sites throughout Southern California, especially fallow agricultural or previously developed sites where it can produce greater than 1,000 seeds per square meter (Cal-IPC 2011). It often forms dense stands, shading out native species and competing with them for resources. In the last summer as their stalks and leaves dry, the mustard can carry wildfires quickly. Further, short-podded mustard is often found growing with other invasive species (e.g., red broom (*Bromus madritensis rubens*), rip-gut *(B. diandrus*) and contributes to thick thatch layers which further shade out and compete with native species.

Short-podded mustard is typically a naturalized herb found occurring throughout most of the upland habitats in southern California. However, on site it was observed along the existing trails and road sides of the Preserve (Figure 6). Because the populations are still small, it is advisable to attempt hand removal as soon as possible. Because of the large number of seeds produced, following this initial removal, the disturbed areas should be inspected annually to determine if new individuals have germinated. These new individuals should be removed by hand or by spraying before they have a chance to set seed (March-April). Herbicides that have proven effective on this species include iron sulfate and sulfuric acid sprays.

3.1.5 Perennial Pepperweed (*Lepidium latifolium*)



As the name implies, perennial pepperweed is a perennial herb which ranges from 3 to 8 feet in height. Also referred to as broad-leafed peppergrass, it often forms dense colonies, especially in disturbed riparian areas. Originally from western Asia, it is now found across Europe and as far east as the Himalayas. In the western hemisphere, it is found throughout the United States and Mexico, and was introduced into California in 1936 (UC Press 2000). It is usually found in wetter places, such as seeps and riparian areas.

Extremely invasive, perennial pepperweed reproduces quickly from

either seeds or pieces of underground stems (rhizomes) to form thick stands, thereby usurping habitat for native species. It has been reported that it has appropriated habitat for several sensitive plant species (Skinner and Pavlik 1994), as well as habitat for some bird and rodent species as well.

Currently one small population of perennial pepperweed is found in the northern portion of the Preserve within the Santa Margarita River streambed (Figure 6). It is critical to control this rapidly spreading species before it can make further inroads along the Santa Margarita River. Control efforts will vary depending upon when and where control efforts commence. At the Preserve is recommended that 4-D Ester Spray be used to control this species prior to flowering (May-June). Established stands of perennial pepperweed will typically take two (2) years to control.

3.1.6 Tamarisk (Tamarix ramossisima)



Tamarisk is one of the most well-known and extremely invasive species found throughout the world. *T. ramosissima* is one of five invasive tamarisk species known in California (Baum 1978 as reported in UC Press 2000). Native to central Asia, it is thought to have been introduced by the Spaniards. It is generally a small tree, which produces feathery pink inflorescences with copious numbers of seeds. It is reported that one plant can produce up to 500,000 seeds (DiTomaso 1996). The thin leaves have salt glands, and it's often possible to observe salt crystals on them. It can reproduce from either seeds or vegetatively from broken-off pieces of leaves and stems.

The effects of tamarisk are many, and include the changing of soil chemistry by the release of salt as the leaves degrade. This in turn can inhibit germination and growth of many plants (Anderson 1996). It re-sprouts quickly following fires, and as a result, can quickly dominate riparian habitats (UC Press 2000).

Tamarisk is a phreatophyte. These plants quickly send down a deep tap root to the water table, at which point secondary roots spread laterally (UC Press 2000). As a result, tamarisk has significant effects on local water resources.

Tamarisk represents a major threat to the riparian habitat along Santa Margarita River within the Preserve. Tamarisk was sighted during 2011 surveys in the southern portion of the Preserve within the river streambed (Figure 6). Because of the copious amount of seed produced and the extremely aggressive nature of the species, any individuals of this species should be removed immediately. All new seedlings should be immediately removed by hand pulling if possible. If not, then they should be sprayed right away to prevent any additional seeds from getting into the soil. The most common control technique is cut-and-daub using triclopyr (as Garlon4®or Garlon 3A®) or glyphosate. Each of these herbicides is approved for use within or adjacent to water (Appendix A). Follow-up inspections should be carried out throughout the year during routine patrols.

3.1.7 Castor Bean (Ricinus communis)

Castor bean is a commonly encountered invasive shrub which can vary from 3 to 15 feet in height. It is easily recognized by its large, palmately-lobed leaves. A native of Asia and Africa, it is most often

found growing in wet areas, especially along drainage ditches and near highway culverts. Its seeds are exceedingly poisonous, and as few as two seeds ingested can be fatal to humans (Cooper and Johnson 1984). It is spread by seeds, and will re-sprout if cut.

Surveys located castor bean growing primarily along the riparian trails and within sandy openings adjacent to Santa Margarita River within the Preserve (Figure 6). Castor bean represents a major threat to the riparian habitat along Santa Margarita River. Because of the copious amount of seed produced and the extremely aggressive nature of the species, any individuals of this species should be removed immediately. Seedlings and saplings of castor bean should be removed from the Preserve by hand clearing. All of the castor bean observed at the Preserve in 2011 occurs along the exiting trail network and these individuals appear to be actively controlled by existing management activities at the Preserve. Ongoing removal of this species should occur prior to flowering (May-July).

3.2 Removal Methods

Some of the more common methods used to eliminate or control non-native invasive plants are discussed below. Because of the Preserve's relatively small size, the steepness of the terrain surrounding the Santa Margarita River, and the highly sensitive nature of the river itself, some techniques discussed may not be applicable. For instance, for the most part, mechanical methods using large equipment are not appropriate for either the steep slopes or the river bottom.

3.2.1 Manual Removal

Manual or hand removal of invasive species is generally practical for smaller patches, or for the search and initial removal of newly growing seedlings. Large scale hand removal is far too time-consuming and costly to be carried out. However, because of the Preserve's small size and relatively pristine nature, hand removal is a viable option.

During yearly inspections for invasive species, should a new individual or small patch of an invasive be found, it should immediately be removed by DPR staff by hand pulling or the use of hand tools. The big advantages to hand removal are that no permits or licenses are required, and with proper training, there is no chance of affecting non-target species.

Hand removal could also be used effectively by groups of community volunteers or school groups. With minimal training, and using shovels, hoes, loppers, or just their hands, newly spotted seedlings (e.g., tamarisk, tree tobacco) could be removed before they have the chance to establish themselves and/or set seed. Such a volunteer program would help enfranchise the general public with a vested interest in the Preserve and its protection, as well as serving as an educational experience whose effects could range beyond the boundaries of the Preserve.

3.2.2 Herbicide Use

Vast amounts of literature have been generated on the effects, or lack thereof, of various chemicals on a variety of plant species and on non-target animal species. Often herbicide treatments are used in conjunction with other methods such as mechanical removal. The advantage of using chemical treatments is that they typically result in high kill rates, and can prevent the invasives from setting seed. Thus in the long run, the invasives are eliminated as their "seed bank" is eventually eliminated. Some disadvantages include the necessity of applicators to be trained and then licensed by the State

of California, the cost of application and safety equipment, the cost of the herbicide itself, the potential to affect non-target species, and the social stigma associated with the use of chemical controls particularly in wetlands situations. In spite of these drawbacks, herbicides, or herbicides with hand/mechanical removal, are the most widely used and effective techniques for controlling invasive plants, and have been used repeatedly throughout the world.

Herbicides are broadly classified into two basic types: pre-emergent and post-emergent. Pre-emergent herbicides are sprayed directly onto the ground and prevent plants from germinating and/or growing. As such, they have a larger potential to impact any native seeds remaining in the soil, and often have longer persistence times in the environment. Post-emergent herbicides are applied directly onto the plants, often during the early phases of their growth, killing them before they have the chance to mature and set seed. Thus with proper equipment and training, they can be applied relatively selectively, and will have no impact on native seeds residing in the soil. However, should the target species be intermixed with growing native species, the chance of affecting these natives would be greatly increased.

Different plants vary in their response to any particular herbicide, and can also vary in their response depending upon which stage in their life cycle the herbicide is applied. Herbicides applied during the "bolting" phase (when flowing stalks are being produced) may have greater kill rates than the same chemical applied during the rosette stage or the flowering stage. Some herbicides are specific to specific groups of plants (e.g., fusillade affects only grasses), while others can kill virtually all kinds of plants. Still others are permitted for use in California, while others are not.

The Preserve is centered on the Santa Margarita River, and as stated above, is the primary site of invasive species establishment. As such, control of non-native invasive plants will likewise be centered on Santa Margarita River. Some herbicides are acceptable and permitted to be used in waterways, while [most] others are not. Appendix A shows the current list of herbicides approved for use in aquatic and wetland habitats in California. Generally speaking, aquatic herbicides are similar to those used for terrestrial environments, but often with slight changes in chemistry to allow their safe use near sensitive aquatic organisms. In many cases, these changes are to the surfactants or adjuvants used to suspend and carry the herbicide active ingredient.

Through careful consultation with a licensed Pest Control Advisor, it is possible to safely and responsibly use herbicides at the Preserve to control invasive species. The use of herbicides, when properly applied with a clear understanding of their limitations and assumptions, remains the most effective way to eliminate or control non-native invasive species.

3.2.3 Mechanical Removal

The use of mechanized equipment for the removal of invasive species is common, but as mentioned, is usually used in conjunction with herbicide treatment. The advantage of using mechanized equipment is that it can cover large areas relatively quickly. The disadvantages include the costs of operator training, initial equipment purchase, and equipment maintenance and transportation. The Preserve is relatively small, and is focused on the Santa Margarita River with steep surrounding hillsides. These steep areas do not lend themselves to mechanized removal methods. Similarly, the presence of mechanized equipment in Santa Margarita River has the potential to increase pollution and sedimentation, as well as potentially introducing increased maintenance costs for the equipment. It is not recommended to use large-scale mechanical methods for invasive species management at the Preserve.

3.2.4 Cut and Daub

The cut and daub method of invasive species control is used primarily on larger trees and shrubs. Using this method, the main stem or trunk of the tree is first cut close to the ground using a chainsaw. This is followed immediately with the application of a concentrated solution of herbicide onto the exposed trunk cross-section. The application timing is critical; if air is allowed to enter the vascular tissue of the plant, it will prevent the translocation of the herbicide to the roots where it does its killing. This technique is commonly used for trees such as tamarisk.

As with general herbicide use, the applicator must be correctly trained, and licensed by the State of California as an Applicator.

3.2.5 Prescribed Fire

The use of prescribed fire for vegetation management, especially for controlling fuel loads, has been used for many decades (Biswell 1989). More recently, prescribed fire has been used as a habitat restoration tool, particularly in grassland habitats (Wills et al. 2000). It has been shown that applied fire at just the right time of grass development can, when applied over the period of a couple of years, eliminate most brome grasses and some wild oats, thereby freeing native species of grasses and forbs from competition, and enhancing the probability of their re-establishment.

Most natural communities in southern California are adapted to fire, but some nevertheless can be severely damaged by it (Keeley & Keeley 1984). Overprotection and quick fire suppression have resulted in understory vegetation becoming overabundant and shrub density to reach unnatural levels, allowing fires to burn quicker and hotter than what was probably the historical norm. As a result, catastrophic wildfires can sweep rapidly through these areas, destroying everything in their path. Additionally, shrub areas often fall to “type conversion” wherein too frequent fires will prevent shrub recovery, and the shrubs are replaced by non-native annual grasses (Minnich & Dezaani 1998). As a result, it is not recommended to conduct prescribed fires in the shrub communities of the Preserve for the purposes of invasive control.

Similarly, the use of prescribed fire in riparian areas is generally not advisable. The highly sensitive nature of the habitat and the high diversity of organisms dependent upon it, would presuppose that the use of fire these would be inadvisable. Prescribed fire is not recommended for the riparian areas of the Preserve.

Chapter 4
Habitat Restoration

The Preserve is generally composed of high quality habitat that provides essential habitat for special status species that are covered under the draft North County MSCP.

As stated in the draft North County MSCP Framework Resource Management Plan (FRMP) (County of San Diego 2009), the goal of habitat restoration is to reestablish or enhance the biological functions and values of habitat that has been degraded from either human or natural causes. Restoration methods range from active revegetation, which recreates habitat, to passive management. For preserve lands, restoration is typically not required; however, in some cases, if resources are available, active restoration may assist the recovery of an area that has been disturbed and is showing difficulty in recovering. The need for restoration activities will be determined based on the results of habitat monitoring and trail maintenance activities. Any proposed restoration activity should utilize current, accepted techniques and avoid/minimize impacts to sensitive species or native habitats. Additionally, revegetation activities should use only local native plant seed or container stock plants that have been propagated from plant material from the Santa Margarita watershed.

The need for active restoration on the Preserve is currently not proposed. Existing trails within the riparian corridor will remain to service the recreational uses including hiking and horseback riding. Existing game trails that occur along the Preserve ridgelines will also remain as these features are essential for wildlife corridor movement. Passive restoration primarily in the form of invasive plant species control is proposed and detailed above in Chapter 3.

Chapter 5
Fire Management

Fire Management consists of fire prevention, fire suppression and the use of prescribed fire to achieve vegetation management goals. The two major goals of all vegetation management activities are public safety and achievement of biological objectives such as invasive species management or habitat enhancement. However, fire that occurs too frequently can alter the vegetation community by reducing the native vegetation and promoting the invasion of non-native species. Prescribed fire can be used to reduce a dangerous heavy fuel load in proximity to residential communities to improve public safety should a wildfire occur.

The Preserve is within the North County Fire Protection District, and is also a State Responsibility Area (SRA) under the jurisdiction of the California Department of Forestry and Fire Protection (CalFire). These two entities respond with appropriate resources commensurate with the fire threat potential as determined by the National Fire Danger Rating System, and with the objective of controlling the fire within the first burning period to 10 acres or less.

5.1 Current Fire Management Practices

Fire management consists of evaluating fire risk and threats and the implementation of activities required for the protection of burnable wildland values from fire and the use of prescribed fire to meet land management objectives. Fire management also includes the construction of fire defense improvements such as water sources, fuel breaks and access roads. An existing recreational staging area with a fire hydrant occurs in the southeastern portion of the Preserve and these facilities are also available to assist with a fire response. Managing the annual grasses within the staging area will minimize potential ignitions and the spread of fire from vehicles and other sources. The Preserve was burned during the Gavilan Fire of 2002 negating the need for prescribed fire in the next 26 years since the fire regime for the Preserve is 35 to 100 years, introducing fire before the 35 years may be detrimental to the vegetation communities and wildlife species that utilize the Preserve. The Preserve is too small and not geographically suited for permanent fuel breaks solely within the Preserve.

5.2 The 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 wildland-urban interface (WUI) areas.

As stated in the San Diego County Final Draft Vegetation Management Report (County of San Diego 2009), the potential is great for a fire to ignite north of the County line in the western portion of Temecula [Riverside County] and spread with a Santa Ana event into De Luz and the back side of Camp Pendleton and Fallbrook. In addition, the Preserve is located within a Very High Fire Hazard Severity Zone. 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 CalFire (Cal Fire 2011) per State of California Public Resources Code, Sections 4201-4204.

5.2.1 Climate

The Preserve lies within the Coastal Climate Zone of San Diego County according to Mapping San Diego (City Data 2011), with average summer temperatures of 70-80˚ F, summer afternoon relative humidity of 60% and summer afternoon sea breezes of 6-8 miles per hour (Figure 7).

The Fallbrook area has experienced summer high temperatures over 100˚F and strong Santa Ana winds in the fall that reduces relative humidity to dangerous levels. The largest and most destructive wildfires have occurred in the fall and winter during these wind events.

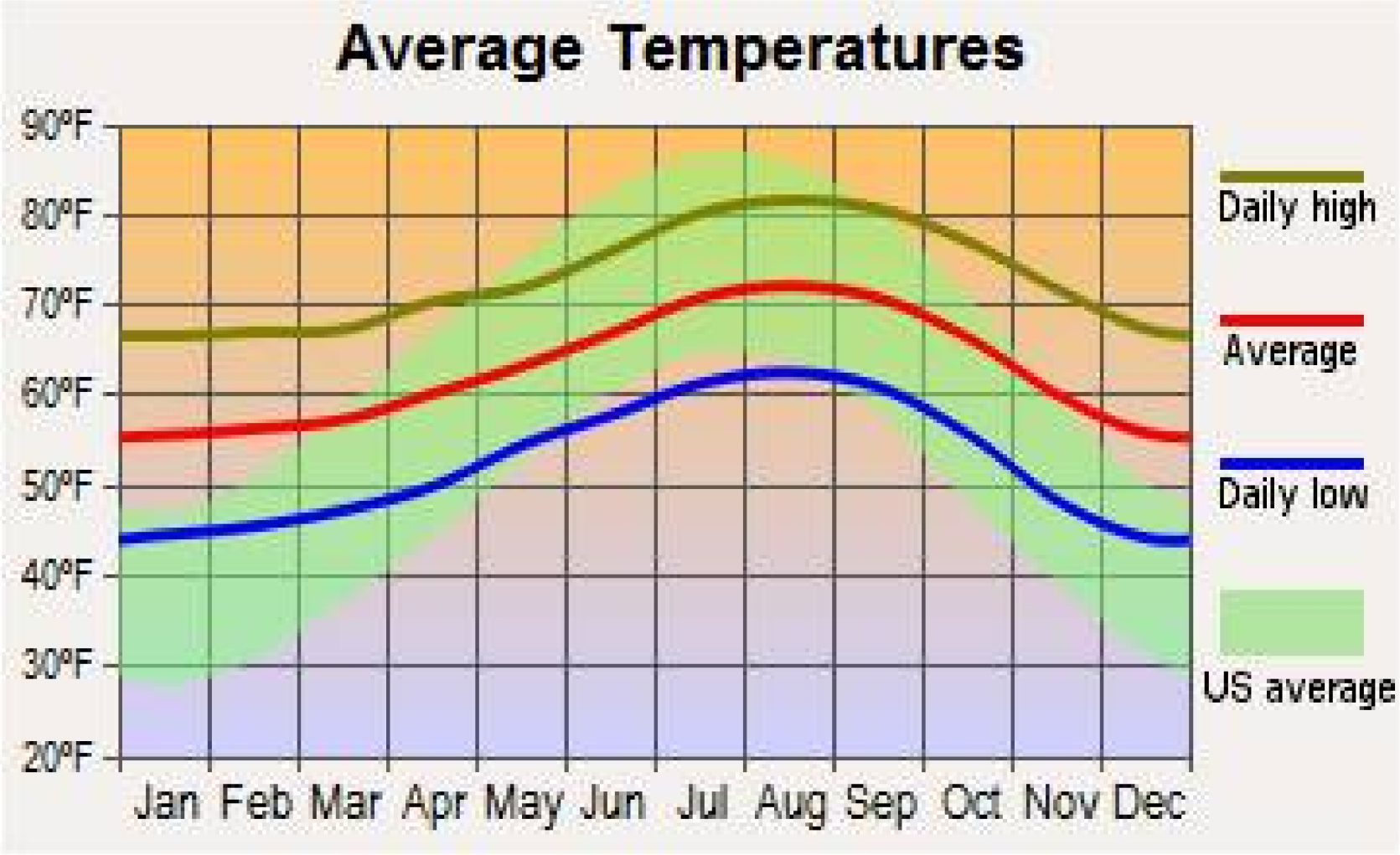
Camp Pendleton is the most complete National Oceanic and Atmospheric Administration record of precipitation with records from 1966 to 1993 the maximum precipitation recorded is 19.2 inches the low is 4.75 and the mean is 11.83. Mapping San Diego provides a mean precipitation range for the northern portion of the Preserve as 18-21 inches and the southern portion as 15-18 inches.

5.2.2 Topography

The general topography of the Preserve is centered on the Santa Margarita River, and includes the steep slopes of the river canyon to the east and west (see Figure 2). The Preserve varies from a gentle river bed with an elevation of 300 feet AMSL, to Patrol Peak, located in the southwest portion of the Preserve along the boundary with Camp Pendleton, with an elevation of approximately 900 feet AMSL with slopes up to 40%. The canyon walls to the west of the Santa Margarita River are very steep with slopes up to = 40%.

5.2.3 Watershed Description

The Preserve is located within Santa Margarita Watershed and Santa Margarita River flows through the eastern and southern portions of the Preserve. Project Clean Water (County of San Diego 2000) describes the Santa Margarita Watershed as follows, “The Santa Margarita River watershed encompasses approximately 750 square miles in northern San Diego and southwestern Riverside



Source: City Data 2011

S:\GIS\Projects\CountyParks&Rec\270.11\mapdoc\bio\vmp\ ig1.MXD(08-15-11)

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Figure 7
Climate History
Santa Margarita Preserve

counties. The watershed contains a variety of nearly intact habitats including chaparral-covered hillsides, riparian woodlands, and coastal marshes. Of the total watershed area, approximately 27% is within San Diego County. The Santa Margarita River is formed near the City of Temecula in Riverside County at the confluence of the Temecula and Murrieta Creek systems. Once formed, the majority of the Santa Margarita River main stem flows within San Diego County through unincorporated areas, the community of Fallbrook, and the Marine Corps Base Camp Pendleton. The lower river and estuary have largely escaped the development typical of other regions of coastal southern California, and are therefore able to support a relative abundance of functional habitats and wildlife."

5.2.4 Fire History

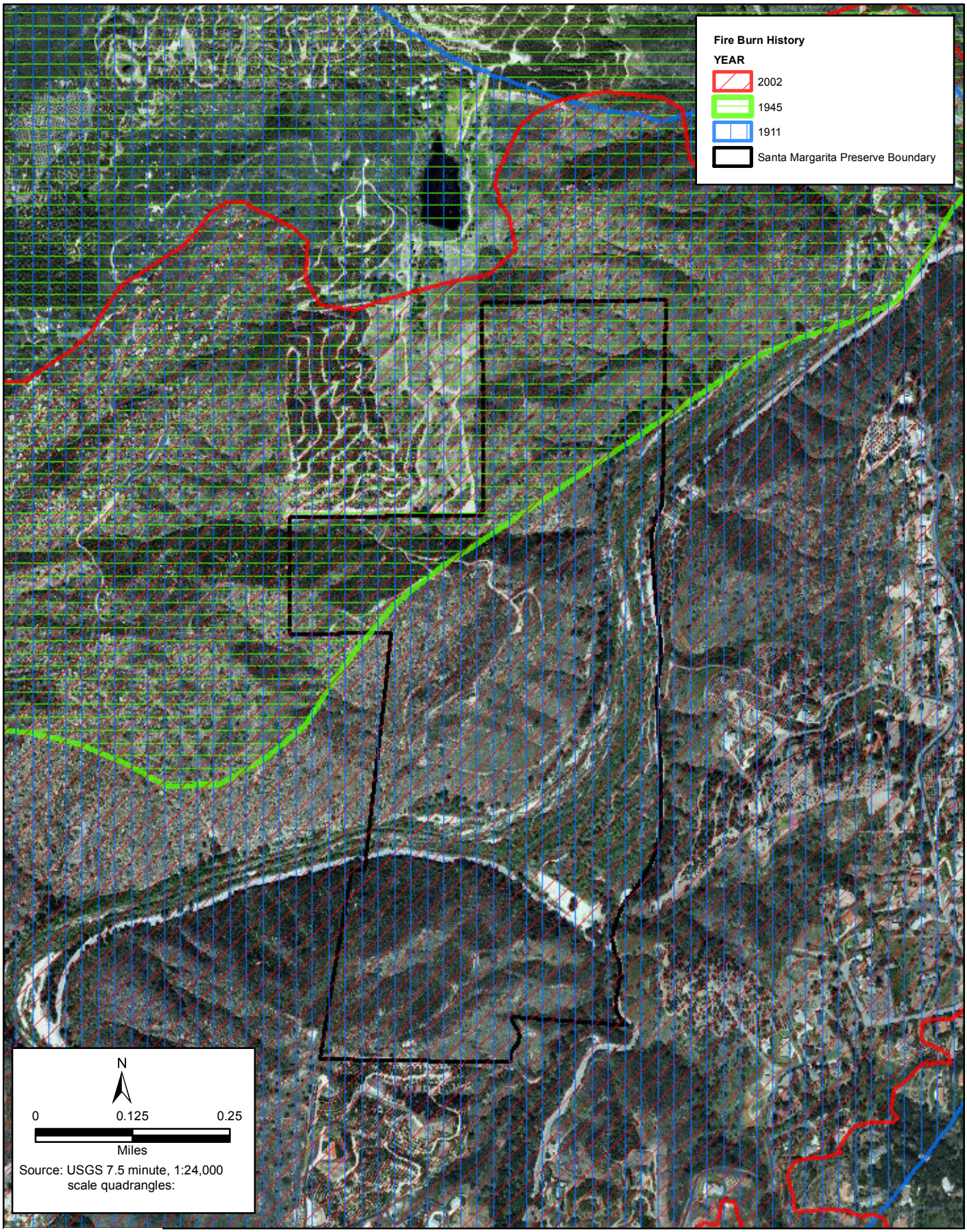
The Preserve was impacted by three fire events during the past century. The earliest recorded fire that impacted the Preserve occurred in 1911 and burned 4,800 acres including the entire Preserve boundary (USGS/California Fire Alliance 2011, Figure 8). In 1945, a 37,000 acre fire burned a small portion of the northwest half of the Preserve. The Gavilan Fire of February, 2002, burned a total of 5,600 acres during a Santa Ana wind event; the exterior boundary of the fire included the entire Preserve.

5.2.5 Vegetation Dynamics and Fuel Loads

The vegetation on the northern slopes of the Preserve is composed of scrub oak and chaparral, this vegetation shows good recovery from previous fires with only some evidence of fire damaged plants remaining. The south and east facing slopes are primarily comprised of Diegan coastal sage scrub that do not show any physical signs (e.g. blackened branches, or fallen vegetation) of being burned in the 2002 fire. However, it should be noted that these habitats do contain an understory element comprised of non-native grasses, which is not a typical conditions for mature Diegan coastal sage scrub. South and east facing slope vegetation is generally not as large or dense as north facing slope vegetation. As a fire moves through a south and east facing slope more vegetation is consumed by the fire so stump sprouts and seed regeneration show less signs of fire scars in the following years. The riparian corridor found along the river bottom also shows evidence of fire damage. See Section 2.2.1 for more details of the Preserve's vegetation.

The Preserve is within a 35 to 100 year fire regime, with mixed severity of damage expected. The 2002 fire was preceded by the 1911 fire which is within this fire regime. With the exception of the northern slopes of the Preserve most of the scrub and chaparral habitats contain a large non-native grass component, which could help carry a fire to the plants recovering from the 2002 fire. Thus, a fire within the next 26 years could continue to alter the vegetative community of the south and east facing slopes. The fire regime class of the Preserve is 35 to 100 year with mixed severity according to Cal Fires Fire and Range Assessment Program, wildfire or prescribed fire within the next 26 years will result in an impaired condition class.

In summary, the fire management environment remains problematic. The vegetation characteristics, combined with topography, climate, and relatively common weather events (i.e., Santa Ana winds), combine to create a fire environment in which prevention and control is extremely difficult.



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Figure 8
Fire History Map
Santa Margarita Preserve

5.3 Fire Management Methods

The State of California Public Resources Code, section 4475, authorizes Cal Fire to participate in vegetation management for the purposes set forth below:

1. Prevention of high-intensity wild land fires through reduction of the volume and continuity of wild land fuels.
2. Watershed management.
3. Range improvement.
4. Vegetation management.
5. Forest improvement.
6. Wildlife habitat improvement.
7. Air quality maintenance.

Cal Fire participation per the stated purposes allows Cal Fire to utilize fire crews and other resources for vegetation management, and the State of California assumes the financial liability should a Cal Fire prescribed fire or other management method cause damage to third parties.

One of the goals of fuel management is to create a mosaic of various age classes of vegetation for habitat improvement, as well as to create vegetation stands of different age classes which contain and retain a higher live fuel moisture content. The mosaic can be applied to small or large areas managing then as appropriate. In the context of San Diego County and the fire history, it is appropriate to look at the macro management style for mitigation of significant wildfires that pose risks to communities. However under Santa Ana wind conditions with low live fuel moistures in late fall, fires may still burn through previously burned mosaics.

Common fuel management methods consist of grazing, hand alteration of vegetation, mechanical alteration of vegetation, chemical applications, or prescribed burning

5.3.1 Grazing

Grazing is not recommended at this time for fire management of the Preserve due to the young age of the vegetation, the absence of neighboring assets at risk and no demonstrated need to control any vegetative communities through a grazing process.

5.3.2 Hand Clearing

Hand clearing consists of removing vegetation with hand tools. Typically these efforts are performed:

1. Around residential property and other infrastructure improvements to achieve a defensible space;
2. Along roadways to achieve additional fuel breaks;
3. To remove ladder fuels or other vegetation to protect riparian areas from wildfire

5.3.3 Mechanical Treatment

Mechanical treatment methods include mechanized equipment, such as chainsaws, weed whackers, or bulldozers to reduce fuel loads in the event of a wildfire or during a wildfire.

Pre-fire mechanical treatment methods include:

a) Crushing vegetation and then burning,

b) Cutting and piling vegetation and burning,

c) Cutting and chipping vegetation, and mowing/weed whacking along a road, trail or driveway to create a safety zone for firefighters or to improve an ingress or egress.

Mechanical treatment methods during a wildfire event may include:

a) Bulldozers or masticators to clear vegetation,

b) Chainsaws to trim/thin/remove thick vegetation to create a temporary fuel break, and

c) Mowing/weed whacking along a road, trail or driveway to slow a fires advance and provide firefighters a safety zone or to improve an ingress or egress and escape route.

5.3.4 Chemical Application

Due to the presence of sensitive wildlife species in the Preserve, chemical treatment on wildfires (such as the use of foam and chemical retardants) is not recommended.

The policy of the United States Forest Service and supported by the National Association of State Foresters is that when using aerial application of fire retardant chemicals a 300 foot buffer is to be maintained around waterways.

5.3.5 Prescribed Burning

Prescribed burning is a method that requires a plan and a prescription that calculates the fuels, weather (temperature, humidity, fuel moisture, wind speed and direction) and topography to achieve a desired result. In the Wildland Urban Interface, the desired result is generally to reduce the vegetation or flammable fuels to keep an advancing wildfire from entering a residential or business community. Prescribed fire is also used to alter the vegetation for specific purposes. For instance it could be to improve grazing, to remove unwanted non-native grasses, or to improve wildlife habitat. The use of prescribed fire must be carefully planned and evaluated because it is a discretionary action that places a potential risk to firefighters and the public.

Prescribed fire is not recommended at this time for fire management of the Preserve due to young age of the chaparral and coastal sage scrub to avoid type conversion. Similarly, the use of prescribed fire in riparian areas is generally not advisable. The highly sensitive nature of the habitat and the high diversity of organisms dependent upon it, would presuppose that the use of fire these would be inadvisable. Prescribed fire is not recommended for the riparian areas of the Preserve.

5.4 Fire Response Plan

Since the Preserve is classified as State Responsibility Area (SRA) for wildfire suppression, Cal Fire has the primary financial responsibility to suppress wildfires within SRA. Structural fire protection on and around the Preserve is the responsibility of the North County Fire Protection District. In the event of a wildfire, Cal Fire would initiate a wildland fire response of fire engines, bulldozers, aircraft, fire crews and overhead (e.g., Supervisors of the firefighting effort and the support staff) based on the National Fire Danger Rating System for the area (Gossner 1999), which is based on vegetation, weather and topography and provides information on ignitability, spread and difficulty of control. Once the initial attack has been initiated, Cal Fire has the ability to augment the resources from within Cal Fire and through the California Fire and Rescue Mutual Aid System. The North County Fire Protection District would be included in the initial dispatch of resources and would be a part of the Unified Command of the fire.

5.4.1 Fire Hazard Evaluation

The Preserve is located in a Very High Fire Danger Severity Zone as determined by CalFire, which is a computation based on vegetative fuels, terrain and weather. Both the site visit for this report, the fire history of the Preserve, and the surrounding area confirms that determination.

Fire history of the area provides information for future fires. The 1911 fire (4,800 acres) approached the Preserve from the north and the 2002 fire (5,700 ac.) approached from the east. Both of these wildfires burned the entire Preserve. The 1945 fire (37,000 ac) burned from the Temecula area south to the northern portion of the Preserve. The Gavilan Fire of February 10, 2002 burned during warm, dry, windy weather. The weather at the time of the Gavilan Fire as recorded in Fallbrook, CA was a high temperature of 80 degrees (a record high for the date) with average Relative Humidity of 15% with a low of 8% and a high of 39% and winds from the east at a maximum of 10 miles per hour with gusts to 17 mph. However, it should be noted that this documented weather does not meet the Red Flag criteria followed by the National Weather Service, the agency responsible for issuing Red Flag Warnings.

The criteria for a Red Flag Warning is either Relative Humidity of 15% or lower with sustained winds of 25 miles per hour or greater and/or frequent gusts of 35 miles per hour or greater for a 6 hour or longer period of time. Or a Red Flag Warning can be issued if the Relative Humidity is less that 10% for 10 hours or more regardless of wind.

The reported weather on February 10, 2002 resulted in a wildfire that burned 5,700 acres and 45 homes and burned through the entire Preserve. The reported weather calculates to a rate of spread of over 200 chains per hour (2.5 mph) with flame lengths of 17 feet. These flame lengths precluded a direct attack by firefighters, forcing them into a defensive mode and they worked the flanks until the weather changed or the fire ran out of vegetation to burn.

Ignition threats to the Preserve include, vehicle related ignitions from the De Luz or Sandia Creek Roads or vehicles in the staging area. Vegetation fires resulting from vehicles along De Luz Road pose a threat to the riparian area to the north of the road or the chaparral hillside the south of the road. The electrical power lines in proximity to the Preserve are a potential ignition source in the event the poles are struck by vehicles, birds flying into the power lines or the power lines should are broken by the wind or falling debris. Campfires and open flames are not allowed within the Preserve; however, these illegal acts could create an ignition source. Smoking on the trails is a possible ignition source.

Illegal off-road vehicle traffic is also a source of ignition. Arson is always a possibility and could be perpetrated from the trails, neighboring property or along one of the adjacent roads.

Habitat is the primary asset at risk within the Preserve; the absence of structure within the Preserve eliminates the need for defensible space around structures in the Preserve. The parcels surrounding the Preserve are zoned Agriculture or Open Space. These adjacent parcels are of adequate size, five acres and larger, for the property owners to implement the 100 foot clearance requirement, creating defensible space on the owner's property will negate the need to clear Preserve property for fire clearance. Defensible space around the neighboring homes will minimize the need to divert resources to structure protection in the event of a wildfire.

Fires within the Preserve would be attacked in a Direct Attack or Indirect Attack method. Direct attack is working directly on the fire line with either fire hoses or cutting line with hand tools, this tactic is accomplished when flame lengths are generally less than eight (8) feet. Wildland fire engines carry 1,200 feet of fire hose for constructing progressive hose lays. A crew can lay out the initial 600 feet of hose in approximately 30 minutes, additional fire engines and firefighters can extend the hose lay until the pressure required exceeds the limit of the fire engine pump. The Preserve averages 1,500 feet wide; two fire engines should be able to lay fire hose across the Preserve.

Flame lengths in excess of eight (8) feet require the use of Indirect Attack methods. During an Indirect Attack firefighters would cut line parallel to and away from the fire and then burn out, or let the fire burn to the control line. Firefighters may also use natural or human created barriers such as rock outcroppings, lakes, and roads to construct a bulldozer line and let the fire burn to these features or utilize a back fire or burning out operation to remove vegetation from the advancing fire. Orchards may be used as an anchor point if the weather and fire behavior are conducive to such a tactic.

Air tankers and helicopters would be dispatched to a reported wildfire within the Preserve during daylight. The air tankers would not drop retardant within 300 feet of a body of water; therefore dropping retardant on an initial attack fire near the Santa Margarita River is not a viable tactic. Helicopters drop water and can refill by dipping their suspended water tanks into a water source or they may be refilled by a fire engine.

The Santa Ana winds begin to arrive in the fall when the vegetation has reached its lowest fuel moisture. The combination of low fuel moisture, high temperatures, low humidity and the Santa Ana winds are capable of creating fires that can consume any vegetation, native or non-native. Orchards and riparian area are also susceptible to these influences and can be burned during a fire fueled by a Santa Ana wind event. Fires fueled by Santa Ana wind events can be extremely dangerous and have caused wildfires to spot across six lane freeways and continue their advance. During a Santa Ana wind event a fire would likely enter the Preserve from the east or northeast.

5.4.2 Emergency Actions and Contacts

Public and firefighter safety should be the primary consideration before and during a wildfire. The following measures shall be implemented at the Preserve:

- Close trails;
- Close staging areas;
- Post fire danger signs at staging areas and trail heads;

- Post signs with phone numbers for Preserve users to call and report suspicious activity or fires;
- Post signage at staging areas instructing trail users to report suspicious activity to the 911 dispatch center;
- Post signage at staging areas instructing trail users to immediately report fire activity to the 911 dispatch center or fire agency; and
- In the event of a fire on the Preserve or a fire approaching the Preserve, designate a Department of Parks and Recreation staff member to provide assistance to CalFire, as necessary.

Contact information for CalFire and the North County Fire Protection District are as follows:

- Cal Fire Headquarters
  San Diego Unit
  Emergency: 911
  Non-Emergency – Unit Chief, El Cajon: 619.590.3100
  Website: http://www.fire.ca.gov/
- North County Fire Protection District
  Emergency: 911
  Non-Emergency – Fire Chief: 760.723.2012
  Website: http://www.ncfireprotectiondistrict.org/

5.4.3 Roads and Access

Access to and within the Preserve can be achieved via Sandia Creek Road and De Luz Road. The western portion of the Preserve is accessible through properties accessed from De Luz Road to Harris Trail to Snogo Mountain Road. Patton Oaks Road, off De Luz Road provides access to the southern portion of Patrol Peak located in the southwest portion of the Preserve. It should be noted that Sandia Creek Road and De Luz Road are considered secondary evacuation routes in the event of a natural disaster.

5.4.4 Fuel Breaks

Fuel breaks are a fire defense improvement that reduces the volume of flammable vegetation prior to a fire season. No existing fuel breaks are located within the Preserve. Due to the size and topography of the Preserve the establishment of fuel breaks is not proposed. However, Sandia Creek Road and De Luz Road could be used as anchor points for roadside fires or used as fire lines and the agricultural orchards that occur northwest and west of the Preserve can be used as part of a fire suppression strategy. Specifically these orchards are currently maintained and would act as a firebreak to small fires consuming understory vegetation. However, the tree canopy in these areas could also be removed if it is determined that would be an appropriate fire control strategy. It should be noted that 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 District Park 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

Emergency staging areas are temporary locations where resources await assignment. Staging areas for trail users should be adequate for this purpose; the existing staging area along De Luz Road is of sufficient size for use as an emergency staging area although because there is only one point of ingress/egress traffic control would be necessary at this location. An incident base is a larger facility that would include logistical support. The Preserve is not considered suitable for such a use.

5.4.6 Location of Existing Hydrants

One fire hydrant (5,000 gallon water tank) is located at the east end of the Preserve staging area. This hydrant has a 2.5 inch fire department connection. Fire hydrants may be utilized during a fire event to refill engines, as necessary.

5.4.7 Other Nearby Water Sources

An agricultural pond to the north of the Preserve could be used as a helicopter dipping source. The Santa Margarita River could also be utilized as a water source depending on the amount and flow. Water tenders (specialized fire fighting apparatus designed for transporting water from a water source to a fire scene) are an optional water source that Cal Fire can rent during a wildfire. Red Mountain Reservoir is located approximately 3.5 miles east of the Preserve staging area and may provide helicopter dipping access.

Chapter 6
Management Directives

This section provides recommendations for vegetation management within the Preserve including management directives specifically related to: invasive species management; habitat restoration; and fire management.

6.1 Invasive Plant Species

Discussed below are directives for DPR staff to follow to the ongoing control of invasive plant species at the Preserve.

- Conduct training of DPR staff in the identification of non-native invasive species, to allow them to quickly determine the extent of any infestations;
- Immediately begin the eradication of target species, especially perennial pepperweed and poison hemlock, which spread rapidly;
- Conduct Preserve surveys twice per year, once in the early spring and once in the fall, to determine the presence and extent of invasive species on the Preserve, including treated areas;
- During each survey, remove any invasive species encountered by hand pulling or spot spraying, and removing any seed bearing parts from the Preserve site;
- If larger infestations are found, carefully plan and perform an eradication program carried out at the most appropriate time of year for the species in question (treatment methods listed above for target species). Most often this will involve the use of selective herbicide treatment(s) by a licensed Pest Control Applicator;
- Following the recommendation of a State-licensed Pesticide Applicator Advisor, only State-licensed Pesticide Applicators may be allowed to spray. All applicators should use appropriate and approved safety equipment as required by the Material Safety Data Sheet for the particular herbicide used, and the amounts and concentrations of chemicals used should be documented for State mandated reports.
- In Traditional Use areas, consultation with Native Americans should be sought about appropriate methods to control invasive species.

6.2 Habitat restoration

The need for active restoration on the Preserve is currently not proposed. Passive restoration primarily in the form of invasive plant species control is described below.

- Monitoring non-native species treatment/removal sites to ensure passive natural recruitment is successful.
- Monitoring habitat quality for sensitive species (riparian corridor) to determine if areas passively restoring require active habitat restoration.

- Monitoring for pests and disease to determine outbreaks and prescribe an active treatment if appropriate.

6.3 Fire Management

The Preserve is located in a wildfire prone area and has been mapped by Cal Fire as a "Very High Fire Severity Zone". Below are Management Directives which address the cooperation between Cal Fire and DPR for maintaining a safe fire environment at the Preserve.

The following items are the beginning framework of an operating plan that will be developed between Cal Fire and DPR:

- Cal Fire has the legal responsibility to suppress wildfire in State Responsibility Areas in a manner that values life, property, and natural and cultural resource values. DPR will provide CalFire with guidance regarding the natural resource and cultural values at risk in the fire area during wildfires on, or threatening, the Preserve.
- Cal Fire should minimize the disturbance of natural and cultural resources during fire suppression on the Preserve, unless not doing so is deemed the most appropriate suppression scenario to protect life or property.
- Signs should be installed indicating access limitations and extents (map form) and provide road quality to local fire 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 fire fighter safety.
- DPR will reduce the threat of wildfire to visitors and Preserve neighbors by limiting access to the Preserve during periods of high wildland fire danger with methods such as seasonal closures and no smoking signs. The operating plan between Cal Fire and DPR will include communicating predicted periods of high fire danger such as Red Flag Watch and Warnings, high temperatures, high wind alerts, low humidity levels, low fuel moisture, etc.
- It is not recommended that prescribed fire be conducted in the chaparral or coastal sage scrub areas for at least 26 more years, as introducing fire in less time could degrade the quality of the vegetation and lead to type conversion. Prescribed fire in a riparian corridor is not advisable under any circumstances.
- Monitor vegetation growth and opportunities for cooperative vegetation management with adjoining properties.
- Use hand and chemical techniques to control non-native invasive vegetation that could result in the rapid spread of wildfire.
- Maintain Preserve staging area and water tank for emergency operations use.
- 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 is good policy (Bell 2009).

Chapter 7
References

7.1 References Cited

Anderson, L.W. 1996. Annual Report on Aquatic Weed Control Investigations. USDA, ARS, AWCRI, Davis, CA.

Baskin, J.M., and C.C. Baskin. 1990. Seed Germination Ecology of Poison Hemlock. Canadian Jour. of Botany 68: 2018-2024.

Baum, B.R. 1978. The genus *Tamarisk*. Israel Academy of Sciences and Humanities. Tel Aviv, Israel.

Bell, C.E. 2009. Invasive Plants and Wildfires in Southern California. University of California, Division of Agriculture and Natural Resources Publication No. 8397. August 2009.

California Department of Forestry and Fire Protection (Cal Fire). 2011. Fire and Resources Assessment Program, "Fire Hazard Severity Zones" Accessed: July 29, 2011. Available at: http://frap.cdf.ca.gov/webdata/maps/san_diego/fhszs_map.37.jpg

California Invasive Plant Council (Cal-IPC). 2011 (Evaluation date 2004). California Invasive Plan Inventory Database: Plant Assessment Form [for *Hirschfeldia incana*]. Accessed July 29, 2011. Available at: http://www.cal-ipc.org/ip/inventory/PAF/Hirschfeldia%20incana.pdf

City Data. 2011. Weather data for Fallbrook, CA. Accessed: July 29, 2011. Available at: http://www.city-data.com/city/Fallbrook-California.html

County of San Diego. 2000. The Clean Water Project – Santa Margarita Watershed. Accessed: July 29, 2011. Available at: http://www.projectcleanwater.org/html/ws_santa_margarita.html

County of San Diego. 2009. County of San Diego Vegetation Management Report: A Report on Vegetation Management in the Unincorporated Area of San Diego County. County of San Diego Department of Planning and Land Use.

County of San Diego. 2010. Report Format and Content Requirements, Wildland Fire and Fire Protection. Department of Planning and Land Use, San Diego, CA.

DiTomaso, J.M. 1996. Identification, biology, and ecology of salt cedar. *In:* Proceedings of the Saltcedar Management Workshop. University of California Extension. Imperial County, University of California, Davis, and the California Exotic Pest Plant Council, Davis, CA.

Gossner, J. 1999 Setting Wildand Dispatch Levels. Accessed: July 29, 2011. Available at: http://www.usfa.dhs.gov/pdf/efop/efo30845.pdf

Keeley, J.E. 2004. Invasive plants and fire management in California Mediterranean-climate ecosystems. In M. Arianoutsou, editor. 10th MEDECOS-international conference on ecology, conservation management. Rhodes, Greece.

Keeley, J.E. and C.J. Fotheringham. 2003. Impact of past, present, and future fire regimes on North American Mediterranean shrublands. Pages 218–262 in T.T. Veblem, W.L. Baker, G. Montenegro,

and T.W. Swetnam, editors. Fire and climatic change in termperate ecosystems of the western Americas. Springer-Verlag, New York.

Kingsbury, J.M. 1964. Poisonous Plants of the United States and Canada. Prentice-Hall, Englewood Cliffs, NJ.

Minnich, Richard A. 1983. Fire Mosaics in Southern California and Northern Baja California. Science. New Series, Vol. 219, No. 4590. Pp. 1287–1294.

Minnich R.A. and Y.H. Chou. 1997. Wildland fire patch dynamics in the chaparral of southern California and northern Baja California. International Journal of Wildland Fire **7**: 221–48.

Parsons, W.T., and E. Cuthbertson. 1992. Noxious Weeds of Australia. Inkata Press, Melbourne.

Skinner, M.W., and B.M. Pavlik. 1994. Inventory of Rare and Endangered Vascular Plants in California. Special Publication No. 1, 5th Edition. California Native Plant Society, Sacramento, CA.

University of California Press (UC Press). 2000. Invasive Plants of California's Wildlands. C.C. Bossard, J.M. Randall, and M.C. Hoshovsky, eds. University of California Press, Berkeley, CA.

University of Nevada Cooperative Extenstion (UN). 2002. Identification and Management of Malta Starthistle (*Centaurea melitensis* L.). Reno, NV.

Managing Poison and Western Water Hemlocks. Fact Sheet No. 04-09. Accessed July 26, 2011. Accessible: http://www.unce.unr.edu/publications/files/nr/2004/FS0409.pdf

U.S. Geological Survey/California Fire Alliance. 2011. Accessed July 29, 2011. Available at: http://wildfire.cr.usgs.gov/calfireplan/viewer.htm

7.2 Photo Credits

All invasive non-native plant photographs are public domain.

Italian thistle. Photo by Brother Alfred Broussau, St. Mary's College. Available at: http://wn.com/Milk_Thistle

Tocalote. Photo by PENARC. Available at: http://ookaboo.com/o/pictures/topic/13541578/Centaurea_melitensis

Poison hemlock. William & Wilma Follette @ USDA-NRCS PLANTS Database / USDA NRCS. 1992. Western wetland flora: Field office guide to plant species. West Region, Sacramento.

Short-podded mustard. Photo by Gianluca Nicolella. Available at: http://luirig.altervista.org/floranam/brassica.htm

Perennial pepperweed, Photo by Michael Becker. Available at: http://www.google.com/imgres?imgurl=http://upload.wikimedia.org/wikipedia/commons/thumb/8/8e/Lepidium_latifolium_2005.07.17_10.31.30.jpg/220px-Lepidium_latifolium_2005.07.17_10.31.30.jpg&imgrefurl=http://en.wikipedia.org/wiki/Lepidium_latifolium&h=460&w=220&sz=59&tbnid=Z-H8L_jNcScTJM:&tbnh=128&tbnw=61&prev=/search%3Fq%3Dlepidium%2Blatifolium%26tbm%3Disch%26tbo%3Du&zoom=1&q=lepidium

+latifolium&hl=en&usg=__3EfcyQvJ9dMhnCFoCy5C-j8TywY=&sa=X&ei=CeQxTsvYD6XiiALwgIHECA&ved=0CCUQ9QEwAg

Tamarisk – Photo by Isidro Martinez. Available from Encyclopedia of Life, at: http://www.eol.org/pages/585674

Appendix A

Current California Herbicides Approved For Water Use

APPENDIX A Current California Herbices Approved for Water Use		
Manufacturer	**Product Name**	**Active Ingredient(s)**
Albaugh, Inc.	2,4-D Amine 4 Herbicide	2,4-D
	Aqua Star	Glyphosate
Alligare, LLC	Alligare Diquat Herbicide	Diquat
	Glyphosate 5.4	Glyphosate
AMREP, Inc.	Misty Glypho Kill 18	Glyphosate
	Misty Glypho Kill 41	Glyphosate
Applied Biochemists	Clearigate	Chelated copper
	Cutrine-Plus	Chelated copper
	Harpoon Aquatic Herbicide	Chelated copper
	Harvester	Diquat
	Master Label - Cutrine-Plus	Chelated copper
	Shoreklear-Plus Aquatic Herbicide	Glyphosate
Baker Petrolite Corporation	Magnacide H Herbicide	Acrolein
BASF Corporation	Habitat Herbicide	Imazapyr
Becker-Underwood, Inc.	Admiral WSP	Acid Blue 9, Acid Yellow 23
Chem One Ltd.	Copper Sulfate Crystals	Copper sulfate
Dow Agroscience	Accord Concentrate	Glyphosate
	DMA 4 IVM	2,4-D
	Garlon 3A	Triclopyr
	Garlon 4	Triclopyr
	Glypro	Glyphosate
	Remedy Ultra	Triclopyr
	Rodeo	Glyphosate
	Scythe	Palargonic acid, Paraffinic petroleum oil
E.I. DuPont De Nemours & Co., Inc.	DuPont Hyvar X Herbicide	Bromacil
	DuPont Karmex DF Herbicide	Diuron
Etigra	Duquat E-Pro 2 L Herbicide	Diquat
EZ-Ject, Inc.	EX-Ject Copperhead Herbicide Shells	Chelated copper
Fabrica De Sulfato El Aguila S.A. De C.V.	Quimag, Quimicos Aquila Copper Sulfate Crystal	Copper sulfate
Helena Chemical Company	Hardball	2,4-D
Loveland Products, Inc.	Amine 4 2,4-D Weed Killer	2,4-D
	Cinco	Glyphosate
	Clean Amine	2,4-D
	Savage	2,4-D
Monsanto Company	AquaMaster Herbicide	Glyphosate
NuFarm Americas, Inc.	Cool Power Selective Herbicide	MCDA, Triclopyr,

		Dicamba
	Grass, Weed and Vegetation Herbicide (Killer) 18% Concentrate contains Glyphosate	Glyphosate
	NuFarm Diquat SPC 2L	Diquat
	NuFarm Polaris Herbicide	Imazapyr
	Riverdale 2,4-D L.V. 4 Ester	2,4-D
	Riverdale Aquaneat Aquatic Herbicide	Glyphosate
	Solution Water Soluable	2,4-D
	NuFarm Weedar 64 Broadleaf Herbicide	2,4-D
	Weedar 64 Broadleaf Herbicide	2,4-D
Old Bridge Chemicals, Inc.	Old Bridget Copper Sulfate Fine Crystals	Copper sulfate
PBI/Gordon Corporation	Glyphomate 41 Weed & Grass Killer Plus Aquatic Herbicide	Glyphosate
	Master Label - EH-1389 Herbicide	2,4-D, 2,4-DP, dicamba
Phoenix Environmental Care LLC	Avocet Aquatic Herbicide	Glyphosate
	Gullwing	Imazapyr
	Kraken	Triclopyr
Sanco Industries, Inc.	Catt Pleax Cattail Control	Glyphosate
	Pond Champs Algae X Algaecide/Herbicide	Copper sulfate
	Weedplex Pro Landscape & Aquatic Herbicide	Diquat
Sepro Corporation	Aquapro	Glyphosate
	Avast! SC	Fluridone
	Habitat	Imazapyr
	Komeen	Copper sulfate
	Nautique Aquatic Herbicide	Chelated copper
	Renovate 3	Triclopyr
	Renovate OTF	Triclopyr
	Sonar A.S.	Fluridone
	Sonar PR Precision Release	Fluridone
	Sonar Q	Fluridone
	Sonar SRP	Fluridone
	Sonarone	Fluridone
SSI Maxim Company, Inc.	Sprakil S-5 Brush Control Granules	Tebuthiuron
Syngenta Crop Protection, Inc.	Reward Landscape & Aquatic Herbicide	Diquat
	Touchdown Pro Herbicide	Glyphosate
United Phosphorus, Inc.	Aquathol K Aquatic Herbicide	Endothall

	Aquathol Super K Granular Aquatic Herbicide	Endothall
	Hydrothol 191 Aquatic Algicide & Herbicide	Endothall
Wilbur Ellis Company	Broadrange 55	2,4-D

Appendix B

Fire Modeling

APPENDIX B

Fire Modeling

The following are the Worst Case Scenarios provided by San Diego County Department of Planning and Land Use, Department of Public Works. Table 1 represents data for a grass fire model, while Table 2 is for a brush fire model. Modeling used the program BEHAVE Plus (vers. 5.0.1). Available at: http://www.sdcounty.ca.gov/dplu/docs/Fire-Report-Format.pdf

Table 1
BEHAVE Plus 5.0.1
Worst case sustained winds (10 minute average and peak) Fuel Model 1 at 50% slope

Zone	Period	Temperature	Relative Humidity	Sustained Wind Speed	Burning Index (99%)	Rate of Spread Feet/min	Flame length
Maritime	Summer	70-89°F	30-34%	17 mph	41	300	8
	Santa Ana	90-109°F	5-9%	18 mph	64	470	10
	Peak	90-109°F	5-9%	22 mph	-	550	11
Coastal	Summer	90-109°F	10-14%	19 mph	57	430	9
	Santa Ana	90-109°F	0-4%	21 mph	112	600	12
	Peak	90-109°F	0-4%	26 mph	-	730	13
Transitional	Summer	90-109°F	10-14%	19 mph	119	430	9
	Santa Ana	90-109°F	5-9%	28 mph	145	730	13
	Peak	90-109°F	5-9%	41 mph	-	730	13
Interior	Summer	90-109°F	5-9%	18 mph	153	470	10
	Santa Ana	90-109°F	5-9%	24 mph	168	730	13
	Peak	90-109°F	5-9%	56 mph	-	730	13
Desert	Summer	90-109°F	5-9%	18 mph	153	470	10
	Santa Ana	90-109°F	5-9%	24 mph	168	730	13
	Peak	90-109°F	5-9%	56 mph	-	730	13

Table 2
BEHAVE Plus 5.0.1
Worst case sustained winds (10 minute average and peak) Fuel Model 4 at 50% slope

Zone	Period	Temperature	Relative Humidity	Sustained Wind Speed	Burning Index (99%)	Rate of Spread Feet/min	Flame length
Maritime	Summer	70-89°F	30-34%	17 mph	41	480	47
	Santa Ana	90-109°F	5-9%	18 mph	64	620	56
	Peak	90-109°F	5-9%	22 mph	-	700	60
Coastal	Summer	90-109°F	10-14%	19 mph	57	989	50
	Santa Ana	90-109°F	0-4%	21 mph	112	740	61
	Peak	90-109°F	0-4%	26 mph	-	870	65
Transitional	Summer	90-109°F	10-14%	19 mph	119	615	54
	Santa Ana	90-109°F	5-9%	28 mph	145	1100	73
	Peak	90-109°F	5-9%	41 mph	-	1600	87
Interior	Summer	90-109°F	5-9%	18 mph	153	620	56
	Santa Ana	90-109°F	5-9%	24 mph	168	870	66
	Peak	90-109°F	5-9%	56 mph	-	2400	105
Desert Chaparral	Summer	90-109°F	5-9%	18 mph	153	620	56
	Santa Ana	90-109°F	5-9%	24 mph	168	870	66
	Peak	90-109°F	5-9%	56 mph	-	2400	105