



JOSEPH D. GRANT AND ED R. LEVIN COUNTY PARKS
RESOURCE MANAGEMENT PLAN



Prepared for:
SANTA CLARA COUNTY
PARKS AND RECREATION
DEPARTMENT

Submitted by:
BRADY AND ASSOCIATES, INC.
PLANNERS AND LANDSCAPE ARCHITECTS

OCTOBER 1996

B R A D Y A N D A S S O C I A T E S , I N C .
P L A N N E R S A N D L A N D S C A P E A R C H I T E C T S

**JOSEPH D. GRANT
and
ED R. LEVIN
County Parks
Resource Management
Plan**

Final

■ ■ ■

Prepared For:
SANTA CLARA COUNTY
PARKS AND RECREATION
DEPARTMENT

Submitted By:
BRADY AND ASSOCIATES, INC.
PLANNERS AND LANDSCAPE ARCHITECTS

In Association With:
WILDLAND RESOURCE MANAGEMENT
THE HABITAT RESTORATION GROUP
RAY BUDZINSKI, RANGE MANAGER

OCTOBER 1996

ACKNOWLEDGEMENTS

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Resource Management Plan
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Chapter I
INTRODUCTION

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A. Introduction

Joseph D. Grant and Ed Levin County Parks are public parks within the Santa Clara County Park System. Grant County Park lies east of the City of San Jose in the foothills of the Diablo Range. At 9,522 acres, it is the largest of the County parks. It was purchased in 1975 and opened to the public in 1978. Levin County Park lies east of the City of Milpitas on the west-facing slopes of the Diablo Range overlooking the Santa Clara Valley and San Francisco Bay. This 1,562-acre park was purchased in two pieces: the lower part was purchased in 1965; the upper part, a 970-acre parcel that once was part of the Minnis Ranch, was added in 1979. This resource management plan deals with all of Grant County Park and 1,170 acres of the undeveloped portions of Levin County Park.

B. Planning Framework

Santa Clara County commissioned a master plan for Grant County Park in 1976. Many of the elements of the initial master plan were completed, and the County commissioned an update in 1989. The updated master plan, adopted in August 1993, now directs use and development of Grant County Park. A master plan has never been prepared for Levin County Park.

The *Joseph D. Grant County Park Master Plan* and the historic recreational uses of Levin County Park establish the basis for the use, development and management of each park. Neither park has a detailed resource management plan that sets out not only management goals but also discusses ways to carry out those goals and to manage all resources in a balanced way.

To date, the grasslands of both parks have been managed primarily through the use of cattle grazing. Santa Clara County has permitted grazing at Levin County Park since 1978 and at Grant County Park since 1979. Concern arose over the effects of grazing on the resources of these and other County

parklands, and in 1987 the County Executive directed County staff to prepare a range management policy. Approved by the Santa Clara Board of Supervisors in July 1992, the *Santa Clara County Parkland Range Management Policy* (see Appendix A) called for the development of a management plan that analyzed all of the resources on each park and provided a balanced approach to manage them. Soon thereafter, the Parks and Recreation Department began the process of preparing a resource management plan for Grant and Levin County parks. Pending completion of the comprehensive resource management plan, the County commissioned the *Range Management Plan for Ed R. Levin County Park and Joseph D. Grant County Park* (Budzinski 1993), which established an interim policy for these two parks. The recommendations of the range management plan were enacted in July 1993.

C. Purpose of the Resource Management Plan

This resource management plan is intended to serve as a policy document and practical guide for the management of all the resources of Grant and Levin County parks, in fulfillment of the *Santa Clara County Parkland Range Management Policy*. It describes each park's natural resources and the best way to manage these resources given their special characteristics, their ability to support recreation, and Santa Clara County's staffing and funding realities. It provides overall direction to the County for managing all of the resources of the two parks, and identifies specific management programs and projects for both parks in both the near term and the long term.

In keeping with the goals of the Range Management Policy, this Resource Management Plan provides comprehensive information for each park regarding the inventory of natural resources and specific goals, techniques and programs used to preserve and enhance them. The goals of the Plan are in concert with the Policy objectives to:

- Provide visitor access and recreational opportunities;
- Provide for the safety of park users;
- Protect, conserve, enhance natural plant communities;
- Minimize fire hazards to parklands and private property by managing vegetative fuels;
- Rehabilitate degraded vegetation and wildlife habitat; and
- Establish cooperative relationships with adjacent property owners.

D. Methodology

The resource management plan was prepared in steps. The first step was preparation of a baseline analysis, which included analysis of existing information; familiarization with the site; site visits; and discussions with the Santa Clara County Parks and Recreation Department. Detailed analyses were prepared for vegetation, wildlife, hydrology, and wildfire.

The baseline analysis was first documented in a separate report, the *Joseph D. Grant and Ed Levin County Park Resource Management Plan Baseline Report*, which was reviewed at a public meeting held on August 10, 1994. The comments from the public review were incorporated into the baseline report, which has now been incorporated into this report.

The second step was the preparation of the draft Resource Management Plan. The Parks and Recreation Department of Santa Clara County published a Draft Resource Management Plan in August 1995. Subsequent to the publication of that document, a series of meetings were held to discuss the Plan and its recommendations. As a result of these meetings, an addendum (Addendum #1, November 1995) to the Draft Grant and Levin County Parks Resource Management Plan was prepared. The Addendum incorporated information and comments on the Plan received from the public, park users, and State and local agencies. Another series of meetings were held to address the changes made in Addendum #1. As a result of those meetings, the Revised Draft Resource Management Plan prepared was in July 1996.

This *Final Joseph D. Grant and Ed Levin County Park Resource Management Plan* contains revisions made in response to comments on the Revised Draft Resource Management Plan.

E. How to Use This Resource Management Plan

This document is meant to provide a complete resource document for managing the resources of the two parks.

Chapters II through VI present the background information necessary to understand the recommendations of the resource management plan and their rationale.

- Chapter II presents the goals upon which the management recommendations in this plan are based.

- Chapter III describes baseline information for the two parks, including the funding, staffing, revenues, and restrictions related to the two parks.
- Chapter IV provides a thorough discussion of the vegetation and wildlife resources on the two parks, by plant community.
- Chapter V describes the management tools available to managers of the two parks, and discusses their strengths, weaknesses, and how and when they should be applied.
- Chapter VI describes park-wide resource management issues and needs for both parks and potential management tools which can be used to address these issues and needs. Refer to this chapter for questions about oak regeneration; control of invasive non-native plants; management for native wildlife, including black-tailed deer, Canada geese, great blue heron, native bats and native fish; management of pest animals, including feral pigs, ground squirrels, and bullfrogs; management of disturbed and eroded areas and water quality; preservation and enhancement of the local gene pool; and wildfire management.
- Chapter VII presents specific recommendations for managing parkwide issues including feral pig population control, ground squirrel population control, oak regeneration, wildfire prevention, and recreational management.
- Chapter VIII presents the recommendations and implementation actions for managing specific areas on Grant County Park.
- Chapter IX presents the recommendations and implementation actions for managing specific areas on Levin County Park.

Refer to the table of contents as a guide for locating recommendations for specific topics. Many of the appendices provide more-detailed information on managing specific resource issues.

Chapter II
RESOURCE MANAGEMENT GOALS



The goals of the resource management plan are based upon goals identified by the Santa Clara County Parks and Recreation Department, the goals of the *Santa Clara County Parkland Range Management Policy* and observations from field studies conducted in order to prepare the initial baseline report. While the goals are described separately, they are intricately interwoven in many ways. Each is described below, preceded by a mission statement that establishes the singular purpose of the two parks as public recreation resources.

Mission Statement: *Grant and Levin County Parks have as their purpose the provision and accommodation of public recreation and public use. It is the role of the resource management plan to acknowledge the recreational purpose of these parks and to support them fully while providing for the protection of natural resources and the enhancement of biodiversity.*

- Goal A. Support planned or established recreational uses and values.
- Goal B. Develop management techniques consistent with the funding and staffing capabilities.
- Goal C. Provide for the safety and enjoyment of park users.
- Goal D. Maintain and enhance the present character and qualities of each park.
- Goal E. Manage each park for biodiversity.
- Goal F. Protect and enhance wildlife species of special status.
- Goal G. Protect and enhance plant species of concern.
- Goal H. Protect and enhance water quality and water resources.

- Goal I. Reduce soil erosion.
- Goal J. Restore degraded or deteriorating resources.
- Goal K. Protect visual quality.
- Goal L. Discourage the spread of invasive non-native plants.
- Goal M. Establish a cooperative relationship with adjacent neighbors.
- Goal N. Minimize wildfire hazards.

Chapter III BASELINE CONDITIONS

■ ■ ■

A. Introduction

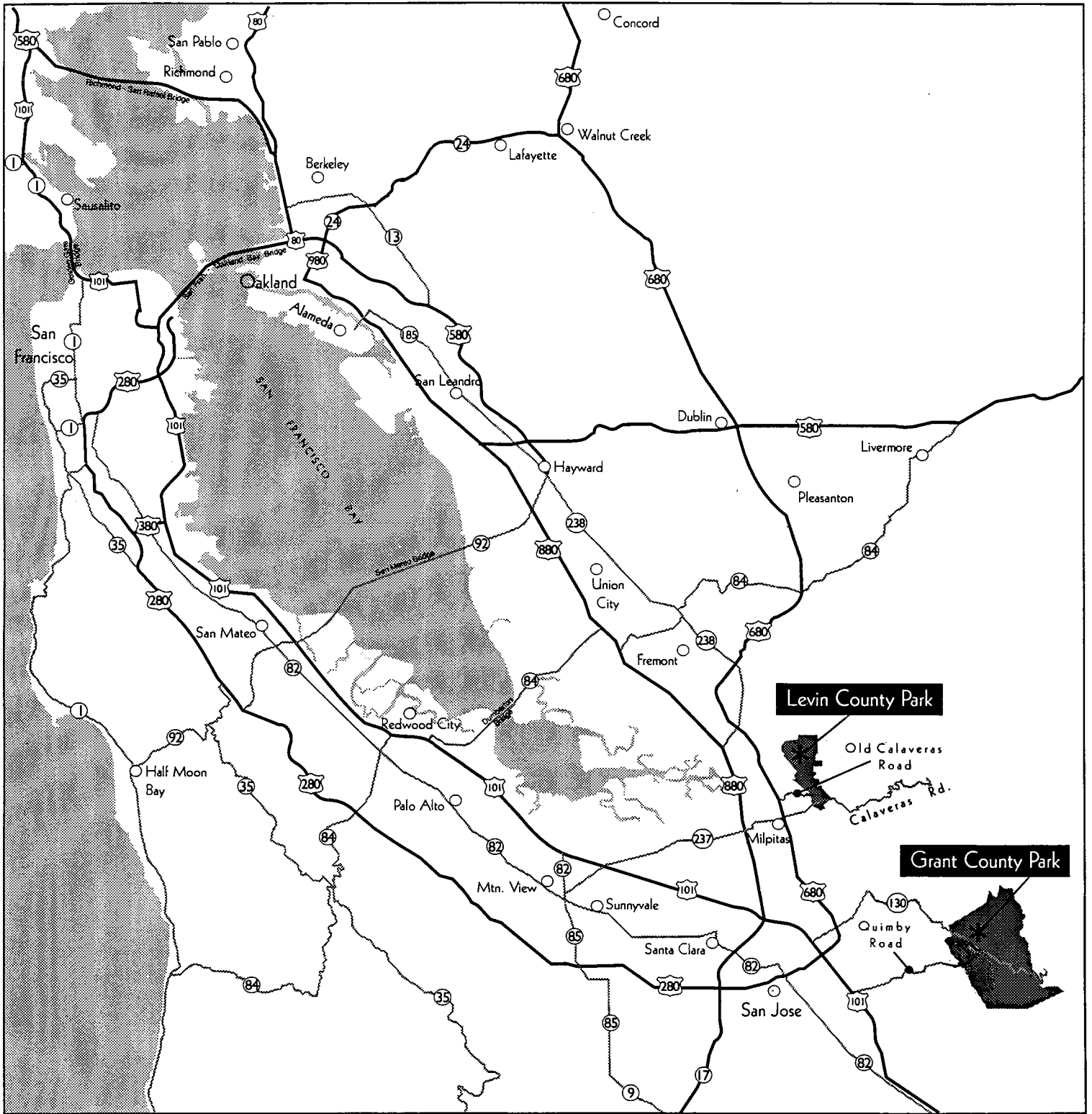
This chapter provides a summary and overview of the baseline conditions concerning access and circulation, existing and planned uses, climate, geology, soils, hydrology, and County funding and staffing resources for both J.D. Grant and Ed Levin County parks. Because of the importance of understanding vegetation and wildlife resources in the parks for the Resource Management Plan, a thorough discussion of the vegetation and wildlife within the two parks is contained in Chapter IV: Vegetation and Wildlife Resources. The information in both of these chapters was taken from the *Baseline Report* prepared by Brady and Associates for the Santa Clara County Parks and Recreation Department in July 1994 as part of the Resource Management Plan.

The description of existing conditions, that is the subject of this chapter and Chapter IV, provides the background research and analysis which has been used to formulate the management and implementation recommendations for each of the parks. The location of the two parks is shown on Figure 1.

1. Grant County Park

Grant County Park lies east of the City of San Jose, immediately behind the foothills of the Diablo Range that rise steeply 2,000 feet or more to form the spectacular edge of the Santa Clara Valley. Grant County Park headquarters, which are in Halls Valley inside the main park entrance, is ten miles by road from downtown San Jose.

Grant County Park is part of what was once the 15,000-acre Mexican land grant awarded to Jose de Jesus Bernal in 1839, which he named Rancho Cañada de Pala. The western boundary of the park runs along the ridgeline that separates the Santa Clara and Halls valleys. It appears to follow the original boundary between the Rancho Cañada de Pala and the grant for the Pueblo Lands of San Jose, which seems to have been set out to follow the



Source: Brady and Associates, 1995



GRANT & LEVIN COUNTY PARKS
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

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FIGURE 1

Location

ridgeline in this area. The southern edge of the park also appears to follow the boundary of the Rancho Cañada de Pala. Smith Creek forms the eastern edge of the park.

Shut off from the Bay Area, Grant County Park is a world apart from the bustle of the valley. Everything within view is rural, and the landscape seems to be of an earlier time. The park's relative inaccessibility, its inward focus, and its rural character belie its proximity to the cities of the Santa Clara Valley just over the ridge. From the ridgeline on the park's western edge and from higher places in other parts of the park, the foreground views of the park stand in sharp contrast to the background views of the Santa Clara Valley and San Francisco Bay.

2. Levin County Park

In contrast to the remoteness and rural character of Grant County Park, Levin County Park is on the eastern edge of the City of Milpitas, and partially within its corporate limits. The park office is about one and one-half miles east of downtown Milpitas, on the south side of Calaveras Road opposite the entrance to the Spring Valley Golf Course.

There are almost always commanding views from the upper portions of Levin County Park, and from the crests of the hills along the park's southwestern boundary. The city seems never far away. The Santa Clara Valley dominates the western and southwestern views. San Francisco Bay stretches to the northwest. The Santa Cruz Mountains form a dramatic backdrop. From the upper ridge that extends south from Monument Peak, there are breathtaking views in almost all directions of the Bay, the Santa Clara Valley with the Santa Cruz Mountains in the background, Calaveras Reservoir and the Diablo Range. From the hills that form the southwestern boundary of the park there are, in addition to impressive views to the west, dramatic views over the lower portions of the park and the steep slopes that climb to the summit of Monument Peak on the park's northern boundary.

The northern boundary of Levin County Park follows the border between Santa Clara and Alameda Counties along Scott Creek. This boundary of Levin County Park abuts the East Bay Regional Park District's Mission Peak and Monument Peak Regional Preserves.

B. Access and Circulation

1. Grant County Park

From Santa Clara Valley and the west, Grant County Park is accessible only from Mt. Hamilton Road (State Highway 130) or from Quimby Road (see Figure 2), which are both extremely narrow and winding two-lane roads. Mt. Hamilton Road passes diagonally through the park and continues from San Jose on to Mt. Hamilton and east. East of the park, it winds through the Diablo Range until it eventually emerges in the Livermore Valley. Quimby Road reaches the summit of the foothills at about the park's western boundary and is a major east/west street in the eastern portion of San Jose. It descends into the park and terminates at Mt. Hamilton Road near Grant Lake. Both roads are designated scenic highways in the Regional Parks, Trails and Scenic Highways element of the *General Plan for Santa Clara County*.

A private fee title road between Mt. Hamilton Road and the northern boundary of the park provides access to the ranch adjoining the northern boundary of the park. Santa Clara County has maintenance access on this road. There are also easements across the park for high-power transmission lines that run along the western edge of the park and through the southeastern corner of the park.

2. Levin County Park

Calaveras Road, which runs through the southern portion of Levin County Park, provides the main access to the park. Calaveras Road is known as Calaveras Boulevard west of the park, and is a major east/west city street, see Figure 3. Calaveras Road is a designated scenic highway in the Regional Parks, Trails and Scenic Highways element of the *General Plan for Santa Clara County*.

Downing Road begins at Calaveras Road just inside the western boundary of the park providing access north into the center of the park. Downing Road is a paved, two-lane road from Calaveras Road to the parking lot and equestrian staging area on the north side of Sandy Wool Lake. It continues as a paved one-lane road to Minnis Ranch where it is gated upon entering and exiting the Ranch area. Beyond the second gate, Downing Road becomes Monument Peak Road, an unpaved road that provides limited access to the higher elevations of the park and to Monument Peak. Monument Peak Road is steep, narrow, and winding, and is often little more than a trail over rock outcroppings. It provides access for park patrols and several hang-glider launching sites.

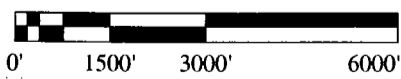
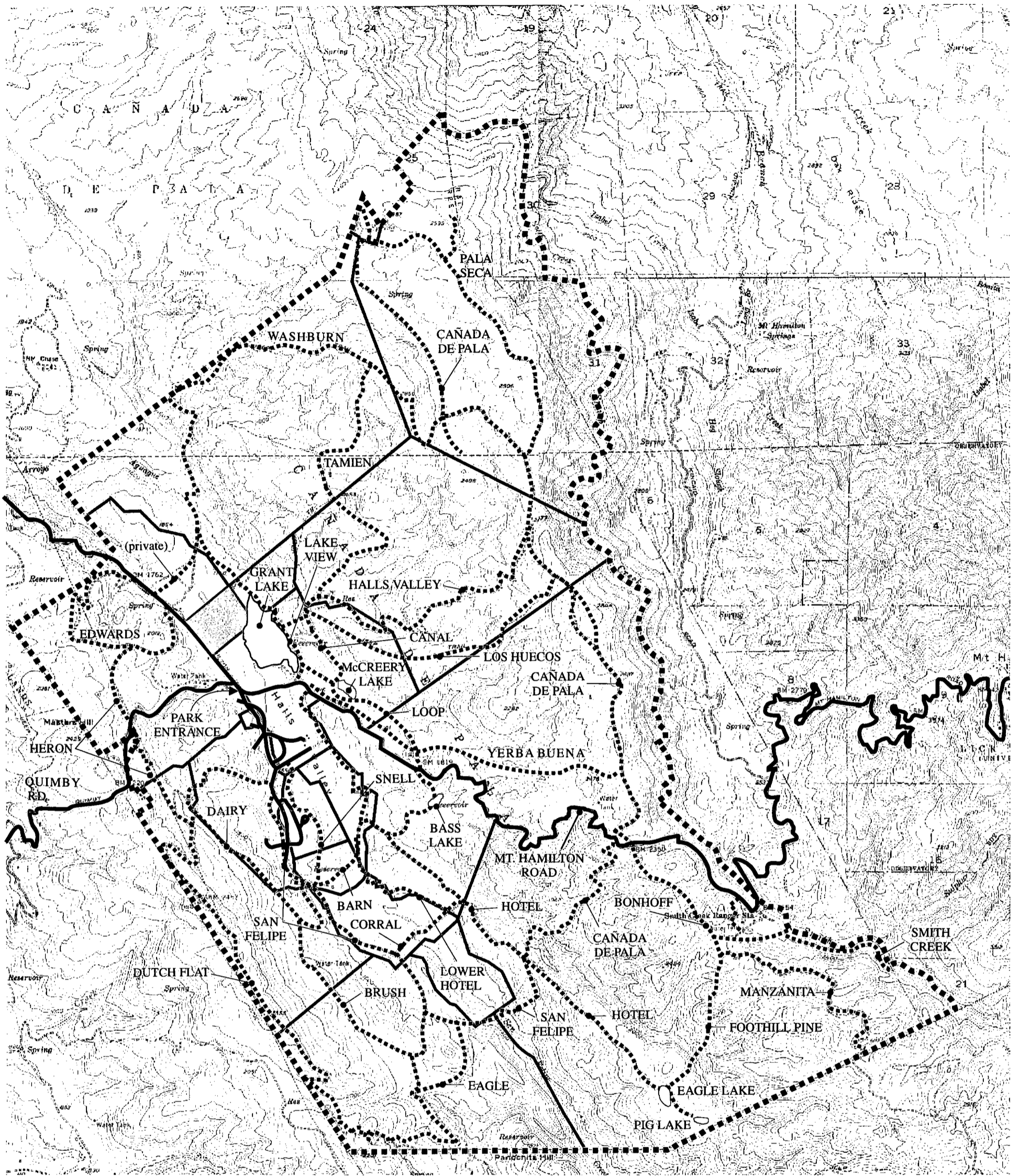


FIGURE 2

Access

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

LEGEND

- Road
- Trail
- Field Boundary
- Lake
- Private Inholding
- ▣ Park/Study Area Boundary

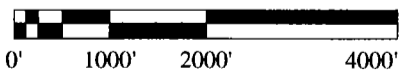
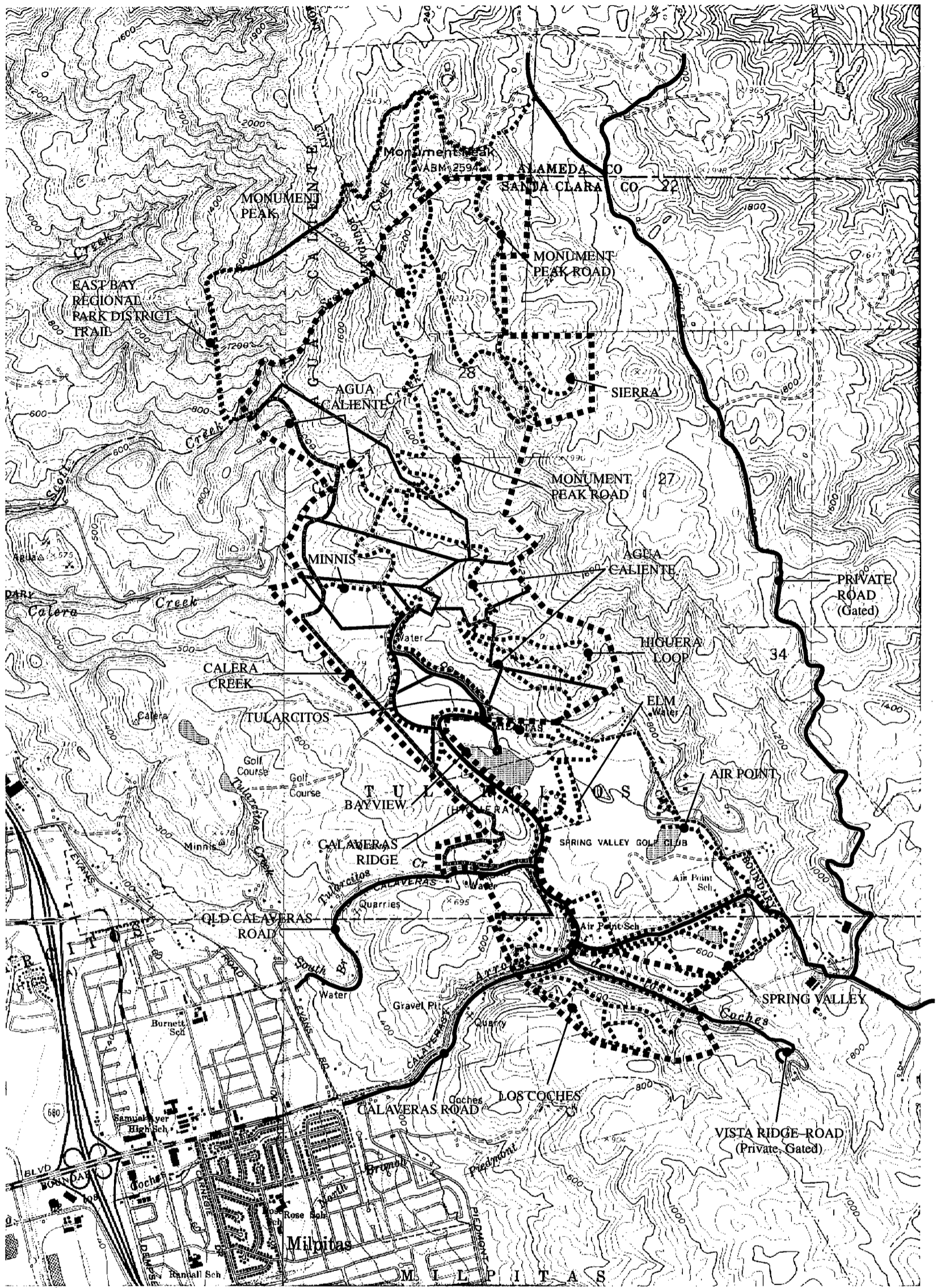


FIGURE 3

Access

ED LEVIN COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

| LEGEND | |
|--------|--------------------------|
| | Road |
| | Trail |
| | Field Boundary |
| | Park/Study Area Boundary |
| | Park Boundary |

Levin County Park is also accessible from Old Calaveras Road, an extension of Kennedy Drive in Milpitas. Old Calaveras Road intersects with Downing Road south of Sandy Wool Lake. Vista Ridge Road, a private, gated road, connects to Calaveras Road within the park, runs along the Arroyo de los Coches, and provides access to the private residential development southeast of the park.

In addition to Monument Peak Road and the other park trails, emergency vehicles currently can travel down but not up the Agua Caliente Trail. The trail is too steep for safe travel or for maintenance. A paved, private road east of and outside the park, formerly Weller Road, provides access to the back of Monument Peak. It is gated approximately one-quarter mile north of Calaveras Road, but keyed to permit emergency access.

Agua Caliente and Monument Peak trails and Monument Peak Road in Levin County Park all extend into the East Bay Regional Park District's Mission Peak and Monument Peak Regional Preserves, connecting Levin County Park with the East Bay Regional Park District's extensive regional trail system.

C. Existing and Planned Uses

1. Grant County Park

Grant County Park has an adopted Master Plan (*Joseph D. Grant County Park Master Plan 1993*) that sets the direction for the development and use of the park. Halls Valley, a broad flat valley with a mostly open floor that runs northwest to southeast through the western half of the park, contains most of the developed park facilities. Within the main meadow area south of Grant Lake, park facilities include a visitor center and park headquarters at the former ranch house complex, restrooms, picnic areas, open space and associated parking. There are also a number of picnic areas dispersed around the main meadow, and campgrounds on the low hills west of the valley floor. See Figure 4.

While the park master plan recommends adding bicycle climbing lanes to Mt. Hamilton Road, there are currently no plans to widen this road. However, the County is planning to provide parking turnouts and signage improvements along Mt. Hamilton Road as part of its master plan implementation program. The 400-mile Bay Ridge Trail has been proposed to pass through Grant County Park and is planned to run along the park's western boundary, overlooking the bay.

The main meadow has the staging area for equestrians, located near the park entrance. In the past, a concessionaire has operated an equestrian concession out of the Grant County Park Stables near the intersection of Mt. Hamilton and Quimby roads. Currently, however, the stables are not in operation. The County intends to request bids for re-opening the stables soon, perhaps with a broader range of services than in the past. The main meadow area also houses living quarters for the resident ranger. The master plan calls for the development of a separate visitor center and a number of other facilities in the area of the main meadow.

Grant Lake is a man-made lake that offers fishing, picnicking and associated parking. There is also fishing at McCreery Lake. Both lakes are stocked with fish. Bass and Eagle lakes are designated in the park master plan to be stocked with fish as well.

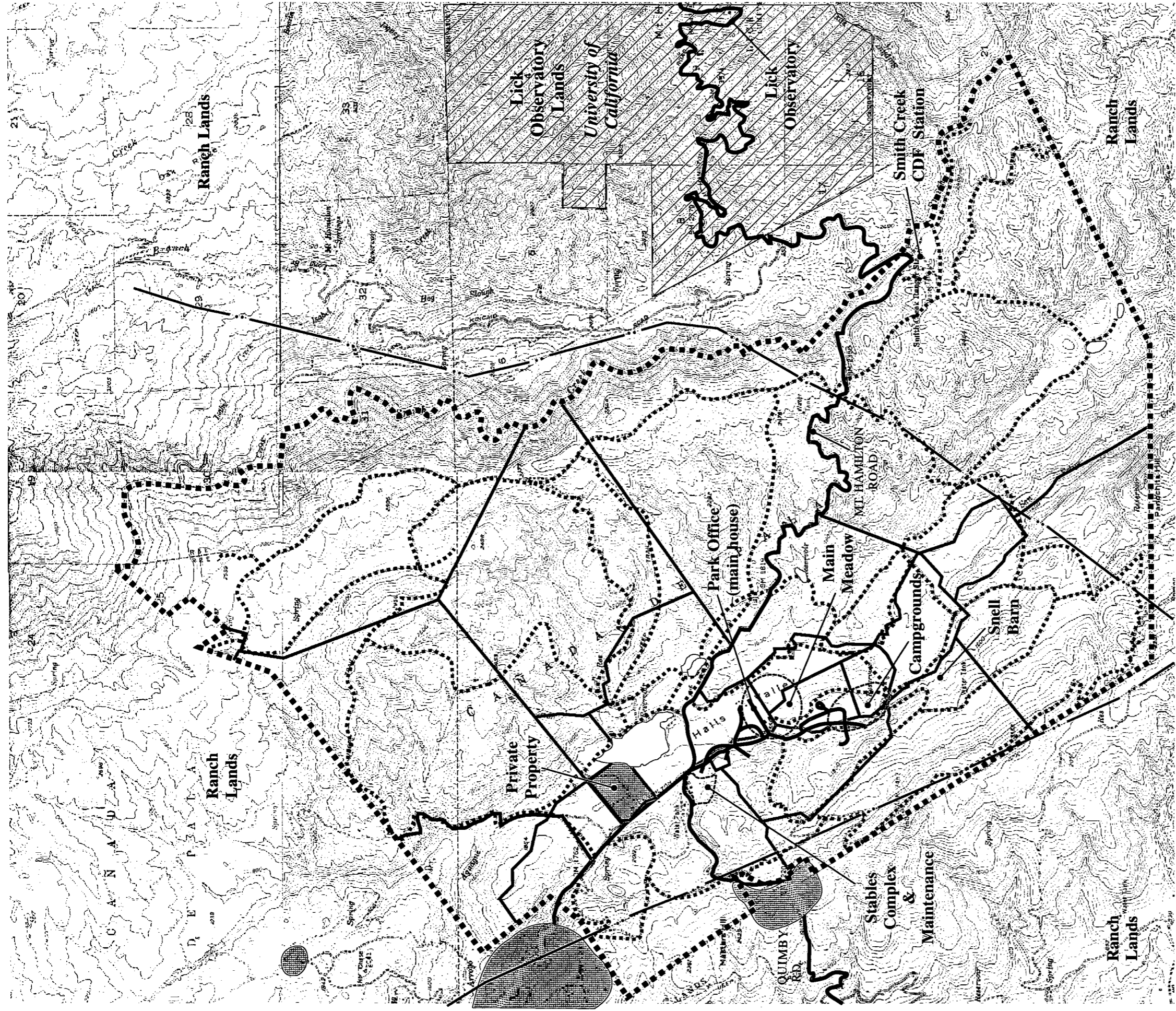
Currently, the campgrounds provide family camp sites and associated facilities, including restrooms, showers, and an amphitheater. There are plans for additions to this camping area and for the development of back country camping sites in Deer Valley in Pala Seca Field and in Brush Field.

The park currently provides nearly 45 miles of hiking, bicycling and equestrian trails. They accommodate a combination of hiking only, hiking and equestrian, and combined hiking, equestrian and bicycle uses. In addition, there are plans to develop a few trails that are accessible to those in wheelchairs as well as to the young and the elderly.

Some accounts suggest that the land now occupied by Grant County Park has been grazed by cattle since the early 1800s. The establishment of the Mission of San Jose in 1797 is known to have brought with it herds of livestock, but whether grazing extended to the area including the park is unclear. The Rancho Cañada de Pala was established in 1839, and it is most likely that grazing in the park began at least at that time. Grazing by cattle occurred prior to purchase of the parklands by Santa Clara County. Grazing has been permitted in the park since 1979, the year after it opened for public use.

Until mid-1993, Grant County Park was licensed for about 4,800 animal unit months.¹ The *Range Management Plan for Ed R. Levin County Park and Joseph D. Grant County Park* (Budzinski 1993) determined that 7,681 acres of the 9,522 acres in the park were potentially available for grazing, and were

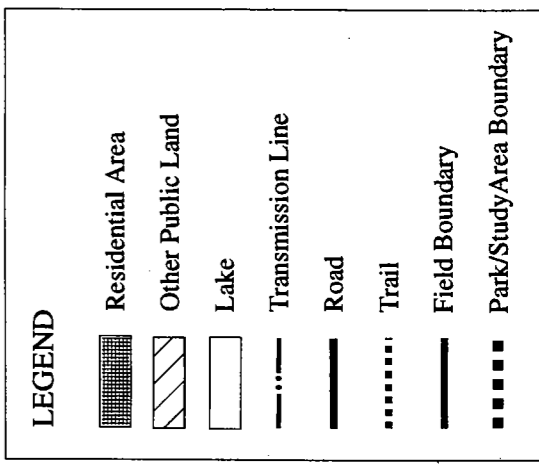
¹ An animal unit month is the amount of forage needed to feed one adult cow or a cow and her calf for a month.



Note: Mt. Hamilton Rd. and Quimby Rd. are designated scenic highways.

FIGURE 4

Existing Uses



J.D. GRANT COUNTY PARK
RESOURCE MANAGEMENT PLAN

Santa Clara County

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 PLANNERS AND LANDSCAPE ARCHITECTS

calculated to have carrying capacity of 4,992 animal unit months, which translates to about 416 adult head of cattle year-round. It confirmed the historic levels of grazing on the park. The range management plan became the basis for the interim grazing plan for the park, which was enacted in July 1993, pending completion of this resource management plan.

Grant County Park contains 21 fields, nine of which are currently excluded from grazing in whole or in part. These include the Alfalfa, South Barn, Pala Seca, Lake, Lower Snell, Middle Snell, Stockyard, and Valley fields. These fields contain wetlands, lakes, and/or riparian areas and their buffer zones along San Felipe Creek and around Grant Lake. Brush Field has been divided into two fields, Brush North and Brush South, and the Brush North Field also has been removed from grazing to preserve a wetland area within it. Grazing in the park has brought about improvements such as ponds, fencing, and a headquarters for the grazing licensee. Figure 5 shows the current configuration of fields on Grant County Park.

2. Levin County Park

For the purposes of this resource management plan, Levin County Park has been divided into an "undeveloped" portion and a "developed" portion, see Figure 6. The undeveloped portions of the park include the upper portions of the park above the Tularcitos Trail, which was once part of the Minnis Ranch; the areas of the park west of Downing Road; and the portions of the park along the Arroyo de los Coches. The remaining "developed" areas of the park are known as the Sandy Wool and Spring Valley day use areas.

The developed portion of the park provides a variety of recreational facilities. The Spring Valley section of the park lies south of Calaveras Road, and houses the park office. This part of the park focuses on Spring Valley Pond and the picnic area that surrounds it. There also is an equestrian arena, parking, substantial open space and multipurpose trails and that extend into the Arroyo de los Coches. Both Spring Valley Pond and Sandy Wool Lake accommodate fishing.

There are two staging areas for equestrians in the lower portions of Levin County Park, and many horses are brought into the park by trailer. However, most equestrians access the park from lands surrounding the park. Some enter the park from the East Bay Regional Park District lands to the north, and are taken out of the park by trailer. No stables or concessions operate within the park, but a private stable near the northeast corner of the park rents horses that are ridden into the park. In addition, a significant number of stables lie just outside the park. Together, these stables are estimated to

accommodate more than 900 horses. Except for a limited number of equestrians who gain access to the park through a private gate at Calera Creek, most ride into the park below Tularcitos Trail, where there are established equestrian entrances (Santa Clara County Parks and Recreation Department).

Spring Valley Golf Course, a public golf course, occupies much of the area immediately north of Calaveras Road. There is a youth group camping area at the northeastern corner of the intersection of Downing and Calaveras Roads. The northern end of this portion of the park focuses on Sandy Wool Lake, and provides extensive picnic areas, a playground, parking, and substantial open space.

The lower portion of the park is interwoven with roads, an extensive trail system, a unifying open space system and landscaping. This trail system links with the trails on the undeveloped portions of the park.

Development in the upper portion of the park is centered at the Minnis Ranch, and includes the ranch house, which is now a training center, stables, barns, corrals, and housing for the grazing licensee. Other development of this upper portion of the park is limited primarily to multipurpose trails, a number of unimproved launch sites for hang gliders, and local access roads. Levin County Park also provides the only public access from northern Santa Clara County into Alameda County and the East Bay Regional Park District's trail system. The 400-mile Ridge Trail passes through Levin County Park.

The upper portion of the park is an important hang-gliding area, with a formal use agreement between the Santa Clara County Parks and Recreation Department and a local hang-glider association. There are a number of undeveloped launching sites throughout the upper portions of the park. Hang gliders launch from the upper portions of the park land in the open space northwest of Sandy Wool Lake.

Development on the lands west of Downing Road consists primarily of recreational trails and fencing to contain cattle, but this area is not currently grazed. Development on the lands along the Arroyo de los Coches is limited primarily to recreational trails. A private, gated road runs along the bottom of the arroyo and provides access to housing above the park to the south. Portions of this area are also fenced, but this area is not currently grazed either.

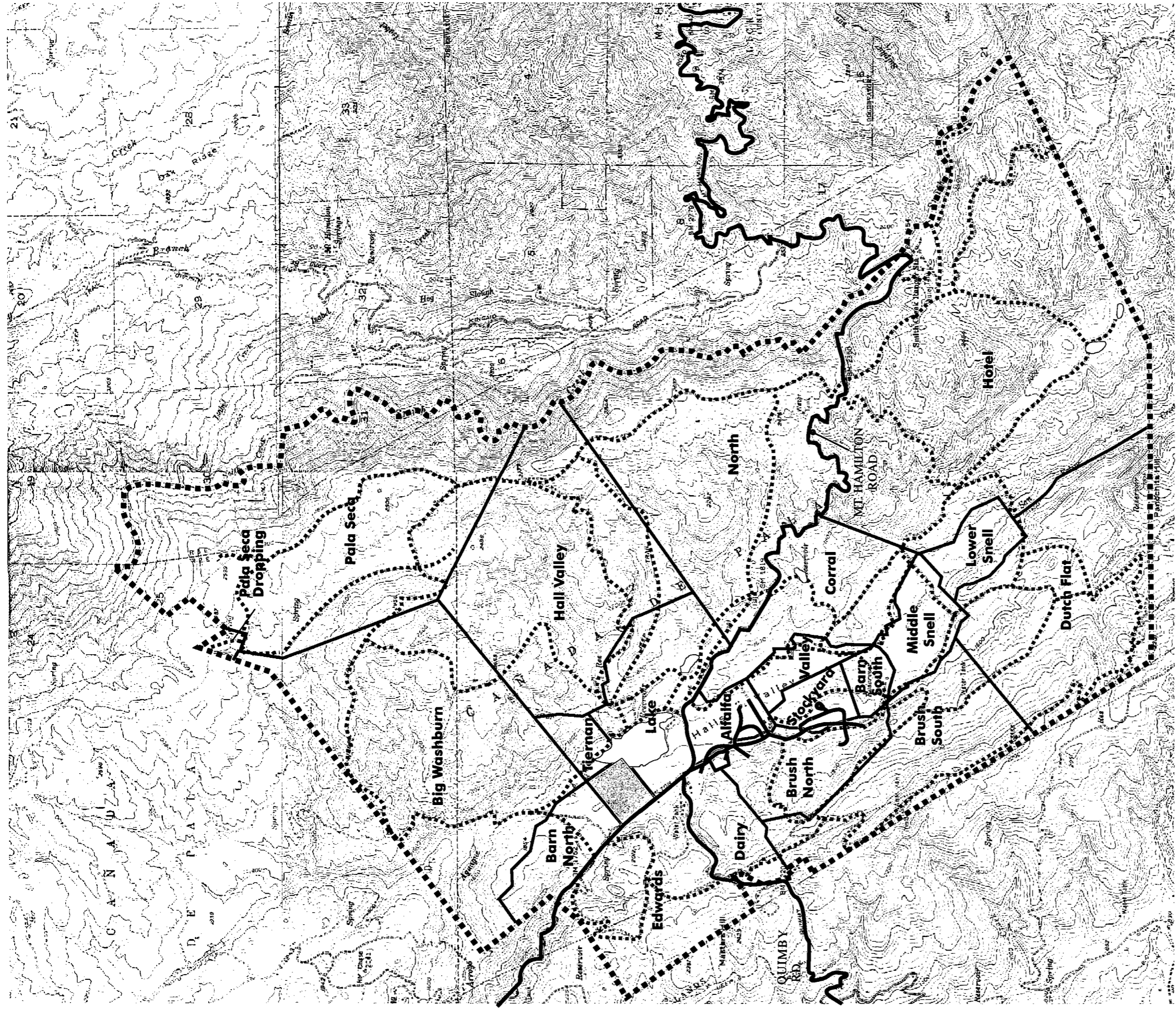


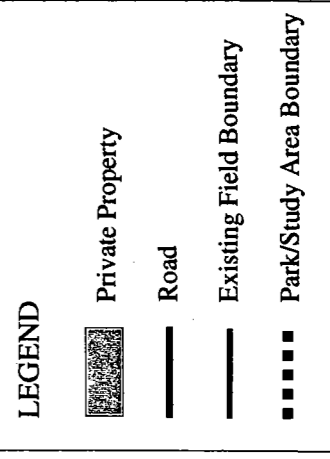
FIGURE 5

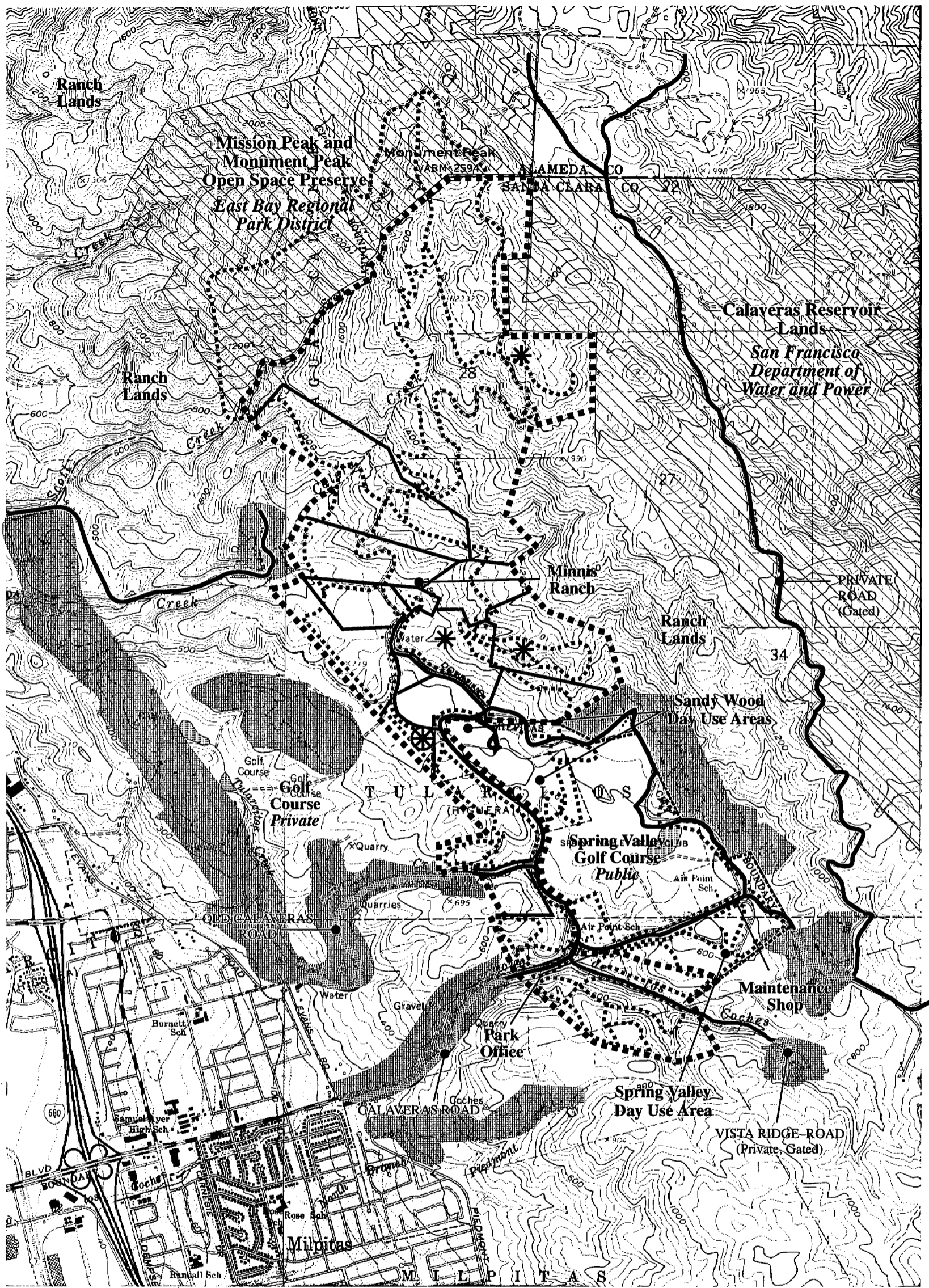
Fields

J.D. GRANT COUNTY PARK

RESOURCE MANAGEMENT PLAN

Santa Clara County





Note: Calaveras Road is a designated scenic highway.

FIGURE 6

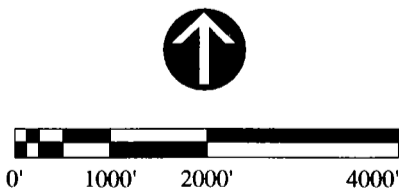
Existing Uses

ED LEVIN COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

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 PLANNERS AND LANDSCAPE ARCHITECTS

LEGEND

- * Hang-Glider Launching Site
- ⊗ Hang-Glider Landing Site
- ▨ Residential Area
- ▧ Other Public Land
- Lake
- Road
- ⋯ Trail
- Field Boundary
- Park/Study Area Boundary
- ⋯ Park Boundary



There is little history regarding grazing on the lands that are now Levin County Park, but it is thought that the early history of grazing on the park is likely to be similar to that of Grant County Park. The upper portions of Levin County Park were part of the historic Minnis Ranch, and were grazed by cattle prior to purchase by Santa Clara County. Grazing by cattle has been permitted in the upper portions of the park since 1978. Until mid-1993, Levin County Park was licensed for 3,000 animal unit months. The *Range Management Plan for Ed R. Levin County Park and Joseph D. Grant County Park* (Budzinski 1993) concluded that a more realistic carrying capacity for Levin County Park would be about 559 animal unit months, equivalent to about 47 adult head of cattle year-round. It greatly reduced the level of grazing on Levin County Park. The 1993 range management plan became the basis for the interim grazing plan for the park, pending completion of this resource management plan.

The grazed portion of Levin County Park is currently divided into 14 fields. All but the three fields west of Downing Road and the Arroyo Field south of Calaveras Road are currently open to livestock grazing. Figure 7 shows the current configuration of fields on Levin County Park.

Residential development borders the northwestern, southern, and the southeastern edges of the park. The housing on the western edge of the park is intermingled with the facilities of the private Summit Point Golf Course. Some houses lie within 1,000 feet of the park. The more intensely urbanized area of the City of Milpitas is only about one mile west of the park.

The remaining areas surrounding the park are primarily open and in generally large land holdings. The San Francisco Water Department owns and manages substantial land surrounding the Calaveras Reservoir southeast of the park. Levin County Park and the reservoir lands adjoin one another along the park's northeastern boundary, and the reservoir lands run along the crest of the ridge that extends southeast from Monument Peak for the length of the park, leaving only a narrow strip of non-public land between the eastern edge of the park and the reservoir lands.

D. Climate

Both Grant and Levin County parks lie in the foothills of the Diablo Range above the Santa Clara Valley. The climate of Levin County Park in its lower elevations is essentially the same as that in the adjacent valley floor, but it changes substantially with increases in elevation. Levin County Park reaches an elevation of nearly 2,600 feet at the summit of Monument Peak. The

park's higher elevations are above the more moderate climate of the valley floor, and are more exposed to the extremes in climate brought on by exposure to sun and wind. Since it is mostly behind the crest of this first set of foothills, Grant County Park is more protected from prevailing winds than is Levin County Park.

In late afternoons and early evenings in the warmer months, and particularly on days when the temperatures in the San Joaquin Valley east of the Diablo Range are especially high, marine air from the Pacific is drawn over the Santa Cruz Mountains across the Santa Clara Valley floor and the Diablo Range. These winds tend to cool the warmer Santa Clara Valley floor, and can blow quite strongly over the face of Levin County Park. Even when there is no wind from the Pacific, Levin County Park can still experience strong winds brought on by warm air rising from the valley floor. The afternoon and evening winds from the Pacific often bring fog into the Santa Clara Valley, and at times this fog extends to the upper elevations of the park. Grant County Park is more protected from these winds, and experiences fog much less frequently than does Santa Clara Valley and Levin County Park.

Rainfall on the floor of Santa Clara Valley averages about 16 inches a year. Although there are no climate records for the Levin County Park area, it is likely that rainfall amounts in the lower elevations of the park are similar to the valley. It is also likely that the rainfall average of the upper elevations of Levin County Park is similar to the rainfall average at Grant County Park. Grant County Park receives about 25 inches of rain per year (*Joseph D. Grant County Park Master Plan 1993*). Snow is infrequent on Levin County Park, but an inch or so of snow is not unusual in Grant County Park every few years (*Joseph D. Grant County Park Master Plan 1993*). In both parks, most measurable rainfall occurs from mid-October to mid-April. Other times of the year tend to be quite dry.

E. Geology and Slope

The major geomorphologic features of Santa Clara County are the Santa Clara Valley, the San Francisco Bay into which the valley opens, and the Santa Cruz Mountains and the Diablo Range that enclose the bay and the valley. The Diablo Range separates the Santa Clara Valley and the Bay Area from the San Joaquin Valley and the interior part of the state. The foothills of the Diablo Range, which form the eastern edge of the valley, rise steeply and abruptly from the valley floor to heights of two thousand feet and more. Grant County Park lies in a small valley behind the first range of foothills. Levin County Park lies on the face of the foothills.

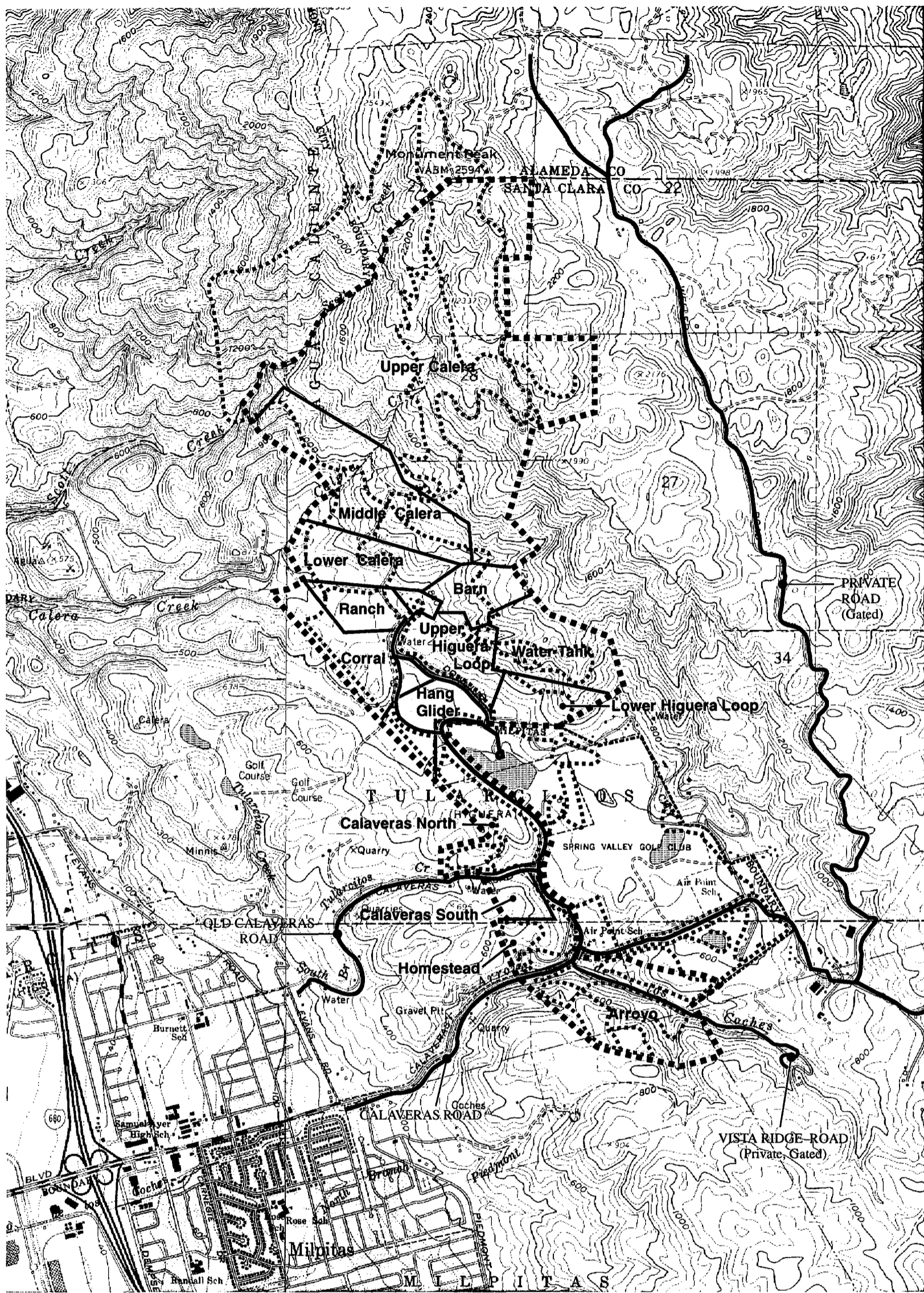


FIGURE 7

Fields

ED LEVIN COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

LEGEND

- Existing Field Boundary
- Road
- ■ ■ ■ Park/Study Area Boundary
- - - - - Park Boundary

1. Grant County Park

The ridgeline that separates Grant County Park from the Santa Clara Valley is as much as 2,457 feet high at one point on the western boundary of the park. The highest elevation in the park is 2,999 feet in the northeastern corner. Mt. Hamilton, which is just east of the park, is 4,213 feet high. The Grant County Park landscape is characterized by Halls Valley, a broad, flat valley with a mostly open floor. Like most of the landforms in the Diablo Range and in much of the rest of the Bay Area, Halls Valley runs northwest to southeast following the Calaveras fault, which runs through it. Smith Creek forms the eastern edge of the park. It is a deeply incised stream with steep banks.

Figure 8 is an analysis of slopes on Grant County Park. Much of Halls Valley and the hills immediately surrounding it have slopes of 30 percent or less. Slopes under 30 percent are also found on the top of the ridge that borders the Smith Creek drainage, as well as on the tops of the fingers of this ridge. Slopes of 30 to 50 percent are found primarily on the hills just below these ridgetops. Areas with slopes of 50 percent or greater are found primarily along the western edge of Smith Creek, although there are also substantial areas with slopes of 50 percent or greater in the north-central and south-central portions of the park.

2. Levin County Park

Levin County Park lies on a terrace above the main floor of the Santa Clara Valley and on the steep slopes of the foothills of the Diablo Range. Monument Peak on the park's northern boundary is 2,594 feet high, the highest point in the park. From the summit of Monument Park, the elevation falls rapidly to the west, and the western boundary of the park at Calera Creek lies at elevation 550. The lowest point in the park is on the west boundary of the park at the Arroyo de los Cochets, which is at an elevation of 300 feet.

Figure 9 shows an analysis of slopes on the wildland portions of Levin County Park. Most of the northern portions of Levin County Park above the 800- to 900-foot elevation have slopes greater than 30 percent. Slopes over 50 percent occur primarily along Scott Creek and the northern reach of Calera Creek, and in the intervening area. Most of the rest of this northern portion of the park has slopes of 30 to 50 percent. The slopes just below the crests of the ridges generally have slopes of 30 to 50 percent. The crests of the ridges are more level, having slopes under 30 percent.

The area of the park west of Downing Road has steep, rolling hillsides with slopes of 30 percent or greater on their faces and slopes of less than 30 percent on their crests. The area along the Arroyo de los Coches has generally steep slopes of 30 percent or greater, except at the tops of the ridge along the southwestern boundary of the park, where the slopes are less.

F. Soils

1. Grant County Park

The soils in Grant County Park are comprised of the Los Gatos-Gaviota-Vallecitos soil association. This soil association is found on gently sloping to very steep sites. It is well-drained to somewhat excessively drained. Soils in this association are shallow to deep gravelly loams and loams.

This soil association, which is found in uplands on both sides of the Santa Clara Valley, consists of soils that formed on hard sandstone and shale. Los Gatos soils are moderately deep to deep, well-drained, and underlain by metamorphosed shale. Gaviota soils are shallow, well-drained to excessively well-drained, and underlain by hard sandstone. Vallecitos soils are shallow to moderately deep, well-drained, and underlain by metamorphosed hard shales. Some areas of Vallecitos soils have rock outcrops, and some are moderately eroded to severely eroded. The soils in the Los Gatos-Gaviota-Vallecitos soil association are used for vineyards, hay pasture, range, wildlife, recreation and watershed.

With the exception of a very few, small, isolated soils along portions of the drainageways, all of the soils in Grant County Park have a high potential for erosion. Given this park-wide tendency towards erosion, it is the slope, plant cover, drainage patterns, and human or other disturbances that differentiate the areas within the park that are likely to experience erosion. As a result, soil associations have not been mapped.

The few exceptions to this high erosion hazard in Grant County Park include a small area of Clear Lake clay along the banks of the Arroyo Aguague, at the reservoir at the northern boundary of the private inholding, and small areas of Clear Lake clay and Yolo loam along the banks of San Felipe Creek below Halls Valley. There is also an area of Yolo loam within the wet meadow at Deer Valley in the Pala Seca Field.

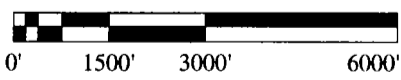
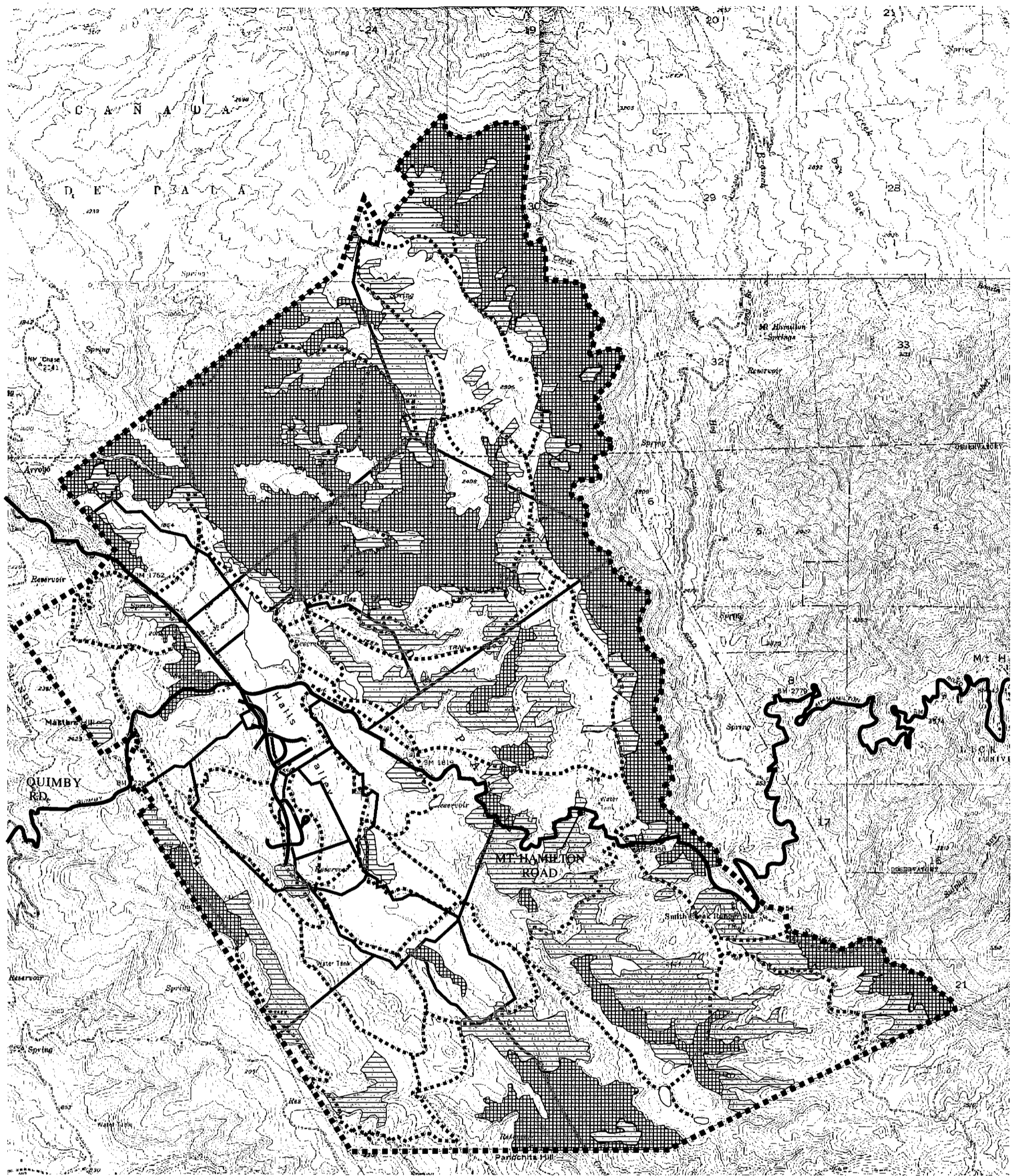


FIGURE 8







Slopes

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County



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LEGEND

-  0 - 30% Slope
-  30 - 50% Slope
-  50% + Slope
-  Road
-  Field boundary
-  Park/Study Area Boundary

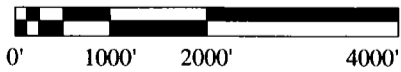
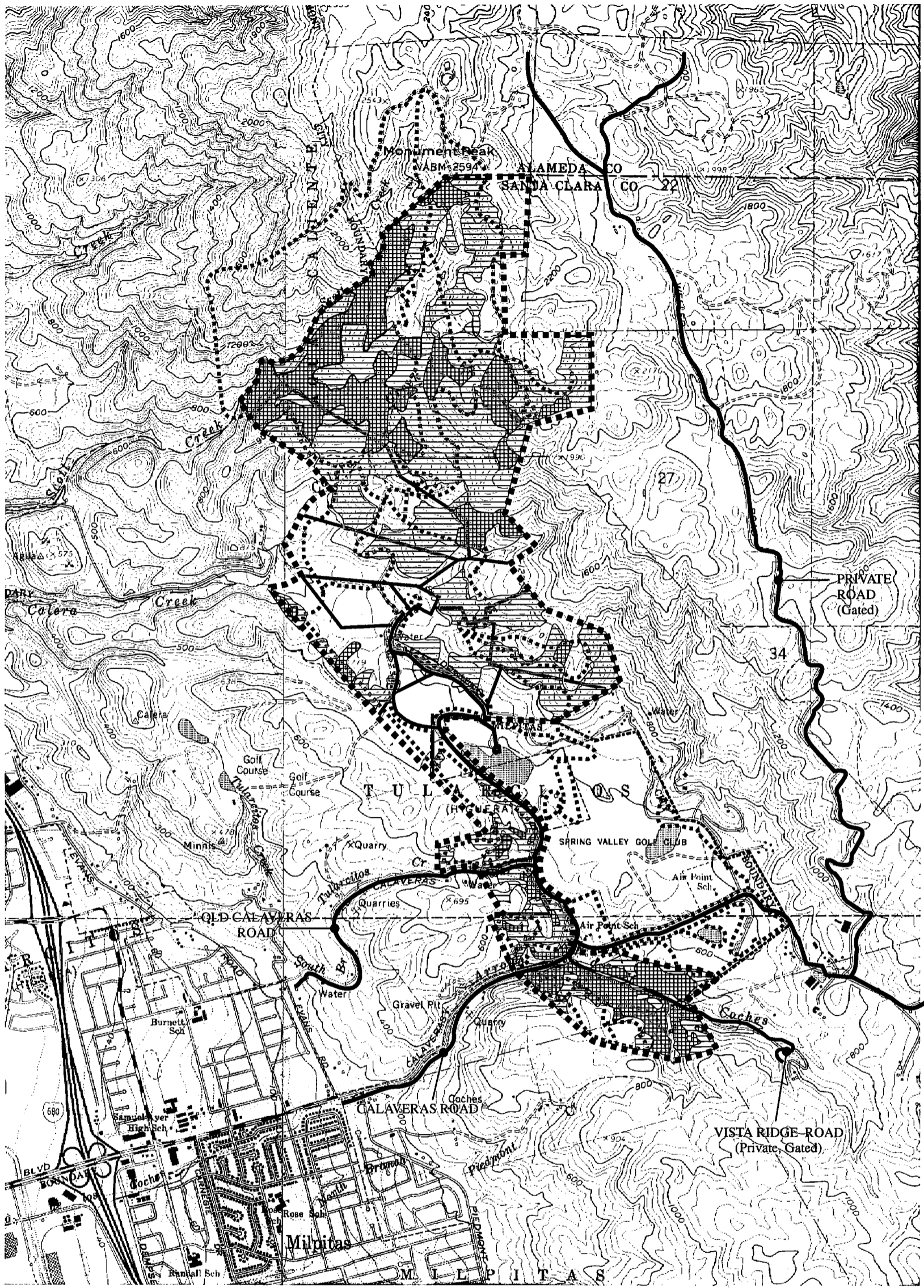









FIGURE 9

Slopes

ED LEVIN COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

LEGEND

-  0 - 30% Slope
-  30 - 50% Slope
-  50% + Slope
-  Road
-  Field Boundary
-  Park/Study Area Boundary
-  Park Boundary

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

2. Levin County Park

The soils in Levin County Park are comprised of the Los Osos-San Benito soil association. This soil association is found on moderately steep to very steep sites. It is well-drained and consists of moderately deep and deep clay loams.

This soil association consists of soils that developed on sandstone and shale. Los Osos soils are underlain by sandstone bedrock. San Benito soils are underlain by calcareous shale. The soils in the Los Osos-San Benito soil association are used for dryland hay, pasture and range.

All soils in Levin County Park have a high potential for erosion. Given this park-wide tendency towards erosion, it is the slope, plant cover, drainage patterns, and human or other disturbances that differentiate the areas within the park that are likely to experience erosion. As a result, soil associations have not been mapped.

G. Hydrology

1. Grant County Park

Regionally, Grant County Park and the area west of Mount Hamilton drain into the Santa Clara Valley and hence San Francisco Bay. Grant County Park lies at the headwaters of the Arroyo Aguague and San Felipe Creek. Smith Creek drains the extreme eastern edge of the park. Figure 10 shows the drainage within the park, as well as the springs, ponds and lakes in the park. It also shows the boundaries of the three watersheds.

Arroyo Aguague drains most areas of the park north of Mt. Hamilton Road. It flows north into Penitencia Creek at Alum Rock Park, which eventually joins Coyote Creek. Coyote Creek flows into San Francisco Bay. San Felipe Creek drains Halls Valley and most of the other areas of the park south of Mt. Hamilton Road. It flows south into Anderson Reservoir and, like Arroyo Aguague, eventually flows into Coyote Creek. Grant Lake, a man-made lake, divides the two drainageways.

Smith Creek, which forms the eastern boundary of the park, is one of the headwater streams of the Southern Alameda Creek watershed. Its headwaters are southeast of the park. It flows north into Arroyo Hondo and Calaveras Reservoir. Smith Creek is deeply incised, and the slopes along it are steep. In most places within the park, Smith Creek drains an area that is no more

than 1,000 feet wide and much narrower in places. Appendix B catalogs each of the springs, ponds and lakes in Grant County Park and their characteristics.

2. Levin County Park

Several year-round streams drain the Levin County Park. Figure 11 shows the drainages within the wildland portions of the park, as well as the springs, ponds and lakes within this area. Scott Creek drains the northern end of the park and forms the park's northern boundary. Two forks of Calera Creek drain the remaining areas of the northern portion of the park. All of these drainageways are small, but nevertheless well-vegetated with mature stands of trees and riparian vegetation in all but their upper reaches. A small tributary of Tularcitos Creek drains a portion of the park below the Minnis ranch headquarters. It appears to be fed by a spring near Downing Road, and supports several riparian areas. All of these creeks drain into San Francisco Bay.

The western portion of the park adjacent to Old Calaveras Road drains into the south fork of the Tularcitos Creek. It has little apparent riparian vegetation along it. Arroyo de los Coches drains the southwestern portion of the park adjacent to Calaveras Road.

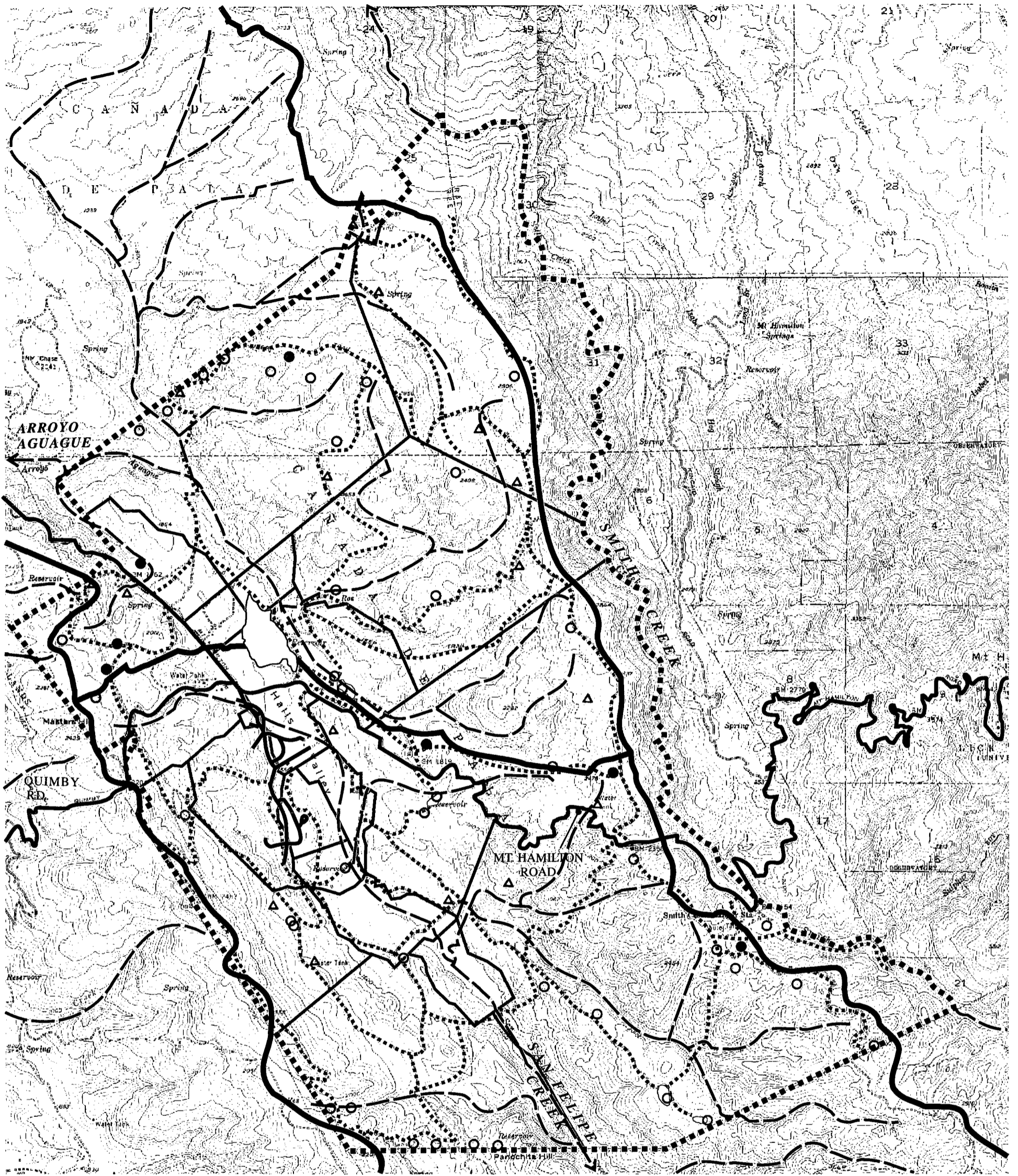
Appendix C catalogs the characteristics of each of the springs, ponds and lakes within the undeveloped portions of the park.

H. Funding and Staffing Resources

1. Funding and Staffing Resources

There are limited resources in the Santa Clara County Parks and Recreation Department budget regarding the availability and use of funds to implement resource management recommendations that might be made for Grant and Levin County parks. Given increasing fiscal constraints, the resource management plan must acknowledge these limitations and develop management techniques that are sensitive to and responsive to budget and staffing realities. The final plan must provide the most cost-effective options for sound resource management practices.

Grant and Levin County parks are two of the four parks that make up the northeastern unit of the Santa Clara County park system. The other two are Penitencia County Park and Alviso Marina. For fiscal year 1994, Santa Clara County approved a budget for the northeastern unit of nearly \$1.3 million.



Note: See Appendix F for complete inventory of water resources.

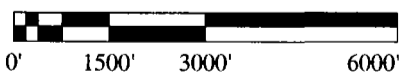


FIGURE 10

Hydrology

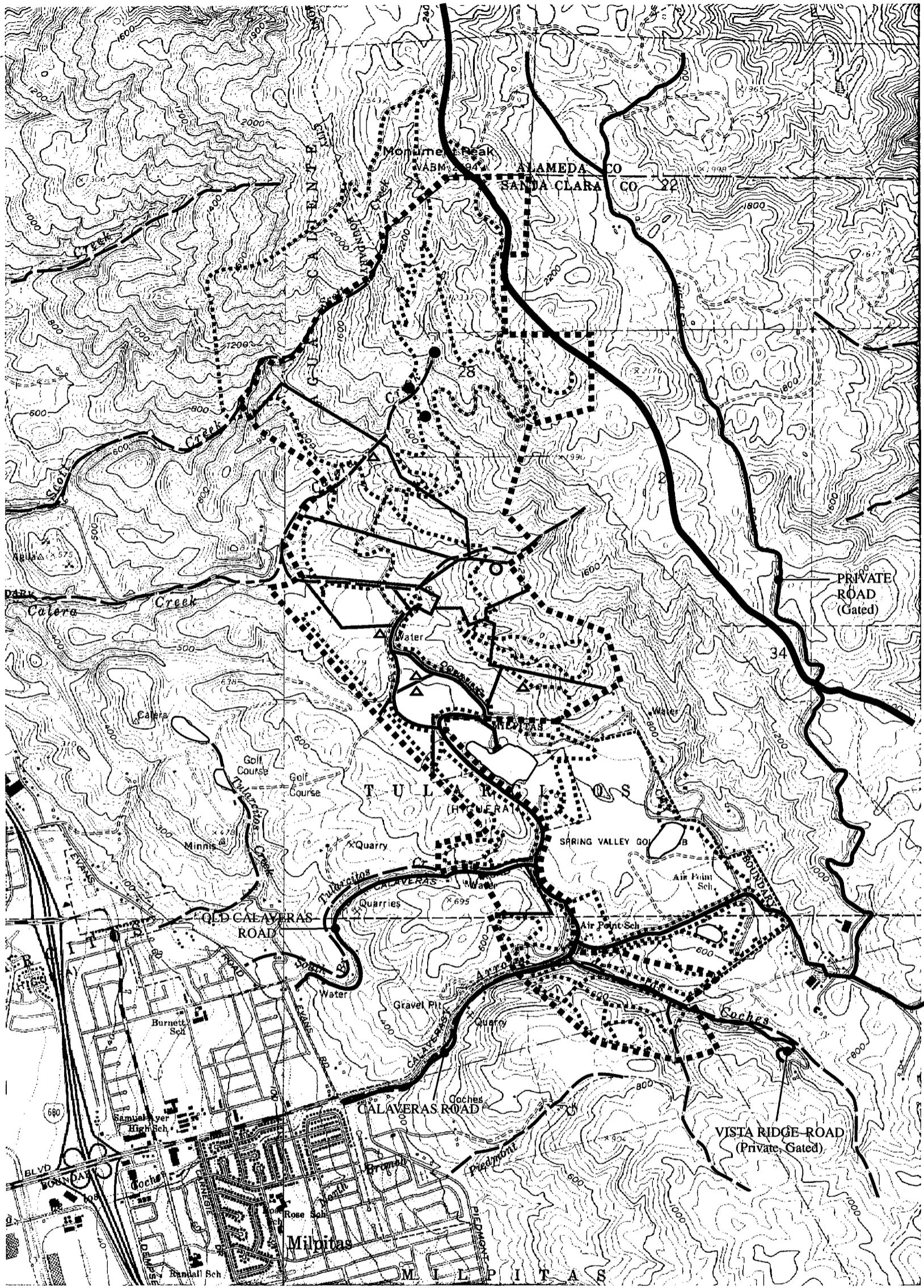
J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County



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LEGEND

- Undeveloped Seep
- ▲ Developed Seep
- Pond
- Lake
- Stream
- Watershed Boundary
- Road
- Field Boundary
- Trail
- Park/Study Area Boundary



Note: See Appendix G for complete inventory of water resources.



FIGURE 11

Hydrology

ED LEVIN COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

| LEGEND | |
|---------|--------------------------|
| ● | Undeveloped Seep |
| ▲ | Developed Seep |
| ○ | Pond |
| □ | Lake |
| — | Stream |
| — | Watershed Boundary |
| — | Road |
| — | Field Boundary |
| ■ ■ ■ ■ | Park/Study Area Boundary |
| | Park Boundary |

The budget provides for permanent full-time employees, part-time seasonal employees, and expenses. It includes \$970,000 for salaries for full-time employees and about \$140,000 for part-time seasonal employees assigned to either park. Grant County Park is budgeted and managed as a single unit. The budget for Levin County Park, however, includes Penitencia County Park and Alviso Marina, and the Levin County staff manages these two facilities as well.

Grant County Park has six full-time permanent employees. Levin County Park employs eight full-time personnel. Of the amount budgeted for part-time seasonal employees each year, Grant County Park typically uses about one third of the amount and Levin County Park typically uses the remainder.

In fiscal year 1994, Santa Clara County budgeted \$135,000 for fixed expenses such as vehicle expenses and utilities for the parks. These expenses are set and are not discretionary. In addition to set expenses, the County budgeted about \$46,500 for services and supplies, which includes \$36,450 for maintenance. This \$36,450 maintenance item is the only portion of the expense budget that is somewhat discretionary and that might be targeted by the Department for a specific management project.

In addition to the ability to shift seasonal employees between the two parks or from project to project, Levin County Park staff is able to make use of inmate labor from the County jail for certain of its projects, and it has a standing program to do so. Currently, Levin County Park staff use up to 40 people daily and up to 60 people on weekends through this program. Levin County Park staff is able to capitalize upon this work force because of the park's proximity to the urbanized parts of the County and the ease of access to the park. Grant County Park's remoteness and more difficult access makes the use of inmate labor a less viable option.

In addition, there is the potential for the County to capitalize upon volunteer groups that have interests in the two parks. Volunteer groups can often bring considerable resources and commitments to specific projects. They are a potentially good resource for extending the County's management resources. The use of volunteers and public interest groups could also be extended to include the involvement of people from local schools and universities, as well. The County could also pursue grants from various sources to implement habitat restoration, revegetation, or endangered species programs.

2. Revenues

Both Grant and Levin County parks generate revenues from concessionaire activities. All revenues received from concessionaires go to the department's general fund. In other words, revenues are not directly tied to the park from which the revenue has been generated. However, these revenues greatly influence the discretionary funding available for all parks and are an important component of the department's budget. Revenues are forecast and budgeted each year based on the previous fiscal year performance.

a. Grant County Park. For fiscal year 1996, Grant County Park received revenues from grazing (\$41,730), entrance fees (\$21,800), camping fees (\$20,650), group picnic fees and special event fees (\$7,100). For fiscal year 1996, the park generated revenues over \$91,000.

b. Levin County Park. For fiscal year 1996, Levin County Park received revenues from grazing (\$16,160), entrance fees (\$88,070), group picnic and special event fees (\$26,610), and golf fees (\$347,610). For fiscal year 1996, the park generated revenues of nearly \$480,000.

I. Legal Commitments and Restrictions

1. Grant County Park

There are a number of legal commitments and restrictions on the use of Grant County Park.

There is a private road on a portion of the park between Mt. Hamilton Road and the northern boundary of the park. This private road provides unrestricted access to the property to the north, and restricted access to park personnel for maintenance and emergencies.

There are two powerline easements on Grant County Park. One high-power transmission line runs along the west side of the park. A second high-power transmission line runs across the southeastern corner of the park and up the east side of Smith Creek.

Santa Clara County bought Grant County Park from the Save the Redwoods and Menninger foundations. Deed restrictions were attached to the park at the time of sale. These restrict development on the park that would impair its natural and scenic character.

While not a long-term legal commitment, the Santa Clara County Parks and Recreation Department cattle grazing license awarded to the grazing licensee is a contractual agreement lasting for a period of three years. The licensee's use of the park is subject to the primary rights of park and recreation users enjoying the park. The County can also terminate grazing prior to the expiration date of the contract. The provisions of the license also specify that natural resource management and recreation objectives take precedence over grazing.

2. Levin County Park

Other than the Spring Valley Golf Course lease and the cattle grazing license awarded to the grazing licensee, there are no legal commitments or restrictions on Levin County Park.

Chapter IV VEGETATION AND WILDLIFE RESOURCES

■ ■ ■

This chapter presents a summary and overview of existing conditions concerning vegetation and wildlife within Grant and Levin parks. This chapter begins with an overview of the field reconnaissance, sources of information, and assumptions used to prepare this chapter and a summary of the plant communities by location and acreage. The description of vegetation and wildlife resources in this chapter is organized by the following plant communities: grassland, oak woodlands, shrubland, riparian areas and wet meadows, and lakes and ponds. Because of the relationships between wildlife and habitat, the discussion of wildlife is organized by plant community. Additionally, a brief discussion of plant and wildlife species of concern or special status species (e.g., considered locally unique, rare, threatened, or endangered by state or federal standards, or in the case of locally unique plants, by the local chapter of the California Native Plant Society) is included at the end of this chapter.

The plant and wildlife species of the two parks are representative of the central California Coastal Range and Valley-Foothills habitats. Vegetation on the two parks is primarily composed of a mixture of native trees, shrubs, annual and perennial native and non-native grasses and other herbaceous plants. Grant County Park supports a mosaic of non-native grasslands, oak savanna, oak woodlands and shrublands. Levin County Park consists primarily of non-native grasslands with some riparian vegetation along the drainageways. These vegetation types support a variety of wildlife species; more than 265 wildlife species have been observed or are expected to occur in the two parks. Wildlife species diversity and abundance in the parks varies seasonally and annually depending on the quantity and quality of resources present and the successional stage of habitat development. Some animals are restricted to certain plant communities due to specific habitat requirements, while many others utilize a combination of the habitats. The presence or absence of water is also a major factor in determining the distribution and abundance of many of the wildlife species.

A. Data Sources and Methodology

1. Vegetation Resources

Grant and Levin County parks were visited by a range specialist on a regular basis from early March through late May, 1994, in order to document the vegetation and plant communities of the two parks. Plant communities were mapped using aerial photographs, USGS topographic maps, and site visits in order to determine their location and extent. Vegetation maps were prepared to document the distribution of plant communities on the two parks.

Biological resource specialists provided input to the work of the range specialist by conducting limited reconnaissance surveys of both parks during May and June 1994. They also evaluated sensitive botanical resources, and plant species of concern through review of available literature and records on file with California Natural Diversity Data Base (CNDDB) and the local chapter of the California Native Plant Society (CNPS).

The plant communities on the two parks are characterized by the dominant, sub-dominant, and associated plant species in each community. Each is described separately below. Appendices D and E provide an inventory of botanical resources documented on the two parks over the course of the growing season. These inventories provide a confirmation of plant species occurring on the two parks; the inventories should not be viewed as an exhaustive record of plant resources, but rather as an ongoing list to which species can be added over time.

Plant communities in this report are named according to Holland's *Descriptions of the Terrestrial Natural Communities of California* (1986), where applicable. Plant communities that do not correspond to descriptions found in Holland are named after the dominant plant(s) in the stand. The plant communities were compared to vegetation types in the California Wildlife Habitat Relationships (WHR) database of the California Department of Fish and Game (Airola 1988, Mayer and Laudenslayer 1988, Timosi et al. 1989, Zeiner et al. 1988a, 1988b, 1990), which is used to predict wildlife species that can be expected to occur within various plant communities.

2. Wildlife Resources

Reconnaissance-level field surveys to qualitatively assess the wildlife habitat on the two parks were conducted on May 9, May 24, and June 9, 1994 at Grant County Park and on June 14, 1994 at Levin County Park. Dip-netting of several ponds to identify amphibian larvae was also conducted on May 9, 1994 at Grant County Park. A topographic map of both parks and a map of known ponds and lakes at Grant County Park were used as guides during the field investigations. A vehicle was used to investigate areas more efficiently, and areas of special interest were also investigated on foot, with observations aided by binoculars. Observation of all species and their signs were recorded in a field notebook, and significant wildlife resources were mapped. Wildlife observed were delineated on a basemap. Focused wildlife surveys were not conducted.

A literature review of wildlife use was conducted to augment field survey information. Reports from other similar projects in the Santa Clara Valley that were reviewed included *Natural Resources Inventory for Coyote Lake County Park* (Habitat Restoration Group 1989), *Natural Resources Inventory for Anderson Reservoir County Park* (Habitat Restoration Group 1989), and *Upper Stevens Creek Park Resource Management Plan* (Brady and Associates 1993).

Knowledgeable persons and agency representatives were consulted regarding observations of wildlife in Grant County Park. These included Raleigh Young, Park Manager of the Northeastern Unit, Santa Clara County Parks and Recreation Department; Eric Remington, manager for 25 years of the Blue Oak Ranch adjacent to the north border of Grant County Park; Bill Bousman, record keeper for the Santa Clara Valley Audubon Society and Project Coordinator for the Santa Clara County Breeding Bird Atlas Project; Martha Schauss, Wildlife Biologist for Santa Clara and San Benito Counties, California Department of Fish and Game (CDFG); and Henry Coletto, Santa Clara County Wildlife Officer, Santa Clara County Sheriff's Department.

The field surveys and literature search were used to generate lists of all wildlife species observed or predicted to occur in the parks. These are included in Appendix F. Because these were reconnaissance-level surveys, the species lists do not constitute an exhaustive inventory of animals present in the parks.

B. Summary of Vegetation and Wildlife Resources

1. Grant County Park

Non-native grasslands and oak savannas cover slightly more than one-half of the park. Oak woodlands cover most of the rest of the park. Shrublands and riparian and wet meadow vegetation occupy the remaining five percent of the park. Together, these plant communities form a stunningly beautiful landscape. The plant communities in Grant County Park are shown on Figure 12 and summarized in Table 1.

Grant County Park provides habitat for a variety of wildlife species. It also currently provides forage for cattle. Wildlife species richness in the park is relatively high due to its large size, the diversity of habitat types present, the occurrence of surface water, and presence of movement corridors. The undeveloped character of the park and of adjacent lands also contributes to the park's wildlife value.

2. Levin County Park

The vegetation on Levin County Park is made up primarily of non-native annual grassland and California bay laurel/coast live oak woodlands. The non-native grasslands cover nearly 85 percent of the park. Oak woodlands cover the remaining 15 percent. The vegetation and plant communities in Levin County Park are shown in Figure 13 and summarized in Table 2.

Levin County Park provides habitat for a variety of wildlife, but species diversity likely is not as high as Grant County Park, due primarily to its smaller size and fewer vegetation communities. However, the proximity of the park to Calaveras Reservoir and other adjacent undeveloped lands along its northern and eastern sides increases its wildlife value. Levin County Park currently provides forage for cattle.

3. Plant and Wildlife Species Diversity

Diversity of plant and wildlife species on the two parks appears relatively high when compared to the region. Certainly, empirical analysis of the two parks, as well as familiarity with and comparisons to other areas in the Bay Area, suggest that Grant County Park has a comparatively high level of plant and wildlife diversity compared to the region. Levin County Park appears to exhibit somewhat less diversity. Quantitative analysis of existing and potential plant or wildlife diversity on the two parks, however, does not exist, and it is not possible to quantify the degree of diversity on the two parks or to state

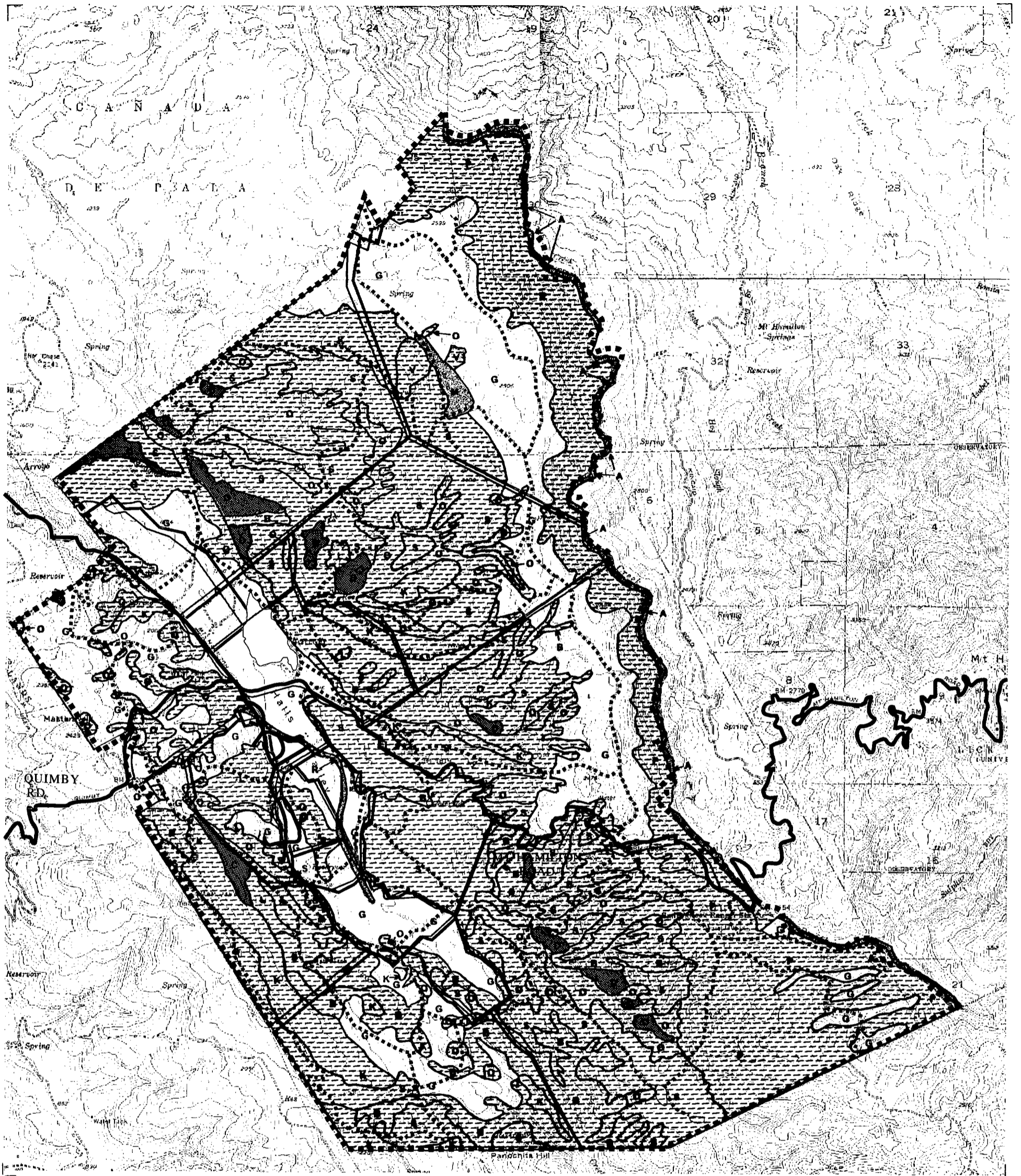


FIGURE 12

Vegetation

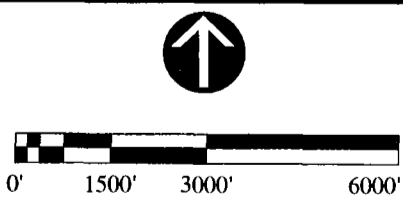
J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County



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LEGEND

- G** Non-native Grassland
- Oak Woodland**
- S** Oak Savanna
- O** Mixed Oak Woodland
- K** Black Oak Woodland
- L** Coast Live Oak Woodland Mixed
- P** Oak/Foothill Pine Woodland
- V** Valley Oak Woodland
- B** California Bay Laurel/Coast Live Oak Woodland
- Shrubland**
- D** Diablian Sage Scrub
- C** Coyote Brush/Poison Oak Scrub
- Riparian and Wet Meadow**
- A** Alder/Maple Riparian
- R** Willow Riparian
- M** Wet Meadow Riparian



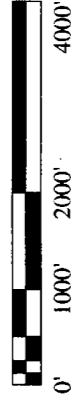
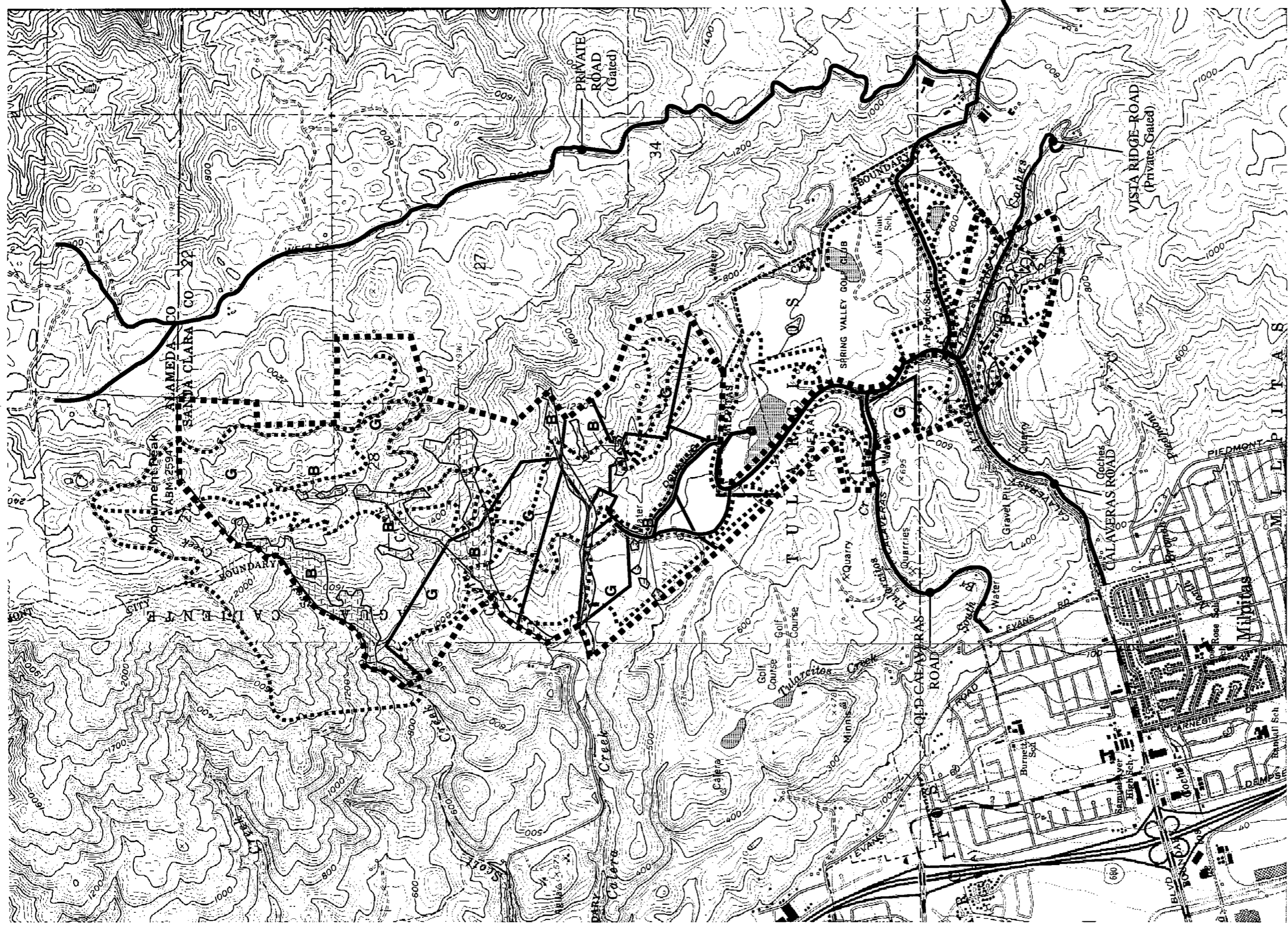


FIGURE 13

Vegetation

| LEGEND | |
|----------|---|
| G | Non-native Grassland |
| | Mixed Oak Woodland |
| B | California Bay Laurel/ Coast Live Oak Woodland |
| | Road |
| | Field Boundary |
| | Park/Study Area Boundary |
| | Park Boundary |

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RESOURCE MANAGEMENT PLAN

Santa Clara County



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Table 1
GRANT COUNTY PARK
PLANT COMMUNITY ACREAGE BY FIELD

| Field | Non-Native Grassland | Oak Woodland | | | | | | | | Shrubland | | Riparian & Wet Meadow | | | Total | |
|--------------------|----------------------|--------------|--------------|------------|-----------|--------------|-----------|------------|-----------|------------|------------|-----------------------|-----------|---|-------|--------------|
| | | G | S | O | K | L | P | V | B | C | D | A | R | M | | |
| Alfalfa | 59 | | | 2 | | 2 | | | | 5 | | | | 2 | | 70 |
| Barn North | 98 | | | 8 | 2 | | | | | 26 | | | | | | 134 |
| Barn South | 27 | | | 9 | | | | | | | | | | | | 36 |
| Big Washburn | 85 | 374 | 347 | | | | | | | 15 | | 64 | | | | 885 |
| Brush | 65 | 55 | 76 | 79 | | | | | | 19 | 6 | | | | | 300 |
| Corral | | 337 | 8 | | | | | | | 13 | | | | | | 358 |
| Dairy | 43 | | 61 | | | | | | | | | | | | | 104 |
| Dutch Flat East | 211 | 48 | 79 | 37 | | | | | | 143 | | | | | | 518 |
| Dutch Flat West | 31 | 222 | 3 | 254 | 13 | | | | | 124 | 22 | | | | | 669 |
| Edwards | 325 | | 120 | 18 | | | | | | | 5 | | | | | 468 |
| Hall Valley | 80 | 314 | 270 | 87 | 10 | 41 | | | | 13 | 33 | 4 | | | | 852 |
| Hotel East | 82 | 155 | 26 | | | | 667 | | | 37 | | | 17 | | | 984 |
| Hotel West | | 417 | 162 | | | | 39 | | 225 | | 31 | | | | | 874 |
| Lake | 131 | 114 | 25 | 23 | 3 | | | | | 7 | | | | | | 303 |
| Lower Snell | 51 | 16 | 7 | 13 | | | | | | 5 | | | | | | 92 |
| Middle Snell | 110 | | 4 | 1 | 2 | | | | | | | | 2 | | | 119 |
| North | 344 | 184 | 202 | 38 | | | 193 | | | 12 | 6 | 39 | | | | 1,018 |
| Pala Seca Dropping | 18 | | | | | | | | | | | | | | | 18 |
| Pala Seca East | 473 | 57 | 1 | | | | 446 | | | | | | 90 | | | 1,067 |
| Pala Seca West | 93 | 54 | 2 | 132 | | | | | 36 | | | | | | 31 | 348 |
| Pig/Eagle Lakes | | 75 | | | | | | | | | | | | | | 75 |
| Stockyard | 43 | | 41 | | 1 | | | | | | | | | 1 | | 86 |
| Tiernan | 28 | 22 | 13 | | | | | | | | 1 | | | | | 64 |
| Valley | 72 | | | | | | | | | | | | 8 | | | 80 |
| Totals | 2,469 | 2,444 | 1,466 | 684 | 31 | 1,386 | 36 | 644 | 28 | 140 | 150 | 13 | 31 | | | 9,522 |

Grassland

G - Non-native grassland

Oak Woodland

S - Oak savanna

O - Mixed oak woodland

K - Black oak woodland

L - Coast live oak woodland

P - Mixed oak/foothill pine woodland

V - Valley oak woodland

B - California bay laurel/coast live oak woodland

Shrubland

D - Diablan sage scrub

C - Coyote brush/poison oak

Riparian and Wet Meadow

A - Alder/maple riparian

R - Willow riparian

M - Wet meadow

Table 2
LEVIN COUNTY PARK
PLANT COMMUNITY ACREAGE BY FIELD

| Field | Domestic | Non-Native Grassland | Oak Woodland | Total |
|---------------------|----------|-------------------------|-----------------|--------------|
| Home Ranch | 5 | | 2 | 7 |
| Hang Glider | | 47 | | 47 |
| Lower Higuera Loop | | 24 | | 24 |
| Upper Higuera Loop | | 31 | 1 | 32 |
| Corral | | 43 | 2 | 45 |
| Ranch | | 29 | | 29 |
| Barn | | 33 | 2 | 35 |
| Water Tank | | 70 | | 70 |
| Lower Calera Creek | | 56 | 4 | 60 |
| Middle Calera Creek | | 192 | 33 | 225 |
| Upper Calera Creek | | 325 | 61 | 386 |
| Calaveras North | | 63 | | 63 |
| Calaveras South | | 17 | | 17 |
| Homestead | | 32 | 2 | 34 |
| Arroyo | | 20 | 66 | 86 |
| Totals | 5 | 982 | 173 | 1,160 |

with certainty whether the parks are as biologically diverse as they could be or should be. Such a quantification of biodiversity on the two parks would require measured analysis over time.

4. Location of Sensitive Botanical Resources

The sensitive botanical resources at Grant and Levin County parks include riparian areas, wetlands, native grassland, wildflower fields, and plant species of concern. Some of the known locations of sensitive botanical resources in Grant County Park are depicted in Figure 14. Sensitive botanical resources in Levin County Park are shown in Figure 15. These sensitive resources are greater in extent at Grant County Park than at Levin County Park, which has been more impacted by development and is much smaller in size.

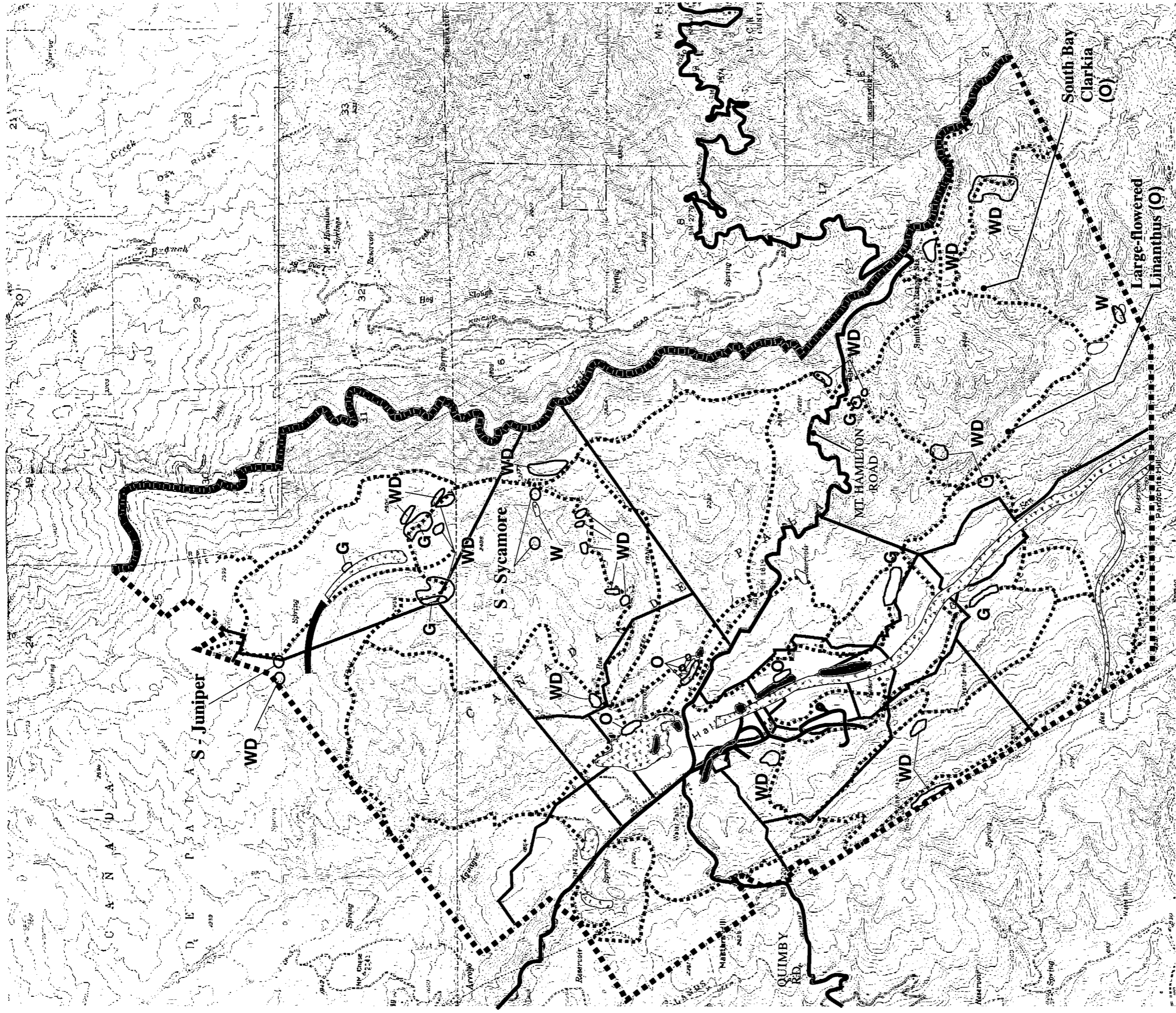


FIGURE 14

Sensitive Botanical Resources

J.D. GRANT COUNTY PARK
RESOURCE MANAGEMENT PLAN

Santa Clara County

| LEGEND | |
|--------|----------------------------------|
| WD | Wildflower Field |
| G | Native Grassland Area |
| | Riparian Woodland |
| O | Area Of Natural Oak Regeneration |
| S | Significant Botanical Occurrence |
| (O) | Observed |
| | Wetlands |
| | Field Boundary |
| | Trail |
| | Park/Study Area Boundary |

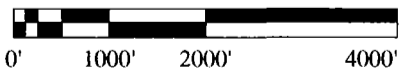
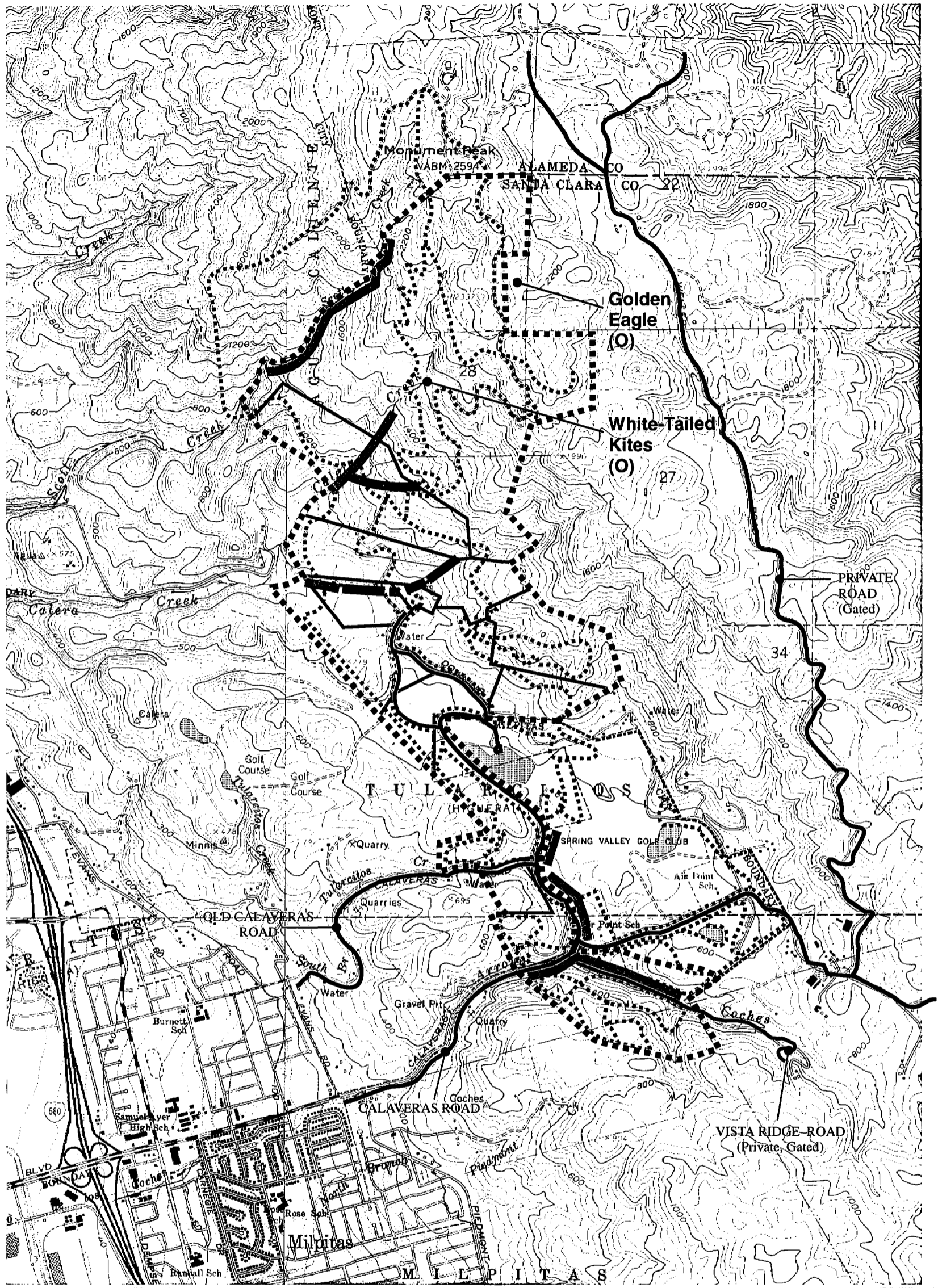


FIGURE 15

**Sensitive Botanical And
Wildlife Resorces**








**ED LEVIN COUNTY PARK
RESOURCE MANAGEMENT PLAN**

Santa Clara County



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LEGEND

-  Riparian Vegetation
-  Barren Stream Course
-  Observed
-  Trail
-  Field Boundary
-  Park/Study Area Boundary
-  Park Boundary

The following is a description of the plant communities and wildlife resources on both parks.

C. Grassland

The grasslands in Grant and Levin County parks are composed primarily of non-native annual grasslands, within which are scattered individuals and stands of native perennial grasses, wildflowers, and other native herbaceous plants. The following is a discussion of the non-native and native grasslands and of the wildflowers in the two parks.

1. Non-Native Grassland

Native perennial grasses were once the dominant grasses in the grassland and woodland plant communities in the coast ranges of California. Native perennial grasses were gradually replaced by non-native annual grasses and herbs introduced by early settlers. Grazing by livestock, drought, conversion to agriculture, urbanization, and fire suppression led to the widespread establishment of non-native annual grasslands throughout the state (Burcham 1957, Heady 1977). Like most of the rest of the state, the grasslands and oak savannas, and oak woodland grass communities of Grant County Park and the grasslands of Levin County Park are now dominated by non-native annual grasses. Non-native annual grasses are now naturalized, and the change is thought by many to be irreversible (Bentley and Talbot 1948, Bartolome 1987).

a. Grant County Park. Grasslands cover about 2,469 acres in Grant County Park. The grassland on Grant County Park is a community of herbaceous vegetation primarily composed of non-native annual grasses. Some may support widely scattered, individual trees or small, isolated groves of trees. The grassland on Grant County Park can vary from little more than a dominant cover of non-native grasses and herbs to a diverse mixture of native and non-native grasses and wildflowers. Plant composition differs widely from location to location, depending on individual site factors, the timing and amount of rainfall during the growing season, and past and current land use practices.

Non-native annual grasses are dominant in the park, and include wild oats (*Avena barbata*, *A. fatua*), soft chess (*Bromus hordaceus*), ripgut brome (*Bromus diandrus*), perennial ryegrass (*Lolium perenne*), wild barley (*Hordeum murinum* var. *leporinum*, *H. murinum* var. *murinum*), foxtail chess (*Bromus madritensis* var. *madritensis*), red brome (*Bromus madritensis* var. *rubens*), silver

hairgrass (*Aira caryophyllea*), and annual bluegrass (*Poa annua*). Park grasslands are typically dominated by wild oats, soft chess, and/or ripgut brome, with the other grasses occurring in lesser amounts or not at all.

b. Levin County Park. Grasslands cover about 974 acres on Levin County Park. The grasslands in Levin County Park consist primarily of non-native annual grasses. Native grasses and wildflowers are scattered throughout. Plant composition differs widely from location to location, depending on individual site factors, the timing and amount of rainfall during the growing season, and past and current land use practices.

For example, native grasses and other herbaceous plant species are poorly represented in the lower portions of the park, but native species increase somewhat with increasing elevation. This may be due to a combination of factors. The park has a predominately south to southwest orientation, which creates relatively harsh conditions due to increased solar radiation and decreased moisture retention. This may impose additional hardship on plant life, which may limit the development of a rich and diverse plant community. In addition, native plants often thrive under hardships that are detrimental to non-native plants. Overgrazing has occurred on Levin County Park, especially when the land was in private ownership, and this grazing pattern, which was particularly heavy on the lower portions of the park, undoubtedly influenced the predominance of non-native grasses.

Ground squirrels, which are plentiful in Levin County Park, also favor warm, south-facing exposures as den sites, and the foraging around den sites may also have had an adverse effect on plant composition.

The shallower and rockier soils in the upper reaches of the park, while also heavily dominated by non-native grasses, support increased numbers of native wildflowers, particularly in the sheltered drainages, rock outcrops, and road cuts. Plant composition here is dominated by slender wild oats (*Avena barbata*), followed by ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordaceus*), foxtail barley (*Hordeum murinum* var. *leporinum*), and annual fescues (*Vulpia* spp.). The native purple needlegrass (*Nassella pulchra*), is widely scattered throughout the upper grassland areas of the park.

Grasslands in the lower portions of the park are also dominated by non-native grasses that include ripgut brome (*Bromus diandrus*), foxtail barley (*Hordeum murinum* var. *leporinum*), annual ryegrass (*Lolium multiflorum*), and slender wild oats (*Avena barbata*). Native grasses are sparse to nonexistent. Purple starthistle (*Centaurea calcitrapa*), and sweet fennel (*Foeniculum vulgare*), which are invasive non-native plants that colonize disturbed ground, have established

a foothold in some of the lower fields, in particular, Lower Calera Field. Bull thistle (*Cirsium vulgare*), and milk thistle (*Silybum marianum*), are common along roads in the lower half of the park.

Calaveras North, Calaveras South, and Homestead fields have been excluded from grazing for a number of years. The grasslands here, with the exception of the Calaveras South Field, have been infested with black mustard (*Brassica nigra*), and bull thistle (*Cirsium vulgare*), among other invasive non-native plants. Grasslands within the Calaveras South Field have remained relatively free of invasive non-native plants, likely as a result of unauthorized grazing by cattle belonging to the landowner to the west.

The northern part of the Calaveras North Field supports some small patches of Harding grass (*Phalaris aquatica*), a non-native, perennial pasture grass. The northern panhandle of the Homestead Field appears to have been settled in the past, and contains an old walnut orchard and scattered walnut and redwood trees. A small grove of eucalyptus occurs at the junction of Calaveras and Downing roads at the southeast corner of this field. The predominant vegetation of the Homestead Field, however, is non-native grassland.

2. Native Grassland

While native perennial grasses are no longer the dominant grasses within the grassland, oak savanna, and woodland grass communities in the coast ranges of California, they still persist sporadically (Barry 1972).

Native grasslands are a diminishing resource in California. They are considered a "significant" plant community according to the California Department of Fish and Game Natural Diversity Data Base due to their limited distribution in the State. A "significant" plant community has been given a priority ranking by the California Department of Fish and Game because of its limited occurrence within the State or its declining status. Significant resources have no formal legal protection.

a. Grant County Park. Native annual and perennial grasses occur in various amounts throughout the non-native grassland on the park, and may form dense, isolated stands in some areas. Based on the limited reconnaissance work, it appears that pure stands of native grasses constitute a small percentage of the total grassland area. Six grassland areas dominated by native plant species were observed during the field reconnaissance. These are shown on Figure 14. An example of native grassland in Grant County Park occurs in Halls Valley on the east side of the Hotel Trail near the junction of

the Corral Trail (Figure 14). Purple needlegrass (*Nassella pulchra*), was the dominant native species observed there. Areas of native grasses occur sporadically within the non-native grasslands, and were not mapped separately. Other areas dominated by native grasses may occur within the park, but more detailed surveys are needed to document them. Native grasses appear to occur more commonly on slopes with rock outcroppings and a thin soil layer, perhaps due to less competition from non-native grasses.

The following is a discussion of the native grasslands on the two parks.

The most common native grasses found in the non-native grassland, oak savanna, and woodland grass communities on the park, in the order of their relative occurrence, include one-sided bluegrass (*Poa secunda* var. *secunda*), purple needlegrass (*Nassella pulchra*), blue wildrye (*Elymus glaucus* var. *glaucus*), annual fescue (*Vulpia spp.*), and California brome (*Bromus carinatus*). Other species such as California melicgrass (*Melica californica*), Torrey melic (*M. torreyana*), junegrass (*Koeleria micrantha*), California fescue (*Festuca californica*), creeping wildrye (*Leymus triticoides*), and meadow barley (*Hordeum brachyantherum*) are less common. Many of the native grasses, particularly blue wildrye, the melicgrasses, and California brome are familiar occurrences in the oak woodlands, where decreased competition from the non-native annuals and the cooler, shaded conditions provide more favorable conditions for growth.

b. Levin County Park. Native grasses are sparse to non-existent in the lower reaches of the park. The greatest amount of native grasslands on Levin County Park occurs in the upper portions of the park. Native purple needlegrass is widely scattered throughout the upper grassland areas of the park.

3. Wildflower Fields

A myriad of wildflowers are interspersed throughout both parks, and in the spring particularly, they can produce a remarkable display. In a few areas, wildflowers form fields that provide spectacular color. Spring wildflower displays are important features in both parks. Such wildflower fields support a diversity of plant species, some of which are considered locally unique. Wildflower displays at Grant County Park were observed in the vicinity of the Cañada De Pala Trail, Los Huecos Trail, and the Smith Creek CDF Station.

a. Grant County Park. Numerous species of both native and non-native broadleaf wildflowers are interspersed among the non-native grasses. Some of the major native wildflower areas observed during the 1994 study are depicted

on Figure 14, although wildflowers are widespread throughout the park. Wildflower displays at Grant County Park were observed in the vicinity of the Cañada De Pala Trail, Los Huecos Trail, the Smith Creek CDF Station, and near McCreery Lake. In most instances, the wildflower areas do not correspond to areas having a high diversity of native grasses. Pig rooting activity was evident in wildflower areas with abundant (*Tritelia* spp.) (i.e., areas along the Cañada de Pala Trail and the grass areas near McCreery Lake). Bulbs and bulblets of (*Tritelia* spp.) had been excavated by feral pigs and exposed from the rooting activity. Evidence of grazing by cattle and/or deer was also observed within most of the wildflower display areas. Cropping has been shown to be beneficial to the establishment and maintenance of wildflowers.

The many rock outcroppings in the park contain interesting botanical resources. Several of the rock outcroppings, particularly along the northern boundary of the park, support diverse wildflower and herbaceous plant species. Such wildflower fields support a diversity of plant species, some of which are considered locally unique. Associated herbaceous species include naked-stemmed buckwheat, yellow mariposa lily, coffee fern, dudleya, California fuchsia and giant-seeded lomatium.

Some of the wildflowers are relatively recent, non-native introductions, while others have been native to the region for millennia. The non-natives usually found in grassland areas of the park include plants like the storksbills (*Erodium cicutarium*, *E. botrys*, *E. moschatum*), bur clover (*Medicago polymorpha*), wild geranium (*Geranium molle*, *G. dissectum*), peppergrass (*Lepidium nitidum* var. *nitidum*), smooth cats ear (*Hypochaeris glabra*), fiddleneck (*Amsinckia menziesii* var. *intermedia*), scarlet pimpernel (*Anagallis arvensis*), mouse-eared chickweed (*Cerastium glomeratum*), black mustard (*Brassica nigra*), bull thistle (*Cirsium vulgare*), shamrock clover (*Trifolium dubium*), sheep sorrel (*Rumex acetocella*), and shepherds purse (*Capsella bursa-pastoris*).

Grasslands, oak savannas, and woodland grass communities in the park support numerous native wildflowers. Some of the more common species include California buttercup (*Ranunculus californica*), Johnny jump-up (*Viola pedunculata*), lupine (*Lupinus bicolor*), checker bloom (*Sidalcea malvaeflora* var. *malvaeflora*), popcorn flower (*Plagiobotrys nothofulvus*, *P. bracteatus*), blue-eyed grass (*Sisyrinchium bellum*), blow-wives (*Achyraea mollis*), red maids (*Calandrinia ciliata*), purple owls clover (*Castilleja exserta* var. *exserta*), dwarf owls clover (*Triphysaria pusilla*), butter and eggs (*Triphysaria eriantha*), soap root (*Chlorogalum pomeridianum* var. *pomeridianum*), birds-eye gilia

(*Gilia tricolor*), California poppy (*Eschscholtzia californica*), blue dicks (*Dichelostemma capitatum* var. *capitatum*), various kinds of clovers (*Trifolium* spp.), sanicles (*Sanicula bipinnatifida*, *S. bipinnata*), several species of lotuses (*Lotus* spp.), goldfields (*Lasthenia californica*), baby stars (*Linanthus bicolor*), biscuit root (*Lomatium utriculatum*), lace pod (*Thysanocarpus curvipes*), slender cottonweed (*Micropus californicus* var. *californicus*), four-spot clarkia, (*Clarkia purpurea quadrivulnera*), phlox (*Phlox gracilis*), and many others.

Non-native grasses and herbs together are the most abundant species in Grant County Park, yet their diversity is relatively low (they make up less than 20 percent of the total number of herbaceous plant species in the park). While native grasses and herbs are less abundant, they make up around 80 percent of the plant species in the park, and grow intermixed in varying proportions with the non-native vegetation.

b. Levin County Park. At Levin County Park, wildflower species are more prevalent in upper areas of the park and on Los Coches Ridge south of Calaveras Road compared to other areas of the park. Common wildlife species include California buttercup, Ranunculus (*californica*), Johnny jump-up (*Viola pedunculata*), lupine (*lupinus bicolor*), checkerbloom (*Sidalcea malvaeflora* spp. *malvaeflora*), and blue-eyed grass (*Sisyrinchium bellum*).

The shallower and rockier soils in the upper reaches of the park support increased numbers of native wildflowers, particularly in the sheltered drainages, rock outcrops, and road cuts.

4. Wildlife Resources of Grasslands

Grasslands provide important habitat for a wide variety of wildlife species. The grasses and forbs produce an abundance of seeds and attract numerous insects, providing food for granivorous and insectivorous wildlife. Sparrows, rabbits and rodents are commonly found in this habitat. Consequently, grasslands are valuable foraging sites for raptors such as hawks and owls, and other predators including coyote, fox, skunk and snakes. Aerial foraging species that occur over grasslands include bats and swallows.

In general, the wildlife values of grasslands are highest along the transition zones (ecotones) between plant communities. A mosaic of open grassy areas surrounded by hardwood forests and shrublands increases wildlife species richness. It creates a diversified habitat that supports wildlife that use grasslands for feeding as well as trees and shrubs for cover and/or nest sites.

a. Amphibians. Abundance and species diversity of amphibians in grasslands is typically low because of the aridity. However, some species such as the California tiger salamander and the California slender salamander use mammal burrows for refuge, and also disperse into grasslands during rainy periods.

b. Reptiles. There are many species of reptiles that forage and breed in grasslands. The abundant insects and rodents provide a prey base for lizards and snakes. Abandoned mammal burrows are used by reptiles for refuge and sometimes as nesting sites. Typical reptile species in this habitat are southern alligator lizard, western fence lizard, common garter snake, western terrestrial garter snake, and western rattlesnake.

c. Birds. Passerine birds that commonly occur in grasslands include savannah sparrow, house finch, lesser goldfinch, and lark sparrow. Grasshopper sparrow, western bluebird, western meadowlark, horned lark, and American robin forage for invertebrates in the ground and in grasses. Say's phoebe and several swallows hawk insects while flying above grasslands. Loggerhead shrikes hunt insects in this habitat from nearby perches such as trees or fence posts. Raptors that feed on small mammals in grassland habitat include golden eagle, northern harrier, American kestrel, white-tailed kite, prairie falcon, red-tailed hawk, peregrine falcon, and common barn-owl. Turkey vultures are commonly seen soaring above grasslands in search of carrion. Birds that breed in grasslands include burrowing owls, horned lark, and western meadowlark.

d. Mammals. Grasslands are productive habitats for small mammals, providing abundant food plants and cover. California ground squirrels are one of the most numerous species, especially in disturbed or heavily grazed areas. Other common species include black-tailed jackrabbit, Botta's pocket gopher, western harvest mouse, and California vole. These small mammals provide a prey base for striped skunk, coyote, gray fox, badger, long-tailed weasel, and bobcat. Big brown bats and pallid bats forage for insects in this habitat. Historically, tule elk grazed these grasslands, but they no longer inhabit these sites. Black-tailed deer are often seen browsing in the late evening. Feral pigs have foraged on grasses and bulbs in this habitat in recent years.

(1) Grassland Habitat on Grant County Park. The grassland habitat in Grant County Park and adjacent properties is extensive. If the grasslands of the oak savannas are included, grasslands occupy more than 50 percent of the park lands. The value to wildlife of the grassland in Grant County Park is likely highest where there are shrubs and woodlands at the edges.

(2) Grassland Habitat on Levin County Park. Grassland occupies more than 80 percent of Levin County Park. Grasslands at Levin County Park are expected to support moderate wildlife use. The wildlife value of the grassland habitat on this park is moderated by a lack of shrubs and diverse plant communities. The transition from grassland to woodland is abrupt, with virtually no ecotone.

D. Oak Woodland

The oak woodland communities on the two parks include mixed- and single-species stands of oak with varying densities of overstory and understory growth. In this report, oak savannas are characterized as having a canopy cover of less than 30 percent. Oak woodlands are characterized as stands of trees having a canopy cover greater than 30 percent.

Oak savannas and oak woodlands on Grant County Park occur as relatively pure stands of a single species in the form of black oak woodland (*Quercus kelloggii*), valley oak woodland (*Quercus lobata*), blue oak woodland (*Quercus douglasii*), and coast live oak woodland (*Quercus agrifolia*), or in mixed oak woodlands which are varied associations wherein no single species of oak dominates. The oak woodlands on Grant County Park include a number of distinct oak communities, including oak savanna, mixed oak woodland, black oak woodland, coast live oak woodland, mixed oak/foothill pine woodland, valley oak woodland, and California bay laurel/coast live oak woodland. Oak savannas and oak woodlands are widespread throughout Grant County Park, covering an area of 6,690 acres, or 70 percent of the park area.

The woodlands on Levin County Park are made up primarily of California bay laurel/coast live oak woodland. Levin County Park contains about 191 acres of oak woodlands, confined mostly to drainageways.

Tree density varies considerably within the oak woodlands, as does the ground cover under them, which ranges from little more than a layer of plant litter to a well-developed understory of shrubs, herbs, ferns, and grasses. At one extreme, coast live oak woodland, which is evergreen, tends to have a sparse ground cover that consists of scattered herbaceous vegetation among a layer of plant litter. The deciduous oak woodlands (valley, black, blue oak and mixed oak/foothill pine woodlands), on the other hand, support a denser and more diverse herbaceous understory.

Shade-tolerant plants typical of coastal Diablo Range woodland settings and thus of the oak woodland on two parks include snowberry (*Symphoricarpos*

albus var. *laevigatus* *S. mollis*), hillside gooseberry (*Ribes californicum* var. *californicum*), poison oak (*Toxicodendron diversilobum*), hedge nettle (*Stachys ajugoides* var. *rigida*), milk maids (*Cardamine californica* var. *californica*), shooting star (*Dodecatheon hendersonii*), nemophila (*Nemophila heterophylla*), pea-vine (*Lathyrus vestitus* var. *vestitus*), vetch (*Vicia americana*, *V. V. sativa*), yarrow (*Achillea millefolium*), farewell to spring (*Clarkia purpurea* var. *quadrivulnera*), Chinese houses (*Collinsia heterophylla*), hounds tongue (*Cynoglossum grande*), Pacific snakeroot (*Sanicula crassicaulis*), miners lettuce (*Claytonia perfoliata* var. *mexicana*), chickweed (*Stellaria media*), woodland star (*Lithophragma affine*), royal larkspur (*Delphinium variegatum* var. *variegatum*), bedstraws (*Galium aparine* (*G. californicum* var. *californicum* (*G. porrigens*)), bur-parsley (*Yabea microcarpa*), sweet cicely (*Osmorhiza chilensis*), goldenback fern (*Pentagramma triangularis* var. *triangularis*), wood fern (*Dryopteris arguta*), dogtail grass, *Cynosurus echinatus*), blue wildrye (*Elymus glaucus* var. *glaucus*). These plants often intermingle with herbaceous plant species from adjacent grassland, oak savanna, and shrubland plant communities.

Each component of the oak woodland communities of the two parks is described separately below.

1. Oak Savanna

Oak savannas are open woodlands with a canopy cover of less than 30 percent. They have an herbaceous understory virtually identical to that of the non-native grasslands.

a. Grant County Park. There are 2,455 acres of oak savanna on Grant County Park, which is 25 percent of the park lands. Valley oak is the dominant tree of most savanna communities in Grant County Park. Valley oak are deciduous. The rather extensive area of oak savanna includes the gentler upland slopes and spur ridges northeast of Halls Valley to the crest of Cañada de Pala Ridge. Other oak savanna communities found in the park contain trees characteristic of the surrounding woodlands, including black oak, coast live oak, or mixed oak savannas.

b. Levin County Park. There are no oak savannas on Levin County Park.

2. Mixed Oak Woodland

Mixed oak woodlands are woodlands in which no single species of oak predominates.

a. Grant County Park. There are 1,463 acres of mixed oak woodlands on Grant County Park, or about 15 percent of the park lands. Mixed oak woodlands occur primarily in the steep areas in the northern end of the park and along the Arroyo Aguague and its tributaries, especially north of Grant Lake. There are also areas of mixed oak woodland just above the western edge of Halls Valley and the drainages on the east-facing slopes west of Halls Valley.

b. Levin County Park. There are no mixed oak woodlands on Levin County Park.

3. Black Oak Woodland

a. Grant County Park. There are 608 acres of black oak woodland on Grant County Park which is about six percent of the parkland. Black oak are deciduous. Much of the black oak woodland in the park is found on the east-facing slopes along the western edge of the park and on the northeast-facing slopes west of the Deer Valley wet meadow.

b. Levin County Park. There are no black oak woodlands on Levin County Park.

4. Coast Live Oak Woodland

a. Grant County Park. There are 74 acres of coast live oak woodlands on Grant County Park. This constitutes less than one percent of the parkland. Most of the coast live oak woodland on the park is confined to the east-facing slopes on the west side of Halls Valley opposite park headquarters.

b. Levin County Park. There are no coast live oak woodlands on Levin County Park.

5. Mixed Oak/Foothill Pine Woodland.

a. Grant County Park. Mixed oak/foothill pine woodlands cover 1,368 acres, or about 14 percent, of the park. A mixed oak/foothill pine woodland extends along northeast-facing slopes above Smith Creek and throughout the southeastern half of the Hotel Field in the southeastern corner of the park. Altogether, there are 1,386 acres of mixed oak/foothill pine woodlands on Grant County Park. In addition to foothill pine (*Pinus sabiniana*), noteworthy members of this community, although relatively infrequent in occurrence, are madrone (*Arbutus menziesii*), and manzanita (*Arctostaphylos glandulosa* var. *glandulosa*). California bay laurel (*Umbellularia*

californica), and California buckeye (*Aesculus californica*), may occur occasionally. Coast live oaks are present within the woodland in the Hotel Field.

b. Levin County Park. There are no mixed oak/foothill pine woodlands on Levin County Park.

6. Valley Oak Woodland

a. Grant County Park. In addition to the valley oaks that are the predominant oak in the oak savannas on the park, there are 36 acres of valley oak woodlands on Grant County Park. This is less than one-third of one percent of the park land. The oak woodland is found on the east-facing slopes west of Deer Valley.

b. Levin County Park. There are no valley oak woodlands on Levin County Park.

7. California Bay Laurel/Coast Live Oak Woodland

California bay laurel/coast live oak woodlands are found on both parks. These woodlands have very different characteristics on each park.

a. Grant County Park. California bay laurel/coast live oak woodlands cover about 670 acres or about seven percent of the park. The California bay laurel/coast live oak woodlands on Grant County Park are restricted to steep, lower drainages and some northeast-facing slopes, where associated tree species may include riparian species such as big-leaf maple (*Acer macrophyllum*) and western sycamore (*Platanus racemosa*), as well as interior live oak (*Quercus wislizenii*), California buckeye (*Aesculus californica*), and canyon live oak (*Quercus chrysolepis*). The community is usually dominated by coast live oak (*Quercus agrifolia*), with California bay laurel (*Umbellularia californica*), occurring as the sub-dominant tree. Shrubs may include poison oak (*Toxicodendron diversilobum*), snowberry (*Symphoricarpos albus* var. *laevigatus* S. *mollis*), hillside gooseberry (*Ribes californicum*), wood rose (*Rosa gymnocarpa*), oso-berry (*Oemleria cerasiformis*), scrub oak (*Quercus berberidifolia*), serviceberry (*Amelanchier utahensis*), and chokecherry (*Prunus virginiana* var. *demissa*).

The herbaceous understory in California bay laurel/coast live oak woodlands is typically sparse. Miners lettuce (*Claytonia perfoliata* var. *mexicana*), chickweed (*Stellaria media*), bur-parsley (*Yabea microcarpa*), hedge nettle (*Stachys*

ajugoides var. *rigida*), California buttercup (*Ranunculus californica*), bull thistle (*Cirsium vulgare*), milk thistle (*Silybum marianum*), and scattered non-native grasses are the most common inhabitants of this plant community. Native grasses may occur in various amounts, and other shade-loving plants of woodland environments may also be present.

b. Levin County Park. California bay laurel/coast live oak woodlands are the only significant oak woodlands found in Levin County Park. Unlike the California bay laurel/coast live oak woodlands on Grant County Park, western sycamore is well-represented in this vegetation community on Levin County Park.

California bay laurel/coast live oak woodlands occupy the major drainages in Levin County Park. Coast live oak (*Quercus agrifolia*), and California bay laurel (*Umbellularia californica*), are the co-dominant trees of this plant community, with western sycamore (*Platanus racemosa*), usually well-represented. Other trees include bigleaf maple (*Acer macrophyllum*), California buckeye (*Aesculus californica*), and red willow (*Salix lasiolepis*). At the southern end of the park in the Los Coches Ridge area, valley oak (*Quercus lobata*), is prevalent.

The understory vegetation ranges from sparse to lush, depending on individual site conditions. Shaded locations outside of the drainageways may support anything from a cover of litter to a mixture of non-native grasses and broadleaf herbs such as ripgut brome (*Bromus diandrus*), foxtail barley (*Hordeum murinum* var. *leporinum*), miner's lettuce (*Claytonia perfoliata* var. *mexicana*), chickweed (*Stellaria media*), poison hemlock (*Conium maculatum*), stinging nettle (*Urtica dioica* var. *holosericea*), pacific snakeroot (*Sanicula crassicaulis*), wild geranium (*Geranium molle*), bur-chervil (*Anthriscus caucalis*), California buttercup (*Ranunculus californica*), and hedge nettle (*Stachys ajugoides* var. *rigida*). The vegetation along the banks of the drainageways contains a greater component of shrubs that includes poison oak (*Toxicodendron diversilobum*), blue elderberry (*Sambucus mexicana*), snowberry (*Symphoricarpos mollis*, *S. albus*), bush monkeyflower (*Mimulus aurantiacus*), blackberry (*Rubus ursinus*, *R. discolor*), and herbaceous broadleaf plants typical of shaded areas. California bay laurel/coast live oak woodlands cover 191 acres of the park.

The California bay laurel/coast live oak woodlands that line certain of the drainageways in the portions of Levin County Park north of Calaveras Road are virtually devoid of understory vegetation in many areas. Portions appear to be heavily impacted by the activity of cattle and by the rooting of feral pigs.

Rooting by feral pigs is believed to continually loosen soil and disrupt plant growth.

The southernmost tributary of Calera Creek is virtually devoid of understory vegetation; signs of browsing, soil compaction, and hoof depressions in wet soil were evident in and around Calera Creek near the crossing of the Monument Peak Trail. The riparian corridor adjacent to and downstream of the Minnis Ranch headquarters has been negatively affected by cattle: cattle have been penned and horses have been corralled within and immediately adjacent to the drainageway, which has resulted in denuded areas and trampled vegetation; and cattle graze within the riparian areas below the farm house. Browsing on wetland and riparian plant species is also evident.

There is a substantial area of California bay laurel/coast live oak woodland in the Arroyo Field south of Calaveras Road. The portion of the woodland that lines the Arroyo de los Coches north of Vista Ridge Road supports a dense understory. The northeast facing slopes south of the arroyo also support a California bay laurel/coast live oak woodland. These are the densest oak woodlands on the park, and as a result the understory on these slopes is sparse.

8. Wildlife Resources of Oak Woodlands

The habitat values among the oak woodlands are somewhat similar, since most wildlife species do not restrict themselves to a single woodland community but move between several. The wildlife value of the oak woodland does vary, however, with the degree of canopy cover and hence the density and diversity of understory plants. This habitat varies from densely wooded canyons to more open oak savannahs. Where the oak woodlands intergrade with shrub communities, mosaics are highly-stratified, offering a greater variety of niches for wildlife species.

Oak woodlands are considered critical habitats for the conservation of many bird and mammal species (Block *et al.* 1990). Important habitat features include acorns and the presence of cavity-bearing trees. As a seasonal food, acorns are important for the survival of many species of wildlife in fall and winter (Tietje 1990). Mature oak trees bear natural cavities that are important resources for cavity-nesting birds and small mammals. Mature oak forests also typically contain snags (standing dead trees). Snags are valuable resources for woodpeckers, which prefer dead trees and limbs for excavation of roosts and nest sites (Thomas 1979). Subsequently, snags receive high levels of use by secondary cavity-nesting birds such as chickadees and wrens.

Snags also support wood-boring insects, which provide food for bark-gleaning insectivorous birds.

Some of the other important food plants for wildlife that occur in this habitat include madrone, snowberry, hillside gooseberry, coffeeberry, blackberry, and poison oak. These plants provide seasonal wildlife food such as berries, which are consumed by many bird and mammal species.

Another important feature of oak woodlands is the abundance of fallen woody debris (e.g., limbs and logs). Woody debris adds structural complexity to the forest habitat, and is important as a cover, nesting, roosting, and foraging substrate for wildlife. Downed wood also helps moderate arid conditions, creating micro-climates suitable for amphibians and reptiles.

a. Amphibians. The mesic micro-climate resulting from the shade of canopy trees and the presence of downed woody debris offers suitable cover for many amphibians. Debris provides suitable breeding and cover sites for species such as arboreal salamander, ensatina, and California slender salamander. Aquatic breeding species such as California newt and California tiger salamander typically spend their terrestrial existence in rodent burrows or under woody debris.

b. Reptiles. Oak woodlands support a high diversity of reptiles due to the abundant prey and cover provided by understory vegetation and fallen woody material. Western skink, common kingsnake and ringneck snake are found in the moist, wooded canyon bottoms. Other common reptiles that utilize the drier portions of this habitat are the western fence lizard and southern alligator lizard.

c. Birds. Richness and abundance of bird species is high in oak woodlands, especially where the understory is stratified and dense. This habitat is especially important to cavity-nesters and those species that consume acorns. As a result of many factors (migratory and local movements, reproduction, mortality, seasonally changing habitat requirements), bird populations are distinctly different from season to season.

Typical cavity-nesting birds include chestnut-backed chickadee, Bewick's wren, plain titmouse, western screech owl, hairy woodpecker, Nuttall's woodpecker and acorn woodpecker. Birds that are dependent on acorns as a seasonal food include acorn woodpecker, scrub jay, band-tailed pigeon, California quail, mountain quail and wild turkey. The insects in the oaks are prey for several birds such as bushtit, ruby-crowned kinglet, and yellow-rumped warbler.

California towhee and fox sparrow forage for insects on the ground beneath oak trees.

Great horned owls, western screech-owls and northern pygmy-owls nest in oak woodlands and prey on rodents that are active at night. Diurnal raptors in this habitat include golden eagle, Cooper's hawk, and sharp-shinned hawk. These raptors feed primarily on small mammals and other birds, but golden eagles may take larger prey. Other representative bird species that occur in the oak woodlands include red-tailed hawk, dark-eyed junco, rufous-sided towhee, black-throated gray warbler, black-headed grosbeak, Hutton's vireo, solitary vireo and orange-crowned warbler.

d. Mammals. Most of the mammals that occur in this habitat are essentially year-round residents. Where the duff layer is abundant, creating moist ground conditions, large invertebrate populations occur, providing prey for insectivores such as shrews and moles. Acorns provide a valuable seasonal food for deer, squirrels, and feral pigs, and oaks offer suitable denning sites for cavity-dwelling mammals. Trees and the aerial habitat of the oak woodland are used by a variety of bat species. The areas of denser vegetation provide good escape cover during the day for larger wildlife such as deer and ringtail that feed at dusk and at night.

Representative species that utilize this habitat include broad-footed mole, dusky-footed woodrat, deer mouse, brush mouse, black-tailed deer, Merriam's chipmunk, western gray squirrel, bobcat, gray fox, striped skunk, Virginia opossum, red bat, hoary bat and California myotis.

(1) Oak Woodland Habitat on Grant County Park. Oak woodlands comprise a total of approximately 70 percent of Grant County Park acreage. The areas of woodland that intergrade with scrub to form a mosaic are expected to represent the highest wildlife values for this habitat type.

(2) Oak Woodland Habitat on Levin County Park. Oak woodlands in Levin County Park are limited to creeks. They cover about only eight percent of the park. The lack of a shrub component and the limited extent of the oak woodlands on the park reduces the overall value of oak woodland to wildlife in Levin County Park. The highest value of this habitat in Levin County Park is as wildlife movement corridors between surrounding undeveloped park and private land.

E. Shrubland

Grant County Park contains approximately 170 acres of shrubland, which is less than two percent of the park land. The shrubland community on Grant County Park consists of Diablan sage scrub and coyote brush/poison oak scrub. Shrubland varies from dense, impenetrable stands to more open stands along the edges between oak woodland and grassland. Shrublands also occur in stands too small to map. There is essentially no shrubland community on Levin County Park.

1. Diablan Sage Scrub

a. Grant County Park. Diablan sage scrub covers about 140 acres, or less than two percent, of the park land. Diablan sage scrub is confined primarily to shallow, rocky soils on steep, south- and southwestern-facing exposures above major drainages. These isolated populations warrant no special management.

Diablan sage scrub is a dense, shrubland vegetation type occupying southern and southwestern exposures on shallow, rocky soils. This community, when it occurs, is found primarily on the steep side slopes of major drainages. California sagebrush (*Artemisia californica*), is the dominant shrub, with poison oak (*Toxicodendron diversilobum*), and bush monkey flower (*Mimulus aurantiacus*), occurring as co-dominants. Coyote brush is a sub-dominant shrub in some stands. The community usually includes a few scattered wild oaks, particularly coast live oak and/or valley oak. The understory vegetation is sparse and made up of scattered annual grasses such as slender oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), red brome (*Bromus maritensis* var. *rubens*), and shade-tolerant herbs like bedstraw (*Galium aparine*), hedge nettle (*Stachys ajugoides* var. *rigida*), hounds tongue (*Cynoglossum grande*), Pacific snakeroot (*Sanicula crassicaulis*), and others. Certain native grasses such as purple needlegrass (*Nassella pulchra*), California melicgrass (*Melica californica*), and creeping wildrye (*Leymus triticoides*) find refuge in the dense vegetation.

2. Coyote Brush/Poison Oak Scrub

a. Grant County Park. Coyote brush/poison oak scrub covers about 31 acres, or about one-third of one percent of the park land. This shrubland type is encroaching into the grassland, oak savanna, and oak woodland communities in Brush Field in the southwestern corner of Grant County Park and into the open floor of Halls Valley. Shrub on the slopes here varies from open shrubland to impenetrable thickets. Shrubland tends to become

increasingly dense and profuse over time, and to displace most other plant species in the process. Over time, shrublands can build a considerable amount of woody fuel, which presents an increased danger from fire.

Coyote brush (*Baccharis pilularis*), and poison oak (*Toxicodendron diversilobum*), are the dominant shrub species of this plant community, forming open to virtually impenetrable thickets. Other shrubs found here are California coffeeberry (*Rhamnus californica*), hillside gooseberry (*Ribes californicum* var. *californicum*), and snowberry (*Symphoricarpos albus* var. *laevigatus* (*S. mollis*). The herbaceous plant understory is poorly developed with extensive areas of bare ground and plant litter. Scattered non-native annual grasses and native herbs, such as Pacific sanicle (*Sanicula crassicaulis*), hedge-nettle (*Stachys ajugoides* var. *rigida*), sticky cinquefoil (*Potentilla glandulosa*), yerba buena (*Satureja douglasii*), hounds-tongue (*Cynoglossum grande*), California manroot (*Marah fabaceus*), and wood fern (*Dryopteris arguta*), occur in these areas, as do other grassland and woodland species depending on the relative openness of the stand.

In addition to occurring in pure stands of a single species, this community is expanding into the grassland, oak savanna and oak woodlands in the Brush Field and Halls Valley where little active management (i.e., burning, mowing, or grazing) has been used to control it. Coyote brush and poison oak are present in the higher elevation oak savanna and woodland areas of the Dutch Flat Field, as well. Some of these areas have historically been brushy, as the name Brush Field implies. Early aerial photographs, however, show a more open grassland and savanna landscape than what occurs presently. Research indicates that some grassland and woodland areas are susceptible to colonization by coyote brush and poison oak when the influence of recurring fire or grazing by cattle is eliminated (McBride and Heady 1968, McBride 1974).

Encroachment of scrub is also especially apparent in certain of the grasslands in Grant County Park, especially around Grant Lake and in Halls Valley, where there has been no continuous program to control it.

In general, where coyote brush occurs on north- and east-facing slopes, there appears to be a long-term succession from dense scrub to woodland, barring disturbance (McBride 1974).

Of botanical interest is the grove of California junipers (*Juniperus californica*), on a large rock outcropping along the northern border of the park. See Figure 14. California junipers occur elsewhere within the Mt. Hamilton Range, but this is the only known occurrence within Grant County Park.

3. Wildlife Resources of Shrubland

The value of shrubland habitat to wildlife changes with age and composition. As shrublands age, they become exceedingly more dense, and in the process wildlife species requiring more open habitat are replaced by those that favor dense cover.

In general, wildlife species abundance and diversity in scrub is influenced by plant community structure and the arid environmental conditions. Thus, habitat preferences of wildlife are described in relation to plant community, successional stage, density of plant cover, proximity to openings, and degree of habitat edge. These characteristics are primarily a function of habitat disturbances, the most important of which is fire. The dense nature of the vegetation is especially suited to secretive wildlife species preferring such conditions for cover. Less dense or disturbed scrub is frequented by those species that require open areas for foraging adjacent to dense cover.

Important features of shrubland habitat where it is found on Grant County Park include: (1) its occurrence within oak woodlands; (2) sandy soils; and (3) areas of rock outcrops. The oaks produce acorns, which are important components in the diet of many wildlife species. The sandy substrate provides habitat for species unique to this substrate type. Rock outcrops contribute to the habitat mosaic of the shrub community and provide supplemental denning, cover and roost sites for wildlife.

- a. Amphibians. The arid environment and lack of surface water in shrubland habitat are expected to limit their use by amphibian species, as dry conditions are generally unsuitable for amphibians. Species such as western toad and Pacific tree frog may occur in mixed scrub, as adults disperse from nearby aquatic breeding sites.
 - b. Reptiles. A wide variety of reptiles make use of shrubland. Prey populations of rodents and invertebrates provide foraging resources, while rock outcrops and the abundance of low-growing shrubs offer excellent cover, sunning and territorial display sites. Typical species include western fence lizard, western skink, California whipsnake, and western rattlesnake.
 - c. Birds. Shrubland supports a limited but distinctive avifauna. The dense vegetation offers excellent cover for secretive birds and those requiring dense cover adjacent to open foraging sites. Representative birds of this habitat include the blue-gray gnatcatcher, wrentit, lazuli bunting, California towhee, California thrasher, scrub jay, fox sparrow, white-crowned sparrow and golden-crowned sparrow. Black-chinned sparrow and sage sparrow occur where scrub
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consists of extensive areas of sage. Rufous-crowned sparrows occur in areas with rock outcrops and California sage. Manzanita and sage provide important nectar sources for Anna's hummingbird and Allen's hummingbird.

d. Mammals. Several mammal species that prefer dense scrub are expected to utilize this habitat. Small mammals include brush rabbit, Merriam's chipmunk, Heermann's kangaroo rat, California pocket mouse, California mouse, dusky-footed woodrat and brush mouse. Predatory species that forage in dense scrub include mountain lion, bobcat, gray fox and spotted skunk. Coyotes forage in open, disturbed areas of shrubland. Feral pigs use shrubland for cover.

(1) Shrubland Habitat on Grant County Park. Extensive stands of shrubland exist above Smith Creek and in the Brush and Dutch Flat fields. There are also many areas where shrubland is interspersed with oak woodland, creating mosaics of high value to wildlife. These areas are so small that they were not mapped on the vegetation map of the park. Overall, the shrubland communities on Grant County Park are expected to increase the diversity and abundance of wildlife.

(2) Shrubland Habitat on Levin County Park. Shrubland habitat is virtually absent from Levin County Park; the oak woodland and riparian habitats are bordered by grassland with little transition or ecotone.

F. Riparian, Wet Meadow and Seeps

Riparian plant communities on Grant and Levin County parks occur primarily along streams. Riparian habitat also occurs along the edges of some lakes and ponds, which are described later in this chapter. At the State level, riparian plant communities are considered sensitive and have been identified by the California Department of Fish and Game (CDFG) as habitat of special concern (Wetlands Resource Policy, California Department of Fish and Game Commission 1987). Riparian habitat is valuable because it supports a high density and diversity of wildlife species, and because it is a diminishing resource.

The smaller, tributary drainageways contain water for only short periods during and after heavy rains. The larger streams contain running water until early or mid-summer, at which time the flow of water subsides but may remain in pools at intervals within the stream course. Wet meadows and seeps (springs) are found throughout Grant County Park. They are limited on Levin County Park.

The stream banks on both parks typically support oaks, California bay laurel, and other trees, with occasional moisture-dependent riparian woodland vegetation, such as willows and western sycamore, occurring where surface or subsurface groundwater is available. In Grant County Park, creeks of this type include San Felipe Creek and Arroyo Aguague. Smith Creek, which forms the eastern boundary of the park, supports a riparian woodland community along its entire length. Remnants of riparian corridors are evident in Grant County Park, as scattered sycamores occur along intermittent drainageways.

The stream banks in the northern portion of Levin County Park along Calera and Scott creeks support substantial overstory vegetation, but they tend to have sparse to non-existent understories. Arroyo de los Coches in the southern portion of Levin County Park has both a dense overstory and a well-developed understory.

1. Alder/Maple Riparian Woodland

a. Grant County Park. Alder/maple riparian areas cover 150 acres, or less than two percent, of the park. This plant community exists in a narrow band within the remote and relatively inaccessible riparian corridor along Smith Creek, which forms the eastern boundary of the park. White alder (*Alnus rhombifolia*), and big-leaf maple (*Acer macrophyllum*), are the dominant trees growing along the rocky, stony banks of this rather impressive stream. Other trees occasionally encountered include California bay laurel (*Umbellularia californica*), interior live oak (*Quercus wislizenii*), canyon live oak (*Quercus chrysolepis*), western sycamore (*Platanus racemosa*), and willow (*Salix* spp). California blackberry (*Rubus ursinus*), snowberry (*Symphoricarpos albus* var. *laevigatus*), and poison oak (*Toxicodendron diversilobum*), are common on the higher ground of the streamcourse, with wild rose (*Rosa californica*), blue elderberry (*Sambucus mexicana*), gooseberry (*Ribes californicum*), California coffee-berry (*Rhamnus californica*), and California honeysuckle (*Lonicera hispidula* var. *vacillans*) occurring more sporadically.

Herbaceous plants along the water's edge and on the higher banks include a varied collection of miners lettuce (*Claytonia perfoliata* var. *mexicana*), chickweed (*Stellaria media*), milk maids (*Cardamine californica* var. *californica*), Pacific snakeroot (*Sanicula crassicaulis*), horsetail (*Equisetum arvense*), California mugwort (*Artemisia douglasiana*), bedstraw (*Galium aparine*), stinging nettle (*Urtica dioica* var. *holosericea*), monkey-flower (*Mimulus guttatus*), watercress (*Rorippa nasturtium-aquaticum*), nemophila (*Nemophila heterophylla*), sweet cicely (*Osmorhiza chilensis*), wood fern

(*Dryopteris arguta*), and meadow rue (*Thalictrum fendleri* var. *polycarpum*). This particular community is, by far, the most healthy and undisturbed of all the riparian areas on the park.

b. Levin County Park. There is essentially no significant alder/maple riparian woodland on Levin County Park.

2. Willow Riparian

a. Grant County Park. Willow riparian vegetation covers about 13 acres, or just over one-tenth of one percent, of the park. Willow riparian vegetation was observed along ephemeral, intermittent and perennial water sources within the park. Willow riparian occurs at the inlet to McCreery Lake. Responding to varying water levels during the year, the willows form a dense thicket; trees range between two to six inches in diameter. Associated species include blue elderberry, mugwort and poison oak. Spiny clotbur, an invasive, non-native plant species, occurs within the riparian thicket and along the lake edge. Remnants of riparian vegetation occur within several other areas of the park, primarily along the headwaters of small drainages. The presence of remnant sycamores indicate that these riparian areas may have been more extensive than currently exist. Some areas may have contained woody growth in the past.

This plant community also occurs along San Felipe Creek within Halls Valley. Fremont cottonwood (*Populus fremontii*), occurs as individual trees in willow thickets at the upper end of the valley. In its upper reaches south of the ranch house, the creek appears to have been impacted by past land practices. The creek bottom contains deposits of silt, is devoid of gravels or pools, and supports few wetland or riparian indicator plants, except for patches of rush or sedge and intermittent groves of willow trees (*Salix lasiolepis*, *S. laevigata*), that characterize the community.

Long sections of this creek within Halls Valley are devoid of woody vegetation. The stream banks here contain mostly weedy plants found on the surrounding valley floor, such as black mustard (*Brassica nigra*), curly dock (*Rumex crispus*), poison hemlock (*Conium maculatum*), bull thistle (*Cirsium vulgare*), and yellow starthistle (*Centaurea solstitialis*), along with a few moisture-loving natives like California blackberry (*Rubus ursinus*), winter-cress (*Barbarea orthoceras*), and California mugwort (*Artemisia douglasiana*). Plant composition along the creek is poor, which may be a legacy of the farming and grazing activities, water diversion, and poor management in the past. Grazing has been removed from the valley for a number of years.

Still, the riparian vegetation along San Felipe Creek shows some evidence of natural regeneration. Areas devoid of vegetation are re-establishing and willow saplings have established themselves between the remnant larger trees. The riparian plant community along San Felipe Creek at the southern end of the park is of a higher habitat value, due to the dense vegetation comprised of willow, western sycamore and coast live oaks. The herbaceous layer is mainly composed of non-native species such as bull thistle and periwinkle (*Vinca major*). Both of these species are considered to be invasive non-native species that can easily displace native riparian species.

b. Levin County Park. There is essentially no significant willow riparian vegetation on Levin County Park.

3. Wet Meadow and Seeps

Wet meadows and seeps are examples of wetlands within the two parks. In general, wetlands are considered sensitive habitats to be protected, and are under the jurisdiction of the Army Corps of Engineers under Section 404 of the Clean Water Act.

a. Grant County Park. Wet meadows cover 31 acres, or about one-third of one percent, of the park. Freshwater marsh and seep plant communities are found in association with many of the numerous seep (springs) and ponds on the park. The wetland vegetation that characterizes this community occurs in and around ponds and in spring areas where the water table remains at or near ground level. A representative example of a seasonal wet meadow at Grant County Park may be found within Deer Valley in the Pala Seca Field.

Freshwater marsh and seep communities on the park include rush (*Juncus spp.*), spike rush (*Eleocharis macrostachya*), sedge (*Carex spp.*), rabbitsfoot grass (*Polypogon monspeliensis*), popcorn flower (*Plagiobotrys sp.*), monkeyflower (*Mimulus guttatus*), stinging nettles (*Urtica dioica* var. *holosericea* U. *urens*), watercress (*Rorippa nasturtium-aquaticum*), cudweed (*Gnaphalium palustre*), water smartweed (*Polygonum amphibium* var. *stipulaceum*), pondweed, *Potamogeton spp.*), aquatic buttercup (*Ranunculus aquatilis hispidulus*), water starwort (*Callitriche heterophylla* var. *bolanderi*), duckweed, *Lemna minor*, elderberry (*Sambucus mexicana*), and willows (*Salix spp.*). Some of the more uncommon freshwater marsh and seep plants include vernal pool goldfields (*Lasthenia glaberrima*), manna grass (*Glyceria borealis*), western yellow cress (*Rorippa curvisiliqua*), fleabane (*Erigeron philadelphicus*), and water wally (*Baccharis salicifolia*).

As with the willow riparian plant community described earlier, the presence of remnant sycamores within some of the herbaceous wetlands and seeps indicate that these areas may have had a greater component of woody plants in the past. Where old remnant trees remain and no new growth is observed, this condition often indicates that the riparian corridor can support additional woody plants, but that something is preventing the generation of new growth. At Grant Park cattle grazing and feral pig rooting and wallowing are thought to be the primary means of new growth suppression. Signs of damage by cattle, including the browsing of herbaceous woody plants, and soil compaction, such as hoof depressions in wet soil, were evident within the seep areas and around the edges of ponds. Wetland seeps along the Cañada de Pala Trail showed evidence of cattle and feral pigs activity. Plant species such as rushes, blue-eyed grass, and sedges were browsed to approximately two to three inches in height. Most pond edges were devoid of vegetation. Damage from rooting by feral pigs was also evident.

b. Levin County Park. The several springs along Calera Creek maintain a perennial flow of water along certain sections of the creek that support wetland plant species. Water overflowing from troughs have created artificial wetlands at developed springs in the Hang Glider, Lower Higuera Loop, and Corral fields. Wetland vegetation is being maintained in a spring-fed pond in the Barn Field and along a drainage channel that conveys runoff and seepage from the pond for several hundred yards. A small, narrow riparian area exists along Downing Road in the Homestead Field. The source originates on the Spring Valley Golf Course, and runs through a culvert under Downing Road. It feeds a narrow waterway lined with willow and elderberry.

The vegetation associated with creeks and tributaries in Ed Levin County Park has variable species composition. The riparian corridor along Calaveras Creek is composed of a mix of overstory tree species, and can be classified as mixed riparian. The dominant species are big-leaf maple (*Acer macrophyllum*), California bay laurel (*Umbellularia californica*), and coast live oak (*Quercus agrifolia*). The understory is open under the dense shade of the bay trees. The dominant species in the shrub layer are poison oak and common snowberry (*Symphoricarpos albus* var. *laevigatus*). The herbaceous layer is mainly composed of non-native species such as bull thistle and periwinkle (*Vinca major*).

Along Downing Creek and Arroyo de Las Coches, the tree overstory is dominated by yellow willow and to a lesser extent coast live oaks occur at the top of the bank. Downing Creek has been degraded due its proximity to Downing Road, exposure to human activities, and horse trails. Weedy species are abundant along Downing Creek, especially fennel, bull thistle and bristly

ox-tongue (*Picris echioides*). A horse trail is located adjacent to portions of the western bank of Downing Creek and fennel is also common in the annual grassland to the west of the creek.

The riparian corridors along Lower Calera Creek, Caliente Creek and Scott Creek have been degraded by a combination of factors such as cattle grazing, pig damage and horse use. Feral pigs have significantly damaged portions of Scott Creek by eroding banks through their rooting activities. This has resulted in a predominance of non-native species such as milk thistle, bull thistle, mustard, and periwinkle. In the low portions of Calera and Scott Creek, willow, western sycamore (*Platanus racemosa*), and California buckeye (*Aesculus californica*) are common; whereas in upper portions along these creeks coast live oak and California bay laurel are dominant.

At Levin County Park, a stock pond dominated by cattail (*Typha sp.*), occurs above Minnis Ranch.

Some common wetland plants associated with freshwater marsh and seep communities on Levin County Park include rush (*Juncus spp.*), spike rush (*Eleocharis macrostachya*), sedge (*Carex spp.*), narrow-leaved cattail (*Typha angustifolia*), rabbitsfoot grass (*Polypogon monspeliensis* (watercress (*Rorippa nasturtium-aquaticum*), California loosestrife (*Lythrum californicum*), monkeyflower (*Mimulus guttatus*), stinging nettles (*Urtica dioica* var. *holosericea* (*U. urens*), cudweed (*Gnaphalium palustre*), elderberry (*Sambucus mexicana*), and willows (*Salix spp.*).

4. Wildlife Resources of Riparian, Wet Meadow and Seeps

Riparian plant communities, wet meadows, and seeps are essential habitat for plant and animal species that require water or a wetland environment for all or part of their life stages. They also enhance the value of the surrounding areas as habitat for wildlife, especially during the hot, dry, rainless summer months when water is limited. Riparian vegetation provides food for wildlife, water, nesting and roosting areas, and refuge and cover from adjacent, more exposed habitats. They also provide valuable movement corridors. Riparian plant communities have been identified by the California Department of Fish and Game as a habitat of special concern. See the discussion of sensitive botanical resources described later in this chapter.

- a. Fish. Native fish species that may occur in creeks on the two parks include California roach, Sacramento sucker, riffle sculpin and rainbow trout.
- b. Amphibians. Amphibians are expected to be more numerous and diverse in this habitat than elsewhere in the two parks. Streamside pools and low-flow shallows provide breeding habitat for Pacific tree frog, foothill yellow-legged frog, California newt and western toad. Other species such as the California slender salamander seek the mesic conditions underneath fallen logs and woodland debris for breeding and refuge.
- c. Reptiles. Common reptile species that utilize this habitat for foraging or escape cover include western aquatic garter snake, western terrestrial garter snake, western skinks, and northern alligator lizard. The striped racer is a common snake in wet meadows.
- d. Birds. Neo-tropical migrants such as Wilson's warbler, warbling vireo, Pacific-slope flycatcher, as well as residents such as winter wren and song sparrow are more abundant in riparian habitats than in adjacent oak woodland. To replenish their migratory fat reserves, neo-tropical migrants feed on the numerous insects that are attracted to deciduous trees (e.g., sycamores and willows). American dippers, herons, belted kingfishers, and waterfowl utilize the nearshore areas of rivers and creeks. Northern pygmy-owls are limited to streamside forests in Santa Clara County, and may nest on the two parks. Swifts, swallows and flycatchers can be found hawking their insect prey over water. Red-shouldered hawks utilize riparian trees for nesting. Waterfowl such as mallards may use wet meadows.
- e. Mammals. In addition to the species using adjacent oak woodland, riparian-associated species that occur in this habitat include raccoon and opossum. Ringtail, long-tailed weasel, and bobcat probably drink from the creeks and forage on rodents found there. Mountain lions are closely associated with riparian areas. This habitat provides movement corridors for several species including black-tailed deer, bobcat, gray fox and coyote. Bats associated with riparian forests include Townsend's big-eared bat, California myotis, long-eared myotis and fringed myotis. Black-tailed deer drink from creeks and forage in the vicinity of wet meadows. Feral pigs also forage in riparian areas and will use the shallow water areas for wallowing.

(1) Riparian, Wet Meadow and Seep Habitat on Grant County Park. Grant County Park has several areas of riparian and wet meadows habitat that are extremely important and valuable to wildlife. These areas are Smith Creek, San Felipe Creek, Arroyo Aguague, the Deer Valley wet meadow in Pala Seca Field, as well as Halls Valley. The wet meadow at Deer Valley is a

high value habitat, and a variety of wildlife has been observed in the area (E. Remington, pers. comm.). The section of San Felipe Creek that runs through Halls Valley is degraded and of poor value to wildlife because of siltation of the creekbed and lack of riparian vegetation. Smith Creek runs along the northeastern border of the park, adjacent to private property that is grazed. This creek is of high value to wildlife, particularly as a movement corridor. Arroyo Aguague provides some excellent wildlife habitat, the value of which appears to be moderated by grazing by cattle. There are numerous seasonal drainages on Grant County Park, the value of which also appear to be similarly moderated by cattle grazing the understory and pigs rooting the banks. Overall, the riparian and wet meadow habitats on Grant County Park are expected to provide areas of high value to wildlife.

(2) Riparian, Wet Meadow and Seep Habitat on Levin County Park.

Riparian areas in Levin County Park include Scott Creek, the two forks of Calera Creek, the Arroyo de los Coches, and a small drainageway in the Corral Field. The creek corridors for Calera and Scott creeks are relatively narrow and steep, with abrupt grassland edges lacking a shrub edge. The understory on these creeks is greatly limited because of the steepness of the creek banks, trampling and grazing by cattle, and the rooting of feral pigs. The water in the creeks contains moderate to high levels of suspended sediments, probably due to the above conditions. These factors moderate the otherwise high value usually assigned to riparian habitat.

Arroyo de los Coches creek corridor is wider, less steep, and more-heavily covered with understory vegetation that are Calera or Scott creeks. Calaveras Boulevard and Vista Ridge Road, both paved roads that parallel the arroyo, moderate its value to wildlife. The highest value to wildlife of these riparian areas is as movement corridors between the park and adjacent undeveloped properties.

G. Lakes and Ponds

1. Lakes and Ponds

This resource type includes permanent lakes or reservoirs, freshwater marshes, and permanent and intermittent ponds. Most of the ponds on the two parks, as well as several of the lakes on Grant County Park, have been significantly disturbed by cattle and feral pigs. Riparian habitat occurs along the edge of some of the lakes. However, a number now provide little or no vegetative cover, and the vegetation, when present, may contain non-native species.

In addition to other values, lakes and ponds on both parks are important recreation and visual resources. The damage to soil and vegetation by cattle and feral pigs detracts from the visual and recreational experience. This disturbance also contributes significantly to degradation of water quality.

- a. Grant County Park. There are about 12 acres of ponds and springs (and their related riparian vegetation, described earlier) on Grant County Park. Grant Lake covers an additional 40 acres of park land.
- b. Levin County Park. The ponds on the wildland portions of Levin County Park (and their related riparian vegetation, described earlier) cover one acre or less.

2. **Wildlife Resources of Lakes and Ponds**

Lakes and ponds provide important foraging and breeding areas for a variety of wildlife species. The presence of wetland plants such as cattails and pond lilies increases wildlife value by providing cover, breeding sites and a food base for a diversified aquatic invertebrate fauna, which form a link in many food webs.

- a. Fish. The open water habitats at the two parks include man-made reservoirs with barriers that restrict upstream movement of native fishes. Grant and McCreery lakes in Grant County Park are stocked with warm water fish species such as large-mouth bass and bluegill.
 - b. Amphibians. California tiger salamanders and red-legged frogs lay their eggs on aquatic vegetation. The larvae of these species are preyed upon by bullfrogs and introduced fishes, thus these amphibians are now more dependent for breeding on the smaller, intermittent ponds where these predators are unable to establish populations. There are many ponds and small lakes in Grant County Park that provide critical breeding habitat for these two species. The Pacific tree frog and western toad are more-abundant species that occur in this habitat.
 - c. Reptiles. This habitat type provides forage for the western aquatic garter snake and breeding habitat for the western pond turtle. Successful breeding of turtles in the larger lakes containing non-native fish in Grant County Park may be limited, since these fish prey on young turtles.
-

d. Birds. Open water and marsh habitat is the most important habitat in Grant County Park for waterbirds. Common wintering birds expected to utilize this habitat include several species of grebe, double-crested cormorants, common mergansers and buffleheads. Common year-round residents include mallards, gadwalls and coots. Canada geese, cinnamon teal, mallards, ruddy ducks and gadwalls nest in grasslands and marshes adjacent to lakes. Great blue herons and great egrets forage in the nearshore areas of lakes and ponds. Killdeer are common in these areas and nest on the bare ground in areas exposed by receding water during summer dry-down. (The term "dry-down" refers to the recedance of water due to increased evaporation during the summer.)

Other birds that use the marsh habitats in the two parks include red-winged blackbird, tricolored blackbird, black phoebe, and song sparrows. During the summer, several species of swifts and swallows hunt insects over lakes and ponds. Wintering bald eagles may hunt from trees or snags adjacent to open water, and species such as red-tailed hawk and white-tailed kites often hunt rodents and rabbits in marshy areas.

e. Mammals. Like riverine systems, open water and marshes are utilized by several mammal species for drinking, foraging and bathing. These include raccoon, striped skunk, gray fox, deer and opossum. Feral pigs also forage on roots and rhizomes of wetland plants and wallow in the shallows. Rabbits and mice frequently use marshy habitat. Several bat species forage on insects over open water.

(1) Grant County Park. The open water and marsh habitat at Grant County Park consists of Grant Lake, McCreery Lake, Eagle Lake, Pig Lake, Bass Lake, and numerous stock ponds and seeps. Grant Lake represents a high value to both resident and migratory wildlife. However, its value to sensitive native amphibian and turtle species is moderated by the presence of non-native fish that prey upon these species' young. The wildlife value to amphibians of most of the other lakes is limited by the presence of non-native, predatory fish and bullfrogs. The lakes in Grant County Park, as well as many stock ponds and seeps, also exhibit degradation to surrounding vegetation from pig rooting and cattle grazing. The siltation of smaller ponds was also identified likely due to erosion of banks denuded of vegetation by cattle and pigs.

(2) Levin County Park. The open water and marsh habitat at Levin County Park consist of a few ponds and seeps. They are important to resident wildlife, as are the drainageways, which also have value to migratory wildlife that use them as corridors. Drainageways in the northern portions of Levin County Park, in particular, exhibit signs of loss and degradation of surrounding vegetation from pig rooting and cattle grazing. The siltation of smaller ponds was also identified likely due to erosion of banks denuded of vegetation by cattle and pigs.

In addition to these open water habitats on the northern portions of Levin County Park, there are three major open water habitats in the lower portion of the park. These include Sandy Wool Lake, the pond in Spring Valley Golf Course, and Spring Valley Lake. Sandy Wool Lake provides the best open water habitat available in this park, but its value to wildlife is moderated by the presence of non-native fish and developed picnic and other facilities surrounding the lake. Its highest value to wildlife is expected to be use by resident and migratory waterbirds. The same is true for the smaller ponds, except their smaller size precludes use by much of the wildlife expected at Sandy Wool Lake.

H. Plant Species of Concern

The reconnaissance-level assessment of the two parks allowed for a habitat screening to determine the potential presence of rare, threatened or endangered species and species considered locally unique within the two parks. Detailed rare plant surveys were not made, and little detailed information concerning the extent and viability of rare plant species in the two parks is available. More detailed observations are needed to ascertain presence or absence of species other than the two described below.

The records of the California Natural Diversity Data Base (1990) and the California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California*, 5th edition (Skinner and Pavlik 1994) indicate that a total of 64 plant species of concern (rare, threatened, or endangered) have the potential to occur in Santa Clara County. These species were screened by assessing habitat and substrate requirements to determine which ones are likely to occur at Grant and Levin County parks. The screening assumed that no serpentine soil occurs at the parks, and therefore species requiring this soil type were omitted from the list. Species requiring coastal habitats were also omitted. The screening resulted in 44 plant species of concern, which are listed in Appendix G. Table G-1 in Appendix G summarizes the status, habitat preference, and bloom period of these species. Two of these species

have known occurrences at Grant County Park: South Bay clarkia (*Clarkia concinna* ssp. *automixa*), and large-flowered linanthus (*Linanthus grandiflorus* (pers. comm. Ray Budzinski). The locations of these sightings are shown on Figure 14.

In addition to the rare, threatened, and endangered species, there are species that are considered to be locally unique according to the local chapter of the California Native Plant Society. Blazing star (*Mentzelia lindleyi*), has been observed at Levin County Park, whereas the following locally unique species have been observed at Grant County Park (CNPS local chapter): spear-leaved agoseris (*Agoseris retrorsa*), service berry (*Amelanchier utahensis*), crimson columbine (*Aquilegia formosa*), blue gilia (*Gilia achilleifolia* ssp. *achilleifolia*), lowland cudweed (*Gnaphalium palustre*), vernal pools gold fields (*Lasthenia glaberrima*), foothill penstemon (*Penstemon heterophyllus* var. *heterophyllus*), brown-mottled phacelia (*Phacelia ramosissima* var. *ramosissima*), water smartweed (*Polygonum amphibium* var. *stipulaceum*), western choke cherry (*Prunus virginiana* var. *demissa*), scrub oak (*Quercus berberidifolia*), chinquapin (*Quercus chrysolepsis*), valley oak (*Quercus lobata*), western yellow cress (*Rorippa curvisiliqua*), false lupine (*Thermopsis macrophylla* var. *macrophylla*), punchbowl-bract clover (*Trifolium barbigerum* var. *barbigerum*), and western trillium (*Trillium ovatum*).

I. Special Status Wildlife Species

Thirty-six wildlife species of special status have been identified as known or potential significant users of the parks and surrounding area, based on a literature review, the California Natural Diversity Data Base, and field surveys. These include state and federal threatened and endangered species, federal candidate species, and state species of special concern. Significant users are those species that breed on the parks or occur regularly during the non-breeding season. A table of these special status wildlife species, as well as detailed descriptions of their status, habitat requirements and distribution are included in Appendix H. Figure 16 shows some of the sensitive wildlife resources on Grant County Park and Figure 15 shows sensitive wildlife species on Levin County Park.

1. Grant County Park

Of these 36 species, all but two have been observed in Grant County Park, either as seasonal users or as residents. The two additional predicted species are the silvery legless lizard and western spadefoot toad. These animals'

secretive nature, in which they spend much of their lives hiding in burrows or under forest litter, makes sighting them difficult. They are included because of their special status and because their known range includes the two parks. One other sensitive species, Swainson's hawk, is included in this list because it was sighted in Grant County Park on several occasions (D. Bland, pers. obs., and E. Remington, pers. comm.); however, it is expected to be only an occasional visitor to the vicinity. Some of the sensitive wildlife resources on Grant County Park are shown on Figure 16.

2. Levin County Park

Information on sightings in Levin County Park is more limited. The only sensitive species sighted were golden eagles and white-tailed kites (D. Bland, pers. obs.); although at least 24 other species are expected to occur regularly in the park either as seasonal visitors or residents.

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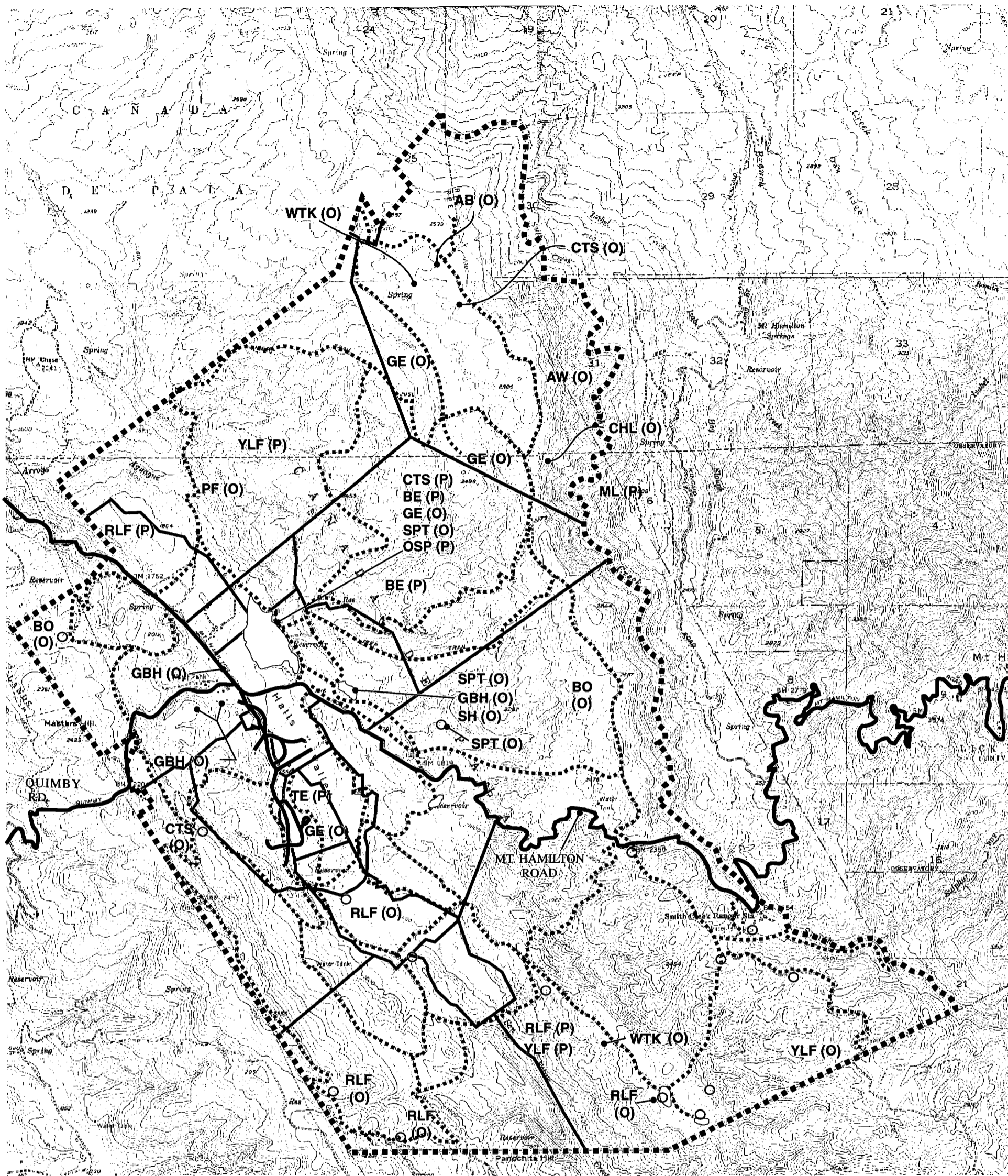


FIGURE 16

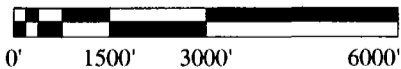
Sensitive Wildlife Resources

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

LEGEND

- Ponds and Springs Surveyed for Amphibians
- (O) Observed
- (P) Potentially Occuring
- AB American Badger
- AW Alameda Whipsnake
- BE Bald Eagles
- BO Burrowing Owl
- WTK White-Tailed Kite
- CHL California Horned Lark
- CTS California Tiger Salamander
- GBH Great Blue Heron
- GE Golden Eagle
- GG Great Egret
- ML Mountain Lions
- OSP Osprey
- PF Prairie Falcon
- RLF Red-Legged Frog
- SPT Southwestern Pond Turtle
- TE Tule Elk
- YLF Yellow-Legged Frog
- SH Swainson's Hawk
- Park/Study Area Boundary



Chapter V VEGETATION MANAGEMENT TOOLS



In this chapter an inventory of the tools that can be used to manage vegetation and habitat resources on Grant and Levin County parks are described. Ultimately, the management tools are one of the means to achieve the resource management goals identified for the two parks. A discussion of the benefits, limitations and use of tools is introduced at this time as a prelude to the discussion of vegetation and wildlife resource management issues and needs presented in Chapter VI. In Chapters VII and VIII, the understanding of existing resources within the two parks, presented in Chapters III and IV, and the management tools identified in this chapter are synthesized and applied to respond to the identified resource management issues and needs and specific management areas.

A. Major Issues

Although a comprehensive discussion of major issues facing the managers of the two parks is presented in Chapter VI, to set the stage for the discussion of management tools, the following is a brief list of the major issues facing the managers in managing the vegetation communities on the two parks.

- **Non-native Plant Infestations.** Infestations of invasive non-native plants have the potential to displace both non-native and native grasses, as well as wildflowers and other herbaceous plants. Generally, native grasses and other herbaceous plants do not thrive where they must compete with non-native grasses and invasive non-native plants. It is possible to manage invasive non-native plants to increase the vigor of native grasses and other herbaceous plants, and subsequently to increase the component of native grasses and other herbaceous plants within the parks over time.
- **Thatch Buildup.** Non-native grasses produce thick layers of thatch over time. Thatch disrupts the establishment and maintenance of native grasses, wildflowers, and other native herbaceous plants, and leads to further establishment of non-native grasses. In addition to native

grasses, oaks are known to have difficulty establishing within the thick thatch produced by non-native grasses.

- **Effect on Biodiversity of Grass Height.** The height at which grasses are maintained affects both the competition of plants for sunlight and the value of grasslands to wildlife. Cropped grasses favor some species of wildlife (e.g., ground squirrels, raptors, and Canada geese) over others (e.g., western harvest mouse, California vole, Botta's pocket gopher, black-tailed deer).
- **Wildfire Hazard.** Although vegetation types within Grant and Levin parks are generally well-adapted to fire, there is some concern that sufficient fuel loads would severely burn oak woodlands and riparian vegetation thereby suppressing regeneration. Of course, park structures and improvements and homes and facilities outside the parks also are at risk from wildfire. The likelihood and severity of wildfire in the two parks is increased by the presence of thatch.
- **Damage to Riparian and Pond Areas.** Riparian vegetation and vegetation surrounding ponds, lakes and wetlands is susceptible to damage by cattle and feral pigs where they have access to it. The invasion of non-native plants also is a concern.
- **Scrub Encroachment.** The amount of new scrub encroachment that might occur on the two parks is not known, but would vary by area. If left undisturbed, some of the grasslands and oak savannas could be expected to be displaced by scrub over time. Scrub might also move into some of the oak woodlands. Although scrub encroachment should be controlled where it interferes with recreational activities, scrub may also be managed as a mosaic that enhances biodiversity.

In the following sections the tools available to manage the plant communities on the two parks are described. Depending on the goals of the management activity, one or a combination of these management tools can be used. The application of these basic management tools to specific areas within Grant and Levin parks, as well as tools for managing other resource concerns, are described in subsequent chapters of this report.

B. Grazing

Grazing involves the use of animals, generally cattle, to control plant growth and composition. Grazing is one means of maintaining grasslands, oak savannas, and some oak woodlands, that are accessible to cattle, that can withstand their activities and where the plants are palatable to livestock.

Refer to Appendix I for additional information regarding grazing techniques and methods.

1. Benefits

Grazing is readily available, relatively cost-effective, and easily regulated when properly managed. Using grazing to manage grasslands, oak savannas, and some oak woodlands could be expected to control scrub encroachment and to control newly established infestations of scrub. The activities of cattle within shrublands can be expected to provide some opening of the shrublands through their trampling and other activities. Grazing could also be expected to help control invasive non-native plants, but additional control might be needed when new infestations occur. Grazing by cattle removes fuel loads and thereby reduces the likelihood and severity of wildfire.

2. Limitations

Grazing animals defoliate, trample, and deposit manure and urine which may have adverse effect on biodiversity depending on timing, grazing intensity, vegetation types, and site conditions. Grazing by cattle is known to be one of the factors that inhibits oak regeneration, although its absolute effect is not known. Grazing by cattle is not effective in producing mosaics of shrublands or riparian vegetation and cannot be expected to reduce well-established stands of shrubs. Cattle can damage sensitive vegetation found in wetlands and riparian areas and can cause erosion.

Grazing cannot be used as a management tool in areas where there is no water for the cattle or areas with steep slopes where cattle are reluctant to enter. Grazing also cannot be used effectively as a management tool in areas where there is little forage for cattle, such as dense oak woodlands.

Grazing presents some negative effects for recreational users. Grazing requires fences, and gates where trails cross fences. The need to open and close gates, particularly for equestrians, can be a major annoyance that detracts significantly from the recreational experience. Failure to close gates can allow cattle to gain access to areas where they should not be and can result in damage to sensitive areas. Gate configurations such as self-closing gates can minimize the need to close gates or reduce the incidence of gates left open, but most recreationists would prefer not to have gates, or at least to keep them to a minimum. Some park users may feel uneasy around livestock and be unwilling to enter fields where cattle are grazing.

While grazing does produce revenue, there are definite costs associated with it including fencing and water trough construction, and staff/specialist monitoring. It is important to note that grazing, within the context of a regional park setting, is not anticipated to be a money making venture, but may be more cost efficient in the long term compared with other related tools such as mowing, pruning or herbicides.

3. Equipment and Resources

Ranchers may maintain a cow-calf operation, in which a base herd of mother cows are retained throughout their reproductive life, and the calves are sold or kept as replacement animals. Another type of operation is a "feeder" operation in which animals are brought on to a property to graze prior to removal and slaughter. The number of animals allowed to graze is generally determined by estimating the amount of vegetation that will be available for livestock to consume in any given year, and then allocating an appropriate number of animals for the intended season of use.

The movement of animals is cyclic and conforms to seasonal changes in plant production, flowering period, and the operational considerations of the rancher and park staff. Plant growth on non-native grasslands is dependent upon and responsive to weather conditions, with vegetation production and composition varying from year to year in response to temperature differences and the timing and amount of rainfall during the growing season. As a result, some adjustments in stocking levels are usually necessary every year to assure that forage utilization standards are achieved.

Grazing requires forage, available water, fencing (if there are areas where cows are not desired), range managers and monitors. Grazing also may require range improvements such as water developments, salting, supplemental feeding, fertilizing, seeding, stock trail construction and herding to control or influence the movement of grazing animals. The training of park staff to monitor cattle impacts and vegetation conditions also is an important component of a grazing program.

In addition to seasonal or annual grazing, spot grazing or high intensity short duration grazing is a technique used to reduce grass height, fuel loading and undesirable exotic species. This technique allows a number of cows to graze a normally restricted area for a brief period of time until vegetation management objectives are met.

4. Monitoring

Monitoring stocking levels using residual dry matter standards is a method that is generally compatible with vegetation management goals on average. Residual dry matter is a measurement in pounds per acre or kilograms per hectare of air-dried plant material that represents vegetation that is to be left ungrazed. Monitoring and inspection activities should involve observing, collecting, classifying, evaluating, and cataloging data and information pertinent to management of vegetation resources.

There are several different monitoring and inspection activities employed in the evaluation of rangelands. These are carried out to assess range condition, document livestock use levels, monitor vegetation, verify compliance to established standards for grazing on park land, and to insure conformity to lease provisions. The information and data collected is used to improve management.

The use of spot grazing as a management tool is designed to improve habitat value such as the control of non-native species. Spot grazing in sensitive areas should not be part of the standard grazing lease, but subject to conditions of approval, on a case by case basis.

Monitoring would be done for a specific management objective (e.g. reduced cover of star thistle) and monitored to determine whether the sensitive area is meeting the highest conditions and standards stated in Tables I-9 and I-11 in Appendix I (i.e., vegetation, wetland and soil conditions). Monitoring should also be conducted to assess the level of soil disturbance such as bank erosion and pockmarked soil.

Monitoring and inspections may be performed together, or in conjunction with other visits. The licensee, park managers, and other specialists should be invited to participate. Each monitoring and inspection activity should be documented, and subsequent action should be taken when and where appropriate.

The following provides background information and a methodology for conducting various monitoring and inspection activities.

- a. Monitoring for Residual Dry Matter. Forage utilization by grazing animals is regulated to assure that appropriate amounts of residual dry matter remain on the ground to achieve desired resource objectives. Residual dry matter is the amount of ungrazed, dried vegetation left behind at the end of the grazing season that acts as a protective layer over the soil to guard against
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erosion, encourages nutrient recycling, and provides a suitable microclimate for plant regrowth. Visual observations or scientific measurements involving clipping and weighing vegetation from small sample plots can determine the degree of forage utilization at different times during the season. These activities also can be used to forecast the amount of plant material remaining, or to measure residual dry matter when forage utilization appears to be approaching or exceeding established standards (described below).

Data should be taken from random sample areas that reflect the prevailing effects of current grazing management practices, and the results should be extrapolated over the entire grazing unit from which the data is taken. Visual estimates of the vegetation can be made in lieu of clipping and weighing when residual dry matter levels appear adequate.

Photographs should be taken to provide visual examples of vegetative cover, and illustrate how the vegetation and landscape appear when different amounts of residual dry matter are present.

b. Residual Dry Matter Standards. Standards for residual dry matter were established by the Santa Clara County Parkland Range Management Policy (see Appendix A) because research indicates that the amount of residual dry matter remaining in any one year can influence plant productivity and plant composition the following growing season. In general, low amounts of residual dry matter tend to favor the growth of undesirable, opportunistic, early-successional plant species. A diverse mixture of desirable, native and non-native plant species results on grassland and oak savanna where, depending on terrain, 600 to 1,000 pounds per acre are left. Too much residual dry matter results in thatch, which favors non-native grasses and inhibits the growth of forbs.

The amount of residual dry matter left on the ground at the end of the grazing season is generally four to six inches of standing vegetation. The standard in pounds for the minimum amount of residual dry matter required to remain on the ground at the end of the grazing season is as follows:

Less than 30 percent slope: leave 600 pounds/acre
Alert level: 800 pounds/acre
30 percent to 50 percent slope: leave 800 pounds/acre
Alert level 1,000 pounds/acre
Greater than 50 percent slope: leave 1,000 pounds/acre
Alert level: 1,200 pounds/acre

Residual dry matter requirements and standards can be tailored to individual areas according to the need to promote soil stability, maintain plant productivity, enhance visual and recreational values, and/or protect wildlife habitat. Forage utilization should be monitored periodically to insure that the licensee receives advance notice when or before residue levels reach 200 pounds/acre above the minimum standards to allow ample time to decrease herd size or remove livestock. This advance notice level is also known as the alert level.

If monitoring shows that RDMs are below the minimum standards that have been established by the Santa Clara County Parkland Range Management Policy, negative consequences or impacts may potentially occur to the environment. Such impacts may include soil erosion, inadequate vegetative cover for wildlife, and poor soil fertility.

4. Timing

The timing of grazing varies with the management goal to be achieved. Generally, grazing primarily occurs during the months of October to May in order to ensure that there is adequate forage and cover for wildlife, especially deer, in the late spring and summer months. Livestock are removed from fields in late May.

When grazing is used as a fuel load management technique, livestock need not graze every year. Instead, grazing an area approximately once every three years, or two successive years out of six, depending on the weather, would generally keep fuel loads down and keep shrubs from invading the grassland to a great extent. Perimeter grazing to reduce the risk of wildfire, however, is required annually.

Grazing to reduce growth of non-native plant species, scrub encroachment, thatch buildup, and the height of non-native grass species in order to enhance growth of native species would need to occur annually.

5. General Costs of Grazing

Unlike other management techniques, grazing produces revenue from grazing licensees. The licensee pays the County an amount per animal unit per quarter (in 1994-95 this amount was \$13.10). The County performs an evaluation of the grazing carrying capacity in animal units in advance of each quarterly period to establish a base fee for the next quarter.

Using grazing as a management tool does carry with it some additional costs associated with range improvements. Range improvements are any developments or treatments undertaken for the purpose of facilitating improved management. Improvements such as water developments, wetland exclosures, fencing, salting, supplemental feeding, fertilizing, seeding, stock trail construction and herding are practices that are used to sustain and control the movement of grazing animals within a given area. Generally, grazing licensees are responsible for maintaining and repairing all buildings, structures and improvements related to grazing use.

The major costs associated with using grazing as a management tool are those associated with monitoring residual dry matter levels and fencing to limit access to resources that need protection from cattle. If water sources have been fenced off from cattle, providing water to areas that are grazed is another cost. Cattle-proof fencing costs approximately \$4.00 per linear foot. Costs for auxiliary watering tanks include a lump sum of approximately \$2,500 for stock tank, appurtenances and piping.

C. Prescribed Burning

Prescribed burning is the intentional ignition of grass, shrub, and woodland fuels. Prescribed burning is generally done in cooperation with the local fire protection district under favorable weather conditions, and generally after extensive precautions, such as installing fire breaks, have been taken and a number of regulating agencies have been notified. Native vegetation (including oak woodlands, shrublands, native grasslands, and wildflower fields) evolved along with a wide range of fire intensities, frequencies, and occurrences. Therefore, concerns regarding impacts to the native flora are generally minimal when fire occurs in the "traditional" fire season. However, public concerns for fire control are at their peak at this time.

1. Benefits

Like grazing, prescribed burning removes fuel loads rather than redistributes them and therefore can be expected to reduce the likelihood of wildfire, and to reduce its severity should it occur. Prescribed burning can be confined to specific areas, regulated in intensity, and controlled. Burning of grasslands and oak savannas can encourage the maintenance and establishment of native grasses and other herbaceous plants. Prescribed burning can be used to remove understory shrubs and woody brush from oak woodlands. In this situation, the fire consumes smaller and drier material without scorching the overstory canopy or heating the bark of larger trees. Prescribed burning can be used to maintain an expanse of existing shrublands or to eliminate scrub infestations, depending upon the length of intervals between burns. Burning is practical for use in large, inaccessible areas, with steep terrain and dense vegetation. Prescribed burning can be used to help establish stands of native perennial grasslands. Native grasslands evolved with fire and established perennial grasses rebound after fire, if the burn is properly timed, while weed seed is destroyed.

2. Limitations

Prescribed burning presents a number of safety concerns, including the chance the fire may escape; the distribution of smoke, ash, and soot; the control of fire intensity; and short-term air quality and visual effects. Burning can kill perennial native grasses if it is conducted when they are in flower or are setting seed and root carbohydrate reserves are low. Because much of the soil cover may be removed during a burn, there may be a temporary increase in water runoff, and erosion can be a concern when burning grasslands. In shrublands adjacent to streams, surface erosion may be a concern because all of the soil cover is exposed after even a "cool" prescribed fire in shrubland. Additionally, recently burned soil can be exposed to exotic invasive species when an abundant seed source of such plant species is nearby. The use of prescribed fire in oak woodlands during spring also raises concerns regarding nesting species. Burning generally is not an effective tool for managing riparian vegetation.

The maintenance of the "seed bank" in the soil is a concern when using fire as a management tool in shrublands. A fire which is too hot can burn and kill wildflower seeds. A fire in soils with high moisture can "steam" seeds and kill both wildflower and shrub species, and thus greatly alter the subsequent post-burn gene pool. A fire during times when immature seeds are still on the plant is likely to kill that year's crop.

A high level of burning may be undesirable visually, as it would affect the visual character of a burned area for several months following a burn. More troublesome, however, is the need to rely on weather conditions, which may make prescribed burns infeasible in some years or may severely limit the amount of land that can be burned. Burns also must be carefully orchestrated using on-site personnel and firefighting equipment.

3. Equipment, Approach and Resources

a. Burning in Grasslands. A "wet-line" and/or strip of bare earth should be established to encircle the area to be burned. Ignition on flat terrain can be done using strip fires. Ignition is accomplished by using drip torches (a hand-held device that drips a flaming mixture of diesel and gasoline), flame throwers on trailers, or helitorches. Ignition is usually begun by igniting a strip of litter and duff approximately one to two feet from the fire line or trail. The vegetation would burn to the line and extinguish (or be extinguished by engines standing by). Another strip of duff approximately two to three feet below the first line is then lit and burns to the first line where the fuel is already consumed and extinguishes. Once this three- to five-foot fuel-free strip is established, a wider strip of approximately five feet may be ignited safely. A progression of five- to ten-foot-wide strips would be lit, working downhill, until the entire area is burned.

To retain areas of grasslands and streambeds in grasslands that are subject to erosion, unburned patches can be retained by wetting or applying foaming agents (it should be noted that foaming agents are problematic with respect to water quality). Additionally, the burn manager can also design the burn to burn away from streambeds. Quick establishment of vegetative cover is also needed after a burn in grasslands to minimize post-burn invasion by undesirable species.

b. Burning in Shrublands. Prescribed burning in shrublands can likely be done without extensive line building because shrublands are generally surrounded by large expanses of grass. Prescribed burns in shrublands should probably be ignited by a helitorch, with a pattern of burning starting at the higher elevations and working downward. To avoid surface erosion from exposed soil where shrubs have been removed from streambeds, one management technique is to leave an unburned buffer above stream channels to serve as a filter for sediment.

Before burning in shrublands, crews must construct a three-foot-wide line around the burn in areas where roads, trails, or other well-defined barriers cannot be used. A one-foot trench may be necessary on the downhill side of the line on very steep slopes in order to catch rolling debris. Burning should be conducted in strip patterns and should start upslope and work down. Ignition on flat terrain can be done using helitorches.

c. Burning in Woodlands. Control of fire intensity is generally the greatest concern when using prescribed burning in oak woodlands, in order to avoid damage to the tree canopy. Concerns regarding erosion can be best handled in oak woodlands by burning under conditions which consume only some of the forest litter or leaf cover. Some increased moisture conditions can create patchy burns and substantial residual soil cover.

Before burning under woodlands, crews construct a three-foot-wide line around the burn in areas where roads, trails, or other well-defined barriers cannot be used. A one-foot trench may be necessary on the downhill side of the line on very steep slopes in order to catch rolling debris.

Burning should be conducted in the strip pattern described for grassland burns. However, fires should be ignited with drip torches rather than with aerial ignition. Using this method, a variety of burning patterns can be produced.

Some stands might need to be pruned of lower branches and thinned of shrubs. Trimmings should be pulled to openings and left scattered rather than in piles. The debris is fed into the fires or consumed in the broadcast burn.

d. Coordination. The conditions under which burning may take place, specifics regarding ignition pattern and technique, as well as equipment and personnel to have on site are all described in a burn plan that must be prepared prior to the prescribed burn and filed with the local fire department. Prescribed burning must be done with the approval of the Bay Area Air Quality Management District (BAAQMD). Coordination and notification of prescribed burns can be major tasks, given the need to notify interested parties such as nearby fire protection jurisdictions, neighboring landowners, and regulating agencies.

4. Timing

Prescribed burning can be done at almost any time when weather conditions are appropriate, but it does need to be timed to achieve the desired management goals for which the burn is being conducted. Timing of burning varies depending upon the weather conditions, seasonal vegetation growth, prioritization of management objectives (such as eradication of non-native species versus wildfire control versus oak regeneration), and the mix of species to be burned. There is occasionally a trade-off between optimum burning conditions and resource impacts. Sometimes objectives for wildfire control may be at odds with objectives for vegetation management. The most often-cited case of this type of conflict is burning shrubland in early spring when control of fire can be more certainly achieved, but fire may damage both the year's crop of seeds as well as those stored in the soil. In general, species-specific information is needed in order to avoid scheduling burns at times that may have a detrimental effect on a certain species. The intervals at which vegetation types are burned also can vary in length (e.g., after a grassland area is burned the first time, the first interval may be three years thereafter, then five years, then two years, etc.). Varying the timing of intervals tends to duplicate a natural cycle which is beneficial for native species. It should be noted that the frequency and timing of prescribed burning to produce a desired objective for a particular vegetation type is complicated and an inexact science at this time, and trial and error may be required.

a. Grasslands and Oak Savannas. Burning of grasslands and oak savannas should be done when fire will carry--that is, when grasses have just cured or herbaceous plants are dry. Burning to reduce wildfire potential and to control thatch in grasslands and oak savannas is recommended once every three to five years. When used to control exotic species, timing of the burn is most effective when the difference in fire's impact on the plants is maximized. For example, one would hope to burn yellow starthistle when flowering is starting (approximately June through October) yet not harm the native grasses or wildflower seed bank. Prescribed burning of perennial grasslands is not recommended when perennial grasses are in flower or are setting seed; a process which varies according to species.

b. Shrublands. Burning in shrublands should probably be done in the late fall when the grass is green, and the moisture in the grass would help contain the fire. The dryness of the shrub leaves and small dead twigs in the shrubs would provide material to continue combustion. Prescribed burning to eliminate existing scrub, such as coyote brush and poison oak, is recommended in two succeeding years then in intervals of three to five years if

it is to be at all effective (in addition to burning, other methods, such as manual or mechanical control, may also be needed to completely eradicate areas of scrub). Prescribed burning to control or manage new encroachments of scrub or create a shrubland mosaic is recommended to be conducted approximately once every five years.

c. **Oak Woodlands.** The recommended timing for understory burns in oak woodlands and mixed oak/pine woodlands is in the months when the grass is green or just beginning to cure. The frequency for prescribed burning to reduce fuel loading in oak woodlands varies. Mixed oak, black and valley oak woodlands are recommended to be burned in five to ten year intervals depending upon scrub encroachment and annual weather conditions. California bay laurel/coast live oak woodlands and mixed oak/foothill pine woodlands are recommended to be burned in intervals of ten to 20 years depending on whether the area has been previously burned and seasonal fuel loading.

5. General Costs of Prescribed Burning

While it is highly variable depending on site conditions and vegetation type, prescribed burning requires approximately 0.30 person-hours of labor per acre.

If prescribed burning is done by the California Department of Forestry and Fire Protection Vegetation Management Program, that program might offer some cost-sharing, particularly when the burn is part of an overall vegetation management plan that reduces the fire hazard of an area. Potentially, up to 90 percent of the costs of a burn may be covered.

D. Mowing

Mowing is a tool available to park managers for managing open level grasslands and for managing and controlling some shrublands and scrub encroachments that are accessible to machinery.

1. Benefits

Mowing can be used to control and manage new infestations of invasive non-native plants. By cropping competing non-native grasses, mowing can improve conditions for the emergence and establishment of native grasses and wildflowers. Mowing also can reduce the severity of wildfires by reducing the amount of available fuel. Mowing can control shrublands encroachment through development and maintenance of mosaic patterns.

2. Limitations

Mowing does not remove thatch. Mowing is not be feasible where there are obstructions, uneven terrain, and steep slopes over 30 percent. Because mowing would crop oak seedlings, mowing should not be used where oak regeneration is desired. Mowing would not be an effective tool in removing existing infestations of scrub. Due to relatively high labor requirements, mowing is not an effective tool for maintaining areas of more than ten acres.

3. Equipment and Resources

The two types of mowers which are often used are the flail mower for mowing grasses and the brush mower for mowing shrublands and riparian areas. A "brush hog" is a generic term for machines that cut, shred or flail brush. To effectively reduce the severity of wildfire in grasslands, mowing would need to be done with a flail mower, which reduces the amount of mown material by cutting it into small pieces and makes raking of grasses unnecessary. A brush mower can be used to develop and maintain the mosaics of shrublands, to maintain riparian areas, and to thin areas of denser riparian vegetation in order to produce a mosaic.

4. Timing

The timing of mowing varies, depending on the management goals to be achieved. Mowing in grasslands to control wildfire should be conducted just before the grass has cured to reduce the chance of roadside ignitions and dampen the intensity of any fire that does start. To reduce the severity of wildfires, areas should be mown at least once every three years when the grass has cured. To be effective in controlling the encroachment of scrub, mowing needs to be conducted at intervals of about five years.

The timing and intervals at which mowing would need to be conducted to control new infestations of non-native plants varies according to the plant being controlled and whether native perennial grasslands are being established. Managing weeds when attempting to establish native grasslands would require mowing in the first year in late March and April to reduce the height of weeds and give young perennial grasslands access to light. Mowing to control weeds and promote native grasses should not be lower than three to four inches. If mowing alone is used to control weed species, a second mowing is usually needed in May or early June. Mowing during the second year is similar to the first; and periodic mowing thereafter (if mowing is the only management tool being used) will be essential to successful establishment of native grasslands. Timing and mowing intervals for specific invasive non-

native plants and the establishment of native grasses are provided in Appendices J, K, and L.

5. General Costs

Mowing requires approximately 1.0 to 1.6 person-hours of labor per acre.

E. Other Mechanical Tools

In addition to mowers, other mechanical tools which can be used are discers and tractors that have separate attachments such as rollers, a horizontal blade (for grading), or a set of chains.

1. Benefits

a. Discing. Discing is commonly used to manage fuel loads around the perimeter of an area. Discing is a very effective barrier to fire spread because it creates an area of discontinuous fuel with many bare spots.

b. Tractor. A tractor with a blade is very effective in producing fire trails and maintaining recreational use along park trails and roads. A tractor with a roller can be used to prepare an area for revegetation of native grassland and wildflower species. Tractors can be outfitted with a spraying device for the cost-effective dispersion of herbicides over a wide area. Tractors are very maneuverable on flatter slopes, and shrubs, trees, and specific areas can generally be left without harm. Tractors outfitted with caterpillar tracks can work on steeper slopes.

2. Limitations

a. Discing. Discing is limited by the presence of trees and steep slopes over 35 percent. Discing can also disturb natural soil profiles and water drainage patterns. The banks on the sides of the disced lanes interrupt cross-slope water travel outside the lane and may accelerate water travel inside the lane. This activity can result in a dramatic change in grassland species composition towards scrub and invasive non-native plants. Discing also can contribute to weed establishment because bare earth provides a habitat for weed germination. Seeds from non-native plants may also be attached to the discer and thereby spread throughout an area.

b. **Tractor.** The use of tractor machinery is limited to slopes under 35 percent. Like discing, the use of tractors for trail scraping can disturb natural soil profiles and water drainage patterns. Tractors may create spots of bare earth that result in surficial erosion when they turn, reverse direction, or slide downhill. Although it is an effective barrier to fire spread, yearly scraping of trails also provides an excellent establishment site for weed species which may be serious fire hazards. Tractors can also spread exotic seeds as the machine travels from an area of exotics into an unaffected area. Any scraping of vertical breaks in mid-summer tends to sow weed seeds such as mustard and Italian thistle. Because the tractor usually is on otherwise undisturbed soils when using brush removal attachments in shrublands, the machine treads may compact the soil, resulting in surficial erosion. Additionally, the vibration associated with tractors may cause heavy soils to slip. Tractors with caterpillar tracks disturb greater areas than rubber-tired tractors which may in turn produce greater compaction of the soil and deeper ruts in a smaller area.

3. **Equipment and Resources**

a. **Discing.** Discing is normally done under contract with a professional who owns a discer. The operator uses a tractor with a disc attachment that cultivates an area approximately 15 feet wide with one pass.

b. **Tractor.** Tractor production rates are highly variable, depending not only on the power, size of cutting blade, and sophistication of the machine, but on the amount of time the machine is in need of repair and the speed with which it can be repaired. The City of Oakland Public Works Department owns a brush hog that can treat one acre in slightly over six hours. In contrast, the East Bay Regional Park District owns a "Royer Woodsman", which is a front-end attachment to a tractor which, with its five-foot blade, can treat one to two acres per day. Machines that are part of a contracted operation generally have dramatically less "down" time, since minor repairs are often done in the field, and parts are ordered in anticipation of needed repair.

Tractor devices that cut shrubs can be purchased as attachments (which may need to be modified) or as entire machines (such as the unimog). The attachments may be fixed to the front or back of the tractor, or be suspended on a radial arm (which would offer more maneuverability). The swath width varies from four and one-half feet (as in some machinery owned by the East Bay Regional Park District) to 15 feet across (for a flail mower).

Attachments on a radial arm have an advantage where the slope falls steeply off the side of a road, since the tractor itself can stay on the road bed while

the brush is cut (it can treat steep slopes up to the length of the arm and attachment).

When using a tractor for fire control grading or trail scraping, the banks on each side of fire breaks should be blended back into the hillside, and the surface restored with a tractor and blade.

4. Timing

- a. Discing. Discing is normally performed once a year shortly after the grass has cured.
- b. Tractor. Depending on the management technique being practiced, tractors can be used almost any time of year. However, most applications are performed after the grass has cured.

5. Costs

- a. Discing. Costs for discing are variable depending on the ownership arrangement and the type of machine used. Discing costs approximately one person hour per acre.
- b. Tractor. Costs for using tractors are variable depending on the ownership arrangement and the type of machine used. Using a tractor costs approximately one person hour per acre.

F. Manual Control

Manual control methods include spot application of a variety of methods: hand-applied chemicals, weed whipping, hoeing, pruning, manual removal of shrubs, and to a lesser extent, pulling of weeds.

1. Benefits

Manual control is especially well-suited to spot weeding of limited areas that are not accessible to machinery, that cannot be burned, or that cannot or should not be grazed by cattle, such as riparian areas. Of all the treatments, manual labor produces the least amount of soil disturbance. Manual weeding with hoes, weed eaters, or scythes is often a practical way to control small infestations of invasive non-native plants, but additional management might be needed when infestations occur. Manual control methods can be used to control encroachment of scrub and established infestations of scrub in

grasslands and oak savannas. To a degree, manual control can help to reduce the severity of wildfire. Pruning provides increased safety from most fires by creating a vertical separation between the shrub or tree crowns and fuels on the woodland floor. Manual control, especially in conjunction with the removal of thatch, could be expected to increase the opportunity for oak regeneration by allowing the selectivity needed to avoid disturbing oak seedlings. Because of the selectivity associated with manual control, weed whipping is often the only type of treatment possible in steep and/or wooded areas, areas adjacent to campgrounds, or around structures.

2. Limitations

Manual control methods are extremely labor intensive and therefore expensive. They are also limited to small areas. Hand controlled tools such as weed whippers generally cannot cut through thick or larger plant material.

3. Equipment and Resources

The typical method for hand weed removal is to pull them out of the ground or cut off the tops, often below the root crown. Common hand tools include a shovel, Pulaski, hoe, weed whip, and "weed wrench" (a tool for pulling the entire plant--root system and all-- out of the ground).

While on the site, individuals or crews can monitor progress, identify areas needing action in the future, and take action concerning incipient erosion problems. The same individual could oversee the use of other types of treatment, so continuity of objectives is retained, and his or her knowledge of the site is best utilized. The use of skilled individuals responsible for removal of weeds and shrubs provides an opportunity for a diverse range of treatments.

a. The Bradley Method of Weed Control. One method of manually eliminating exotic plants by hand from areas where native plants can easily be reestablished is called the Bradley method. The method consists of hand weeding without replanting selected small areas of vegetation in such a manner that after weeding, each area will be promptly re-inhabited and stabilized by the regeneration of native plants. Hand weeding, using this method, works from the best stands of native vegetation towards the worst area of weed infestations. Using this method, it is essential that no native plants are pulled up and no weeds are left behind. The sequence to follow to accomplish this method involves the following activities:

- 1) Prevent deterioration of good areas by weeding and checking once or twice a year. Spot occurrences and small colonies of

weeds seem harmless; however, this is the way most large infestations begin.

- 2) Weed a place that is easily accessible and where the native vegetation is strong. Start with a strip about 12 feet wide and no longer than an area that can be covered about once a month during the growing season.
- 3) Do not push deeper into the weeds until the native plants have stabilized in the weeded area. Natives should form a dense groundcover before continuing.
- 4) When new growth consists of only a few weeds, move into the heavily infested areas.

b. Weed Whipping. Weed whipping is done with a hand-held tool (normally gas-powered for use in open spaces) that cuts grass and very small shrubs with a fishingline. This treatment accomplishes approximately the same result as a mower -- it reduces the fuel height and thus the rate of spread of a wildfire should such a fire occur. It does not create areas of bare soil as discing does, so the fuel remains continuous, albeit lower in height. The production rate of weed whipping is approximately 50 feet an hour if the strip is 15 feet wide.

c. Vista Pruning. Pruning is generally done for fire control. The use of hand labor for pruning is sometimes called "vista pruning." Vista pruning is so named because, once the operation is complete, one can see through the lower portion of the stand. The resulting structure of the vegetation is often referred to as "open and park-like". The lower branches of trees, in some cases entire shrubs, and all dead branches, are removed. In tree stands, the branches are pruned to a height of eight to ten feet, as high as can be reached. The overstory is generally kept intact, but branches and small shrubs that start low and reach vertically (but do not take much canopy space) are removed to reduce the overall fuel load. Additionally, some thinning is considered part of this management technique; trees under two to eight inches in diameter may be removed, depending on the distribution of tree sizes in the stand. When prunings are cut into smaller pieces and scattered on the ground, the biomass is not removed, but the "fluffiness" of the fuel is reduced to the point where the mixture of oxygen and fuel is not optimum, thereby reducing the rate of fire spread. Alternately, prunings can be hauled away or burned. By hauling away, or moving around the branches, the litter or duff is often inadvertently "swept" into the piles or into the material to be hauled away. This removal of duff and litter is much preferred because the consumption of the duff and litter can produce tremendous heat output in most vegetation types.

4. Timing

Work is normally staggered throughout the growing season, keyed into a specific stage of plant growth. Weed whipping to reduce fuel height is done after the grass has cured, whereas cutting of thistles takes place while the plant is growing and before it sets seed. Pruning can be undertaken almost any time of the year.

5. Costs

Costs for hand control vary according to the manual control method used, the objective to be achieved, the level and type of infestation, and the size of the area to be worked. An approximate cost for pruning is one person hour per 15 square feet. Assuming a heavy infestation of non-native species, manual control may cost eight person hours per acre. Lighter infestations or spot control would be less expensive.

G. Herbicides

The limited use of herbicides is one means of managing selected areas of the two parks.

1. Benefits

Like manual control, the use of herbicides is especially suited to limited areas that are not accessible to machinery, that cannot be burned, or that cannot or should not be grazed by cattle. Herbicides can provide real and cost-effective solutions to serious weed problems. Herbicides can be used to control scrub and non-native plant infestations.

2. Limitations

The use of herbicides should only be used for special, limited situations such as to control the encroachment of scrub or infestations of invasive non-native plants. Care must be taken when choosing and using herbicides because they may control native or useful plants that provide competition for non-native exotics, soil cover, forage, biological diversity or wildlife habitat. If poorly managed, the use of herbicides may create health impacts to wildlife and park users. Potential water quality issues are also associated with the improper use of herbicides.

3. Equipment and Resources

Proper, knowledgeable and safe use of herbicides should always be observed. Precautions include both safety to humans and to the environment. Herbicides must be used according to labels, and all restrictions should be observed in accordance with existing regulations. Herbicides may be sprayed on small selected areas using a container which may be hand carried or carried on a back pack. Herbicides can also be applied from a container mounted on a truck or tractor to treat large areas. Known areas of plant infestations are marked and targeted for spraying at the proper time. The use of herbicides requires a written recommendation from a licensed pest control advisor (PCA). The Parks Department currently has a licensed PCA on staff. Information concerning herbicides is readily available from the County Agricultural Commissioners office and the U.C. Cooperative Extension.

There are many kinds of herbicides for different management purposes. Foliar-applied postemergent herbicides are most effective when temperatures are warm, soil moisture is high, and plants are actively growing. Non-selective herbicides, like glyphosate, are effective for spot treatments. Broadleaved herbicides such as Banvel, triclopyr, or 2,4-D will leave grasses unaffected.

4. Timing

The use of herbicides must be properly timed for the species to be eradicated, the type of herbicide to be used, and seasonal variations. More than one application per growing season may be necessary.

5. Costs

Costs for application of herbicides varies depending on the type of chemical to be used and the size of the area to be sprayed. The use of herbicides can be cost effective. When applied with a broadcast sprayer mounted on a truck or tractor, an acre can be treated in approximately one person hour. The herbicide may cost approximately ten to 20 dollars per acre for a total of approximately \$35 to \$45 per acre. For spot control with a back pack applicator, an approximately 50 foot long strip that is 15 feet wide can be treated in approximately one person hour.

Chapter VI
RESOURCE MANAGEMENT ISSUES AND NEEDS



This chapter describes resource management issues and needs for both Grant and Levin parks. The management issues and needs described in this chapter are organized by major needs which are the following: enhance plant communities for biodiversity; protect riparian areas, wetlands and water quality; protect plant species of special concern and native plant populations; protect special status wildlife species and species benefitting from special management; and manage for wildfire control. For each need or issue described in this chapter, the management tools that can be used to address these issues or needs are identified. An objective of this chapter is to present a broad array of potential management tools. Generally, the relative costs and feasibility, in terms of staffing and budget constraints, of choosing or using identified tools have not been considered in this chapter. In Chapters VII: Grant County Park Resource Management Program and VIII: Levin County Park Resource Management Program of this report, the information in this chapter is synthesized with the analysis of management tools provided in Chapter V to formulate specific management recommendations regarding the use of tools to respond to management issues and needs identified in each park management area.

A. Enhance Plant Communities for Biodiversity

The discussion of issues regarding the enhancement of plant communities for biodiversity is organized by major vegetation community where this need is a concern.

1. Grasslands and Oak Savanna

The grasslands in the two parks are composed primarily of non-native annual grasslands, within which native perennial grasses, wildflowers, and other native herbaceous plants are scattered. Oak savannas are open woodlands with an overstory cover of less than 30 percent and an understory virtually identical to that of the non-native grassland.

a. Promote Oak Regeneration. Many oak woodland communities, including oak savannas, in California exhibit low rates of natural oak regeneration (Muick and Bartolome 1987). There is no one specific cause for the apparent decline in oak regeneration in California. Studies indicate that acorn consumption, browsing, grazing, and root damage caused by deer, cattle, rabbits, rodents, feral pigs and defoliating and stem-boring insects are all factors that inhibit seedling growth and establishment (Griffin 1971, 1980, McClaran 1986, McCreary 1989). Changes in plant cover, fire suppression efforts, and land-use practices may have created an environment that cannot sustain seedling growth (Twisselman 1967, Griffin 1971, Anderson and Pasquinelli 1984). Studies show that considerable oak seedling mortality continues to occur even when one or several of these inhibiting factors are experimentally excluded (Griffin 1971, White 1966).

Oak savannas are used extensively by livestock, deer, feral pigs and rodents that, in the process of grazing and foraging, browse on, trample, or uproot oak seedlings, roots and acorns. Wild pigs extensively use all of the oak savannas and woodlands on both parks for food and cover. They are thought to be one of the factors that may inhibit oak regeneration, given their propensity to root for acorns, resulting in decreased seed availability for natural oak regeneration. Continued disturbance of soil and vegetation resulting from the rooting activities of feral pigs results in the need to manage for and artificially maintain the early successional stages of oaks and other vegetation.

Oaks have difficulty regenerating under natural conditions in areas dominated by non-native grasses. Generally, seedling survival in dry, grassy areas is limited by competition with non-native grasses for water and nutrients. Under these circumstances, it is likely that regeneration is not occurring at a rate necessary to replace trees as they mature and die.

Oak seedlings with the best chance for survival are those that grow under the following conditions: cool and shaded, not inhibited by thatch, not cropped by grazing or mowing, not damaged by wildfire, not excessively browsed or foraged, and not damaged by trampling and other disturbance to their root systems.

Grant County Park has 2,455 acres of oak savanna which consist primarily of valley oaks. The rate of oak recruitment in the savanna habitats on Grant County Park appears to be low evidenced by a lack of trees with mixed age classes, and most of the trees are mature with few saplings or seedlings. Without action to address this problem, trees within the oak savannas in Grant County Park will decrease over time. Levin County Park contains no oak savannas.

Although the level of oak regeneration on Grant County Park is uncertain and management options to ensure natural oak regeneration cannot be determined precisely, oak savannas and woodlands on both parks should be managed to maximize oak regeneration as much as possible.

(1) Tools.

- When spotted by rangers or range managers, naturally occurring oak seedlings, especially in grazed areas, should be protected with reinforced wire cages in order to enhance prospects for their survival.
- Grow acorns and seedlings from local genetic stock and plant them in areas where there is poor natural oak regeneration. Consider "overplanting" more acorns or seedlings than needed for a stocking program to diminish the risk of loss. Fence limited, specified regeneration areas until oaks reach a height (approximately 54 inches) that allows them to survive even with some browsing by cattle and deer. If oak regeneration is prolific within the fenced area, thin seedlings as needed. Protect individual seedlings with reinforced wire cages.
- Encourage planted and naturally occurring oak seedling survival by clearing competing vegetation, and by burning or selectively thinning competing vegetation in areas thought to show poor oak regeneration.
- Work with private and public interest groups that may be willing to sponsor and/or undertake oak seedling protection and/or planting activities.
- Conduct an ongoing periodic evaluation of oak regeneration to determine how oak communities are faring over time.
- Use the California Department of Forestry and Fire Protection, Fire and Rangeland Resources Assessment Program's "Decision Key For Oak Regeneration Assessment", included in Appendix M.
- Monitor damage by feral pigs in oak savannas, if damage is excessive, control feral pig populations.
- Control feral pig populations by opening the parks to limited live trapping and killing by professionals. This control method would require changes to County

ordinances limiting firearms in public parks, and would likely engender considerable community debate. This program would require close coordination with the California Department of Fish and Game. It should be noted that this control program can not be expected to eliminate feral pigs in the parks, but professional trapping and killing has the potential to manage populations of pigs so that their damage to sensitive plant communities and habitats is minimized.

- Initiate a monitoring program after starting a trapping program for feral pigs. If trapping does not sufficiently control damage by feral pigs, selectively fence sensitive resources in which damage continues.
- Establish joint management programs of feral pig populations through coordination and cooperation with adjacent property owners.

a. Control Non-native Plant Infestations. The native plants that were historically present on the two parks have been out-competed and displaced by non-native species, most notably European grasses and herbaceous plants. Invasive non-native plants can spread from infestations on or near the two parks, or can be spread with the movement of cattle, horses, people, or other potential carriers. Areas disturbed by the rooting of feral pigs increases the probability that invasive non-native plants will move into these areas. There is also some possibility that invasive non-native plants could be spread to the parks in feed and hay brought in as supplemental feed for cattle, although there is little or no evidence that this is now occurring or that it has occurred in any significant amount in the recent past. Invasive non-native plants can also gain a foothold in areas where vegetation has been lost or disturbed from off-trail use, discing, or erosion.

Invasive, non-native species such as fennel, star thistle, bull thistle, milk thistle, Italian thistle, poison hemlock, and common yellow mustard have displaced the native plant species in some areas of both parks. The removal of these invasive, non-native species would increase the ability of native plants to compete and would potentially increase the diversity of native plants on the two parks, thereby also improving the diversity of wildlife on the parks. Existing infestations of invasive non-native plants should be controlled in both parks, and new infestations of invasive non-native plants should be prevented whenever possible.

(1) Tools.

- Tools for eradicating and controlling non-native plant infestations include grazing, prescribed burning, mowing, using mechanical tools, using manual control methods, and using herbicides.
- Methods for controlling and eradicating specific, invasive, non-native species are described in Appendices J and K.
- Work with surrounding property owners to control nearby infestations of invasive non-native plants that might spread to the parks.
- Monitor areas used for supplemental feeding to determine if new infestations of non-native plant species are occurring. If infestations occur, confine feedings to specified areas and monitor and remove weed species.

b. Control Encroachment of Scrub. Coyote brush/poison oak scrub tends to become increasingly dense and profuse over time, and to displace most other plant species in the process. This scrub type can encroach into grassland, oak savanna, and oak woodlands if not controlled. Research indicates that some grassland and woodland areas are susceptible to colonization by coyote brush and poison oak when the influence of recurring fire or grazing by cattle is eliminated (McBride and Heady 1968, McBride 1974).

(1) Tools.

- Where desired, remove and control established scrub in grasslands by grazing, prescribed burning and/or mechanical removal for two years in a row, after which control can be reduced to approximately five-year intervals.

c. Preserve and Enhance Native Grasses and Wildflowers. Native perennial grasses and native wildflowers persist both sporadically throughout the non-native grasslands and in limited stands in which native plants are the dominant species. Enhancement and restoration of native grasslands could increase the amount of native grasslands on either park, increase the diversity of the parks, and contribute to the biodiversity of the region. Such a program could also add to the knowledge of methods to create native grasslands. Like native grasses, wildflowers respond favorably to the reduction or removal of non-native plant species.

Feral pigs are a problem in wildflower fields, as they root for the bulbs of wildflowers and native herbaceous species and feed upon them, thereby reducing their numbers and the resultant wildflower display.

(1) Tools.

- Initiate programs to maintain and enhance limited select areas of existing native grasslands. Procedures for establishing new stands of native grasses include selecting an appropriate site, preparing the site as a seed or planting bed, seeding or planting of local stock, hand-clearing of competing vegetation, and mowing, burning or grazing to reduce the competition from the more aggressive, non-native annual plants. Appendices K and L detail techniques for establishing native grasses.
 - Initiate programs to manually remove thatch and invasive, non-native plants at three-year intervals for small wildflower fields of about an acre or less. For larger fields, initiate weed-whipping programs or high-intensity, short-duration grazing (the intensity and duration of grazing would vary seasonally, annually, and from site to site and would require monitoring).
 - Crop grasslands through mowing, burning, or grazing at least once every three years. Cropping to enhance grasses can be accomplished by mowing in approximately April to May, or by prescribed burning from mid-April to mid-October. Prescribed burning to promote wildflowers should be done in late summer or fall after wildflowers have set seed.
 - Control thatch buildup (see section f. for specific tools to control thatch buildup).
 - Seed or plant local seed or plant stock. (See also section C.7. in this chapter.)
 - In limited areas, use hand control methods to remove competing plants.
 - Work with public or private groups or volunteers that might have the interest, commitment and resources to enhance an area of existing native grassland or establish new native grassland.
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- Control feral pig populations through a trapping program to protect wildflowers from pig rooting.

d. Restrict Non-native Grass Overseeding. Overseeding, used to enhance plant production and to increase palatable and nutritious forage for cattle, displaces native vegetation and may genetically compromise native plant species.

(1) Tools.

- Where overseeding or reseeding is necessary, use native species adapted to the conditions of the site and representative of the surrounding vegetation.
- Anticipate and coordinate the need to seed with the availability of native grass seed, and seed only when native seed is available.

e. Prevent Thatch Buildup. If not cropped periodically, non-native grasses develop dense layers of thatch over time. Thatch is known to negatively affect the maintenance, establishment and vigor of native grasses, wildflowers, and oaks, and can encourage the encroachment of undesirable herbaceous plants (Talbot et al. 1939, Biswell 1956). Reducing or removing thatch from areas of non-native grasses and herbs can maintain and enhance native herbaceous plant diversity (Talbot et al. 1939, Heady 1956, Bartolome et al. 1980, Menke and Langstroth 1987, Parker 1989).

(1) Tools.

- Crop non-native grasslands at least once every three years to prevent thatch buildup.
- Use a combination of grazing, burning, mowing with a flail mower, limited hand control, and limited use of herbicides to manage the grasslands and prevent thatch buildup.

f. Evaluate Management Techniques for Effect on Biodiversity. Any management techniques for grasslands that are implemented should be monitored over time to determine whether they are meeting the goal of increasing biodiversity. If the chosen management technique is not successful, adjust the management plan accordingly.

(1) Tools.

- Monitoring recommendations for grazing are provided in Appendix I.
- Monitor prescribed burning for increases in biodiversity. Survey techniques are included in Appendix N.
- Monitor mowing and other mechanical control for increases in vegetation and wildlife biodiversity. Survey techniques are included in Appendix N.

2. **Oak Woodlands**

For the purposes of management, oak woodlands can be grouped into two groups based primarily upon the characteristics of the understory. These groups include: 1) mixed oak, black oak, valley oak, and mixed oak/foothill pine woodlands, which have understories generally composed of grasses, herbs, and shrubs; and 2) coast live oak and California bay laurel/coast live oak woodlands, which have relatively sparse understories with only a minor component of grasses. Oak woodlands in Grant Park include mixed oak, black oak, coast live oak, mixed oak/foothill pine, valley oak, and California bay laurel/coast live oak woodlands. Levin County Park contains only the California bay laurel/coast live oak woodlands.

a. Mixed Oak/Valley/Black Oak/Mixed Oak and Foothill Pine Woodlands. Mixed oak, valley oak, black oak and mixed oak/foothill pine woodlands are found only on Grant County Park. Like oak savannas, these oak woodlands are grazed by cattle, but not as extensively. It is likely that cattle eat acorns and browse on oak seedlings, especially when other preferred forage is not available. The range analysis conducted for this report estimates that these oak woodlands provide livestock approximately 40 percent of the forage of the grasslands and oak savannas. In addition to forage for cattle and a number of wildlife species, these oak woodlands provide shade and shelter as well. Both black oak and mixed oak/foothill pine woodlands provide significant habitat for black-tailed deer.

The overstory cover of these woodlands helps to slow or prevent the encroachment of scrub and invasive non-native plants, depending on their tolerance of shade. Non-native plants generally need greater exposure to sun in order to thrive. As a result, management need not be as intensive as for grasslands or oak savannas. The more open character of the edges of these woodlands potentially would support shrubs as well as invasive non-native plant species, and management may be needed for these areas.

(1) Maintain the Grassland Understory. The issues related to management of the grassland understories of mixed oak and valley oak woodlands are identical to those for maintaining the biodiversity of grasslands and oak savannas described previously.

(a) *Tools.*

- Manage the understory of the mixed oak and valley oak woodlands by prescribed burning or grazing. Burn the understory of these oak woodlands once every five to ten years, depending on weather conditions. Burning can be done from the time the grass just begins to cure to approximately mid-October. However, burning in the spring is optimal because a substantial component of non-cropped grasses and shrubs can be maintained for summer forage for black-tailed deer and other wildlife that prefer taller understories. Burning in the spring also maximizes the benefits of burning to reduce the likelihood of wildfire.

(2) Promote Oak Regeneration. There is concern for oak regeneration on the moderately dense mixed oak, black oak, valley oak and mixed oak/foothill pine woodlands on Grant County Park. Poor regeneration is evidenced by a lack of trees with mixed age classes. Most of the trees are mature with few saplings or seedlings. Grazing and feral pig activity is thought to have an effect on oak regeneration; however, the severity of this impact is not known, and it is likely that other factors (e.g., fire conditions, climatic conditions, non-native species competition, etc.) also contribute to oak decline.

(a) *Tools.* The management tools to promote oak regeneration in mixed oak/valley oak woodlands are the same as for the oak savannas (see section 1.a).

b. Coast Live Oak and California Bay Laurel/Coast Live Oak Woodlands. Coast live oak and California bay laurel/coast live oak woodlands are dense stands of trees with dense overstories. They support an understory of herbs and shrubs. These woodlands are evergreen. The thick, persistent leaf canopy maintains a shaded environment year-round, which inhibits understory growth to a considerable degree. These dense woodlands typically occupy steep drainages and associated side slopes.

The understory of coast live oak and California bay laurel/coast live oak woodlands on Grant County Park tends to be sparse. The range analysis

conducted for this analysis estimates that this group of oak provides little if any forage for livestock. These oaks, however, do provide shade and shelter, especially at their edges. Management for these oak woodlands need not be as intensive as for the previous woodlands.

The California bay laurel/coast live oak woodlands in the northern portions of Levin County Park along Smith and Calera creeks have little if any understory. Some areas show extensive damage from cattle and feral pigs.

(1) Maintain the Woodland Understory. The understory of coast live oak and California bay laurel/coast live oak woodlands is substantially different from the understory of the previous oak woodlands. This group of oak woodlands provides little if any forage for livestock.

(a) *Tools.*

- The understory of coast live oak and California bay laurel/coast live oak woodlands should be managed through prescribed burning or by hand control such as by weed-whipping in limited areas.
- Limited, intensive spot-grazing by cattle may also be used to manage the understory in areas where there is a component of forage for cattle.
- Retain a component of downed trees and branches in order to provide additional cover for wildlife.

(2) Control Access by Livestock. Where coast live oak and California bay laurel/coast live oak woodlands occurs in Levin County Park, its narrowness and easy accessibility makes it very susceptible to damage by cattle and feral pigs. The understory appears to be heavily foraged and browsed in areas that are accessible to cattle and damaged by rooting of feral pigs. Cattle should be kept from these areas in Levin County Park, and feral pig populations should be managed.

(a) *Tools.*

- Monitor the condition of the understory in coast live oak and California bay laurel/coast live oak woodlands.
- Fence coast live oak and California bay laurel/coast live oak woodlands where cattle need to be restricted from it.

- Monitor damage from feral pig populations, and, if necessary, control feral pig populations through a trapping program.

(3) Restore Understory Vegetation. Where coast live oak and California bay laurel/coast live oak woodlands occur in the northern portion of Levin County Park, the understory accessible to cattle and feral pigs show signs of damage, especially along Scott and Calera creeks. Where damage is severe, these areas should be restored.

(a) *Tools.*

- Control livestock access by fencing to restore damaged coast live oak and California bay laurel/coast live oak woodlands.
- Monitor damage by feral pigs, and manage the population of feral pigs by trapping.
- Where understory vegetation has been damaged or does not exist, seed or plant local understory plant species; however, it is likely that understory species will restore themselves once cattle and feral pigs are removed.

(4) Promote Oak Regeneration. There appears to be no oak regeneration in the coast live oak and California bay laurel/coast live oak woodlands in the northern portions of Levin County Park.

(a) *Tools.* The management tools to promote oak regeneration in coast live oak woodlands are the same as for the oak savannas (see section 1.a).

3. Shrublands

Shrublands occur as stands of nearly pure scrub species (i.e., Diablan sage scrub on Grant County Park), as large, dense, impenetrable stands of mixed scrub (i.e., coyote brush/poison oak scrub on Grant County Park), and as scattered small stands along the edges of and between oak woodland and grassland. There are essentially no shrubland communities in Levin County Park.

a. Manage Shrublands as a Mosaic. Coyote brush/poison oak shrublands can provide a plant community that has a high value for a diversity of species and wildlife habitat. Shrubland can be retained and managed to produce a "mosaic" of successional stages (from dense thickets to less dense or disturbed scrub) adjacent to other vegetation communities, thereby maximizing its value for watershed, wildlife habitat and plant diversity.

(1) Tools.

- To manage shrublands as a mosaic, prescribed burning can be used on a rotational basis so that an area of scrub is treated by prescribed burning at about once every five to ten years.
- Mechanical control, using a tractor with an attachment or a unimog, can also be used at approximately five year intervals to produce shrubland mosaics of different ages and conditions.

b. Control Unwanted Scrub Infestation. Coyote brush, poison oak and other scrub species have encroached and continue to encroach into grasslands, oak savannas and woodlands. Where unwanted encroachment of coyote brush/poison oak scrub is occurring, it should be controlled. This issue was previously discussed in section A.1.c. in this chapter.

(1) Tools.

- Coyote brush/poison oak scrub can be removed by prescribed burning, mowing, hand control, and herbicides. In areas where encroachment is occurring, measures to remove it need to be conducted for two years in a row, after which management to control encroachment can be reduced to about once every five years.

B. Protect Riparian Areas, Wetlands and Water Quality

Riparian vegetation communities primarily occur along creeks, streams and drainages, but may also occur along the edges of some lakes and ponds. Riparian vegetation maintains water quality, prevents bank erosion, helps regulate stream flows and flood regimes, and provides important wildlife habitat. In addition to riparian areas, other important wetland habitats which should be protected are wet meadows, seeps, lakes and ponds. The water quality of these habitats and resources in the two parks is critical to the health

and ongoing stability of the vegetation communities and wildlife that depend on water resources.

1. Protect Riparian Areas from Damage by Cattle, Pigs, and Ground Squirrels

Riparian areas, wet meadows, seeps, lakes and ponds can be substantially damaged by livestock, feral pigs, and ground squirrels. The damage to soil and vegetation by cattle and feral pigs detracts from the visual and recreational experience. This disturbance also contributes significantly to degradation of water quality and habitat values.

Cattle and horses have the potential to cause substantial erosion, damage to wet areas and waterways, and disturbance to riparian vegetation by defoliating, trampling, compacting soils and depositing manure and urine. Manure left by cattle and horses is unsightly and affects water quality.

Riparian areas, wet meadows, and seeps, and the shorelines of ponds and lakes are principal rooting and wallowing areas for feral pigs, which appear to favor rooting in moist areas. Feral pigs also trample riparian vegetation. These activities adversely impact riparian areas and wetlands by decreasing water quality, disturbing plant species, and increasing erosion hazard due to disturbance of soil.

Ground squirrels can cause substantial damage to drainageways and water impoundments. Their excavations and burrowing can have adverse effects on the stability of structures such as earthen dams at stock ponds and can cause significant erosion problems in drainageways.

a. Tools.

- Monitor and manage grazing of cattle in riparian areas and around ponds and lakes. Where damage occurs from inappropriate or improper grazing by cattle, cattle can be removed and the land rested until the vegetation cover is restored. Before grazing is reintroduced, reduce animal numbers and improve animal control, distribution, and rotation.
 - Fencing can be used to exclude cattle from sensitive riparian areas, wetlands, lakes and ponds. However, these resources are often important sources of water for both wildlife and cattle. Fencing should prohibit access by cattle, but allow wildlife to pass through and retain access to water. After fencing, where water for cattle is not available, alternative sources of water will be
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needed. Water for cattle should be piped to troughs outside the fenced area on dry land. Where water is piped to troughs, sufficient water must remain in the wetlands to protect the vegetation and wildlife communities depending upon it. Additionally, fencing should be used discriminately because there can be negative aesthetic impacts, as well as impacts to recreation users.

- If fencing is required for resources that are visible from trails or otherwise within the view of recreationists, fencing should be placed behind vegetation and topography as much as possible; riparian and wetland resources should not look like fenced compounds. Generally, fencing should be visually pleasing and should control cattle but should not impede the movement of wildlife.
- Because they attract concentrations of cattle, salt licks should be placed well away from riparian corridors.
- Monitor damage to riparian areas from feral pigs. If necessary, control feral pigs through live trapping and killing by professionals.
- Initiate a monitoring program after starting a trapping program for feral pigs. If trapping does not sufficiently control damage by feral pigs, selectively fence wet areas, riparian zones, and other sensitive resources in which damage continues. Costs for pig-proof fencing can be limited where fencing is also needed for the control of cattle. Use of pig-proof fencing, however, has a number of serious disadvantages, including the potential disruption of scenic values and recreational experiences; their high cost, especially when erected separately from cattle fencing (about \$5,000 per mile); fencing off special park features; staff time needed to patrol and maintain fences; and the creation of a potential barrier to movement of wildlife species.
- Monitor ground squirrel activity to determine if they are damaging structures or causing significant erosion problems in or adjacent to pond dams or riparian areas. If there is significant damage, initiate management programs. These programs can include encouraging predators that can control ground squirrel numbers by installing owl boxes and hawk perches near problem areas; trapping and removing squirrels, and poisoning ground squirrels. The use of poison to control ground squirrels should, however, be carefully controlled because of potential effects on carnivores and water quality.

- Mechanical tools, such as discers and mowers, should be prohibited in riparian corridors where their use may cause soil compaction and erosion.

2. Eliminate Invasive Non-native Plants from Riparian Areas and Wetlands

Where invasive, non-native plants have encroached, they should be removed to encourage the reestablishment of native vegetation.

a. Tools.

- The relatively limited infestations of invasive non-native plants in and around riparian and wetland resources are best controlled by hand-pulling in the spring when the soil is moist. Plants that are uprooted should be placed in bags and removed. Where removal leaves areas of bare soil, local plants should be seeded or planted. The use of manual control should be limited and focused because it is costly. Large infestations can be controlled by weed whipping.
- Remove non-native plants in riparian areas by hoeing the infested areas to a depth of two inches below ground level before plants set seed.
- Because of potential effects to water quality, herbicides and prescribed burning should not be used in riparian corridors or wetland areas.

3. Restore Degraded Riparian Plant Communities

The growth of herbaceous woody understory species can be suppressed by livestock grazing and feral pig rooting and wallowing. Signs of damage by cattle, include the browsing of herbaceous woody plants and soil compaction. The most disturbed areas should have the highest priority for restoration. Areas for restoration should be identified by the amount of bare or eroded soil, paucity of native species, and the abundance of invasive non-native plants. Where they have been degraded, revegetate and enhance selected riparian areas, wet meadows and seeps.

a. Tools.

- Seed or plant native vegetation in degraded riparian areas. Encourage reestablishment of native vegetation by removing invasive, non-native plants by manual control where possible.
- Fence highly degraded riparian areas and allow area to restore itself naturally or in conjunction with other management strategies.
- Monitor fenced riparian areas for non-native species infestations, damage from pigs, and to determine whether the area is regenerating. If necessary, upgrade fencing to exclude pigs, control non-native infestations, and consider a revegetation program.

4. Prevent Erosion and Reductions in Water Quality

A number of areas on both parks are subject to erosion, which contributes to the loss of vegetation and soil and to the degradation of water quality. A certain amount of erosion can be expected naturally because of steep slopes, immature soils, areas of naturally sparse vegetation, and unstable geologic conditions. Generally, the likelihood of erosion is less a function of the characteristics of individual soils on the two parks than it is a function of the steepness of slope and the type and density of vegetation. Still, much of the erosion on the two parks can be attributed to flooding, poor livestock grazing practices, degradation of riparian vegetation, recreational use, wildfire, improper road and trail placement that results in channeling of runoff and washing of roads and trails, improper crossings over drainageways, illegal off-road vehicle use, rodent activity, and a host of other factors.

Management for erosion control and improvements to water quality are closely tied to those of the management of riparian vegetation, the management of lakes and ponds, the management of feral pigs, and the management of damage by ground squirrels and other rodents, all of which are described previously in this chapter.

a. Tools.

- Whenever feasible, prohibit activities (e.g., improper road or trail placement, creek crossings, and off-trail recreation uses) that contribute to vegetation disturbance on areas with slopes greater than 50 percent.
 - Whenever feasible, limit disturbance to and activities on areas with slopes between 30 and 50 percent.
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- Minimize soil and vegetation disturbance during construction and maintenance. Use temporary construction fencing to designate where equipment and storage of materials should not be allowed. Coordinate with maintenance workers to define which trails can be used for access to facilities such as overhead powerlines.
- Divert recreational uses and defer grazing as needed to promote plant establishment on highly disturbed areas.
- In restoring disturbed or eroded areas, use native plant species appropriate to the site.
- Stabilize severely disturbed sites as rapidly as possible by removing the disturbance and establishing an herbaceous plant cover.
- Remove trails from the top of creek banks and drainageways.
- Limit crossings of creeks as much as possible. Where crossings must occur, construct culvert or bridge crossings.
- Enforce the County's 150-foot setback from the top of stream banks along creeks and drainageways for structures including corrals, stables and holding pens.
- Manage livestock to keep their manure out of streams, dry creekbeds, and drainage areas.

C. Protect Plant Species of Special Concern and Native Plant Populations

The native plants that were historically present on the two parks have been out-competed and displaced by non-native plant species, notably European weeds and grasses. Management of non-native invasive plant species cannot be expected to restore the native vegetation communities on the two parks, but it can be expected to increase the absolute numbers of native plants, help to preserve and maintain the local gene pool, and help to control the introduction of invasive non-native plant species.

While site reconnaissances has been conducted on both parks, and a thorough review of literature and records was conducted as part of this analysis (see Chapter IV), neither Grant nor Levin County parks in their entirety have been formally surveyed for rare, threatened, and endangered plant species or other plant species of special concern. Appendix G of this report lists two observed species (South Bay Clarkia and large-flowered linanthus) and 42 potential

species of concern that may occur in the two parks. Although the legal status of these species is variable, all are valuable and acknowledged by the California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California*, 5th edition (Skinner and Pavlik, 1994). If any of the potential species are found at either park, they would be considered a significant botanical resource, contributing to the goal of increasing the biodiversity of native plant species.

1. Protect Known Plant Species of Concern

The rare, threatened, and endangered plant species or other plant species of special concern listed in Appendix G of this report merit protection and should be surveyed for during their appropriate bloom period. In general, the range of bloom periods for these species is from March through November. Native grassland areas, wildflower fields, rock outcrops and other known areas supporting South Bay Clarkia and large-flowered linanthus are high priority areas for surveying for other plant species of concern.

a. Tools.

- Determine protective measures on a site by site basis.
- Consider rerouting trails, moving recreation activities, changing proposed projects, and constructing protective fencing to protect known species. Fencing and signage should be used as a last resort as they draw unwanted attention to sensitive resources.
- Where a species of concern is found, demarcate its location in the field as well as on maps.
- Protect known locations of species of concern from human, wildlife activities and other negative impacts such as erosion. In some very limited instances, such as for endangered or threatened species, protective fencing or wire baskets may be needed to protect species. Erosion can be controlled as described in section B.5. of this Chapter.
- Monitor locations supporting known species of concern on a yearly basis during the appropriate bloom period.
- As staffing and budget allow and on a case-by-case basis, remove non-native plant species that appear to be competing with a species of concern.

2. Verify Plant Species of Concern at Construction Sites

It is important that limited surveys for plant species of concern (especially those listed in Appendix G) be undertaken for all projects that have the potential to disturb the ground surface. Disturbance includes any physical manipulation on both parks that has the potential to disturb the soil or ground surface through grading or clearing.

(1) Tools.

- Review any physical manipulation on both parks that has the potential to disturb the soil through grading or clearing.
- Survey the site to determine the presence of plant species of concern, and, if possible, vary the project as necessary to avoid damage or disturbance to these plants.
- Survey techniques are described in Appendix N.

3. Verify Plant Species of Concern Near Trails

Plant species of concern are potentially subject to collecting or trampling by humans who primarily move through the two parks on trails. Before implementing measures to curtail the potential damage from humans, the existence of species of concern adjacent to trails must first be verified.

(1) Tools.

- Survey techniques are described in Appendix N.
- Where plant species of concern are identified, protect them as described previously in section C.1.

4. Document and Record Findings of Plant Species of Concern

Since the two parks have not been surveyed for the existence of plant species of concern, surveys on both parks are recommended to be undertaken when staffing and budget allow. However, findings of plant species of concern made before surveys are completed should be documented and recorded. When a species of concern is found by trained staff or volunteers, the find should be recorded on the California Department of Fish and Game's California Native Species Field Survey Form.

a. Tools.

- Send photocopies of completed survey forms to the Natural Diversity Data Base, California Department of Fish and Game.
- Map the location of all identified plants on park maps that should be kept in the park office as a management tool. Over time, such information can be used to evaluate the need for changing or adding protective measures.
- As staffing and budget permit, conduct rare plant surveys on both parks, focusing on the 44 species identified in Appendix G.
- Procedures for surveying plant species of concern are described in Appendix N.
- Surveys can be directed by a specialist but conducted by park staff, survey volunteers from the Santa Clara Chapter of the California Native Plant Society (CNPS), the plant taxonomy students from San Jose State University, or some other public or private group.
- When undertaken, surveys should be conducted monthly from March through November, in order to cover the range of bloom periods for plant species of concern.

5. Encourage Staff and Volunteer Support for Identifying Plant Species of Concern

To help in the surveying effort, staff and volunteers should be encouraged to be educated in recognizing and identifying species of concern. Additionally, research opportunities through local colleges or related educational organizations can be contacted for their participation in conducting formal plant surveys. Staff and volunteers should be encouraged to learn to recognize plant species of concern, so that they can add to the recorded knowledge as much as possible.

a. Tools.

- Line drawings and species descriptions can be obtained from *Illustrated Flora of the Pacific States* (Abrams, Volumes I-V, 1940, 1944, 1951, and 1960) and *The Jepson Manual of Higher Plants of California* (Hickman, 1993). This information can be made available to staff and volunteers to help in identifying plant species of concern.

- Plant species identification programs should be integrated into the interpretive program described in the *Joseph D. Grant County Park Master Plan*.

6. Establish New Stands of Native Plant Species

Research indicates that native perennial grasses do not establish well on most non-native grassland sites without site preparation, and follow-up treatment is often necessary in order to reduce competition from the more aggressive non-native annual plants (Bentley and Talbot 1948, Daubenmire 1968, Parker 1989). In addition to seeding, establishment of new stands of native grasses and plants may require hand-clearing of competing species, and mowing, burning, or grazing to reduce the competition from the more aggressive, non-native annual plants. Other native plant species, such as wildflowers and oaks, also should be reestablished.

a. Tools.

- Maintain, encourage and enhance native plants as staffing and budget allow.
- Initiate programs to convert non-native grasslands adjacent to sensitive botanical resources to native grasslands.
- Select a number of wildflower fields on each park to be specifically managed to enhance the number and diversity of wildflowers.
- Appendices K and L describe detailed methods for establishing new stands of native plant species.
- Establish new stands of native plant species through farming or cultivation.
- Oak regeneration tools are described in section A.1.a. of this chapter.
- Establishment of wildflowers also are described in section A.1.d. of this chapter.

7. Use Native Plant Materials for Revegetation

Native seed and regenerative plant materials collected locally or carefully screened should be used for revegetation projects. The genotypes of plants and seeds used in revegetation projects must be assessed carefully; non-local

planting stock can introduce novel, undesirable or maladapted genotypes into the ecosystem.

a. Tools.

- Focus revegetation projects on techniques that encourage natural regeneration from adjacent native plant species (see Appendix J).
- Use native seed and regenerative plant materials that have been collected locally for revegetation projects.
- Gather and use local native plants in all restoration projects. If local stock is not available, selected nurseries can certify seed that is compatible with the restoration site. State or federal nurseries or native plant societies are good first choices.
- If it is necessary to purchase supplemental seed, choose nurseries that can certify a seed origin that is compatible with the restoration site. The California Native Grass Association or Elkhorn Ranch can often provide information as to the availability of grass seed or plugs having an appropriate origin. Information for contacting these organizations is included in the references chapter of this report. Techniques for preserving and enhancing the local gene pool are included in Appendix L.

**D. Protect Special Status Wildlife Species
and Species Benefitting from Special Management**

The baseline analysis for the two parks identified 36 special status wildlife species which potentially occur in the two parks (see Appendix H for the list). These species include those listed as endangered or threatened, candidate species, and species of special concern. Informal observations have been reported for all except two of the 36 species. However, no focused surveys have been conducted at either park to determine the current distribution of these species or to identify important areas, such as nesting sites, for those species that should be protected.

While the entire management program for the two parks is intended to enhance the habitat for native wildlife, a number of native wildlife species would benefit from special attention, these include black-tailed deer, native bats, Canada geese, herons, native fish and amphibians. Other invasive species, such as bull frogs, ground squirrels, and feral pigs, also require special management.

1. Avoid Development in Sensitive Wildlife Areas

Sensitive species should be protected from development and other human activities, especially during the breeding season, when human disturbance can potentially cause nest abandonment and reproductive failure for the season. Park facilities should be sited to avoid impacts to sensitive wildlife areas.

Wildlife movement corridors are sensitive areas that are especially critical to the successful existence of native wildlife. Wildlife corridors provide connections between habitat areas, enhance species richness and diversity in the local area (Harris 1984, Adams and Dove 1989), and help to maintain regional biodiversity. Movement corridors are especially important to wide-ranging mammals such as mountain lion, bobcat, and gray fox and to seasonal migrants such as yellow warblers. Disruption of wildlife movement corridors can lead to habitat fragmentation and isolated populations.

Both Grant and Levin County parks are adjacent to other open spaces within the Diablo Mountain Range, enhancing the opportunities for movement of wildlife in the region. The major creeks in both parks probably provide the primary movement corridors for wildlife. Additionally, in Grant County Park the numerous tributaries of these major creeks are also important to wildlife movement within the park.

a. Tools.

- Retain riparian corridors and oak woodlands as connected, unfragmented systems that can be used by wildlife as movement corridors.
- Trails and campsites should be planned to avoid sensitive wildlife areas.
- Where necessary, seasonal closures of sensitive wildlife areas should be enforced.
- Recommendations for known sensitive areas are described in the management recommendations for the individual management areas on each park in Chapters VII and VIII.

2. Encourage Staff and Volunteer Support for Identifying Special Status Wildlife

Since no parkwide surveys for sensitive wildlife species were conducted at either park as part of this project, focused surveys are recommended to be conducted as staffing and budget allow in order to determine the current

distribution of these species in the parks and to identify important wildlife areas.

a. Tools.

- Methods for conducting focused surveys and recording sightings are described in Appendix N.
- Detailed records of the sighting of sensitive wildlife should be kept at each park office as a management tool. Over time, such information can be used to evaluate the need for changing or adding protective measures.

3. Maximize Habitat for Black-tailed Deer

Black-tailed deer populations have decreased in both parks over the last several years (M. Schauss, CDFG, personal communication). Although the causes are not well documented, reasons may include competition with pigs and cattle for forage and lack of suitable fawning habitat. Black-tailed deer are a species that prefer non-cropped grasslands (Kie and Loft 1990). While all areas of the parks and surrounding undeveloped lands are important habitat for black-tailed deer, black oak woodlands, mixed oak/foothill pine woodlands, and wet meadows and seeps in particular, are especially important habitat.

a. Tools.

- Restrict cattle grazing in grasslands, oak savannas and oak woodlands by: limiting grazing to the months of October through May, in order to provide summer forage for black-tailed deer; implementing a rotational grazing regime; or implementing a short-duration, high-intensity grazing regime.
- Retain a component of downed trees and branches in oak woodlands in order to provide additional cover for fawns.
- Restore and enhance riparian, lake, pond and wetland vegetation to increase browse and cover.
- Manage shrublands as mosaics to provide a variety of cover and browse opportunities.
- Control feral pig populations through live trapping and shooting.

4. Minimize Cattle Disease Transmission to Deer

Cattle can transmit diseases, such as bluetongue, EHD and P13, into deer populations.

a. Tools.

- Test cattle brought onto both parks and certify that they are free of diseases, such as bluetongue, that can be transferred to deer.
- Contact adjacent property owners regarding initiating a similar program.

5. Maintain Bat Habitat

Abandoned structures provide good roost sites for pallid bat, Townsend's big-eared bat, and long-eared bat. With loss of natural habitat to increasing urbanization and development, man-made structures are becoming important roost sites for bats. Bats need roost areas in which to rest during the day, as well as "nursery roosts" for raising young. Two large barns in Grant County Park provide roosts for several species of bats, including at least three sensitive species. Structures within Levin County Park may also provide roosts for bats. Habitat for bats should be maintained and provided in both parks.

a. Tools.

- Retain existing structures used by bats, for as long as feasible, and provide bat boxes in addition to these structures or as these structures are removed.
- In Grant County Park, maintain the Snell and White barns as long as possible for their value as bat roosts.

6. Protect Avian Nesting Areas

A variety of bird species nest in Grant and Levin County parks. As noted previously, a formal survey of important nesting sites has not been conducted for both parks. However, it is known that the eucalyptus grove west of Grant Lake provides important habitat and nesting sites for great blue heron and other wildlife. Great blue heron are an important wildlife resource that should be protected and encouraged, and the need to protect the eucalyptus grove for herons overrides the desirability of removing the eucalyptus because it is non-native. Formerly, great blue heron nested in other nearby groves, but no nests have been documented in those groves in recent years. This

condition is perhaps due to disturbance associated with the horse stables and the group picnic area.

a. Tools.

- As staffing and budget allow, survey the parks for avian nesting sites.
- Retain the eucalyptus grove.
- During breeding season (February through May), restrict activities near the eucalyptus grove. Consider restricting activities at the horse stables and group picnic area, as well.

7. Maximize Habitat for Native Fish and Amphibians

Riparian corridors, wet meadows, seeps, lakes and ponds are especially important habitat for native fish and amphibians, and this is true of both seasonal and year-round resources. In particular, many native amphibians are dependent on seasonal pools to lay their eggs, for development of tadpoles, and for preventing predation from non-native bullfrogs.

Lakes and ponds also provide habitat for native pond turtles. Where lakes and ponds are subject to stocking with non-native fish, pond turtles need protection from predation.

Good stream habitat for native fish includes the presence of an understory and a dense canopy along streams, that provide shade and keep water temperatures cooler. Loss of understory from grazing and browsing, and increased erosion have all degraded the quality of Calera Creek in Levin County Park and possibly San Felipe and the creeks that run through Deer Valley in Grant County Park.

Non-native bullfrogs have moved into a number of the lakes and ponds on the two parks. Bullfrogs prefer permanent year-round ponds because their larval stage takes longer to complete, generally in the range of six months. Most often, bullfrog tadpoles over-winter before metamorphosing into adults. By comparison, native frog tadpoles transform three to five months after hatching, and therefore do not require permanent water for their reproductive success. Bullfrogs prey on the larvae of several sensitive amphibian species such as red-legged frogs, which can lead to localized eradication. Predation by bullfrogs is thought to have caused the eradication of California red-legged frogs from the floor of the Central Valley and adjacent Sierra foothills (Moyle 1973).

Stocking of warm water game fish is proposed in Grant County Park *Master Plan* for Grant, McCreery, Bass, and Eagle lakes. Non-native fish such as bass prey upon young pond turtles and amphibian larvae, and can virtually eliminate several native species from what would otherwise be suitable habitat if there were no game fish.

a. Tools.

- Conduct focused pond and seep surveys in winter and spring, when most amphibians migrate to ponds to lay their eggs, to determine those ponds that are important breeding areas for sensitive native amphibian species such as California tiger salamander, California red-legged frog, foothill yellow-legged frog, and western spadefoot toad.
 - When considering projects and facilities that may impact ponds, lakes and wetland habitat, conduct focused surveys for sensitive amphibian and native fish species.
 - Manage erosion and revegetate degraded riparian areas.
 - Work with local universities and the California Department of Fish and Game to pursue research on new and effective methods of eradicating non-native bullfrogs.
 - Prioritize removal of non-native bullfrogs based upon the relative importance of ponds for breeding of native amphibians.
 - Control bullfrogs in ponds by gigging (spearing) at night with spotlights early in the winter before the breeding season of most amphibians, seine netting to remove tadpoles, and complete drying down of small ponds. Drying down ponds is the least desirable method since it would only be effective if conducted during the summer when wildlife most need the water and the ability to refill ponds might be uncertain. The most effective control would include a combination of gigging and seine netting.
 - Maintain an ongoing program for bullfrog removal as they are highly mobile and can quickly recolonize an area.
 - Where feasible, do not stock lakes and ponds with non-native fish in order to protect young pond turtles and native amphibian species. However, it should be recognized that stocking with native fish provides an important recreation resource. On Grant County Park do not stock McCreery, Pig, or Eagle lakes.
 - Establish or enhance dense stands of tule in lakes and ponds, especially those subject to stocking of non-native fish, in order to
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provide pond turtles, amphibians and their larvae with cover to help protect them from predation by bullfrogs.

- Protect water resources used by native amphibian and fish species from use by cattle and feral pigs.
- Determine the presence of native fish species in creeks and whether creeks could support native species through surveys and by working with a local university or the California Department of Fish and Game.
- Where feasible, work with the California Department of Fish and Game to restock native fish in creeks.
- Monitor lakes and ponds for the presence of domesticated ducks, if found, control domesticated ducks by trapping and donating them to interested non-profit groups or killing them.

8. Maintain Habitat for Ground Squirrel Populations

Ground squirrels thrive where natural habitat conditions have been modified resulting in removal or substantial reduction of the native ground cover and areas of bare ground or low grasses. The burrow systems they dig for cover are elaborate, with many entrances and connecting tunnels. Ground squirrels are an important food for many carnivores. Their burrows also provide cover for wildlife such as the California tiger salamander and nest sites for wildlife such as the burrowing owl.

Ground squirrels in unusually high densities can present several problems within the parks, including: habitat degradation, structural damage, and potential disease outbreak (such as sylvatic plague among deer and cattle). Reproduction potential is so great in squirrels that as long as preferred habitat exists, ground squirrels will reoccupy the same space and return to former numbers in a short period. Ground squirrels should be controlled only where they are damaging habitat or structures, are causing significant erosion problems, or are a potential nuisance for park users.

a. Tools.

- Restore natural habitat through revegetation of denuded ground by resting the area from cropping and encouraging regeneration of native species.
- Monitor ground squirrel populations and activity in or adjacent to ponds, dams, and drainageways for damage to structures or significant erosion. Establish a management threshold (subject to

staffing and budget) for unacceptable ground squirrel damage and population.

- Destroy burrow systems and control ground squirrel populations if their activities threaten the integrity of the water containment areas or are causing significant erosion. Keep ground squirrel damage within reasonable limits by encouraging predation through the installation of owl boxes and hawk perches near problem areas. Live trapping and poisoning are other management tools. Poison should be used as a last resort. The potential impacts of selected poisons on water quality, carnivores, and vegetation communities should be carefully evaluated prior to application of that method.
- Initiate an on-going monitoring program to evaluate damage and/or the effectiveness of control methods.

9. Control Feral Pig Populations

As described previously, feral pigs are adversely impacting the two parks and surrounding areas. Over the years there has been a dramatic increase in the population of pigs in Santa Clara County. The size of the local population in the two parks varies greatly from year to year depending on rainfall, habitat, and food sources. The pigs can reach several hundred pounds and have no predators in the parks (other than man). The sow has an average of two litters per year with four to six piglets per litter. In high public use areas which are irrigated, making the soil easier to work, pig rootings tend to increase which is a nuisance for park managers and park users.

Confirmed impacts of feral pigs on natural resources include:

- Consumption of native herbaceous species, especially bulbs.
 - Competition for forage with native herbivores such as deer.
 - Continued disturbance of soil and vegetation resulting in the need to manage for and artificially maintain the early successional stages of oaks and other vegetation.
 - Increased probability that invasive non-native plants will move into areas disturbed by the rooting of feral pigs.
 - Consumption of acorns, resulting in decreased seed availability for natural oak regeneration.
 - Decreased water quality resulting from trampling and wallowing in riparian areas, wetlands, and seeps.
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- Disturbance to plant species and wildlife values in wetland habitat areas.
- Increased erosion hazard due to disturbance of soil by their rooting.
- Conflicts with recreational users including intimidating hikers and campers and overturning garbage cans and tables in picnic areas.

Feral pig populations should be reduced in both parks.

a. Tools.

- Tools to control feral pigs can be categorized into two approaches: protection of the resources from the pigs (primarily fencing) or removal of the pigs from the resources (trapping). Trapping of feral pigs to effectively reduce their population is the preferred management tool to control the damage caused by feral pigs. Pig control measures are most effective if intensively applied when the animals are under stress (e.g., during a drought or in the late fall or winter after a poor acorn crop when other foods are limited.)
- Initiate a program to monitor the feral pig population and their effect on park resources.
- Tools to control feral pigs are described in sections A.1. and B.1. of this chapter. Appendix O provides a more complete description of monitoring and management techniques for wild pigs in California.

E. Manage for Wildfire Control

Wildfire is a potential hazard that threatens all the resources in the two parks to some degree. Generally, the natural resources within Grant and Levin parks are well adapted to fire, but there are some concerns regarding grassland fires and the consequences of intense fires. Improvements, including trails, structures, residences, facilities, and historic structures, are also at risk from wildfire. Trails can suffer from erosion following a fire if adequate erosion mitigation measures have not installed. Fires might also cross park boundaries and damage resources outside of the park. Houses are generally the most valued resource at risk from wildfire.

Grass has the greatest ignition potential which is exacerbated by human access and activity. Large portions of public roads are bordered by grass. Roadside

ignitions are the cause of 80 percent of fire ignitions in California. Powerlines are also a concern because they can cause fires, especially during dry windy conditions. Thatch buildup in non-native grasslands can contribute to an increased intensity of wildfire and the speed with which wildfires move through grass. However, grasslands are generally the easiest areas in which to stop the progression of wildfires.

Fires in shrublands are generally not very intense because surface fuel loads are light if the shrubs are young with very little dead material, and the foliage contains little volatile material. However, older unmanaged shrublands (especially dense stands of coyote brush/poison oak) can build a considerable amount of woody fuel, which presents an increased danger from fire.

The major purpose in using prescribed fire in oak woodlands is to remove some of the leaf litter, grass, brush and scrub understory and "pockets" of plentiful fuel that can burn fiercely. Avoiding damage to the tree canopy and the torching of individual trees are generally the greatest concerns when using prescribed fire in woodlands. Oak savannas that have grass understories are characterized as grassland fuel types because the oaks within savannas generally would not contribute much to fire behavior. They are too large to ignite easily, and the height at which branches start is generally too high to be involved in the fire.

The following are some concerns with prescribed burning. Trees within oak savannas and woodlands weakened from other environmental stresses, such as trampling, soil undercutting or drought, tend to be more prone to damage from fire, and oaks under these stresses in the parks might succumb to an intense fire. Other resources potentially at risk from an intense fire are riparian vegetation communities along creeks and ponds that might be inundated with erosion sediment caused by a wildfire.

Appendix P contains a more detailed description of wildfire factors and control on Grant and Levin County Parks.

1. Tools

- Manage thatch in grasslands by grazing, prescribed burning or by cropping and removing the thatch. For wildfire management, thatch buildup needs to be removed at intervals of about once every six years, depending on growing conditions. (When managing thatch for other reasons, prescribed burning may need to occur at shorter intervals.)
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- Mow or weed-whip a 30-foot-wide strip around the campground in Grant County Park and around all other recreation areas once each year immediately after the grass cures (approximately mid-April to mid-May). Vista prune as well.
 - Mow or weed-whip a 30-foot-wide strip around all park structures once each year immediately after the grass cures.
 - In addition to mowing or weed-whipping around the perimeter of campgrounds, remove understory shrubs and prune trees (vista-prune) to a height of eight to ten feet for a distance of 100 feet around the perimeter of campgrounds. Pruning can be done at any time of the year; however, power equipment should not be used during dry weather. Remove shrubs at intervals of once every ten to 20 years. Prune trees at least once every 20 years.
 - Strengthen public roads in their capacity to act as fire breaks. Mow or weed-whip a ten-foot-wide strip along both sides of major paved roads at least once every year shortly after the grass cures (mid-April to mid-May). Contact Caltrans, which already has a program to mow its facilities, to coordinate with them concerning the desired width of the mown area and preferred timing of mowing. Vista-prune trees and remove understory shrubs for 30 feet along the public roads to enhance emergency access.
 - Strengthen those internal roads used as fire breaks and for emergency access. Mow or weed-whip a 15-foot-wide strip along both sides of internal roads that provide vehicular access and emergency access to structures or facilities, especially in woodland areas. Vista-prune trees and remove understory shrubs within this 15-foot wide strip.
 - Protect the external boundaries from fire spread onto and off of parkland where feasible due to slope and vegetation conditions. In grasslands mow a 15-foot-wide strip with a flail mower along the boundaries once every year shortly after the grass cures. Do not disc park boundaries. In shrublands and woodlands along the boundary, monitor for fuel loading and manage potential fire conditions by mechanical or manual control methods.
 - Amend fire management plans to designate areas where heavy equipment and fire-fighting activities should be off-limits during emergencies to protect sensitive resources such as rock outcroppings; wet meadows, springs, seeps and ponds; steep
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slopes; sensitive vegetation areas; sensitive biological areas; and sensitive cultural resource areas.

- Manage the understory of the black oak, valley oak, mixed oak/foothill pine and mixed coast live oak woodlands by prescribed burning to minimize the potential for wildfire. The intervals at which to burn the understory of these oak woodlands vary depending on species and weather conditions (see Appendix P).
- Prescribed burning in shrublands to control for wildfire should occur once every ten years.
- Control the timing of prescribed burning in areas which are most open to public view so that burning takes place when vegetation growth after the burn will be most rapid.

Chapter VII
PARKWIDE ISSUES
RESOURCE MANAGEMENT PROGRAM

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This chapter provides a resource management program for parkwide issues that concern both Grant and Levin County parks. In the following chapters, management and implementation programs for specific areas in Grant and Levin parks will be provided.

Five parkwide management issues are described in this chapter; feral pig population control, ground squirrel population control, oak regeneration, wildfire prevention, and recreational management. Specific actions regarding these issues for Grant County Park and Levin County Park are included in the management programs for these issues.

The sections in this chapter are organized in the following manner: first a management program is described; next, specific actions are recommended, and finally estimated costs are provided. The costs provided are preliminary and based on existing information. Actual costs may vary significantly depending on conditions at the time of implementation.

A number of management objectives are parkwide in their application. These objectives are listed below and are not repeated within the management program chapters for Grant and Levin parks.

- Maintain or enhance recreational uses and facilities.
- Reduce feral pig damage to natural resources.
- Reduce impacts of feral pigs on recreation facilities.
- Manage vegetation resources to prevent wildfire.
- Control existing infestations of non-native plant species.
- Prevent new infestations of non-native plant species.
- Increase native species biodiversity and wildlife habitat.
- Promote oak regeneration, especially for oak savannas, valley and black oak woodlands.

- Reduce ground squirrel damage to park resources.
- Manage grasslands and oak savannas to control grass height, thatch formation, and species composition.

A. Feral Pig Control

As described previously in Chapter VI, feral pigs cause considerable damage to resources within Grant and Levin County parks.

1. Management Program

Management of feral pig populations requires yearly eradication in order to reduce populations to reasonable levels. If population management does not produce satisfactory results, then a combination of pig-resistant perimeter fencing and population control may be required. This report recommends population control as a first step.

It would be expensive to construct pig-resistant fencing around the perimeter of either park. The approximately 20 miles of pig-resistant fencing needed for Grant County Park would cost approximately \$528,000 at \$26,400 per mile. The approximately 10 miles of pig-resistant fencing around Levin County Park would cost about \$264,000 at \$26,400 per mile. Even if pig-resistant fencing were erected, control of feral pig populations would still be needed until populations were eradicated, and then populations would need to be monitored.

Population models predict that at least 70 percent of the feral pig population must be eliminated annually in order to result in a stable population for the following year. The goal for Grant and Levin County parks should be to reduce pig populations on the two parks by 70 to 80 percent.

While there are no counts of feral pig populations on the two parks, estimates range to as high as 20 pigs per square mile in some parts of California. At 20 pigs per square mile, there could be as many as 300 feral pigs within the nearly 15 square miles of Grant County Park, and approximately 40 feral pigs in the nearly two square miles of the portions Levin County Park being studied. Actual populations could be higher or lower than these estimates. Reducing the pig population to approximately five pigs per square mile is a recommended goal.

a. Actions.

- Beginning in year one, negotiate a memorandum of understanding with the California Department of Fish and Game to issue Depredation Permits for feral pig control programs on the two parks.
- In year one, negotiate memoranda of understanding with adjacent property owners regarding cooperation on area-wide pig control programs.
- In year one, remove approximately 225 feral pigs from Grant County Park through a live trapping and killing program. (See Appendix O.)
- In year one, remove approximately 30 feral pigs from Levin County Park.
- Annually monitor and evaluate effectiveness of feral pig population management program by visual inspection of damaged areas.
- Continue feral pig elimination program from Grant and Levin County parks for four more years after year one. Remove approximately 70 percent of the feral pig population each year, or until the population is maintained at a maximum of five pigs per square mile.
- After year one maintain cooperative agreements with adjacent property owners regarding management of feral pig populations, or until the population is maintained at a maximum of five pigs per square mile.
- After five years of pig population control and monitoring, begin fencing areas still experiencing significant damage by feral pigs.
- After the fifth year, continue pig control program (trapping/depredation) on a yearly basis, as necessary, to reduce the feral pig population to a density of approximately five pigs per square mile or less.

a. Costs. Ongoing costs for feral pig management are likely to drop each year, but this decrease cannot be estimated without an analysis of the effectiveness of the previous year's efforts. While costs may vary from year to year, for budgeting purposes costs can be estimated to decrease 10 percent per year based upon estimated year-one costs, until they level out at the end of five years at 50 percent of year one costs.

- Grant Park year one: 225 feral pigs @ \$150 per feral pig = \$33,750

- Levin Park year one: 30 feral pigs @ \$150 per feral pig = \$4,500
Total estimated year-one costs : \$38,250
- Total estimated year-two costs: \$35,500
- Total estimated year-three costs: \$31,000
- Total estimated year-four costs: \$27,000
- Total estimated year-five costs: \$23,000
- Annual estimated costs after year five for monitoring and hunting/trapping: \$20,000
- Costs for fencing after year five, assume \$5.00 per foot of pig-proof fencing.

B. Ground Squirrel Monitoring and Control

As described previously in Chapter VI, large colonies of ground squirrels can cause considerable damage to park structures such as dams and trails, and can be a nuisance in active recreation areas within Grant and Levin County parks.

1. Management Program

Management of ground squirrel populations requires yearly monitoring and, if damage levels are significant, elimination in order to reduce populations to reasonable levels.

a. Actions.

- Monitor ground squirrel populations and activity through visual reconnaissance and recording of population numbers and burrowing activity.
 - Establish a management threshold for unacceptable population and/or damage to resources or facilities.
 - To control squirrels, destroy burrow systems, encourage predation, implement a live trapping program, consider using poison.
 - Continue ongoing monitoring program.
 - See Section D.8. in Chapter VI for specific management actions that can be applied to Grant and Levin County parks concerning monitoring and control of ground squirrel populations.
-

- b. Costs. Potential costs associated with a monitoring and control program are approximately \$200 per year for each park. The monitoring program can be included in the feral pig population monitoring program cost.

C. Oak Regeneration

As described previously in Chapter VI, Section A, many oak woodland communities exhibit low rates of natural oak regeneration although there is no one specific cause for the apparent decline. Factors that inhibit seedling growth and development include acorn consumption, browsing, grazing, feral pig activity, insect activity, competition by non-native grasses, thatch buildup, wildfire suppression efforts, and changes in land use practices.

1. Management Program

Efforts to promote oak regeneration on Grant and Levin parks can be maximized by creating cool and shaded conditions for oak seedlings that are not invaded by thatch, not cropped by grazing or mowing, not excessively browsed, foraged or damaged by trampling.

a. Actions.

- Protect oak seedlings with reinforced wire cages; grow and plant acorns and seedlings from local genetic stock; fence limited, specified regeneration areas to protect seedlings from cattle, deer, and feral pigs; control feral pig populations.
- Work with volunteers and interested groups that are willing to undertake seedling protection and planting programs.
- Periodically evaluate oak regeneration on the parks; use the "Decision Key for Oak Regeneration Assessment" (Appendix M).
- See Section A.1.a in Chapter VI for specific management actions that can be applied to Grant and Levin County parks concerning oak regeneration efforts.

- b. Costs. Potential annual costs associated with an oak regeneration and monitoring program are approximately \$3,000 for Grant County Park and \$200 for Levin County Park.

D. Wildfire Management

Wildfire is a potential hazard that threatens Grant and Levin County parks. This hazard has been discussed previously. The Grant County Park Master Plan contains a description of a Fire Management Program (see Section 4.4.2.3.). Appendix P of this report contains detailed information on wildfire factors and control. Chapter V, Section C of this report contains a description of the actions and timing associated with prescribed burning, and Chapter VI, Section E of this report contains a description of wildfire management and control tools to be used to prevent wildfires.

1. Management Program

Those actions which are specific to Grant or Levin parks are included in the following management program.

a. Actions.

- Manage campgrounds for ignition prevention and to slow invasion of poison oak or other noxious weeds. When grass cures, annually mow or weed whip (using hand-carried weed-whipper) grasslands and brush around all campgrounds and for 30 feet beyond the most exterior campsite. For 100 feet beyond the most exterior campsites, remove understory shrubs and dead vegetation (treat shrub regrowth in 10 to 20 years), and vista prune trees to a height of eight to 10 feet using a mechanized pole saw (pruning should occur in 20 year intervals, see Chapter V, Section F of this report).
- Manage exterior roads including Mount Hamilton, Quimby, Calaveras and Downing roads for wildfire by requesting Caltrans to increase width of mown area to 10 feet on both sides of the road. When grass cures, annually mow fire prevention strip. County staff should selectively remove shrubs within the 10-foot strip so that heavier equipment need not maneuver around the individual shrubs. Where woodlands or shrublands are located adjacent to the roads, remove understory shrubs every 10 to 20 years and vista prune trees every 20 years to a height of eight to 10 feet within approximately 30 feet from the road.
- Manage internal paved roads for wildfire by annually mowing a 15-foot strip along all internal roads. Ensure that shrubs within the 15-foot strip are kept free of dead material or removed.
- Manage structures and inholdings for wildfire by annually mowing and weed-whipping an area of 30 feet around structures when the grass

cures. Shrubs and trees within 30 feet of structures should be free of dead material.

- Manage trails along western and southeastern boundaries of Levin County Park for wildfire by annually using a flail mower to create a fire break 15 feet wide on either side of trails adjacent to park boundaries. Enter into an agreement with EBRPD to mow the portion of Agua Caliente Trail that falls outside Levin Park.

b. Costs.

- Treating grasslands around campground areas can be done by two staff in two days (\$1,000). Treating shrubs and vista pruning around campgrounds can be done in approximately 20 person days per acre.
- Mowing grasslands around structures and paved internal roads on Grant Park can be done in approximately four days (\$1,000).
- A flail mower can treat the trails, paved roads, and boundary firebreaks on Levin Park in two days (\$500).
- Mowing grasslands and providing firebreaks around structures on Levin park can be done in approximately two days (\$500).

E. Recreational Management

1. Management Program

The resource management program provided in this document should be friendly to the recreational users of the parks. The following recommended actions enhance recreational use or minimize recreational impacts.

a. Actions.

- Park visitors will be provided advance notification of all resource management practices that affect park use - i.e., rotational grazing schedule, pig population control, prescribed burn program, etc. Recommended notification methods include providing interpretive pamphlet information distributed at each park and at the Park Administration Building, posting information on park bulletin boards or press releases.
 - Grazing will not be allowed from June through September at Grant Park and from August through December at Levin Park to allow visitors periodic unimpeded access.
-

- Where possible, prescribed burning will be scheduled during the non-peak recreational season to minimize impacts to park visitors. Some burning may be required during the summer and spring to control non-native infestations or reduce fuel load in woodlands. Burning during the high use period will require intensive notification to ensure that the public understands the precautionary actions to be taken and the reasons for implementing the burn program.
 - Relocate fencing and gates, wherever possible, to minimize barriers along trails and other recreational use areas.
 - Locate fencing so as to minimize disruption of the visual character of the area for recreationists by placing it behind topographic features and vegetation whenever feasible.
 - Relocate water troughs 50 feet or more from trails to lessen the potential for cattle and horses to congregate on trails, thereby reducing trail blockage, hoof damage to trails and manure deposits on trails.
 - Lock open gates located in fields not in use for grazing. Place signage on gates which indicates gates to be closed by user unless locked open.
 - Provide 5'-0" to 6'-0" wide gates with easy opening devices for ease of trail use.
 - Install culverting and fencing improvements at trail/creek intersections to reduce the number of barriers to trail use.
 - Revise park brochures to indicate that cattle may be seasonally present in the park to meet the objectives of managing grassland health and reducing fire hazards, and that all grazed lands are open for public use. Include points of etiquette regarding gate closure and public contact with cattle.
- b. Costs. Cost actions described above are included in the estimated annual costs described for specific actions on Grant and Levin parks presented in the following chapter.

Chapter VIII
GRANT COUNTY PARK
RESOURCE MANAGEMENT PROGRAM

■ ■ ■

The following is a description of the management program for Grant County Park. The description of management issues and tools in this chapter is abbreviated. More complete descriptions of the management issues related to each type of resource are included in earlier chapters of this report. These more thorough descriptions of issues should be referenced if additional information is desired.

For the purposes of this report, Grant County Park has been divided into eight management areas that are comprised of fields which share common resources and management issues. In this chapter, the management and implementation program for each management area in Grant County Park is described separately.

The sections in this chapter are organized in the following manner: first the primary management objective(s) are presented; next, for each management area, recommended management actions organized by resource management issue are described; finally, implementation recommendations for projects are presented in a matrix format. The matrix summarizes actions, location, phasing, timing, quantity, and costs.

A. Grant Lake Management Area

Lake and Tiernan fields are included within the Grant Lake Management Area. Important natural resources in this area include Grant and McCreery lakes and the riparian vegetation surrounding the lakes. The Grant Lake Management Area and its recommended management program are shown on Figure 17.

1. Objectives

The following objectives relate to management issues within the Grant Lake Management Area.

- Restore Grant Lake riparian and wetland vegetation.
- Encourage seasonal waterfowl in Grant Lake and McCreery Lake.
- Encourage nesting of great blue heron.
- Control encroachment of coyote brush/poison oak scrub around Grant Lake.
- Protect native amphibians and pond turtles in Grant and McCreery Lakes.
- Restore McCreery Lake riparian and wetland vegetation.
- Promote oak regeneration on east side of Grant Lake.
- Maintain recreational fishing at Grant Lake.

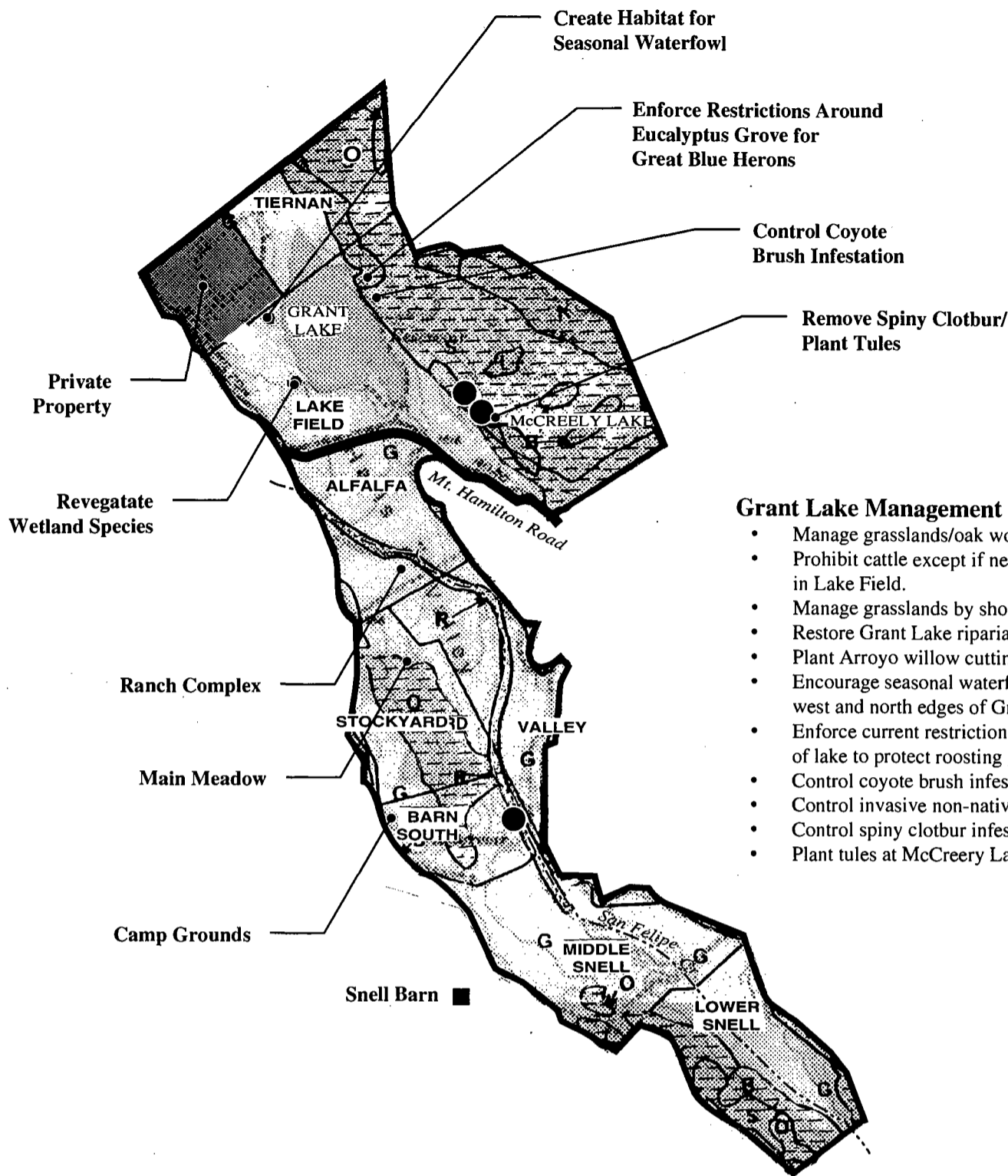
2. Resource Management Program

The following is a description of the recommended management actions organized by issue or area for the Grant Lake Management Area. Table 3 contains a summary of actions for this Management Area.

a. Grasslands and Oak Savannas. Cattle have been excluded from the area surrounding Grant Lake. For a number of reasons described earlier in this report, rotational grazing is not the most appropriate management tool for this area, although spot grazing may be considered a useful tool during the dry season.

(1) Actions.

- Use prescribed burning as the primary means of managing the vegetation in Lake Field. Burn Lake Field grasslands and oak savanna approximately every three to five years in the fall.
 - Between burns, monitor grasslands for non-native plant infestations.
 - During seasons of high rainfall and considerable vegetation growth, prescribed burning can be supplemented by annual mowing, when the grass cures, to reduce grass height and control thatch buildup.
-

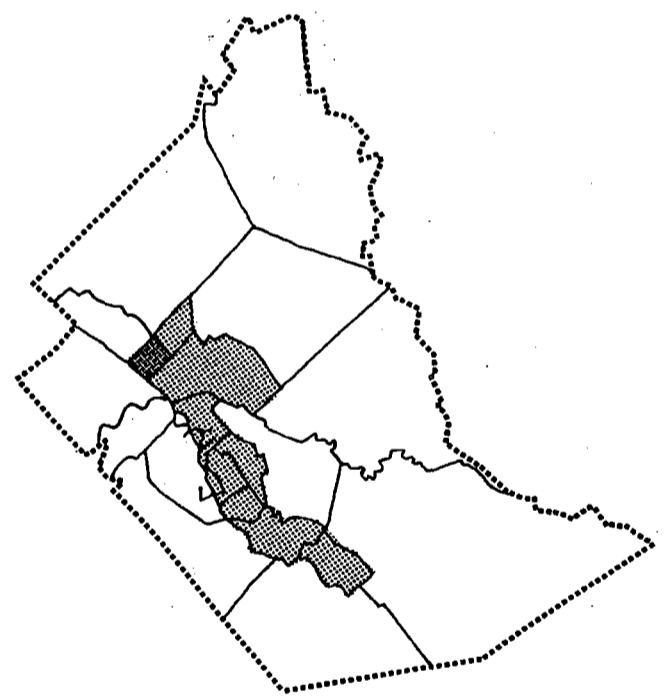


Grant Lake Management Area (Lake and Tiernan Fields)

- Manage grasslands/oak woodlands by burning in Lake Field.
- Prohibit cattle except if needed for high-intensity spot grazing in Lake Field.
- Manage grasslands by short term grazing in Tiernan Field.
- Restore Grant Lake riparian and wetland vegetation.
- Plant Arroyo willow cuttings on south end of Grant Lake.
- Encourage seasonal waterfowl by mowing grasslands on the west and north edges of Grant Lake.
- Enforce current restrictions around eucalyptus grove east of lake to protect roosting great blue herons.
- Control coyote brush infestation on the east shore of Grant Lake.
- Control invasive non-native plants around Grant Lake.
- Control spiny clotbur infestation at McCreery Lake.
- Plant tules at McCreery Lake.

Halls Valley Management Area (Alfalfa, Stockyard, Barn South, Valley, Middle and Lower Snell Fields)

- Eradicate yellow starthistle and other invasive non-native plants in Valley grasslands.
- Manage Halls Valley burning.
- Manage a portion of the Valley through revegetation of native grasslands program.
- Prohibit cattle except if needed for high-intensity spot grazing.
- Control encroachment of scrub on the open valley floor by burning and manual control.
- Limit non-native ornamentals to the areas immediately surrounding the ranch headquarters and living areas.
- Monitor San Felipe Creek riparian areas for revegetation.
- Retain Snell barn as bat roosting area.
- Relocate fences along Lower Hotel, Corral and San Felipe trails to allow unimpeded trail access.



LOCATION MAP

..... New Fences

● Ponds and Seeps(Springs)

■ Private Property

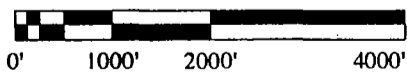


FIGURE 17

Grant Lake and Halls Valley Management Areas

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

LEGEND

- G** Non-Native Grassland
- Oak Woodland**
- S** Oak Savanna
- O** Mixed Oak Woodland
- K** Black Oak Woodland
- L** Coast Live Oak Woodland Mixed
- P** Oak/Foothill Pine Woodland
- V** Valley Oak Woodland
- B** California Bay Laurel/Coast Live Oak Woodland
- Shrubland**
- D** Diabian Sage Scrub
- C** Coyote Brush/Poison Oak Scrub
- Riparian and Wet Meadow**
- A** Alder/Maple Riparian
- R** Willow Riparian
- M** Wet Meadow Riparian

Table 3
GRANT LAKE MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|----------------|--------------------|--|--|--|-----------------------|------------------------------------|-----------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Burn grasslands/oak savannas | Lake | 1 | Fall | 3-year interval | CDF BAAQMD Neighbors | 303 acres | \$9/acre | \$2,727 |
| Short term grazing | Tiernan | 1 | Oct 1-Oct 7 Feb 22-Mar 1 May 22-May 31 | Annually | Licensee | 64 acres 46 AUMs | \$12/AUM | \$550 est. rev. |
| Revegetate Grant Lake | Lake, Tiernan | 1 | Spring & Fall | Once/monitor as appropriate | Volunteers CDFG | 10 acres | \$5,000 est. | \$5,000 |
| Burn and manually control scrub infestation Promote oak regeneration | Lake | 3 | Spring-Fall | 2 successive years/ annual touch up | CDF BAAQMD Neighbors Volunteers | 2 acres | \$9/acre/burn \$120/acre/manual | \$258 |
| Protect/Monitor great blue heron nest site | Lake | 1 | Feb - May | Annually | -- | 1 acre | -- | -- |
| Manage eucalyptus grove | Lake | 1 | June - Jan | Annually | -- | 1 acre | -- | -- |
| Manually control exotic plants at McCreery Lake, consider revegetation program | Lake | 2 | Spring | Monitor for 3 years | Volunteers | 1 acre | \$1,000 est. | \$1,000 |
| OPTIONAL PROGRAM | | | | | | | | |
| Spot grazing | Lake | 1 | Oct 1-Nov 31 | Annually, or as needed | Licensee | 293 acres 264 AUMs | \$12/AUM | Varies |
| Mow grasslands for waterfowl | Lake | 2 | Fall | Annually | -- | 10 acres | \$15/acre | \$150 |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.

- Use short term grazing in Tiernan Field in both the Spring and Fall. Tiernan Field could be grazed for a period of one week in early October, late February and in late May, at a level of 46 animal unit months (AUMs). Strict monitoring is required to protect aquatic resources and shorelines given the intensity of use during this period.
- High-intensity and spot grazing can also be used to manage grasslands in Lake Field. Under this management scenario, Lake Field could be grazed during a two month period from October 1 through November 31 at a level of approximately 264 animal unit months (AUMs). Grazing would need to be strictly monitored during this time (at least once a week) to ensure that cattle were not causing too much damage to riparian resources.

b. Grant Lake Riparian and Wetland Vegetation. The riparian and wetland vegetation around Grant Lake needs restoration. Marsh areas, willow thicket riparian areas, wet meadow habitat, and coast live oak riparian areas in and around the lake are in need of restoration and provide little cover for wildlife. The western boundary of the lake is especially degraded and needs to be planted with appropriate wetland species. Invasive non-native plants (primarily spiny clotbur and yellow starthistle) have begun to encroach upon the shore of Grant Lake and should be removed.

(1) Actions.

- Plant arroyo willow cuttings along the southern boundary of Grant Lake in the fall.
 - Revegetate the western boundary of the lake with appropriate wetland species to include common rush, sedge and spike rush salvaged as clumps during their winter dormancy and transplanted immediately. Maintain the revegetation plantings by controlling erosion, weeding, replacing dead plants, and providing supplemental watering as needed.
 - Plant dense tules along the southern and western lake edge as a refuge for pond turtles.
 - Control invasive non-native plants within the riparian revegetation zone using hand control and the Bradley method of removal (see Chapter V, Section F). Hand control of invasive species is required in riparian areas because mechanical control or burning could harm sensitive riparian resources.
-

- Annually monitor areas where invasive non-native plants have been controlled and remove them as necessary.
- Continue to restrict fishing on the western shore at Grant Lake to protect environmental resources.
- Implement the Master Plan's Grant Lake Vegetation Enhancement Zone Program.

b. Seasonal Waterfowl at Grant Lake. A variety of waterfowl, in particular Canada Geese, are residents of or seasonal visitors to Grant Lake. Canada geese prefer short, open stands of grass.

(1) Actions.

- Use prescribed burning and annual mowing to produce the short stands of grass that Canada geese and other seasonal waterfowl prefer. Each year, burn (or mow if during the years in between burning interval) grasslands west and north of the lake to encourage winter waterfowl habitat. If burning is impractical due to weather or other constraints, limited spot grazing or mowing can be used in lieu.

c. Great Blue Heron Nest Sites. The eucalyptus grove east of Grant Lake provides important habitat and nesting sites for great blue heron and other wildlife. Great blue heron are an important wildlife resource that should be protected and encouraged, and the need to protect the eucalyptus grove for herons overrides the desirability of removing the eucalyptus because it is non-native. Formerly, great blue heron nested in other nearby groves, but no nests have been documented in those groves in recent years. This condition is perhaps due to disturbance associated with the horse stables and the group picnic area.

(1) Actions.

- Retain the eucalyptus grove and the current restrictions around the grove, as recommended in the Master Plan.
 - During breeding season (February through May), restrict high intensity activities such as group events near the grove.
-

d. Eucalyptus Grove. Eucalyptus present a high danger in the event of wildfire, and the eucalyptus grove needs to be managed to reduce this danger.

(1) Actions.

- Management of the eucalyptus grove includes trimming the lower branches and removing the seeds and duff that accumulate on the ground approximately every three years.

e. Oak Woodlands and Shrublands in Lake Field. Coyote brush and poison oak and invasive non-native plants have begun to encroach upon the east bank of Grant Lake. Scrub encroachment is threatening oak regeneration.

(1) Actions.

- To remove approximately 50 percent of the coyote brush on the east shore of the Grant Lake, burn the scrub areas for two consecutive years in the fall. In the spring, given the relatively limited extent of this infestation, remaining coyote brush should be removed by hand-digging or with a weed wrench. Remove when the plants are not in flower, in order to remove the crown and prevent sprouting. Plants are easiest to uproot in spring when the soil is moist. Conduct intensive removal efforts for two successive years in order to bring the coyote brush infestation under control. Try to get volunteer labor to accomplish this task. After two years, burn the scrub area at three-year intervals and manually control as necessary.
- Where scrub infestations have been removed, plant coast live oak seedlings, collected on the park or grown from collected acorns, spaced at 10-foot triangular spacing around the eastern perimeter of Grant Lake to replace the loss of coyote brush, and to establish oaks around the perimeter of the lake.
- Commit to a two-year program of coyote brush removal before committing resources to this program. Other actions (such as prescribed burning) can be undertaken as funding permits, and do not necessarily carry with them this two-year commitment to action.

f. Amphibians and Pond Turtles in Grant Lake. Grant Lake is subject to stocking of warm water non-native fish for recreational fishing purposes. Warm water non-native fish prey upon young turtles and native amphibians.

(1) Actions.

- Protect pond turtles and native amphibians by establishing dense stands and clumps of tule around the lake. Incorporate this effort into the revegetation program.

g. McCreery Lake Riparian and Wetland Vegetation. The riparian willow vegetation community at McCreery Lake has been infested by spiny clotbur and other exotic plants.

(1) Actions.

- Control spiny clotbur and other invasive non-native plants in the willow habitat of McCreery Lake by hand-pulling in the spring when the soil is moist. Alternatively, the plants may be removed by hoeing the soil to a depth of two inches below the ground level before the plants set seed. Care should be taken not to disperse seed, and plants that have formed burs should be bagged and removed.
- The lake should be monitored annually for three years following the initial removal, and any plants or seedlings of non-native plants should be removed by hand-pulling invasive non-native plants as necessary. Try to establish a volunteer group for this action.

h. Amphibians and Pond Turtles in McCreery Lake. Do not reestablish the fish stocking program at McCreery Lake because of fish predation of pond turtles and native amphibians.

(1) Actions.

- Protect pond turtles and native amphibians by establishing dense stands of tule in the lake.

3. Expected Results

The management recommendations for the Grant Lake Management Area can be expected to greatly enhance the habitat value of the area and to add significantly to the diversity of plants and wildlife in the park. They will also enhance the recreational and visual values of Grant Lake and McCreery Lake.

B. Halls Valley Management Area

Alfalfa, Stockyard, Barn South, Valley, Middle Snell, and Lower Snell fields are within the Halls Valley Management Area. Important natural resources in this area include the Halls Valley grasslands, and San Felipe Creek. The Halls Valley Management Area and its recommended management program are shown on Figure 17.

Halls Valley, a visually-contained, visually-unified landscape, contains the greatest concentration of recreational facilities in Grant County Park, and is the heart and central focus of the park. Halls Valley contains the park headquarters, major maintained open spaces, parking and restrooms. The Master Plan acknowledges the importance of Halls Valley, and stresses the importance of maintaining its open, cohesive quality.

Cattle have been excluded from Halls Valley for a number of years. The park Master Plan specifies that management of the valley by grazing would not be in keeping with the desired character or intense recreational use of the valley.

1. Objectives

The following objectives relate to management issues within the Halls Valley Management Area.

- Maintain Halls Valley's open quality.
- Remove the infestation of yellow starthistle within the grasslands of Halls Valley.
- Control encroachment of coyote brush/poison oak scrub within the Valley, oak woodlands and along trails.
- Restore riparian vegetation along San Felipe Creek.
- Maintain and enhance bat habitat.
- Maintain historic gardens at the Grant Ranch House facilities.
- Control erosion along the San Felipe Trail.
- Improve recreational access along Lower Hotel, Corral, and San Felipe trails.

2. Management Program

The following are specific recommendations for the Halls Valley Management Area. Table 4 provides a summary of management activities for this area.

a. Grasslands. The grasslands of Halls Valley are a contained, strong visual unit that forms the heart of the park. This open, unified character should be maintained. Grasslands in Alfalfa and Valley fields, where more intensive recreational uses take place, are managed by mowing.

Large portions of the valley grasslands have been infested with invasive non-native plants, especially yellow starthistle, which are forming near monocultures in many areas. This program assumes that control of invasive non-native plants is needed in Alfalfa, Stockyard, Valley, Barn South, Middle Snell, and Middle and Lower Snell Fields, a total of 470 acres, exclusive of riparian areas. The program for controlling invasive non-native plant species presents an opportunity to establish native grasslands to replace eradicated species.

(1) Actions.

- There is an opportunity to select portions of fields to be used as pilot programs for the management of grasslands and starthistle. These different programs could be implemented and monitored over approximately six years. The eradication programs could emphasize: 1) repeated controlled burning in three year intervals, 2) intensive short-term grazing on an annual basis, 3) burning and herbicide application in conjunction with native grassland reseeding or revegetation.
- For the prescribed burning program, if there is enough dry material to carry a fire, burn Halls Valley and adjacent infested areas from June through October. See Appendix K for more specific information on a starthistle control program. Prescribed burning can be augmented by herbicide application in May through August, grazing in May and October, biological control using insects, and planting of preferable species to out-compete starthistle populations. Appendix K provides a thorough description of control methods. All fields are suitable for prescribed burning in combination with the other management techniques.

Table 4
HALLS VALLEY MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|---|--------------------|-----------------------|---|--|-----------------------|--|-----------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Burn grasslands, consider herbicide application, biological control | All fields | 1 | Summer-Fall | Burn/3 year intervals Herbicide/as needed | CDF BAAQMD Neighbors | 468 acres | \$9/acre/burn \$40/acre/herbicide | \$4,212 min. |
| Burn non-native plants/revegetate with native grasslands | Middle Snell, Alfalfa | 1 | Annual 5-year program | Annually - see Appendix K | Volunteer | 15 acres | \$40-45,000 Year 1 \$975 Year 2 \$6,150 Year 3 \$1,725 Year 4 \$1,000 Year 5 | Varies |
| Burn/manually control scrub within woodlands/grasslands | All Fields | 2 | Spring & Fall | 2 successive years/ every 5-10 years | CDF BAAQMD Neighbors Volunteers | -- | \$9/acre/burn \$120/acre/manual control | Varies |
| Control scrub along trails with herbicides/manual control | All Fields | 1 | Summer | Annually | -- | -- | \$15/750 sq.ft. | Varies |
| Monitor San Felipe Creek corridor, consider revegetation program, implement enhancement program | Alfalfa, Valley, Barn South, Middle Snell | 1 | Spring-Summer | Annually monitor, once for revegetation program. See Master Plan. | CDFG Volunteers | 50 linear feet | \$120 est./monitor \$5,000 est./revegetation | \$5,120 |
| Implement Green Barn area/San Felipe Creek bank stabilization | Alfalfa | 1 | Spring-Fall | See Master Plan | CDFG | 1 acre | -- | -- |
| Monitor Snell Barn for safety and bat habitat | Barn South | 1 | -- | Annually | -- | 1 barn | -- | -- |
| Relocate fence along Lower Hotel, Corral, and San Felipe trails | Corral, Middle and Lower Snell | 1 | Spring-Fall | -- | Licensee | 6,600 linear feet | \$20,000 est. | \$20,000 est. |
| OPTIONAL PROGRAM | | | | | | | | |
| Short term grazing | Lower and Middle Snell, Barn South | 1 | May and Oct | Annually, or as needed | Licensee | 238 acres 218 AUMs | \$12/AUM | Varies |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.

- Short term, intensive grazing, otherwise known as spot grazing, can occur in the fall when fields are driest or during the bolting stage for star thistle, which typically occurs from May through June. Spot grazing by cattle must be carefully timed and monitored so that it achieves vegetation management objectives and does not negatively impact recreation activities. Water must be available for cattle. Lower Snell, Middle Snell, and Barn South are appropriate for spot grazing at a level of approximately 200 AUMs.
- As part of the management of grasslands in Halls Valley and to assist in prevention of invasive non-native plant infestations, native grasses can be reestablished in the valley. A successful program of native grass establishment could become a source of native grass seeds for restoration and overseeding on the two parks, and has the potential to become a seed source for other restoration projects as well. Appendix K: Control of Starthistle provides a step by step three-year action program for the control of starthistle and the revegetation of native perennial grassland. Alfalfa and Middle Snell fields are appropriate for this management technique. Middle Snell Field is adjacent to the large area of existing native grasslands in Corral Field. The fence between Corral and Middle Snell fields should be moved to include the native grasslands in Middle Snell Field.
- Do not begin the native grass revegetation program in Halls Valley until adequate native perennial grass seed is available to seed cleared areas, and unless the recommended procedures can be continued for the recommended minimum three years.
- Manage Halls Valley in patterns that match the natural form of the valley. This can best be accomplished by following contour lines. Where fences must be constructed, place fences to follow contour lines as much as possible. Use similar patterns for other management, as well. As fences need replacing over time, place them to follow contour lines, as well.

b. Shrubland Encroachment. Coyote brush and poison oak have begun to encroach on the Halls Valley grasslands, oak woodlands, and trails.

(1) Actions.

- Burn scrub areas along with grasslands in order to lessen the amount of plant material that would otherwise need to be hauled away.
- The year following the initial burn, heavy coyote brush infestations in grasslands must be removed again by burning, hand-digging, or weed wrenching when the plants are not in flower, in order to remove the crown and prevent sprouting. Plants can most easily be removed by hand in spring when the soil is moist. Removal efforts need to be conducted for two successive years if coyote brush is to be brought under control with any success. Following the initial two-year treatment, control can be reduced to five-year intervals.
- In oak woodlands, prescribed burning to control scrub infestation can occur approximately every 10 years after the initial two consecutive years of control.
- Remove scrub that is encroaching on trails through manual control or the selective use of herbicides.

c. Developed Recreation Areas. Halls Valley contains the majority of developed recreation facilities in Grant County Park.

(1) Actions.

- Relocate fences along Lower Hotel, Corral and San Felipe trails to allow unimpeded access along a popular trail loop. Fence with barbed wire.
- Generally continue to manage the developed recreation areas of Halls Valley as currently done. See Section A.3 in this chapter for a discussion of wildfire prevention actions in developed areas.
- Restrict ornamental non-native plants to those that currently exist in the gardens around the ranch house and the Bonhoff House.
- Control erosion along San Felipe Trail as per Master Plan recommendations, including realigning or recontouring the trail to reduce steep grades and improve trail surface.

d. San Felipe Creek Riparian Vegetation. San Felipe Creek flows along the eastern edge of the lower portions of Halls Valley and through the center in much of the upper portions. The creek shows signs of riparian vegetation deterioration from past grazing activities and feral pigs. Long stretches of San Felipe Creek are devoid of woody vegetation. Because of the lack of

vegetation, erosion and siltation of the Creek, wildlife habitat values have decreased.

(1) Actions.

- Monitor riparian vegetation for erosion, increasing damage, and exotic plant infestations. Implement the San Felipe Upper and Lower Riparian Enhancement Zone Programs for San Felipe Creek, as recommended in the Master Plan for degraded areas. Actions include controlling erosion, manually removing exotic weeds, and replanting native plants as needed.

e. Bat Habitat. The Snell Barn in Barn South Field provides high value as bat habitat.

(1) Actions.

- Evaluate Snell Barn annually to ensure public safety is not at risk.
- Retain Snell Barn, for as long as feasible, and provide bat boxes in addition to this structure or if this structure is removed.
- Remove Snell Barn when structural decay threatens public safety.

3. Expected Results

The burning and reseeding with native grassland vegetation of Halls Valley is an effective way to manage the valley in keeping with the character recommended in the Master Plan. Removal of invasive non-native species from Halls Valley would remove competition with grassland species, and potentially increase the diversity of native plants and thereby improve wildlife habitat. It would also remove a major source of weed seed that has the potential to infest other areas. The control of scrub encroachment will act to retain the open character of the valley. Farming can be provide a seed base to reestablish native grasses within the park. Protecting structures that are used by bats should allow bat species to remain in the parks. Relocating fences will allow for unimpeded recreational access. Restoring San Felipe Creek will control erosion and increase biodiversity in the creek corridor.

C. Pala Seca Management Area

The Pala Seca Management Area consists of the Pala Seca East and the Pala Seca West Fields. Deer Valley meadow, an ephemeral wet meadow, lies in the Pala Seca West Field in the headwaters of a tributary creek that drains into Arroyo Aguague. The Deer Valley meadow is a diverse, fragile ecosystem that contributes significantly to the biodiversity of Grant County Park and the surrounding area. The meadow contains a mixture of wetland and dryland plants, the latter of which may be increasing due to lowering of the water table as a result of active downcutting in the stream channel at the lower end of the meadow. Deer Valley meadow also is an important recreational and visual feature of the park. This area should be managed in recognition of these features.

Other important natural resources in the Pala Seca Management Area consist of Smith Creek, wildflower fields, stands of native grasslands, and mixed oak/foothill pine woodlands on the steep east-facing slopes of Smith Creek.

The Pala Seca Management Area and its recommended management program are shown on Figure 18.

1. Objectives

Specific objectives for the Pala Seca Management Area are described below.

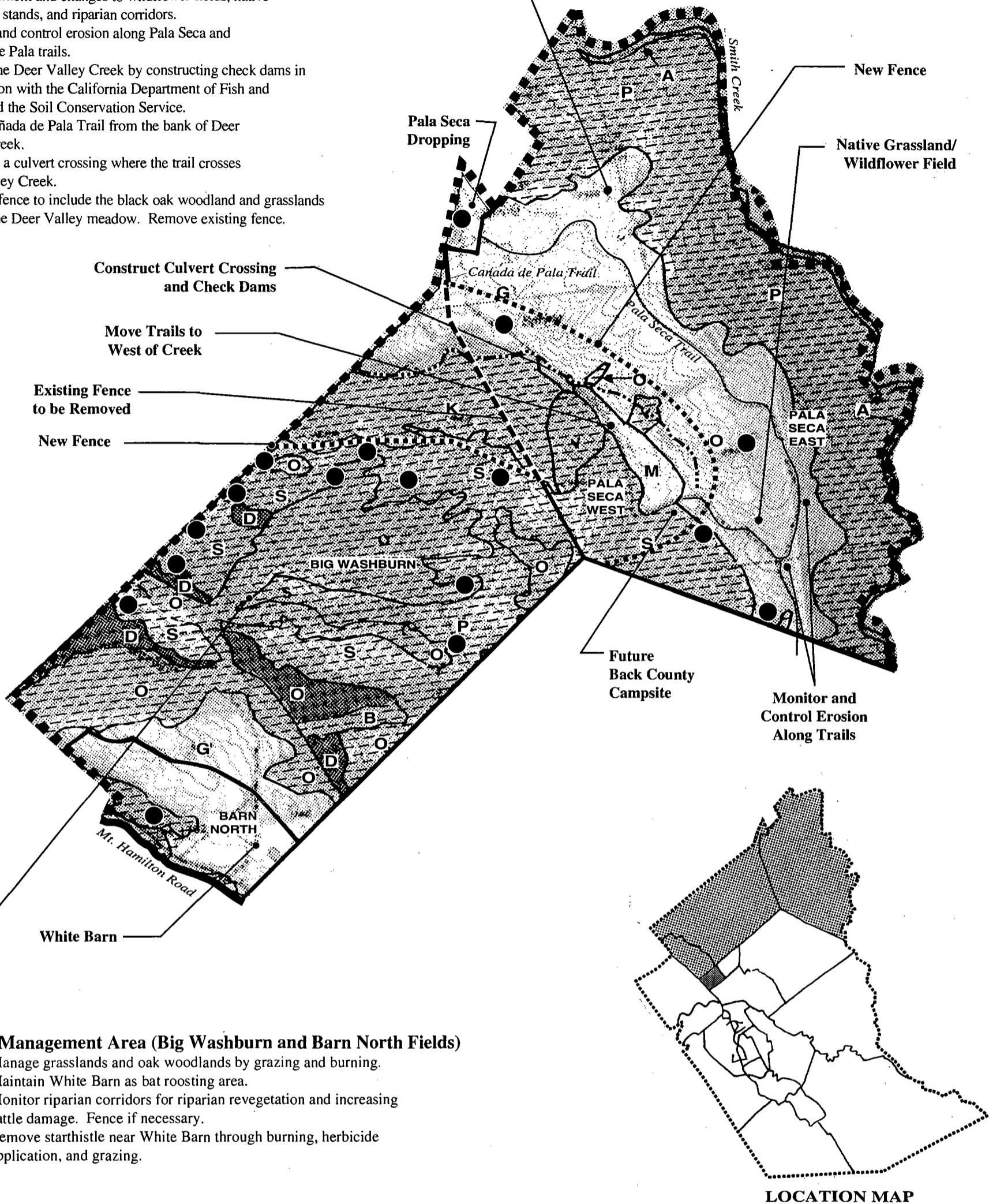
- Protect the fragile habitat of the Deer Valley wetlands.
- Control active downcutting in the northern portion of the creek that runs through Deer Valley.
- Manage the Deer Valley wet meadow habitat in conjunction with the adjacent black oak and valley oak woodlands to the west for improved biodiversity and black-tailed deer habitat.
- Protect and enhance native grasses and wildflower stands.
- Improve habitat for black-tailed deer.
- Monitor and control erosion along Pala Seca and Cañada de Pala trails.
- Promote the recreational values of a back-country campsite.

2. Resource Management Program

The following are specific recommendations for the Pala Seca Management Area. Tables 5 and 6 contain a summary of actions for this Management Area.

Pala Seca Management Area

- Manage grasslands through rotational grazing and burning.
- Manage oak woodlands and wetlands through spot grazing and burning.
- Spot graze or burn Deer Valley meadow protected area.
- Monitor extent and changes to wildflower fields, native grassland stands, and riparian corridors.
- Monitor and control erosion along Pala Seca and Cañada de Pala trails.
- Restore the Deer Valley Creek by constructing check dams in cooperation with the California Department of Fish and Game and the Soil Conservation Service.
- Move Cañada de Pala Trail from the bank of Deer Valley Creek.
- Construct a culvert crossing where the trail crosses Deer Valley Creek.
- Relocate fence to include the black oak woodland and grasslands west of the Deer Valley meadow. Remove existing fence.



North Management Area (Big Washburn and Barn North Fields)

- Manage grasslands and oak woodlands by grazing and burning.
- Maintain White Barn as bat roosting area.
- Monitor riparian corridors for riparian revegetation and increasing cattle damage. Fence if necessary.
- Remove starthistle near White Barn through burning, herbicide application, and grazing.

..... New Fences

● Ponds and Seeps(Springs)

■ Private Property



FIGURE 18

Pala Seca and North Management Areas

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

LEGEND

- G** Non-Native Grassland
- Oak Woodland**
- S** Oak Savanna
- O** Mixed Oak Woodland
- K** Black Oak Woodland
- L** Coast Live Oak Woodland Mixed
- P** Oak/Foothill Pine Woodland
- V** Valley Oak Woodland
- B** California Bay Laurel/Coast Live Oak Woodland
- Shrubland**
- D** Diablian Sage Scrub
- C** Coyote Brush/Poison Oak Scrub
- Riparian and Wet Meadow**
- A** Alder/Maple Riparian
- R** Willow Riparian
- M** Wet Meadow Riparian

a. Deer Valley Creek. The creek that drains the Deer Valley wet meadow has begun serious undercutting, resulting in erosion of the creek and degradation of water quality. The undercutting appears to be lowering the water level under the meadow. In response, the wet meadow shows signs of shrinking in size and its biological composition appears to be changing. Much of the undercutting of the creek appears to be related to the location where the Cañada de Pala Trail fords the creek at the lower end of the valley and runs for a while along the creek bed.

(1) Actions.

- Move approximately 2,000 feet of the Cañada de Pala Trail from the creek bank, and construct a culvert crossing where the trail fords the creek. Revegetate the old trail with native vegetation. Revegetation techniques are described in Appendix K and L.
- The results of a different management regime (which may include prescribed burning and spot grazing) and relocating the Canada de Pala Trail, should be monitored for a three-year period to evaluate any improvement in creek erosion and the Deer Valley wet meadow habitat. If there are no significant improvements by the end of three years, construction actions (i.e., check dams) should be implemented in order to reduce creek erosion and undercutting.
- Prepare specific site design and construction documents for constructing check dams, a trail crossing of the creek, and moving the trail. Coordinate with the local Soil Conservation Service, the Army Corps of Engineers, and California Department of Fish and Game (CDFG) to design and implement these provisions.
- Construct check dams on the creek in order to control the undercutting and potentially raise the level of the creek and thereby the water level under the wet meadow.
- Annually monitor the creek for improvement. If the creek is not restoring itself after improvements have been made, coordinate efforts to restore the creek with the CDFG.

Table 5
PALA SECA MANAGEMENT AREA (PALA SECA EAST FIELD)

| Action | Field/Location | Phase ^a | Timing | Frequency/Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|----------------|--------------------|-------------------|----------------------|----------------------------|-----------------------|------------------------|-----------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Graze grasslands/oak savannas | Pala Seca East | 1 | Nov and April/May | Annually | Licensee | 531 acres 371 AUMs | \$12/AUM | \$4,450 est. revenue |
| Monitor vegetation for wildfire conditions | Pala Seca East | 1 | Summer-Fall | Every 3 years | CDF | 1,067 acres | \$360 est. | \$360 est. |
| Provide water trough for cattle | Pala Seca East | 1 | -- | -- | Licensee | 1 | \$2,500/trough | \$2,500 |
| Control erosion along Pala Seca/Cañada de Pala trails | Pala Seca East | 1 | Summer-Fall | As needed | -- | 100 feet | \$15/hour | \$125 est. |
| OPTIONAL PROGRAM | | | | | | | | |
| Burn mixed oak/foothill pine woodlands | Pala Seca East | 1 | Fall-Spring | 10-20 year intervals | CDF BAAQMD Neighbors | 536 acres | \$9/acre | \$4,824 |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.

Table 6
PALA SECA MANAGEMENT AREA (PALA SECA WEST FIELD INCLUDES DEER VALLEY AREA)

| Action | Field/Location | Phase ^a | Timing | Frequency/Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|------------------------|--------------------|-----------------|----------------------|-------------------------------|-----------------------|------------------------|-----------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Construct culvert crossing of creek and check dams | Pala Seca West | 2 | April 15-Oct 15 | Once | SCS, CDFG, Corps of Engineers | 1 crossing | \$10,000-\$40,000 | Varies |
| Move trail, improve eroded areas | Pala Seca West | 2 | Summer | Once | -- | 2,000 feet | \$5,000 est. | \$5,000 |
| Monitor Deer Valley wet meadow vegetation for weed infestations, manually control if found | Pala Seca West | 1 | Spring | Annually | Volunteers | 31 acres | \$120 est. | \$120 |
| Burn meadow, grasslands and oak savanna | Pala Seca West | 1 | Fall | 10-year intervals | CDF BAAQMD Neighbors | 178 acres | \$9/acre | \$1,602 |
| Burn oak woodlands | Pala Seca West | 1 | Fall-Spring | 10-20 year intervals | CDF BAAQMD Neighbors | 170 acres | \$9/acre | \$1,530 |
| Fence black oak woodlands to include in Deer Valley Field and fence in Deer Valley protected area | Pala Seca/Big Washburn | 1 | -- | Once | -- | 16,000 linear feet | \$4/foot | \$64,000 |
| Monitor vegetation for wildfire conditions | Pala Seca West | 1 | Summer-Fall | Every 3 years | CDF | 500 acres | \$360 est. | \$360 |
| Monitor native grasslands and wildflower fields for weed infestations, manually control | Pala Seca West | 2 | Spring | Annually | Volunteers | 30 acres (approx.) | \$120 est. | \$120 |
| Spot grazing | Pala Seca West | 1 | Oct-Dec | Annually | Licensee | 348 acres 246 AUMs | \$13/AUM | Varies |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.

b. Wet Meadow Habitat and Associated Black Oak Woodlands. Deer Valley wet meadow has been disturbed by cattle and by feral pigs. In response, the County recently removed cattle from the Pala Seca Field. Rotational grazing should continue to be restricted from the Pala Seca Field. Wet meadows are especially important habitat for black-tailed deer especially in conjunction with adjacent black oak woodlands. There is a black oak woodland on the hillside northwest of Deer Valley in Big Washburn Field (see North Management Area).

(1) Actions.

- Relocate barbed wire fence on the western side of the field to include black oak woodlands in Big Washburn Field (see North Management Area and Figure 18). Remove existing boundary fence between Pala Seca and Big Washburn fields. Add fencing to entirely surround the wet meadow area in Deer Valley to include adjoining hillside slopes in a protected area.
- Burn Deer Valley wet meadow at an interval of once every 10 years. (A 10-year interval is recommended because of the sensitive wet meadow habitat.) Prescribed burning can be conducted in the fall, approximately mid-October.
- High intensity spot grazing can be implemented as a secondary management tool if conditions warrant (e.g., excessive forage is available due to a wet winter). However, grazing should only occur in the fall when the wet meadow is drier and must be carefully monitored to ensure that sensitive resources are not damaged.
- Monitor Deer Valley Wet Meadow for increases and decreases in the type and extent of plant species present and infestations of non-native plant species. Field survey guidelines are included in Appendix N. If found, non-native weeds should be manually eradicated as soon as possible.

c. Grasslands and Oak Savannas. Grasslands and oak savannas outside the wet meadow area should be managed for wildfire prevention, thatch reduction, biodiversity, non-native species infestations, and control of scrub encroachment.

(1) Actions.

- Manage this area by grazing on a rotational basis (see Table 5), or
- Burn grasslands and oak savannas at approximately five to 10-year intervals (depending on annual grass height) in the fall to spring.

a. Mixed Oak/Foothill Pine Woodlands. This habitat type has sparse patches of open vegetation and pockets of more plentiful fuels that could burn fiercely. Prescribed burning can be used to manage this habitat type.

(1) Actions.

- Prescribed burning can be used to manage mixed oak/foothill pine woodlands. Prescribed burning should occur in the fall to spring to help maintain fire control. The mixed oak/foothill pine woodlands area can be burned in intervals of 10 to 20 years depending on fuel conditions. The prescribed burn should begin on the upper ridge and work down.
- Monitor the mixed oak/foothill pine woodlands for fuel loading and potential wildfire conditions (i.e., concentrations of dead trees, limbs or brush, thick dry leaf litter, dense stands of scrub, drought conditions) approximately every three years. Consider burning or clearing flammable materials.
- Spot grazing can also be allowed in the mixed oak/foothill pine woodlands. However, this vegetation type supplies less forage for cattle than the grasslands and oak savannas.

b. Wildflower Fields and Native Grasslands. A number of wildflower fields and stands of native grassland were identified in the southwestern portion of Pala Seca Field along the Cañada de Pala Trail (see Figure 14).

(1) Actions.

- In the spring, monitor the native grassland areas and wildflower fields for increasing levels of damage by cattle and feral pigs, changes in extent and species composition, and non-native plant infestations. If warranted, institute a program to enhance the extent and health of native grasslands and wildflower fields. (See Appendices J, K, and L.) An enhancement program may include weeding, fencing, cropping non-native grasses, and seeding with appropriate native species.
-

c. Cañada de Pala and Pala Seca Trails. The Cañada de Pala Trail (at the intersection with the Pala Seca Trail) and the Pala Seca Trail just north of this intersection has washed out in the past and caused substantial erosion. In the winter of 1994/1995 these problems were addressed by recontouring and revegetating the trails.

(1) Actions.

- Monitor abandoned sections of trail just prior to and following rains, and intercept any rills that are forming in the disturbed area. Continue monitoring until grasses are able to maintain area.
- Install brush check dams or hay bales in large gully east of old Pala Seca Trail to slow runoff and decrease erosion.

3. Expected Results

The recommendations for this area can be expected to allow the wet meadow to begin to restore itself over time. Improvements to the creek and the trail can be expected to stop the undercutting of the creek, and may allow it to rebuild to earlier levels. Any raising of the creek bed can be expected to raise the water level of the wet meadow, thereby changing its dynamics and composition and increasing its size. Improvements to the creekbed and relocation of the road can be expected to improve water quality in the creek, restore the biodiversity of an important biological area, and maintain and enhance the diversity of plants and wildlife in the area. If burning or spot grazing is used to maintain this area, increased habitat for black-tailed deer can be expected.

Managing the Pala Seca Management Area by grazing, burning or spot grazing can be expected to reduce fuel loads, control thatch buildup and enhance biodiversity. Monitoring and possible enhancement of wildflower fields and native grasslands can be expected to allow those resources to increase in extent and biodiversity. Monitoring and continuing actions to stabilize trails will control erosion.

D. North Management Area

The North Management Area includes the Big Washburn Field and the Barn North Field. This Management Area is shown on Figure 18. Significant natural resources in this area consist of the riparian areas, woodlands and steep areas along the Arroyo Aguague; grasslands; and mixed oak woodlands

along drainageways. Substantial portions of this management area has slopes of over 50 percent. An area in the northwestern portion of the Barn North Field alongside Mt. Hamilton Road has a spring and substantial areas with slopes over 50 percent.

1. Objectives

The specific objectives for this Management Area are listed below.

- Protect the Arroyo Aguague riparian corridor.
- Remove starthistle infestations in Barn North Field.
- Protect bat habitat in White Barn.

2. Resource Management Program

The following are specific management recommendations for the North Management Area. Table 7 contains a summary of actions for this Management Area.

a. Grasslands and Oak Woodlands. The grasslands and oak woodlands of this area should be managed primarily by annual, rotational grazing. However, it should be noted that cattle do not like steeper slopes and may not graze slopes over 50 percent sufficiently for wildfire control.

(1) Actions.

- Manage this area by grazing on an annual rotational basis (see Table 7).
 - Monitor residual dry matter in May to determine acceptable level for vegetation management needs.
 - If monitoring determines that levels of residual dry matter are sufficiently high, consider more intensive rotational grazing levels or a prescribed burn program (generally at 10-year intervals).
 - To control yellow starthistle in the Barn North Field between White Barn and Mt. Hamilton Road, burn the area from June through October, graze the area in May and October, and consider herbicide application from February to May (see Appendix K). Recolonize the area with appropriate grass species.
-

Table 7
NORTH MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|--|-----------------------------|--------------------|--|---|----------------------------|-----------------------|--|--------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Graze grasslands, oak savannas, mixed oak woodlands | Barn North | 1 | Oct 1-Oct 7 Feb 22-Mar 1 May 22-May 31 | Annually | Licensee | 108 acres 102 AUMs | \$12/AUM | \$1,220 est. revenues |
| Graze grasslands, oak savannas, mixed oak woodlands | Big Washburn | 1 | Oct 8-Nov 7 Mar 2-Mar 21 May 16-May 21 | Annually | Licensee | 806 acres 526 AUMs | \$12/AUM | \$6,310 est. revenues |
| Monitor Arroyo Aguague riparian corridors for weed infestations, erosion | Big Washburn, Barn North | 2 | Spring | Every 3 years | Volunteers | -- | \$120 est. | \$120 |
| Monitor White Barn for bat habitat | Barn North | 1 | -- | Annually | -- | 1 barn | -- | -- |
| Use burning/grazing/herbicide use to control starthistle infestation | Barn North | 1 | Spring-Fall | Burn/Fall Graze/May or Oct Herbicide/Spring and Fall | CDF BAAQMD Neighbors | 15 acres | \$9/acre/burn \$40/acre/ herbicide | \$735 est. |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.

b. Arroyo Aguague and Tributaries. Some areas along the Arroyo Aguague and its tributaries shows signs of damage by cattle and feral pigs. These areas are generally in Barn North Field and the grassland portion of Big Washburn Field that has slopes under 30 percent.

(1) Actions.

- Annually monitor the Arroyo Aguague and tributaries in winter and spring to determine whether revegetation is occurring or cattle damage is increasing, and whether areas need additional management. Consider fencing if areas deteriorate.

c. Bat Habitat. White Barn in Barn North Field provides high wildlife value as a roosting location for bat species.

(1) Actions.

- Evaluate White Barn annually to ensure public safety is not at risk.
- Retain White barn, for as long as feasible, and provide bat boxes in addition to this structure or if this structure is removed.
- Remove White Barn when structural decay threatens public safety.

3. **Expected Results**

These management recommendations can be expected to allow the vegetation along Arroyo Aguague to regenerate in areas where it is now degraded, and to produce a diversity of plant composition, density, and age in areas where it is now mature or maturing. Such a program would be expected to add to the diversity of the plants and wildlife in the park. Retaining White Barn can be expected to assist bat species in remaining in the park.

E. Eastern Management Area

The Eastern Management Area includes Hall Valley and North fields. Significant natural resources in this management areas include Smith Creek and tributaries of the Arroyo Aguague, wildflower fields, and two sycamore wetland areas. The Eastern Management Area consists primarily of oak savannas, oak woodlands along the drainageways and grasslands. This Management Area is shown on Figure 19.

1. Objectives

The specific objectives for the Eastern Management Area are listed below.

- Control erosion along the Cañada de Pala Trail.
- Protect sycamore wetland area.
- Enhance wildflower stands along the Cañada de Pala Trail.

2. Resource Management Program

The following are specific recommendations for the Eastern Management Area. Table 8 contains a summary of actions for this Management Area.

a. Grasslands and Oak Savannas. The grasslands and oak savannas of the Eastern Management Area can be managed primarily by grazing.

(1) Actions.

- Graze the management area on a rotational basis from October through May (see Table 8).
- Monitor North and Hall Valley fields for appropriate amounts of residual dry matter in May to determine acceptable level for vegetative management needs.
- If monitoring determines that levels of residual dry matter are sufficiently high, consider more intensive rotational grazing levels or a prescribed burn program (generally at 10-year intervals).

b. Mixed Oak/Foothill Pine Woodlands. This habitat type has sparse patches of open vegetation and pockets of more plentiful fuels that could burn fiercely. Prescribed burning can be used to manage this habitat type. The mixed oak/foothill pine woodland vegetation type in the Hall Valley and North fields are very steep and not suitable for grazing.

(1) Actions.

- Prescribed burning can be used to manage this area. Prescribed burning should occur in the spring (just when the grass begins to cure) to help maintain fire control. The mixed oak/foothill pine woodlands area can be burned in intervals of 10 to 20 years depending on fuel conditions. The prescribed burn should begin on the upper ridge and work down.

Table 8
EASTERN MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|--|-----------------------|--------------------|-------------------------------|---|----------------------------|-------------------------------|---|-------------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Graze grasslands and oak savannas and mixed oak woodlands | Hall Valley | 1 | Jan 16-Feb 21 Mar 22-Apr 7 | Annually | Licensee | 751 acres 537 AUMs | \$12/AUM | \$6,440 est. revenues |
| Graze grasslands and oak savannas and mixed oak woodlands | North | 1 | Dec 1-Jan 15 Apr 8-Apr 21 | Annually | Licensee | 768 acres 624 AUMs | \$12/AUM | \$7,480 est. revenues |
| Monitor mixed oak/foothill pine woodlands for wildfire conditions, burn woodlands if necessary | Hall Valley, North | 2 | Summer/monitor Winter/burn | Every 3 years/ monitor 10-20-year intervals/burn | CDF BAAQMD Neighbors | 234 acres | \$120 est./ monitor \$9/acre/burn | \$120/monitor \$2,106/burn |
| Monitor wildflower fields for weed infestations, manually control, enhance fields. | Hall Valley | 2 | Spring | Annually | Volunteers | 30 acres (approx.) | \$120 est. | \$120 |
| Fence sycamore wet areas | Hall Valley | 1 | Spring | Once | -- | 2 areas, 100 feet of fence | \$4 per foot | \$400 |
| Control erosion along Cañada de Pala Trail relocation | North | 1 | Summer-Fall | Once | PG&E | 50 linear feet | \$15/hour | \$125 est. |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.

- Monitor the mixed oak/foothill pine woodlands for fuel loading and potential wildfire conditions approximately every three years.

c. Sycamore Wet Areas. The two areas of sycamore wetlands in Hall Valley Field (see Figure 19) should be protected from cattle. These areas show some damage from cattle browsing and feral pig rooting.

(1) Actions.

- Using hogwire, fence the wet sycamore areas to prevent access by cattle and feral pigs.

d. Wildflower Fields. A number of wildflower fields were identified in the Hall Valley Field. One exceptionally large field is located east of the Cañada de Pala Trail near where it intercepts with the Halls Valley Trail (see Figure 14).

(1) Actions.

- In the spring, monitor the native grassland areas and wildflower fields for increasing damage by cattle and feral pigs, changes in extent and species composition, and non-native plant infestations. If warranted, institute a program to enhance extent and health of native grasslands and wildflower fields. (See Appendices J, K, and L.) An enhancement program could include weeding, fencing, cropping non-native grasses, and seeding with native species.

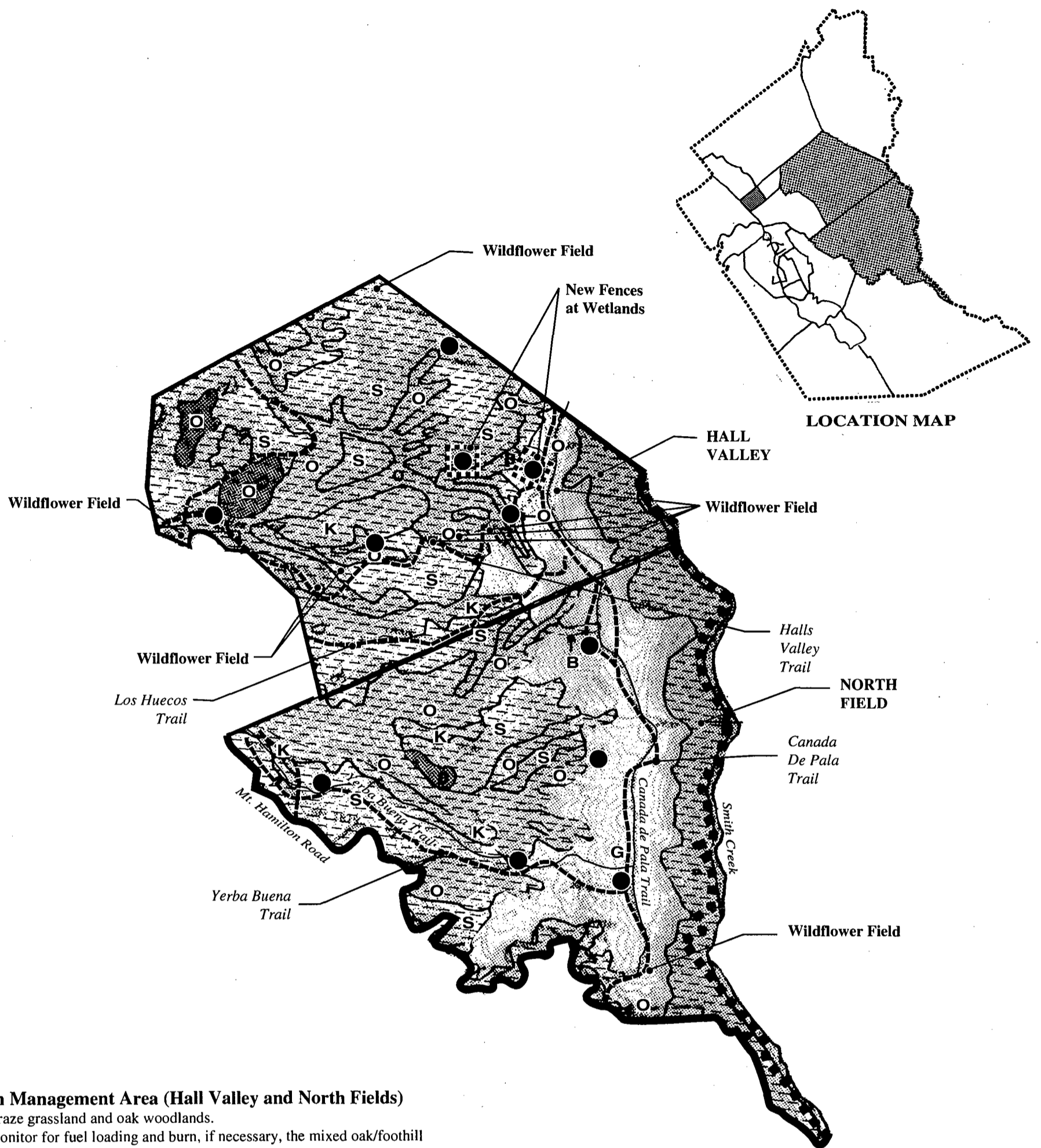
e. Cañada de Pala Trail. A section of the Cañada de Pala Trail between Mt. Hamilton Road and Yerba Buena Trail is subject to erosion problems.

(1) Actions.

- Recontour or realign eroded sections of trail as per Master Plan recommendations.

3. **Expected Results**

Grazing is an effective way to manage the grasslands and oak savannas. Prescribed burning can manage the mixed oak/foothill pine woodlands for wildfire prevention. Fencing the sycamore wet areas to protect them from damage by cattle and pigs will assist these areas to restore themselves. Monitoring and enhancing (through weeding or overseeding with native species, if warranted) the wildflower fields will ensure that this resource is



Eastern Management Area (Hall Valley and North Fields)

- Graze grassland and oak woodlands.
- Monitor for fuel loading and burn, if necessary, the mixed oak/foothill pine woodlands.
- Fence the two sycamore sites to protect from cattle.
- Monitor and control erosion on Cañada de Pala Trail above Mt. Hamilton Road.
- Monitor wildflower fields for increasing damage and changes in extent and promote enhancement.

..... New Fences

● Ponds and Seeps(Springs)

■ Private Property

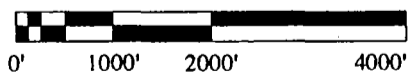


FIGURE 19

Eastern Management Area

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

LEGEND

- G** Non-Native Grassland
- Oak Woodland**
- S** Oak Savanna
- O** Mixed Oak Woodland
- K** Black Oak Woodland
- L** Coast Live Oak Woodland Mixed
- P** Oak/Foothill Pine Woodland
- V** Valley Oak Woodland
- B** California Bay Laurel/Coast Live Oak Woodland
- Shrubland**
- D** Diablian Sage Scrub
- C** Coyote Brush/Poison Oak Scrub
- Riparian and Wet Meadow**
- A** Alder/Maple Riparian
- R** Willow Riparian
- M** Wet Meadow Riparian

maintained. Recontouring or realigning the Cañada de Pala Trail will control erosion.

F. Hotel and Corral Fields Management Area

The Hotel and Corral Fields Management Area (comprised of Hotel East and Hotel West and Corral fields) primarily includes grasslands, oak savannas, and oak woodlands in the drainageways. Significant natural resources in this Management Area include Smith Creek, the tributaries draining into San Felipe Creek, mixed oak/foothill pine woodlands, Bass, Eagle and Pig lakes, wildflower fields and stands of native grasslands. This Management Area is shown on Figure 20.

1. Objectives

Specific objectives for the Hotel and Corral Fields Management Area are described below.

- Maintain Bass Lake for recreational fishing.
- Protect sensitive amphibian species and wetland habitat in Pig and Eagle lakes.
- Protect known populations of south bay clarkia and large-flowered linanthus, known sensitive plant species, in Hotel Field.
- Restore native grasses in Corral Field (near Round Corral).

2. Resource Management Program

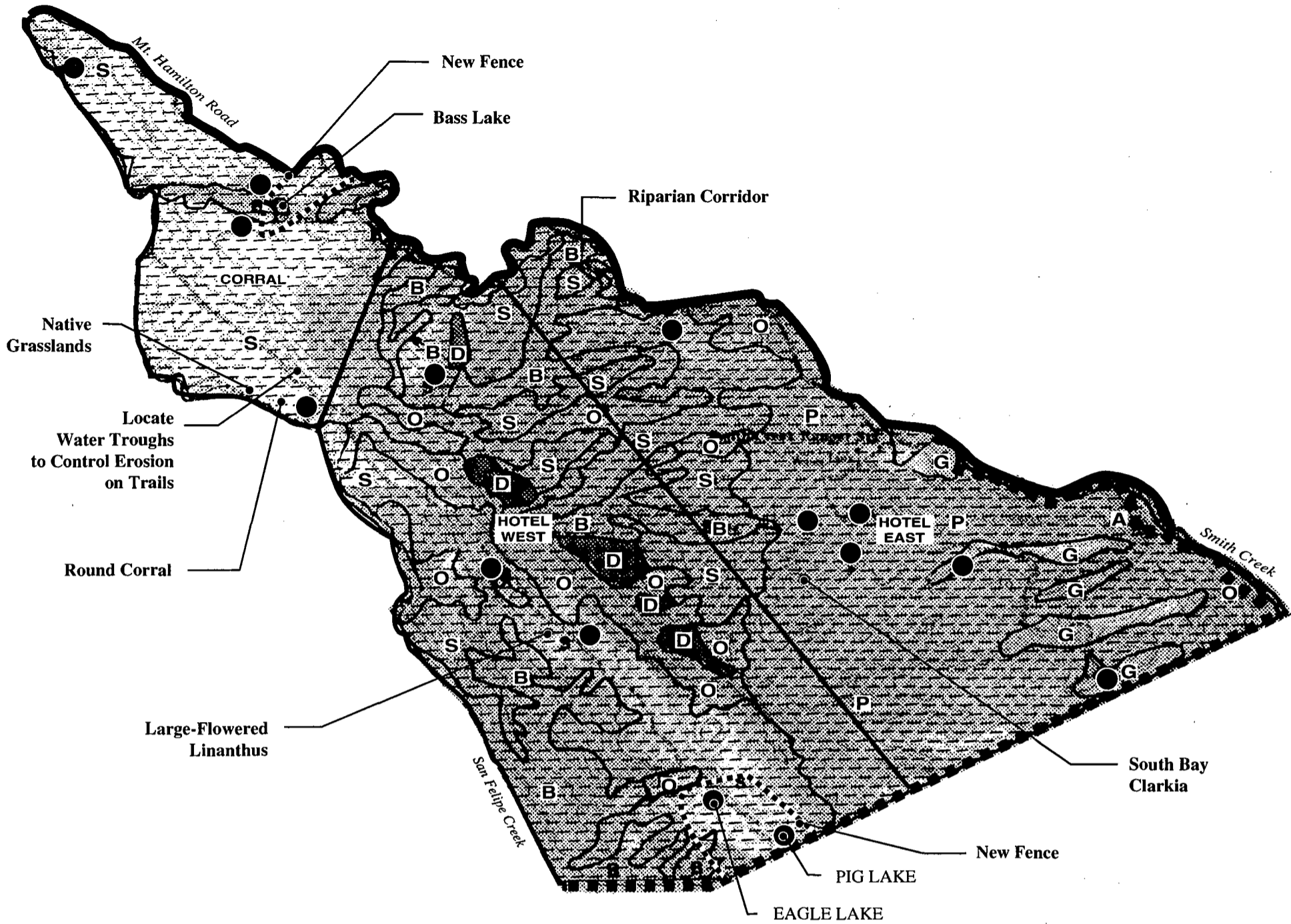
The following are specific recommendations for the Hotel and Corral Fields Management Area. Table 9 contains a summary of actions for this Management Area.

- a. Eagle and Pig Lakes. Eagle Lake and Pig lakes lie at the south central edge of the park. Both are fed by perennial springs and provide abundant wetland vegetation. In 1990, Eagle Lake dried completely as a result of drought, and fish in the lake died. After more-normal rainfall returned, the lake refilled, but it has not been re-stocked with warm-water fish. Bullfrogs are present in the lake. Eagle Lake is also a strong feature for recreationists using the Foothill Pine Trail.
-

Table 9
HOTEL AND CORRAL FIELDS MANAGEMENT AREA

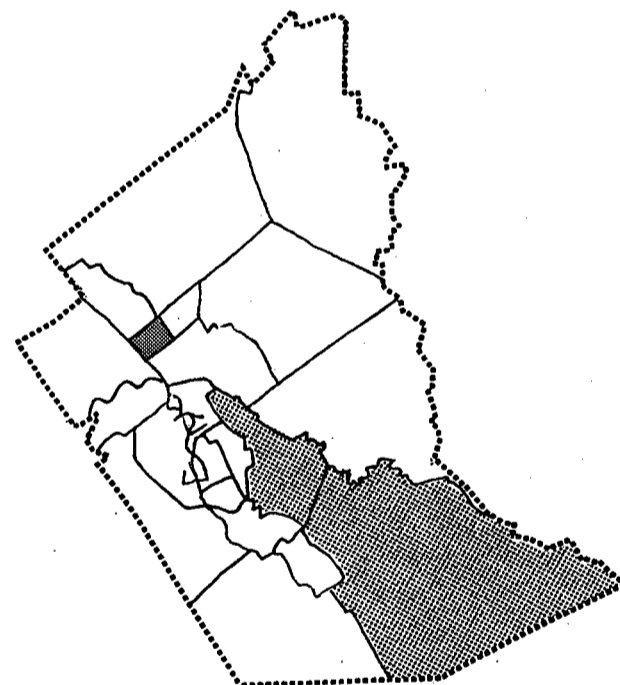
| Action | Field/Location | Phase ^a | Timing | Frequency/Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|--|------------------------------|--------------------|---------------------------------|---|--|-------------------------|---|-------------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Grazing grasslands and oak savannas and mixed oak/foothill pine woodlands | Hotel East and West | 1 | Nov 22-Dec 31 Mar 16-May 31 | Annually | Licensee | 1,548 acres 913 AUMs | \$12/AUM | \$10,950 est revenue |
| Grazing grasslands and oak savannas and mixed oak/foothill pine woodlands | Corral | 1 | Nov 1-Nov 31 Feb 22-Mar 14 | Annually | Licensee | 345 acres 332 AUMs | \$12/AUM | \$3,980 est. revenue |
| Monitor woodlands for wildfire conditions and prescribe burn if necessary | Hotel, Corral | 2 | Winter/burn Summer/monitor | 10-20 years/burn Every 3 years/ monitor | CDF BAAQMD Neighbors | 706 acres | \$9/acre/burn \$120 est./ monitor | \$6,354/burn \$120/monitor |
| Monitor native grasslands and wildflower fields for weed infestations, cattle damage | Hotel, Corral | 1 | Spring | Annually | Volunteers | 30 acres (approx.) | \$120 est. | \$120 |
| Short term grazing in holding pen area used for cattle branding operations | Corral | 1 | Late Winter and early Spring | Annually | Licensee | 8 acres | \$12/AUM | Varies |
| Monitor creek riparian corridors for weed infestations | Hotel, Corral | 2 | Spring | Annually | CDFG | -- | \$120 est. | \$120 |
| Fence Pig and Eagle lakes | Hotel West | 1 | -- | Once | -- | 3,000 feet | \$4/foot | \$12,000 |
| Burn or spot graze Bass, Eagle and Pig Lakes fenced areas | Pig/Eagle Lakes Bass Lake | 1 | Fall | Burn/3-year interval, graze/as needed | CDF BAAQMD Neighbors Licensee | 83 acres 60 AUMs | \$9/acre/burn \$12/AUM | \$747/burn varies/graze |
| Monitor and survey Pig and Eagle lakes for sensitive species, weed infestations | Hotel | 2 | Spring and Winter | Annually | Volunteers | 2 lakes | \$120 est. | \$120 |
| Control bullfrogs in Pig and Eagle lakes | Hotel | 1 | Winter | Annually | Volunteers | 2 lakes | \$120 est. | \$120 |
| Fence Bass Lake | Corral | 1 | -- | Once | -- | 3,000 linear feet | \$4/foot | \$12,000 |
| Fence portion of San Felipe Creek | Hotel | 3 ^c | -- | Once | -- | 1,000 feet | \$4/per foot | \$4,000 |
| Relocate water troughs | Hotel, Corral | 1 | -- | Once | Licensee | 3 troughs | \$2,500/trough | \$7,500 |
| OPTIONAL PROGRAM | | | | | | | | |
| Burn grasslands and oak savannas | Hotel, Corral | 3 | Spring | 5-10-year intervals | CDF BAAQMD Neighbors | 1,066 acres | \$9/acre | \$9,594 |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.
^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.
^c As determined after monitoring.



Hotel and Corral Fields Management Area

- Protect Eagle Lake and Pig Lake.
 - Fence the lakes to protect them from cattle.
 - Manage the fenced Eagle Lake and Pig Lake area by burning.
 - Prohibit cattle except as needed for high-intensity spot grazing.
 - Control bullfrog population.
 - Do not restock fish in the lakes.
 - Relocate Hotel and Foothill Pine trails.
- Monitor the mixed oak/foothill pine woodlands for fuel loading and burn if necessary.
- Graze or burn grasslands and oak woodlands.
- Monitor the riparian corridors of San Felipe and Smith Creek for continuing damage and fence if necessary or feasible.
- Monitor content and changes to stands of native grasslands and wildflower fields and enhance, when necessary, in Corral Field. Control any weed infestations through manual control.
- Relocate water troughs to minimize trail erosion.
- Implement spot grazing in the existing holding pen near Round Corral to enhance native grasslands



LOCATION MAP

..... New Fences ● Ponds and Seeps(Springs) ■ Private Property

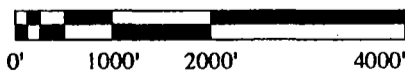


FIGURE 20

Hotel and Corral Fields Management Area

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

LEGEND

- G** Non-Native Grassland
- S** Oak Woodland
- O** Oak Savanna
- K** Mixed Oak Woodland
- L** Black Oak Woodland
- P** Coast Live Oak Woodland Mixed
- V** Oak/Foothill Pine Woodland
- B** Valley Oak Woodland
- B** California Bay Laurel/Coast Live Oak Woodland
- D** Shrubland
- D** Diablian Sage Scrub
- C** Coyote Brush/Poison Oak Scrub
- Riparian and Wet Meadow**
- A** Alder/Maple Riparian
- R** Willow Riparian
- M** Wet Meadow Riparian

(1) Actions.

- Maintain and reestablish as required the existing fence line that separates Hotel East and Hotel West fields. Although requiring gate improvements, maintenance of this fence will provide better grazing management for one of the largest areas in the park.
- Fence Eagle and Pig Lakes using barbed wire to protect them from damage by cattle. Include adjacent grassland areas.
- Manage the oak savanna and woodlands in the fenced area primarily with prescribed burning every five to 10 years in the fall, depending on weather and vegetation conditions.
- Pipe water from Eagle Lake into a trough outside of fenced area for cattle.
- Relocate Foothill Pine and Hotel trails north of Eagle Lake to provide buffer between the lake and the fence.
- Limited spot grazing can also be used on the oak savanna as an alternative to burning (see Table 9). Grazing must be carefully monitored to ensure that cattle do not damage sensitive riparian vegetation. The fenced area can support approximately 50 AUMs.
- Do not restock fish in Eagle Lake.
- Control bullfrog populations by letting Pig and Eagle Lakes dry out. This action is more effective than gigging or seine netting in areas where there is no perennial water. If lakes do not dry out, gigging and seining may be used to control bullfrogs. See also Chapter VI, Section D.7 for a more complete description of bullfrog management techniques. If control of bullfrogs is not successful, establish dense tule within the two lakes to provide cover for pond turtles and amphibians.
- Consider working with local universities, research groups, volunteers, and CDFG to conduct monitoring and focused surveys of sensitive amphibian and pond turtle populations in Pig and Eagle lakes.

b. Mixed Oak/Foothill Pine Woodlands. The mixed oak/foothill pine woodlands in the southeastern portions of the Management Area provide only limited forage for cattle, therefore, cattle stocking is recommended at a much reduced level. This habitat type can pose wildfire hazards if pockets of fuel are allowed to remain.

(1) Actions.

- Include the mixed oak/foothill pine woodlands in the area to be grazed from October through May.
- Use prescribed burning in the spring at intervals of 10 to 20 years to manage this area for fuel load reduction. However, in areas of known to have specific wildlife use, such as deer fawning areas, it is preferable to perform prescribed burning in the fall.
- Monitor the mixed oak/foothill pine woodlands for fuel loading and potential wildfire conditions (i.e., concentrations of dead trees, limbs, or brush, thick dry leaf litter, dense stands of scrub, drought conditions) approximately every three years. Consider burning or manually removing fuels.

b. Grasslands and Oak Savannas. The grassland and oak savanna portions of the Hotel and Corral fields can be managed primarily by grazing.

(1) Actions.

- Graze grasslands and oak savannas from October to May.
- Monitor Hotel and Corral fields for appropriate amounts of residual dry matter in May to determine acceptable level for vegetation management needs.
- If monitoring determines that levels of residual dry matter are sufficiently high, consider more intensive rotational grazing levels or a prescribed burn program (generally at 10-year intervals).

c. Stands of Native Grasslands and Wildflowers. An approximate 10-acre stand of native grassland, in which the dominant species is purple needle grass, occurs on the west side of Corral Field, in a small holding pen adjacent to Round Corral (see Figure 14). Another smaller stand of native grassland occurs in Hotel Field below Mount Hamilton Road. There are extensive fields of wildflowers in Hotel Field, especially along the Manzanita Trail. The two plant species of significance (south bay clarkia and large-flowered linanthus) both occur in Hotel Field.

(1) Actions.

- Implement spot grazing in the existing holding pen near Round Corral to enhance the native grassland.
 - Monitor the native grasslands, wildflower fields, and sensitive plant species for increasing damage by cattle and feral pigs, and
-

changes in extent and species composition, and non-native plant infestations. If warranted, institute a program to enhance extent and health of native grasslands. (See Appendix J and Chapter VI, Section C.)

d. Bass Lake. Bass Lake wetland vegetation and recreation values have been damaged by extensive cattle use.

(1) Actions.

- Fence Bass Lake using barbed wire to protect the area from cattle. If necessary, pipe water from Bass Lake to a trough to be located below the dam for use by cattle. The trough should be constructed away from trails to minimize erosion problems.
- Manage oak savanna in fenced area by prescribed burning every five to 10 years in the fall. Consider spot grazing as an optional management technique. The fenced area can support approximately 20 AUMs. Spot graze the area in the fall or early winter months.
- Maintain stocking of Bass Lake as per Master Plan recommendations.
- Monitor riparian and wetland vegetation for regeneration and exotic weed infestations. Manually control infestations and consider a revegetation program if naturally occurring vegetation processes are not progressing.

e. San Felipe Creek Riparian Vegetation. San Felipe Creek flows along the western edge of Hotel Field. Creeks within Hotel and Corral fields drain into San Felipe Creek. There are signs of riparian vegetation deterioration from grazing activities and feral pigs in the southern Hotel Field portion of San Felipe Creek. This vegetation needs to be protected from cattle where they have access to it and from damage by feral pigs.

(1) Actions.

- Monitor past damage, where current damage is increasing and for exotic infestations. If needed, fence cattle out to allow the riparian vegetation to restore itself. Fence the creek 25 to 50 feet from top of creek bank.
-

f. Smith Creek Riparian Corridor. Much of Smith Creek is inaccessible to cattle due to the long, steep slopes leading to it. At the southern end of the creek south of the crossing of Mt. Hamilton Road and near the Smith Creek fire station, however, the creek is accessible to cattle and shows signs of damage.

(1) Actions.

- Where accessible, monitor Smith Creek for erosion, cattle damage, and exotic infestations. Work with adjacent property owners to protect the creek corridor.

g. Trails. Existing cattle water troughs adjacent to Round Corral and the Hotel trailhead, near the ranch house, are located too close to adjacent trails. Erosion of trail surfaces is a problem in this area.

(1) Actions.

- Relocate trough near Round Corral and replace it with two troughs, one for equestrian use and one for cattle. Relocate troughs away from trails.
- Relocate cattle trough near Hotel trailhead to the east side of the Corral Field fence.

3. **Expected Results**

This management program can be expected to allow the riparian vegetation of Eagle, Pig and Bass lakes to restore itself, and to enhance plant and wildlife diversity in and around the lakes. Additionally, recreational values at Bass Lake should be enhanced. If a rotational grazing program is used, biotic resource values of the grasslands should increase. Grazing and burning the mixed oak/foothill pine woodlands can be expected to decrease the potential for wildfire. Monitoring and protecting, if warranted, riparian vegetation and corridors and lakes would ensure that cattle do not extensively damage these areas. Controlling erosion from troughs would increase trail recreational values.

G. Southwestern Management Area

The Southwestern Management Area includes Dutch Flat, North and South Brush, and Dairy fields. Significant natural resources in this management areas include riparian vegetation associated with San Felipe Creek and its drainages, wildflower fields, and native grassland fields. This area includes a substantial area of coyote brush/poison oak scrub, black oak woodlands, and grasslands. This Management Area is shown on Figure 21.

1. Objectives

The specific objectives for the Southwestern Management Area are listed below.

- Enhance wildlife habitat by managing shrublands to produce a mosaic of successional stages.
- Control erosion along San Felipe Creek.
- Enhance wetlands in woodland Youth Camp.

2. Resource Management Program

The following are specific recommendations for the Southwestern Management Area. Table 10 contains a summary of actions for this Management Area.

a. Oak Woodlands and Shrubland. The mixed oak woodlands are being encroached upon by coyote brush/poison oak scrub. The coyote brush/poison oak scrub on the slopes west of Halls Valley varies from open shrublands to impenetrable thickets. Scrub tends to become increasingly dense and profuse over time, and to displace most other plant species in the process. Over time, scrub can build a considerable amount of combustible woody fuel, which presents an increased fire danger. However, shrublands can be managed to produce a mosaic of successional stages adjacent to oak woodlands and grasslands, thereby maximizing watershed, wildlife habitat, and plant diversity values.

(1) Actions.

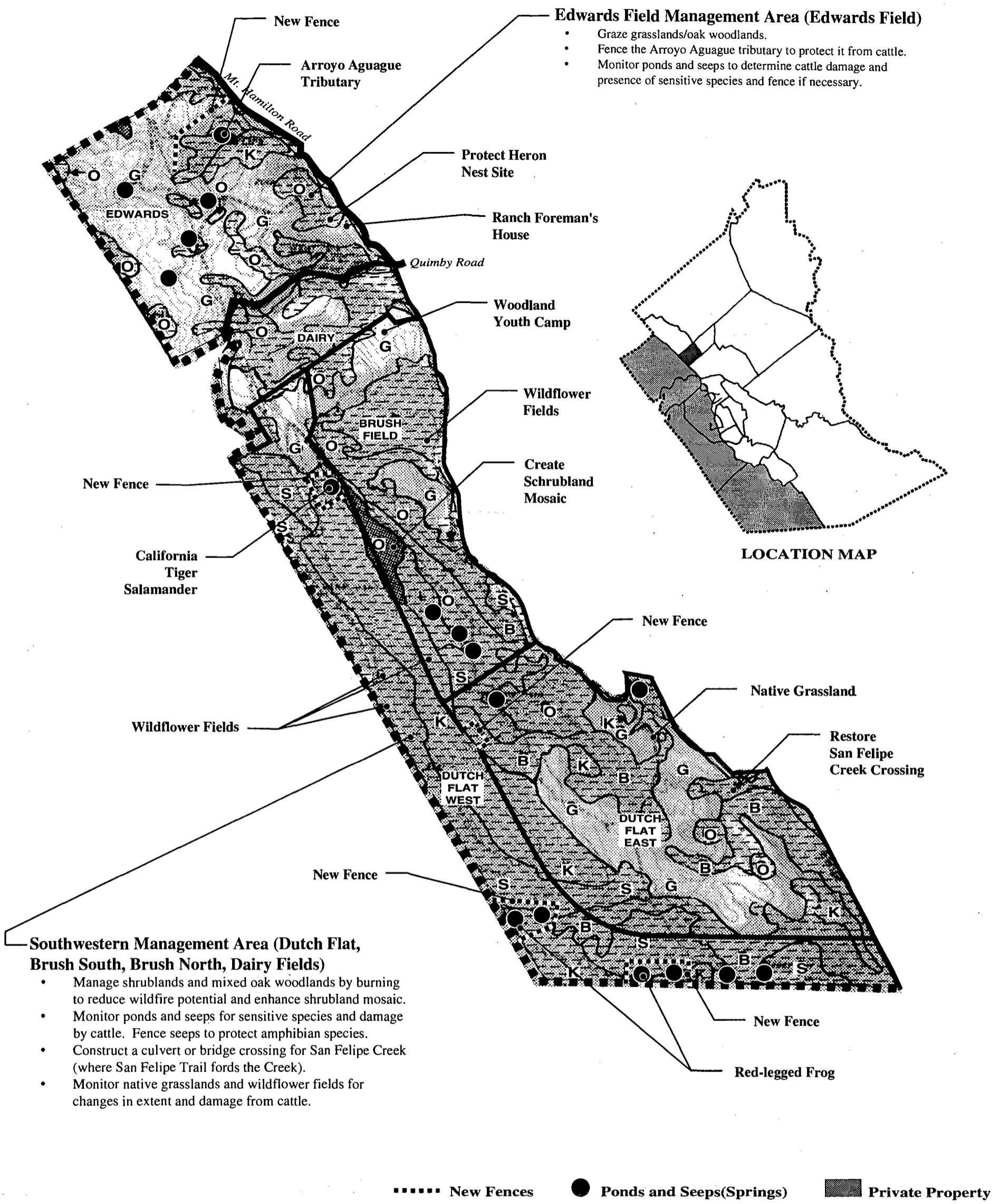
- Prune, thin and burn woodlands and shrublands in Brush South, Brush North and Dairy fields along the western side of Grant Park. Initiate burning program in year one.
 - Divide the area to be burned into three units to be burned at separate times. Burn from the upper elevations down to the
-

Table 10
SOUTHWESTERN MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|---------------------------------------|--------------------|-----------------|--|------------------------------------|-----------------------|------------------------|-----------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Graze grasslands, oak savannas, mixed oak woodlands | Dairy, Dutch Flat East and West | 1 | Jan 1-Feb 21 | Annually | Licensee | 982 acres 600 AUMs | \$12/AUM | \$7,200 est. revenues |
| Construct all-purpose crossing San Felipe Creek | Dutch Flat East | 3 | Summer-Fall | Once | CDFG Corps of Engineers PG&E | 1 crossing | Varies | \$50,000- \$75,000 |
| Monitor San Felipe Creek riparian vegetation for weed infestations | Dairy, Dutch Flat | 1 | Spring | Annually | Volunteers | -- | \$120 est. | \$120 |
| Burn woodlands to control scrub encroachment, produce a scrub mosaic, prevent wildfire | Dairy, Brush | 2 | Spring | 10 - 15-year intervals | CDF BAAQMD Neighbors | 350 acres | \$9/acre | \$3,150 |
| Burn scrub areas east facing west slope for wildfire prevention | Dairy, Brush | 2 | Fall | 2 consecutive years then 5-10-year intervals | CDF BAAQMD Neighbors | 31 acres | \$9/acre | \$279 |
| Monitor seeps and ponds for sensitive amphibians, fence if found | Brush Dutch Flat East and West | 2 | Winter & Spring | Annually | Volunteers | 10 ponds/ seeps | \$15/area | \$150 |
| Fence seeps where sensitive amphibian species were found and are likely to occur and existing water trough area | Brush, Dutch Flat West | 1 | Spring | Once | -- | 6,600 feet of fence | \$4/foot | \$26,400 |
| Monitor native grasslands and wildflower fields for weed infestations | Dutch Flat East and West, Brush South | 3 | Spring | Annually | Volunteers | 15 acres est. | \$120 est. | \$120 |
| Implement wetland interpretation program at Woodland Youth Camp | Brush | 2 | Summer-Fall | See Master Plan | CDFG Corps of Engineers | 4 acres | -- | -- |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.



Edwards Field Management Area (Edwards Field)

- Graze grasslands/oak woodlands.
- Fence the Arroyo Aguague tributary to protect it from cattle.
- Monitor ponds and seeps to determine cattle damage and presence of sensitive species and fence if necessary.

LOCATION MAP

Southwestern Management Area (Dutch Flat, Brush South, Brush North, Dairy Fields)

- Manage shrublands and mixed oak woodlands by burning to reduce wildfire potential and enhance shrubland mosaic.
- Monitor ponds and seeps for sensitive species and damage by cattle. Fence seeps to protect amphibian species.
- Construct a culvert or bridge crossing for San Felipe Creek (where San Felipe Trail fords the Creek).
- Monitor native grasslands and wildflower fields for changes in extent and damage from cattle.

..... New Fences ● Ponds and Seeps(Spring) ■ Private Property

FIGURE 21

Southwestern and Edwards Management Area

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

| LEGEND | |
|----------|---|
| G | Non-Native Grassland |
| S | Oak Savanna |
| O | Mixed Oak Woodland |
| K | Black Oak Woodland |
| L | Coast Live Oak Woodland Mixed |
| P | Oak/Foothill Pine Woodland |
| V | Valley Oak Woodland |
| B | California Bay Laurel/Coast Live Oak Woodland |
| D | Diablian Sage Scrub |
| C | Coyote Brush/Poison Oak Scrub |
| A | Riparian and Wet Meadow |
| R | Alder/Maple Riparian |
| M | Willow Riparian |
| M | Wet Meadow Riparian |

lower elevations towards Halls Valley. Previous to a broadcast burn, concentrations of shrubs under trees will need to be cut and hauled out from under the tree canopy. Burn woodlands when the grass is green or just beginning to cure.

- Extensive stands of scrub (not under woodland canopy) can be burned in the fall. See Chapter V, Section C for guidelines concerning broadcast burning in oak woodlands and shrublands. If a large amount of dead material is created by the burn, a re-burn may be scheduled within three years. This scenario would occur if the burn scorches but does not consume shrubs and small trees or if the burn was exceptionally cool.
- Burn the woodland area at an interval of approximately 10 to 15 years. Shrublands can be treated every five to 10 years.

b. Grasslands and Oak Savannas. Much of this management area consists of grasslands and oak savannas.

(1) Actions.

- Manage this area by grazing on an annual rotational basis (see Table 10).
- Monitor residual dry matter in May to determine acceptable levels for vegetation management needs.
- If monitoring determines that levels of residual dry matter are sufficiently high, consider more intensive rotational grazing levels or a prescribed burn program (generally at 10-year intervals).

c. Ponds and Seeps. Ponds, seeps, and wet areas are likely to contain wetland vegetation and sensitive amphibian species. Red legged frogs have been found in seeps within the southern portion of Dutch Flat Field, and California tiger salamanders have been found in seeps in Brush South Field.

(1) Actions.

- Monitor ponds and seeps in winter and spring to determine whether sensitive species are present and whether cattle damage is increasing. Work with local universities, research groups or volunteers to conduct surveys in the winter and spring when amphibians lay their eggs.
 - Fence ponds and seeps where cattle have access to them where sensitive species have been found or cattle damage is severe.
-

- As shown in Figure 21, using barbed wire fencing, fence the ponds and seeps where sensitive species have been found and are most likely to be found.

d. San Felipe Creek. Where the San Felipe Trail fords San Felipe Creek, the creekbed and creek bank have been degraded and are eroding. Portions of the creek in Dutch Flat are also sustaining damage from cattle.

(1) Actions.

- Prepare specific site design and construction documents for constructing a trail crossing of the creek.
- Construct a culvert or bridge at the trail crossing of San Felipe Creek. See Master Plan Section 4.2.5.
- Monitor San Felipe Creek where cattle have access to determine whether damage to riparian vegetation and erosion are increasing. Monitor for invasive species, as well. If warranted, consider fencing cattle out of those portions of the creek. Control invasive species by manual control methods.
- Implement the San Felipe Upper and Lower Riparian Enhancement Zone Programs for San Felipe Creek, as recommended in the Master Plan.

e. Stands of Native Grasslands and Wildflowers. A stand of native grassland, in which the dominant species is purple needle grass, occurs on the east side of Dutch Flat Field. Brush South Field contains two fields of wildflowers.

(1) Actions.

- Monitor the native grasslands and wildflower fields for increasing damage by cattle and feral pigs, and changes in extent and species composition, and non-native plant infestations. If warranted, institute a program to enhance extent and health of native grasslands and wildflower fields. (See Appendix J and Chapter VI, Section C.)

f. Wetland Area Enhancement. A wetland area is located in Brush North Field near the Woodland Youth Camp. A wetland enhancement and interpretation program is recommended in the Master Plan.

(1) Actions.

- Implement the wetland enhancement and interpretation program as recommended in the Master Plan, see Section 4. Recommended actions include constructing a boardwalk, fencing the area, restricting mowing and spraying, implementing a public education program, and removing exotic species.

3. Expected Results

The mixed oak woodlands and shrublands on the east-facing slopes west of Halls Valley offer an ideal opportunity to create and manage a mosaic of shrubland that will create a plant community not found extensively elsewhere on the park. These shrublands are well-located for such a program, since the uphill slope is open grassland that will act to contain wildfire and prevent its escape from the park. Development of such a mosaic will add greatly to the biodiversity, watershed uses, wildlife habitat and plant diversity. Grazing of grasslands and oak savannas will reduce wildfire potential and non-native weeds and will increase biodiversity. Fencing, monitoring and enhancing ponds and seeps will protect wetland vegetation and sensitive amphibian species. Restoring San Felipe Creek will control erosion. Monitoring and enhancing native grasslands, wildflower fields and wetland areas will increase biodiversity and recreational values.

H. Edwards Field Management Area

Edwards Field is a small field isolated from the rest of the park by Mt. Hamilton and Quimby roads. It consists primarily of grasslands, although there are some riparian areas associated with the Arroyo Aguague drainages as well as ponds and seeps. Figure 21 shows this Management Area.

1. Objectives

The specific management objectives for this Management Area are listed below.

- Protect riparian corridors and wetlands along Arroyo Aguague tributaries.
 - Protect heron nests behind the ranch foreman's residence.
-

2. Resource Management Program

The following are specific management recommendations for the Edwards Field Management Area. Table 11 contains a summary of actions for this Management Area.

a. Grasslands and Oak Savannas. The grasslands and oak savannas in Edwards Field can be managed by grazing.

(1) Actions.

- Manage this area by grazing on an annual rotational basis (see Table 11).
- Monitor residual dry matter in May to determine acceptable levels for vegetation management needs.
- If monitoring determines that levels of residual dry matter are sufficiently high, consider more intensive summer grazing levels or a prescribed burn program (generally at 10-year intervals).

b. Arroyo Aguague Riparian Vegetation. There is a segment of riparian vegetation along the eastern border of Edwards Field, associated with a tributary of the Arroyo Aguague, that is exhibiting signs of damage from cattle.

(1) Actions.

- Fence this riparian area as shown on Figure 21.

c. Heron Nest Site. An active heron nesting site is located in trees behind the ranch foreman's residence. This nesting site should be protected from disturbances.

(1) Actions.

- Retain the trees used by the heron and keep developed recreation facilities and activities away from this area.
- During breeding season (February through May), consider posting signs along trails to educate recreationists about not disturbing nesting pairs of herons.

3. Expected Results

These management recommendations can be expected to continue the existing character of Edwards Field. Excluding access by cattle to the riparian area can be expected to allow this area to restore itself. Protecting the heron nesting area would allow continuing use of this site.

Table 11
EDWARDS MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|----------------|--------------------|--------------|------------------------|--------------|-----------------------|------------------------|--------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Graze grasslands, oak savannas, mixed oak woodlands | Edwards | 1 | Oct 1-Oct 31 | Annually | Licensee | 463 acres 380 AUMs | \$12/AUM | \$4,560 est. revenues |
| Monitor Arroyo Aguague Creek riparian vegetation for weed infestations | Edwards | 2 | Spring | 3-year intervals | Volunteers | -- | \$120 est. | \$120 |
| Fence Arroyo Aguague riparian vegetation | Edwards | 2 | -- | Once | -- | 2,200 feet of fence | \$4/foot | \$8,800 |
| Monitor riparian area after fencing for weed infestations, revegetation | Edwards | 3 | Spring | 3-year intervals | Volunteers | 3 acres | \$15/acre | \$45 |
| Protect, monitor heron nest site | Edwards | 1 | Feb-May | Annually | -- | 1 acre | -- | -- |

^a Phase generally refers to the years when a program should begin. Phase 1: years 1 through 5; Phase 2: years 6 through 10, Phase 3: years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Revenues associated with grazing are estimated based on 1995-96 rates.

Chapter IX
LEVIN COUNTY PARK
RESOURCE MANAGEMENT PROGRAM

■ ■ ■

The following is a description of the management program for Levin County Park. As was the case in the preceding chapter, the description of management issues and tools is abbreviated. The more complete descriptions of the management issues included in earlier chapters of this report should be referenced.

For the purposes of this report, Levin County Park has been divided into three management areas that are comprised of fields or portions of fields which share common resources and management issues. In this chapter, the management and implementation program for each management area in Levin County Park is described separately. Park-wide management objectives and management actions for park-wide issues in Grant and Levin parks (i.e., feral pig control, ground squirrel monitoring and management, and wildfire management) were described and discussed in Chapter VII of this report.

The sections in this chapter are organized in the following manner: first, specific management objectives are presented for a management area; next, for each resource management issue, recommended management actions are described; finally, implementation actions for projects are presented in a matrix format. The matrices summarize actions, location, priority, timing, quantity, and unit cost for each management area.

A. Calera Management Area

Upper Calera and Middle Calera fields are included within the Calera Management Area. Important natural resources within this Management Area include riparian vegetation along Scott Creek and the two forks of Calera Creek. The Calera Management Area encompasses the higher elevations of the park, and large expanses of this Management Area have slopes over 50 percent. This management area and its recommended management program are shown on Figure 22.

1. Objectives

The following objectives relate to management issues within the Calera Management Area.

- Restore Calera Creek riparian corridor.
- Restore Scott Creek riparian corridor.
- Improve recreational access on trails.

2. Resource Management Program

The following is a description of the recommended management actions organized by issue or vegetation type for the Calera Management Area. Table 12 contains a summary of actions for this Management Area.

a. Grasslands. In the past, the upper portions of Levin County Park have been lightly grazed compared to the lower portions of the park, primarily due to the steepness of slopes leading to it and the relative lack of water. The grasslands in Upper Calera Field appear stable and not subject to encroachment of scrub or infestations of invasive non-native plants. Generally, the upper reaches of the park are the most abundant in terms of native grasses and wildflowers. Native purple needlegrass is widely scattered throughout the upper grassland area of Upper Calera Field. The grasslands in Middle Calera Field are comprised of non-native grasses. Some areas are heavily infested with non-native weed species such as fennel, bull thistle, yellow starthistle, and blue starthistle.

Upper and Middle Calera fields should be annually monitored for infestations of non-native plants, grass height and thatch buildup. If conditions warrant, these fields should be spot grazed to meet management objectives.

(1) Actions.

- Spot graze the Calera Management Area on an as-needed basis (see Table 12). Coordinate with range specialist for timing of spot grazing.
- Monitor Upper and Middle Calera fields for appropriate amounts of residual dry matter to determine acceptable level for vegetation management needs and adjust grazing levels and timing of grazing accordingly.

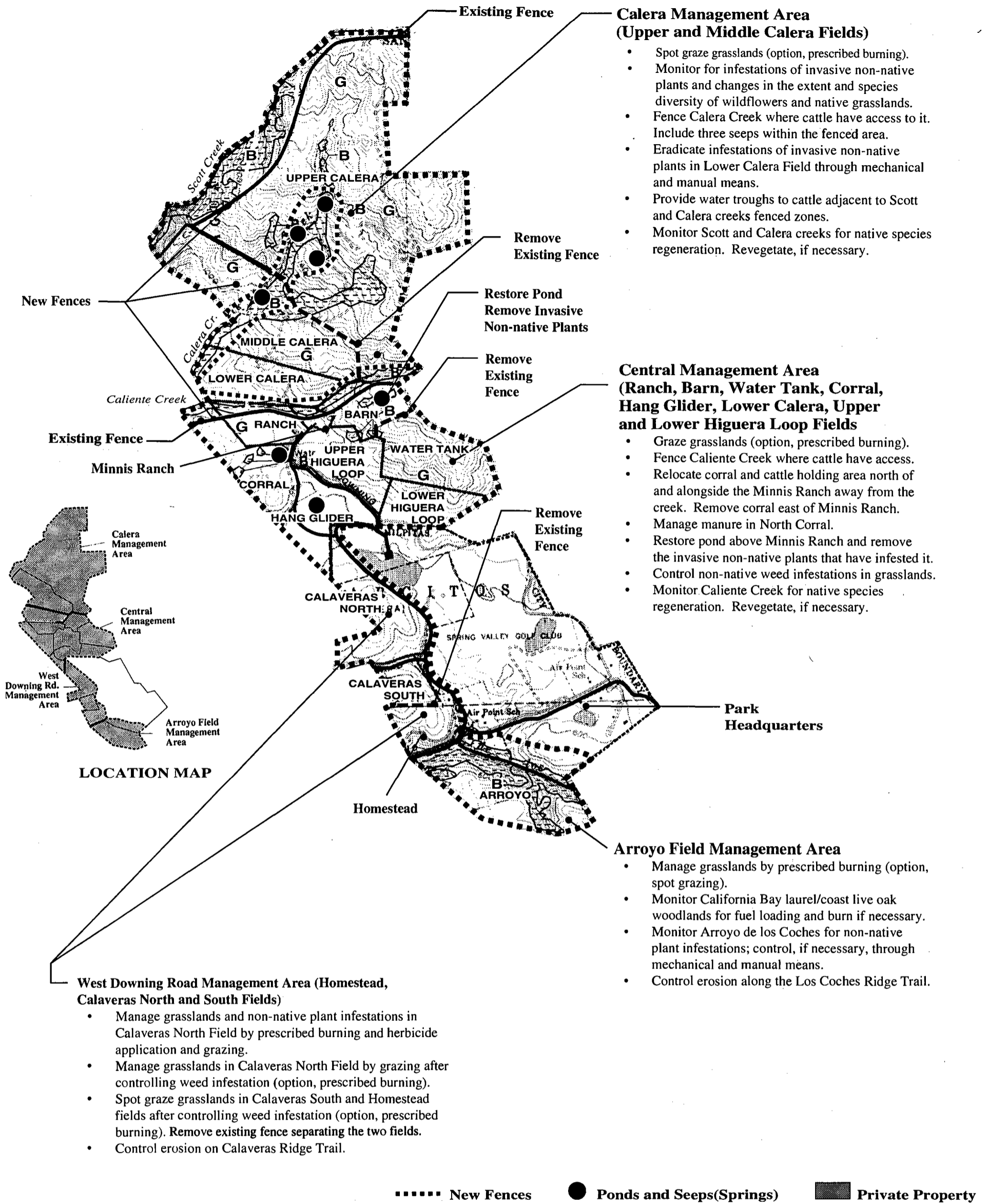


FIGURE 22

Management Areas

ED LEVIN COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

LEGEND

- Grassland
- G Non-native Grassland
- ▨ Mixed Oak Woodland
- B California Bay Laurel/Coast Live Oak Woodland
- Road
- Field Boundary
- ▬▬▬▬ Park/Study Area Boundary
- ⋯⋯⋯ Park Boundary



Table 12
CALERA MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|--|-------------------------|--------------------|-------------|------------------------|----------------------------|-----------------------|------------------------|--------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Spot graze grasslands | Upper and Middle Calera | 1 | Varies | As required | Licensee | 517 acres 298 AUMS | \$12/AUM | Varies |
| Monitor Scott Creek for fire hazards and weed infestations | Upper and Middle Calera | 1 | -- | -- | -- | 7,000 feet | \$15/hour monitor | Unknown |
| Monitor Calera Creek and, if necessary, fence the creek where cattle have access | Upper and Middle Calera | 3 | -- | -- | -- | 7,500 feet | \$4/foot | \$30,000 |
| Provide water troughs for cattle outside Scott and Calera Creek corridors | Upper and Middle Calera | 1 | -- | -- | Licensee | 2 | \$2,500/trough | \$5,000 |
| Fence north side of Caliente Creek | Upper and Middle Calera | 1 | -- | -- | -- | 1,300 feet | \$4/foot | \$5,200 |
| Manually control non-native weeds in Calera and Caliente creek corridors | Upper and Middle Calera | 1 | Spring | Varies | Volunteers | Varies | \$15/hour | Unknown |
| Monitor Calera and Caliente creeks for revegetation, consider revegetation program | Upper and Middle Calera | 2 | Spring | 3-year intervals | CDF | 6,000 feet | \$15/hour monitor | \$120 |
| OPTIONAL PROGRAM | | | | | | | | |
| Burn grasslands | Upper and Middle Calera | 2 | Fall-Spring | 3-year intervals | CDF BAAQMD Neighbors | 517 acres | \$9/acre | \$4,650 |

^a Phase generally refers to the time in which a program should begin: Phase 1, years 1 through 5; Phase 2, years 6 through 10, Phase 3, years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Grazing revenues are based on the 1995-96 year.

- Monitor grasslands for infestations by invasive non-native plants and changes in the extent and species diversity of wildflowers and native grasses. (See Appendix N for monitoring and sampling techniques.) In the event that the numbers or types of native grasses, wildflowers, and herbs appear to be diminishing over time, reduce grazing by shortening the length of time the cattle are in the field. Control infestations of non-native plants (see section e. below).
- Consider a prescribed burning management regime to control for wildfire conditions. Generally burning can occur from fall to spring in three-year intervals.

b. Scott Creek Riparian Corridor. Scott Creek forms the boundary between Levin County Park and the East Bay Regional Park District (EBRPD) lands to the north. The Scott Creek riparian corridor is relatively narrow and steep and lacks a shrub edge. In some areas, the riparian vegetation and banks along Scott Creek have been disturbed by feral pig rooting. This activity has resulted in a predominance of non-native species such as milk thistle, bull thistle, mustard and periwinkle in the understory along the creek. Scott Creek is completely fenced within Levin Park to protect the riparian vegetation from cattle. There is no fencing on EBRPD lands.

(1) Actions.

- Monitor Scott Creek for wildfire potential, non-native plant infestations, and revegetation of riparian species. If warranted, remove trees, dead limbs, and brush by mechanical or manual means and control non-native infestations by manual controls.
 - Establish a cooperative program with EBRPD and enter into a memorandum of understanding or some other formal agreement between Santa Clara County and EBRPD regarding joint management of the Scott Creek. Work with EBRPD to improve the condition of Agua Caliente Trail where it crosses Scott Creek.
 - Provide water troughs outside of Scott Creek fenced riparian corridor to provide water for cattle.
 - Provide a gate on Monument Peak Trail at the park boundary with EBRPD lands. The gate will provide protection from cattle encroachment from EBRPD lands.
-

c. Calera Creek Riparian Corridors. The understory of Calera Creek is greatly limited because of the steepness of the creek banks, rooting of feral pigs, and trampling and grazing by cattle and horses. Water in the creek contains moderate to high levels of suspended sediments, probably due to the above conditions. Additionally, much of the creek bank has been denuded, and invasive, non-native plants have invaded portions of the riparian zone.

(1) Actions.

- Fence Calera Creek where cattle have access to it (see Figure 22). Because the majority of Calera Creek will be in Upper and Middle Calera fields which will not be in an annual grazing program, the level of damage attributed to cattle should be monitored. If monitoring determines that damage is occurring, the creek should be fenced or the spot grazing program should be modified (i.e., reduce AUM level and change timing of use to the driest season possible) to eliminate creek impacts. Where trails cross the creek, culvert the creek and fence on either side of the culvert to provide unimpeded trail access.
- Monitor the riparian vegetation along Calera Creek annually in the spring to determine whether the vegetation is restoring itself. If levels of restoration are insignificant, consider an active revegetation program. Attempt to get volunteers to help with this project.
- If necessary, provide water troughs outside fenced riparian zone in order to provide water for cattle.

d. Protect Ponds and Seeps. There are three undeveloped seeps and one developed seep within the Calera Creek drainageway in the Calera Management Area (see Figure 22). These seeps may support wetland vegetation and sensitive amphibian species.

(1) Actions.

- Include the three seeps within the fenced area protecting the Calera Creek riparian area.

3. Expected Results

The recommended management program can be expected to allow creek vegetation to regenerate resulting in significant improvements to water quality and a substantial increase in plant and wildlife diversity. The removal of fennel and other invasive non-native species would remove competition with native plant species, potentially increase the diversity of native plants, and improve the diversity of plants and wildlife in the park. It would also remove a source of weed seed. Culverting and fencing trail crossings of creek corridors would maintain recreation access.

B. Central Management Area

The Central Management Area includes Ranch, Barn, Water Tank, Upper Higuera Loop, Lower Higuera Loop, Corral, Lower Calera, and Hang Glider fields. Significant water resources in this Management Area are Caliente Creek and the pond above Minnis Ranch. This Management Area and its recommended management program are shown on Figure 22.

1. Objectives

The following objectives relate to management issues within the Central Management Area.

- Restore Caliente Creek riparian corridor.
- Restore the pond above Minnis Ranch.
- Maintain the Hang Glider Field for safe recreational use.
- Improve recreational access on trails.

2. Resource Management Program

The following is a description of the recommended management actions organized by issue or vegetation type for the Central Management Area. Table 13 contains a summary of actions for this Management Area.

**Table 13
CENTRAL MANAGEMENT AREA**

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|--|--------------------|--------------|----------------------------|----------------------------|-----------------------|--|------------------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Graze grasslands | Corral, Upper and Lower Higuera Loop, Lower Calera | 1 | Jan 1-Jul 15 | Annually | Licensee | 154 acres 154 AUMs | \$12/AUM | \$1,840 est. revenue |
| Graze or mow grasslands | Hang Glider | 1 | Jan 1-Jul 15 | Annually | Licensee | 47 acres 47 AUMs | \$12/AUM \$15/acre/mow | \$560 est. revenue \$500 to mow |
| Graze grasslands, reserve for first-calf heifers until they calve | Ranch, Barn | 1 | Jan 1-Jul 15 | Annually | Licensee | 62 acres 62 AUMs | \$12/AUM | \$700 est. revenue |
| Control non-native plant infestations in grasslands | All fields | 1 | Varies | Annually | -- | Varies | \$15/acre/mow \$9/acre/burn \$40/acre/herbicide application est. | Unknown |
| Fence and monitor Calera Creek for fire hazards and weed infestations, control infestations | Lower Calera | 1 | Spring | -- | Volunteers | 800 feet | \$4/foot \$15/hour to monitor and control weeds | \$3,200/fence |
| Fence north side of Caliente Creek | Lower Calera | 1 | -- | -- | -- | 3,000 feet | \$4/foot | \$12,000 |
| Remove horse corral east of Minnis Ranch and relocate to the north | Ranch | 1 | Summer | -- | Licensee | -- | Unknown | Unknown |
| Monitor Caliente Creek corridor for revegetation, consider revegetation program | Ranch, Barn, Lower Calera | 2 | Spring | 3-year intervals | CDF | 4,500 feet | \$15/hour/monitor | \$120 |
| Monitor for and manually control, if necessary, non-native weeds in Caliente Creek corridor | Ranch, Barn, Lower Calera | 1 | Spring | Annually | Volunteers | Varies | \$15/hour | Unknown |
| Repair fence and dam at pond, and manually control weed infestations | Barn | 2 | Spring | As needed for weed control | Inmates Volunteers | 1 acre | -- | \$10,000 est. |
| OPTIONAL PROGRAM | | | | | | | | |
| Burn grasslands | Corral, Upper and Lower Higuera Loop, Water Tank, Lower Calera | 2 | Fall-Spring | 3-year intervals | CDF BAAQMD Neighbors | 275 acres | \$9/acre | \$2,475 |

^a Phase generally refers to the time in which a program should begin: Phase 1, years 1 through 5; Phase 2, years 6 through 10, Phase 3, years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Grazing revenues are based on the 1995-96 year.

a. Grasslands. Grasslands in the Central Management Area are comprised of non-native grasses. Some fields in this management area are infested with non-native plants such as bull thistle, milk thistle, yellow starthistle and blue starthistle. Fennel and other invasive non-native plants are a problem in Lower Calera Field. The grasslands are currently grazed.

(1) Actions.

- Graze the Central Management Area fields on a rotational basis between January and July (see Table 13). Adjust the grazing program annually to best meet resource and recreation objectives. Limit grazing use within the January to July period to the shortest period possible. Consult with a resource specialist to refine the grazing season. The criteria for evaluating the length of the grazing season should include: recreational access needs, compatibility with recreational uses, climate and seasonal conditions, resource conditions, economics and fire management needs.
- Hang Glider Field grasses should be maintained at a consistent short height for assisting hang gliding landings. Grasses can be cropped at frequent intervals by grazing or mowing.
- Lower Calera Field should be reserved as a holding area for use during branding and shipping operations (which occur in Barn Field). Branding is conducted around March and April. Livestock should be gathered into the Lower Calera Field and funneled into Barn Field where they would be worked in the corral. Animals should then be returned to other appropriate fields.
- Monitor these fields for appropriate amounts of residual dry matter to determine acceptable level for vegetation management needs and adjust grazing levels and timing of grazing accordingly.
- Monitor grasslands for infestations by invasive non-native plants and control infestations appropriately (see Appendices J and K).
- If grazing is removed from fields in this Management Area, another option is a prescribed burning management regime to control for wildfire conditions. Generally burning can occur from fall to spring in three-year intervals.
- The procedures for eradicating fennel and other invasive non-native weeds through cutting, herbicide application, and manual control as described in Appendix J.

- Trail access improvements include the elimination of the gate between Barn Field and Water Tank Field, and a new gate configuration to accommodate equestrians at Corral and Lower Calera. The new gate will be five to six feet wide, with easy opening devices to be located in the existing fence line adjacent to the existing vehicular gate. All gates are to be locked open when cattle are not in adjoining fields.
- b. Caliente Creek Riparian Corridor. Caliente Creek which runs just north of and alongside the Minnis Ranch, has been badly degraded due to the presence of a horse corral and a cattle holding area on its banks. Much of the creek bank has been denuded; cattle browsing on wetlands and riparian vegetation is evident, water quality has been degraded from runoff of soil and manure, and invasive, non-native plants have invaded portions of the riparian zone. The encroachment of livestock operations should be ended and the creek should be restored.
- (1) Actions.
- Fence Caliente Creek where cattle have access to it (see Figure 22). Where trails cross the creek, culvert the creek and fence on either side of the culvert to provide unimpeded trail access.
 - Remove horse corral east of Minnis Ranch. Relocate the corral north of Minnis Ranch at least 150 feet from the top of the creek bank as per County riparian setback requirements.
 - A manure management program should be required for any intensive use of the corral north of Minnis Ranch. This program should be in compliance with local and state health and water quality standards and should address on- and off-site control of manure waste.
 - Remove by manual control non-native weed infestations in Caliente Creek riparian corridor to assist the native vegetation restoration process.
 - Monitor the riparian vegetation along Caliente Creek annually in the spring to determine whether the vegetation is restoring itself. If levels of restoration are insignificant, consider an active revegetation program. A revegetation program may include planting native riparian plants taken from healthy riparian corridors in the park. Attempt to get volunteers to help with this project.
-

- If needed, provide water troughs away from Caliente Creek fenced riparian corridor in order to provide water for cattle.

c. Restore Pond Above Minnis Ranch. The spring-fed pond above the Minnis Ranch in the Barn Field has been infested with invasive, non-native plants (predominantly cattail which interferes with its water-holding capacity and lowers its biodiversity). The dam is leaking and in need of repair.

(1) Actions.

- Rebuild or repair the pond and dam and remove invasive non-native plants during the earth moving operations, if possible.
- Once the integrity of the dam is reestablished, monitor for damage by ground squirrels and other pest animals, and control their populations through encouraging predation, live trapping, destroying burrows and poisoning, if necessary.
- Repair the fence around the pond as needed. Construct rail fencing to ameliorate the visual impacts of fencing this pond and to allow easy access to the pond for wildlife.
- If the pond and dam are not rebuilt, cattail, poison hemlock, thistle, and fennel around the pond should be removed by mechanical means, hand-pulling, or weed wrenching.
- Poison hemlock should be removed in the spring when the soil is moist and before the plants have set seed.
- Fennel and thistle should be uprooted or pulled by hand when the plants are small, and may be hoed to a depth of two inches below the soil surface before they set seed. Additional information about the removal of invasive non-native plants is included in Appendix J. Herbicides should not be used.
- Approximately 50 percent of the cattail in the pond should be removed by mechanical means such as weed-whipping. Alternatively, cattail may be removed by burning it in the spring with blow torches. Neither of these control methods remove the corms which are underwater and must be removed manually. Control methods will need to be conducted periodically to maintain the 50-percent open lake area.

3. **Expected Results**

The recommended management program can be expected to allow creek vegetation to regenerate resulting in significant improvements to water quality and a substantial increase in plant and wildlife diversity. The removal of invasive non-native species would remove competition with native plant species, potentially increase the diversity of native plants, and improve the diversity of plants and wildlife in the park. This management program can be expected to restore the water-holding function of the pond above Minnis Ranch and to subsequently increase biodiversity around the pond. Maintaining a low grass height in Hang Glider Field would promote hang glider safety. Culverting and fencing trail crossings of creek corridors would maintain recreation access.

C. West Downing Road Management Area

Calaveras North, Calaveras South and Homestead fields are included in the West Downing Road Management Area. This Management Area and its recommended management program are shown on Figure 22.

1. Objectives

The specific management objective for this Management Area is stated below.

- Stabilize soils along Calaveras Ridge Trail to provide year-round pedestrian and equestrian access.

2. Resource Management Program

The following is a description of the recommended management program for the area. Table 14 contains a summary of actions for this area.

- a. Grasslands. The West Downing Road Management Area includes a number of smaller grassland fields with steep slopes that have been excluded from grazing for a number of years. The grasslands here, with the exception of the Calaveras South Field, have been infested with black mustard and bull thistle, among other invasive non-native plants. Grasslands within the Calaveras South Field have remained relative free of invasive non-native plants, likely as a result of unauthorized grazing by cattle belonging to the landowner to the west. This area should be managed first by a program of prescribed burning and mowing and then by grazing.
-

(1) Actions.

- On Calaveras North and Homestead fields, control non-native plant infestations through a program of prescribed burning, (summer) followed by herbicide application or grazing, as appropriate. Control of non-native plant infestations will probably require at least three years of intensive management. Appendices J and K contain more specific information on controlling non-native plant infestations.
- Remove existing fence separating Calaveras South and Homestead fields.
- When sufficient forage is available, include Calaveras North Field in the grazing regime for the Central Management Area (see Table 14).
- When sufficient forage is available, include Calaveras South and Homestead fields in a spot grazing program if water resources can be developed. Another option is to develop an agreement with the landowner to the west to continue short-term, high intensity grazing of Calaveras South Field, and include Homestead Field in this grazing program.
- Monitor Calaveras North, Calaveras South and Homestead fields for appropriate amounts of residual dry matter to determine acceptable level for revegetation management needs and adjust grazing levels and timing of grazing accordingly.
- Monitor grasslands annually for increasing infestations by invasive non-native plants.
- Another option for long-term management of Calaveras North, South and Homestead fields is a prescribed burning program to control for wildfire conditions and non-native infestations. Generally burning can occur from fall to spring in three-year intervals.

b. Trails. Recreation users would like to increase year-round access to this Management Area and control erosion on the Calaveras Ridge Trail.

(1) Actions.

- Work with the equestrian community who use the park to create a year-round trail along the Calaveras Ridge Trail. Options to control erosion include implementing trench drains, culverting, drainage swales, rock surfacing and trail rerouting.

Table 14
WEST DOWNING ROAD MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|--------------------------------------|--------------------|---------------|---|----------------------------|---------------------|------------------------|--------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Burn and use other methods to control non-native weeds | Calaveras North, Homestead | 1 | Summer-Fall | Burn/3-year intervals; other methods annually | CDF BAAQMD Neighbors | 95 acres | \$9/acre burn | \$855 min. |
| Graze grasslands as part of lower fields unit after control of non-native weeds | Calaveras North | 1 | Jan 1-July 15 | Annually | Licensee | 63 acres 60 AUMs | \$12/AUM | \$720 est. revenue |
| Spot graze grasslands after control of non-native weeds and development of water for cattle | Calaveras South, Homestead | 1 | Varies | Annually | Licensee | 49 acres 49 AUMs | \$12/AUM | Varies |
| Control erosion on Calaveras Ridge Trail | Calaveras South and North, Homestead | 1 | Summer-Fall | -- | Equestrian community | 4,000 feet | Varies | Unknown |
| OPTIONAL PROGRAM | | | | | | | | |
| Coordinate with adjacent owner to allow grazing of fields | Calaveras South, Homestead | 1 | Varies | Annually | Neighbor | 49 acres | -- | -- |
| Burn grasslands for weed and wildfire control | Calaveras South and North, Homestead | 2 | Fall-Spring | Burn/3-year intervals | CDF BAAQMD Neighbors | 112 acres | \$9/acre | \$1,008 |

^a Phase generally refers to the time in which a program should begin: Phase 1, years 1 through 5; Phase 2, years 6 through 10, Phase 3, years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Grazing revenues are based on the 1995-96 year.

3. Expected Results

The recommended management program can be expected to decrease and contain non-native weed infestations, prevent wildfires, remove thatch, promote biodiversity of grasslands, and control erosion on the Calaveras Ridge Trail.

D. Arroyo Field Management Area

The Arroyo Field Management Area includes the portions of the study area south of Calaveras Road. Significant natural resources in this area include Arroyo de los Coches riparian corridor and significant stands of California bay laurel/coast live oak woodlands. This Management Area and its recommended management program are shown on Figure 22.

1. Objectives

The specific objective for this Management Area is stated below.

- Stabilize soils at Los Coches Ridge trailhead to provide year-round trail access.

2. Resource Management Program

The following is a description of the recommended management program for the Arroyo Field Management Area. Table 15 contains a summary of actions for this area.

a. Grasslands. This area includes limited grasslands along the southern ridge. There are a number of steep slopes in the Arroyo Field. This field is not grazed by cattle.

(1) Actions.

- Burn the grasslands in Arroyo Field at approximately three-year intervals in the spring in order to control wildfire, thatch buildup and non-native plant infestations. If prescribed burning is not possible, other options are to include this field in a spot grazing program if water resources for cattle can be developed.

b. California Bay Laurel/Coast Live Oak Woodlands. There is a substantial area of California bay laurel/coast live oak woodlands in the Arroyo Field. The portion of the woodland that lines the Arroyo de los Coches supports a dense understory. The woodlands on the northeast facing slopes south of the Arroyo has a sparse understory because of the dense overstory.

(1) Actions.

- Monitor the California bay laurel/coast live oak woodlands for potential wildfire conditions at approximately five-year intervals.
- Consider a prescribed burning program at 15 to 20-year intervals in the spring.

c. Arroyo de los Coches Riparian Corridor. Arroyo de los Coches runs down the center of this Management Area. The creek corridor is wider, less steep than Smith or Calera creeks and has a dense overstory and well-developed understory. This creek corridor has a high value as a movement corridor between the park and adjacent undeveloped properties.

(1) Actions.

- Monitor the Arroyo de los Coches for wildfire conditions and non-native plant infestations at approximately five-year intervals. If conditions warrant, remove non-native species through mechanical and manual means.

d. Trails. Recreation users would like to increase year-round access to this Management Area and control erosion along the Los Coches Ridge Trail.

(1) Actions.

- Work with the equestrian community who use the Park to create a year-round trail at the Los Coches Ridge trailhead. Options to control erosion include implementing trench drains, culverting, drainage swales, rock surfacing, and trail rerouting.

3. **Expected Results**

The recommended management program can be expected to reduce the fuel load within the Arroyo de los Coches riparian corridor and the California bay laurel/coast live oak woodlands, control non-native infestations, and control erosion along the Los Coches Ridge Trail.

Table 15
ARROYO FIELD MANAGEMENT AREA

| Action | Field/Location | Phase ^a | Timing | Frequency/ Interval | Coordination | Quantity | Unit Cost ^b | Estimated Annual Cost |
|---|----------------|--------------------|----------------|-------------------------|----------------------------|---------------------|------------------------|--------------------------|
| PRIMARY PROGRAM | | | | | | | | |
| Burn grasslands for wildfire control | Arroyo | 1 | Fall-Spring | 3-year intervals | CDF BAAQMD Neighbors | 20 acres | \$9/acre | \$180 |
| Monitor woodlands for wildfire conditions | Arroyo | 2 | Summer | 3-year intervals | -- | 66 acres | \$120 est. | \$120 |
| Burn woodlands for wildfire control | Arroyo | 2 | Winter-Spring | 15 to 20-year intervals | CDF BAAQMD Neighbors | 66 acres | \$9/acre | \$594 |
| Monitor Arroyo de los Coches for non-native weeds and erosion | Arroyo | 2 | Spring | 3-year intervals | -- | 3,000 feet | \$60 est. | \$60 |
| Control erosion on Los Coches Ridge Trail | Arroyo | 1 | Summer to Fall | -- | Equestrian Community | 2,000 feet | Varies | Unknown |
| OPTIONAL PROGRAM | | | | | | | | |
| Spot graze grasslands if water can be developed | Arroyo | 2 | Varies | As required | Licensee | 20 acres 20 AUMs | \$12/AUM | Varies |

^a Phase generally refers to the time in which a program should begin: Phase 1, years 1 through 5; Phase 2, years 6 through 10, Phase 3, years 11 through 15.

^b Detailed site design and program development is needed to refine costs. Cost of administration, design, management, maintenance, operations, and equipment is generally not part of the cost estimates unless so noted. If no costs are assigned assume that staff time is used. No costs have been assigned when using volunteer or inmate labor, however, it should be recognized that inmates and volunteers will need to be trained and monitored. Grazing revenues are based on the 1995-96 year.

Chapter X
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Appendix A
SANTA CLARA COUNTY PARKLAND RANGE
MANAGEMENT POLICY

■ ■ ■

Exhibit 1

SANTA CLARA COUNTY PARKLAND
RANGE MANAGEMENT POLICY

1. The Department of Parks and Recreation is hereby authorized to administer a program of cattle grazing at designated parklands, following Board adopted policy designed to protect, conserve, and enhance the natural resources of the parklands and to promote public recreational opportunities.
2. The primary land use objectives for each given parkland must govern the decision whether and how to best employ a grazing program.

Land management objectives include the following, in priority order:

- a. Provide visitor access and recreational opportunities.
 - b. Provide for the safety of park users.
 - c. Protect, conserve, enhance natural plant communities.
 - d. Minimize fire hazards to parklands and private property by managing vegetative fuels.
 - e. Rehabilitate degraded vegetation and wildlife habitat.
 - f. Establish cooperative relationships with adjacent property owners.
3. All grazing by domestic stock on any parklands shall be managed so as to maintain the quality of the soil, water, vegetation, and wildlife. The following specific goals and commitments will guide the program:
 - a. Each site shall have a management plan (and/or E.I.R. as required by law) which describes the natural resources present and the specific goals, techniques, and monitoring programs used to preserve and enhance them.
 - b. The plan shall provide sufficient detail on management techniques to support their use in accomplishing the stated goals. For example, a grazing plan must provide information and justification for stocking rate, spatial and seasonal patterns of use, and type of livestock.
 - c. The appropriate vegetation management technique(s) should be selected after considering a variety of options including: no action, prescribed fire, mowing, integrated pest management, herbicides, and grazing. The Department may opt to provide for any, all, or none of the above in combination in a parkland.
 - d. A monitoring program should include appropriate periodic measurements of plant and wildlife species composition, density, and frequency. (Other standards, like residual dry matter and stubble height, are useful operational tools but they do not examine the effects of management on the native vegetation).
 - e. Special attention shall be given to the effects of grazing on rare plants and rare plant communities, oak regeneration, riparian and wetland areas, and native perennial grasslands, and threatened or endangered wildlife. Attention should also be given to the relationship between grazing and the spread of weedy exotics such as star thistle.

- f. Seasonal rather than year-around grazing will be encouraged at parklands which experience heavy summer visitor use, so as to minimize use conflict. Seasonal grazing will be employed when year around programs cannot be sustained due to inadequate forage production, low water availability, or other environmental protection needs.
- g. Normal weather and public use patterns and resultant forage production will be considered when authorizing grazing in a park. Stocking rates will be reviewed quarterly, adjusted as necessary.
- h. A conservative approach will be used to determine parkland cattle stocking rates so as to avoid short-term resource damage or long-term range decline.

Residual dry matter (RDM) standards are used to determine the amount of each year's vegetative production that should remain on the ground at the end of the grazing season. This residue or mulch acts as a protective layer over the soil to guard against erosion, encourage nutrient recycling, and promote optimum conditions for plant growth. For Santa Clara County the acceptable RDM levels are:

- * Less than 30% slope: leave 600 lbs./acre
Alert level: 800
- * 30 to 50% slope: leave 800 lbs./acre
Alert level: 1000
- * Greater than 50% slope: leave 1000 lbs./acre
Alert level: 1200

These standards generally translate into 4 to 6 inches of standing vegetation at the end of the grazing season. Individual areas may have special circumstances that will require that additional mulch remain. Residue requirements will vary according to the need to promote soil stability, maintain plant productivity, enhance visual and recreational values, or protect wildlife habitat. Staff will be given clear, practical, visual monitoring guidelines which correlate with RDM requirements.

- i. Natural resource management and recreation objectives will take precedence over revenue generation in establishing grazing programs.
- j. Appropriate fencing will be required to ensure the protection of sensitive natural resource areas such as springs and ponds and riparian habitats. Such fencing may not inhibit wildlife or human access to water.
- k. Rare species of plants and animals and their habitat will be identified, inventoried, and protected.
- l. Archeological sites will be preserved in undisturbed condition.
- m. Existing native plants and animals will be encouraged.
- n. Soil erosion will be minimized to prevent soil loss or surface water sedimentation.
- o. Agricultural landscapes and improvements will be maintained to good visual standards and not detract from positive visitor experience.
- p. The spread of noxious non-native plant species will be minimized.

- q. Public access to all park areas will be maintained.
4. License agreements will be formulated and administered with an intent to be non-adversarial and supportive of sound long-term working relationships between the Department of Parks and Recreation and its licensees; the grazing operations must be economically viable to both the Department and Licensee to be effective. Environmental standard and recreational opportunities will not be sacrificed for the benefit of cattle grazing.
 5. Existing licensees who have successfully met their contractual obligations will be given the opportunity to renegotiate their new licenses under these program guidelines. If these negotiations are not successful, an open competitive bidding process will be followed to solicit grazing tenants, with minimum bid set by the Department.
 6. Revenues derived from grazing licenses must reflect fair market value.
 7. The Department of Parks and Recreation will ensure proper and effective management of the grazing program by educating and maintaining expertise on staff and using outside experts as necessary to audit the program and/or provide necessary staff training.
 8. Reasonable means will be taken to inform the visiting public about the grazing program in each grazed park: the purposes (i.e., grassland maintenance, fire hazard reduction, protection of native plant species, maintenance of healthy agricultural economy, revenue generation and so on) and about range etiquette (i.e., using gates, climbing fences, reporting dead animals and so on) and general safety guidelines for being around the animals.
 9. No cattle, sheep, goats or other domestic animal will be permitted to graze in County parks except by written license as approved by the Board of Supervisors.
 10. Most public agencies with grazing programs are currently studying the effects of grazing on wildlife and natural plant communities and reviewing their policies and practices, and the scientific community is conducting intensive research and expanding our knowledge of the interactions between livestock grazing and wildlife and native plant community resources; therefore, grazing policy and practices of Santa Clara County will be reviewed in a public forum at least every four (4) years, beginning in two years from the date when grazing begins under this policy. These policy reviews will be based on a comprehensive Department report which includes: (a) progress toward goals stated in the site management plans; (b) a full exposition of costs and revenues. The Parks and Recreation Commission shall review the Department report and if appropriate recommend modification to the Board of Supervisors.

Appendix B
WATER RESOURCES INVENTORY
FOR GRANT COUNTY PARK

■ ■ ■

Appendix B is a water resource and development inventory for the known water sources on Grant County Park. It was completed by the range specialist during the inventory of the plant communities. This inventory documents the existence and the location of undeveloped seeps and springs, developed springs, and ponds. The water resources information is summarized in the following table which is followed by information about each water resource provided on a separate sheet for each resource.

The locations of each of the water resources has been assigned a discrete number according to the field in which it is located, the type of water resource it is (spring or pond), and the order in which it was found within the field. Thus, HOP1 is the first pond in Hotel Field; WS3 is the third spring located in the Big Washburn Field. The locations of each of the water resources on Grant County Park are shown in Figure B-1, identified by their discrete numbers.

The individual description sheets for each water resource list the type of resource, whether the water resource is within a grazed area or not, the discrete identification number assigned to it during this inventory, the field in which it is located, a general description of the type of water resource, the components such as fencing that surround it, the existence of aquatic or emergent vegetation, the resource's approximate dimensions and condition, and its history. If there are specific comments about a particular water resource, they are included.

The following is the list of abbreviations for each of the fields used in numbering and mapping the water resources. The locations of fields in Grant County Park is shown in Figure 5 in the body of this report.

| | |
|----|--------------------|
| BN | Barn North Field |
| B | Brush Field |
| C | Corral Field |
| D | Dutch Flat Field |
| E | Edwards Field |
| HO | Hotel Field |
| H | Hall Valley Field |
| L | Lake Field |
| N | North Field |
| P | Pala Seca Field |
| W | Big Washburn Field |

Please note: if this copy of the Resource Management Plan does not include individual description sheets for each water resource type, that information can be obtained at the Santa Clara County Parks and Recreation Department.

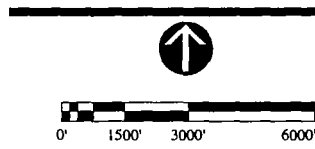
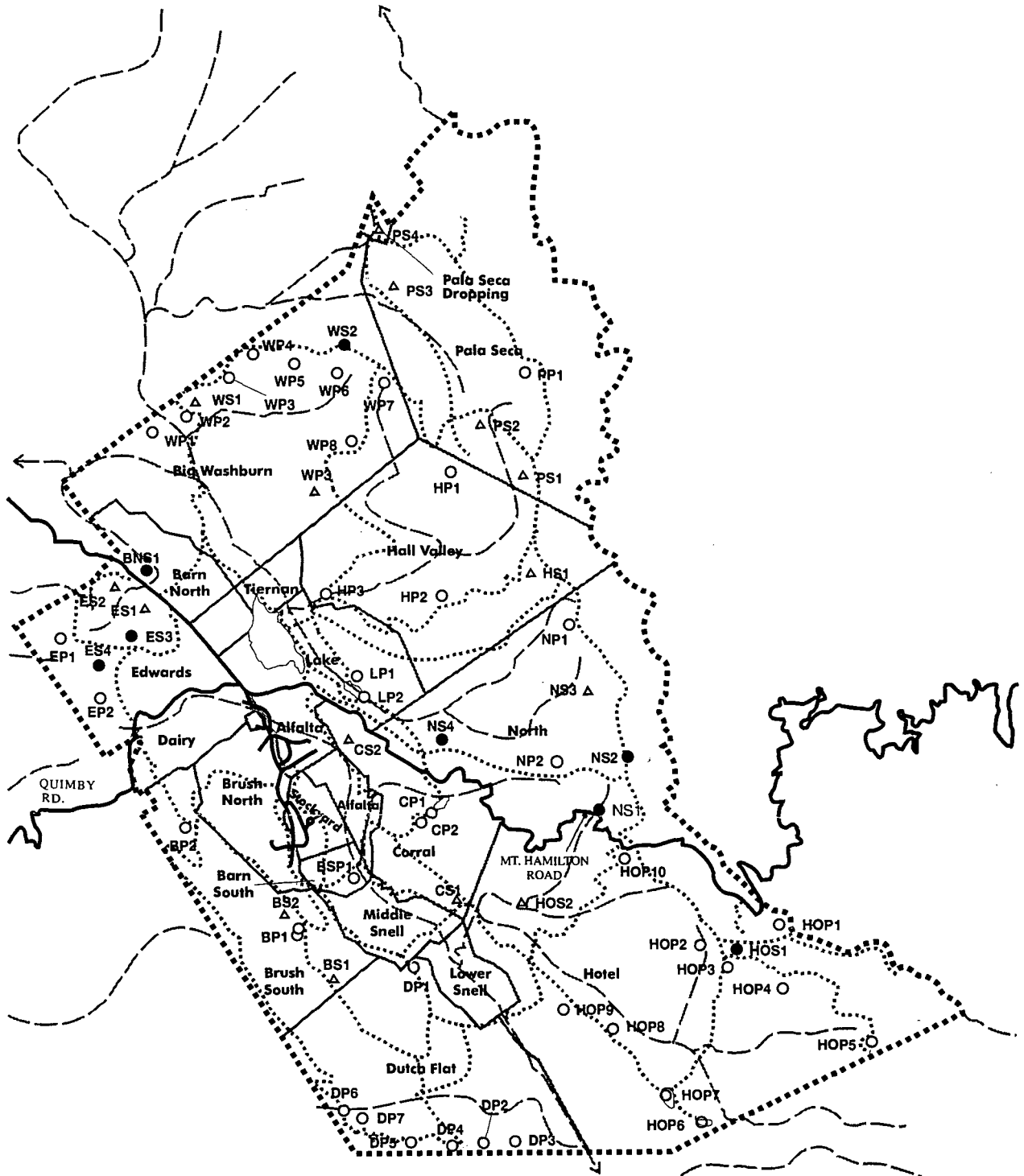


FIGURE B-1

Lakes and Ponds

J.D. GRANT COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County



BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS

| LEGEND | |
|--------|--------------------------|
| ● | Undeveloped Seep |
| ▲ | Developed Seep |
| ○ | Ponds or Lake |
| ▭ | Lake |
| --- | Stream |
| — | Road |
| --- | Field Boundary |
| | Trails |
| ■■■■ | Park/Study Area Boundary |

TABLE 7

 JOSEPH D. GRANT COUNTY PARK
 WATER RESOURCES INVENTORY SUMMARY

| SPRING/ POND CODE | PERENNIAL EPHEMERAL | SPRING FED | IN DRAINAGE IN UPLANDS | POND DIMENSIONS | | | SPRING DIMENSION | | WETLAND VEGETATION | ASSOCIATED EROSION | GRAZED UNGRAZED | CONDITION GOOD/FAIR/POOR |
|----------------------|------------------------|---------------|---------------------------|------------------|-----------------|-----------------|------------------|-----------------|-----------------------|-----------------------|--------------------|-----------------------------|
| | | | | LENGTH IN FT. | WIDTH IN FT. | DEPTH IN FT. | LENGTH IN FT. | WIDTH IN FT. | | | | |
| BNS1 | P | - | D | | | | 50 | 10 | FREQUENT | Y | G | F |
| BP1 | E | - | U | 150 | 60 | 0.5 | | | ABUNDANT | N | U | G |
| BP2 | E | N | U | 80 | 30 | 3 | | | NONE | N | G | F |
| BS1 | P | - | U | | | | | | OCCASIONAL | N | G | F |
| BS2 | P | - | U | | | | | | OCCASIONAL | N | U | F |
| CP1 | P | Y | D | 300 | 300 | 15 | | | ABUNDANT | Y | G | E |
| CP2 | E | N | U | 60 | 60 | 2 | | | ABUNDANT | N | G | G |
| CS1 | P | - | U | | | | 60 | 20 | ABUNDANT | Y | G | F |
| CS2 | - | - | U | | | | - | - | NONE | N | G | G |
| DP1 | E | N | D | 50 | 30 | 5 | | | NONE | Y | G | F |
| DP2 | E | N | D | 50 | 50 | 2 | | | FREQUENT | N | G | F |
| DP3 | E | N | D | 0 | 0 | 0 | | | ABUNDANT | N | G | G |
| DP4 | E | N | D | 30 | 30 | 4 | | | NONE | N | G | F |
| DP5 | P | Y | U | 35 | 35 | 3 | | | ABUNDANT | Y | G | G |
| DP6 | P | Y | U | 150 | 120 | 10 | | | ABUNDANT | Y | G | G |
| DP7 | P | Y | D | 40 | 40 | 5 | | | FREQUENT | Y | G | F |
| EP1 | E | N | U | 90 | 75 | 4 | | | OCCASIONAL | N | G | G |
| EP2 | E | N | D | 120 | 100 | 8 | | | OCCASIONAL | N | G | G |
| ES1 | P | - | U | | | | | | NONE | N | G | F |
| ES2 | P | - | U | | | | 30 | 30 | SPARSE | N | G | G |
| ES3 | P | - | U | | | | 100 | 15 | FREQUENT | Y | G | P |
| ES4 | P | - | D | | | | 300 | 50 | ABUNDANT | Y | G | P |
| HOP1 | E | N | U | 75 | 20 | 1 | | | FREQUENT | Y | G | F |
| HOP2 | P | ? | UD | 80 | 75 | 6 | | | SPARSE | N | G | F |
| HOP3 | E | N | D | 75 | 20 | 3 | | | SPARSE | Y | G | F |
| HOP4 | E | N | D | 75 | 20 | 2 | | | SPARSE | Y | G | F |
| HOP5 | P | Y | U | 200 | 120 | 8 | | | ABUNDANT | N | G | E |
| HOP6 | P | Y | U | 225 | 150 | 10 | | | ABUNDANT | N | G | E |
| HOP7 | P | Y | U | 450 | 150 | 6 | | | ABUNDANT | N | G | G |
| HOP8 | P | N | U | 60 | 60 | 6 | | | FREQUENT | N | G | G |
| HOP9 | P | Y | U | 150 | 40 | 4 | | | ABUNDANT | N | G | G |
| HOP10 | E | N | D | 65 | 50 | 4 | | | SPARSE | Y | G | F |
| HOS1 | P | - | U | | | | 50 | 10 | ABUNDANT | Y | G | P |
| HOS2 | P | - | D | | | | 300 | 15 | ABUNDANT | Y | G | F |
| HP1 | P | N | U | 35 | 35 | 4 | | | SPARSE | N | G | F |
| HP2 | NO INFO | - | - | - | - | - | - | - | - | - | G | - |
| HP3 | NO INFO | - | - | - | - | - | - | - | - | - | G | - |
| HS1 | P | - | U | | | | | | FREQUENT | N | G | G |
| LP1 | P | Y | D | 450 | 150 | 20 | | | ABUNDANT | N | U | E |
| LP2 | P | Y | D | 150 | 90 | 2 | | | ABUNDANT | N | U | E |
| NP1 | P | N | D | 105 | 105 | 8 | | | OCCASIONAL | Y | G | F |
| NP2 | NO INFO | - | - | - | - | - | - | - | - | - | G | - |
| NS1 | P | - | D | | | | 35 | 12 | FREQUENT | Y | G | F |
| NS2 | P | - | D | | | | 180 | 60 | FREQUENT | Y | G | F |
| NS3 | P | - | U | | | | | | OCCASIONAL | N | G | G |
| NS4 | E | - | D | | | | 600 | 15 | FREQUENT | Y | G | F |
| PP1 | E | N | U | 25 | 25 | 6 | | | NONE | N | G | F |
| PS1 | P | - | U | | | | 20 | 8 | OCCASIONAL | N | G | G |
| PS2 | P | - | U | | | | 10 | 7 | OCCASIONAL | Y | G | G |
| PS3 | P | - | U | | | | 20 | 20 | SPARSE | Y | G | G |
| PS4 | P | - | U | | | | 150 | 150 | FREQUENT | Y | G | F |
| WP1 | P | N | U | 100 | 100 | 8 | | | OCCASIONAL | N | G | G |
| WP2 | E | N | D | 75 | 50 | 10 | | | OCCASIONAL | Y | G | F |
| WP3 | E | N | D | 50 | 50 | 5 | | | SPARSE | Y | G | F |
| WP4 | E | N | D | 75 | 30 | 6 | | | SPARSE | Y | G | F |
| WP5 | E | N | D | 50 | 50 | 8 | | | OCCASIONAL | Y | G | F |
| WP6 | E | N | D | 50 | 25 | 4 | | | NONE | Y | G | F |
| WP7 | E | N | D | 30 | 30 | 3 | | | NONE | Y | G | F |
| WP8 | E | N | D | 50 | 30 | 2 | | | NONE | Y | G | F |
| WS1 | P | - | U | | | | | | NONE | N | G | G |
| WS2 | P | - | D | | | | 15 | 10 | NONE | Y | G | P |
| WS3 | P | - | U | | | | | | NONE | N | G | G |

FILE NAME: GRANTH2O.WQ1

Appendix C
WATER RESOURCES INVENTORY
FOR LEVIN COUNTY PARK

■ . ■ . ■

Appendix C is a water resource and development inventory for the known water sources on Levin County Park. It was completed by the range specialist during the inventory of the plant communities. This inventory documents the existence and the location of undeveloped seeps and springs, developed springs, and ponds. The water resources information is provided on separate sheets for each water resource. The locations of each of the water resources has been assigned a discrete number according to the field in which it is located, the type of water resource it is (spring or pond), and the order in which it was found within the field. Thus, BP1 is the first pond in Barn Field; HGS1 is the first spring located in the Hang Glider Field. The locations of each of the water resources on Levin County Park are shown on Figure C-1 and identified by their discrete numbers.

The description sheets list the type of resource, whether the water resource is within a grazed area or not, the discrete identification number assigned to it during this inventory, the field in which it is located, a general description of the type of water resource, the components such as fencing that surround it, the existence of aquatic or emergent vegetation, the resource's approximate dimensions and condition, and its history. If there are specific comments about a particular water resource, they are included.

The following is the list of abbreviations for the fields used in numbering and mapping the water resources. The locations of fields in Levin County Park are also shown in Figure C-1.

B Barn Field
C Corral Field
HG Hang Glider Field
LH Lower Higuera Loop Field
MC Middle Calera Field
UC Upper Calera Field

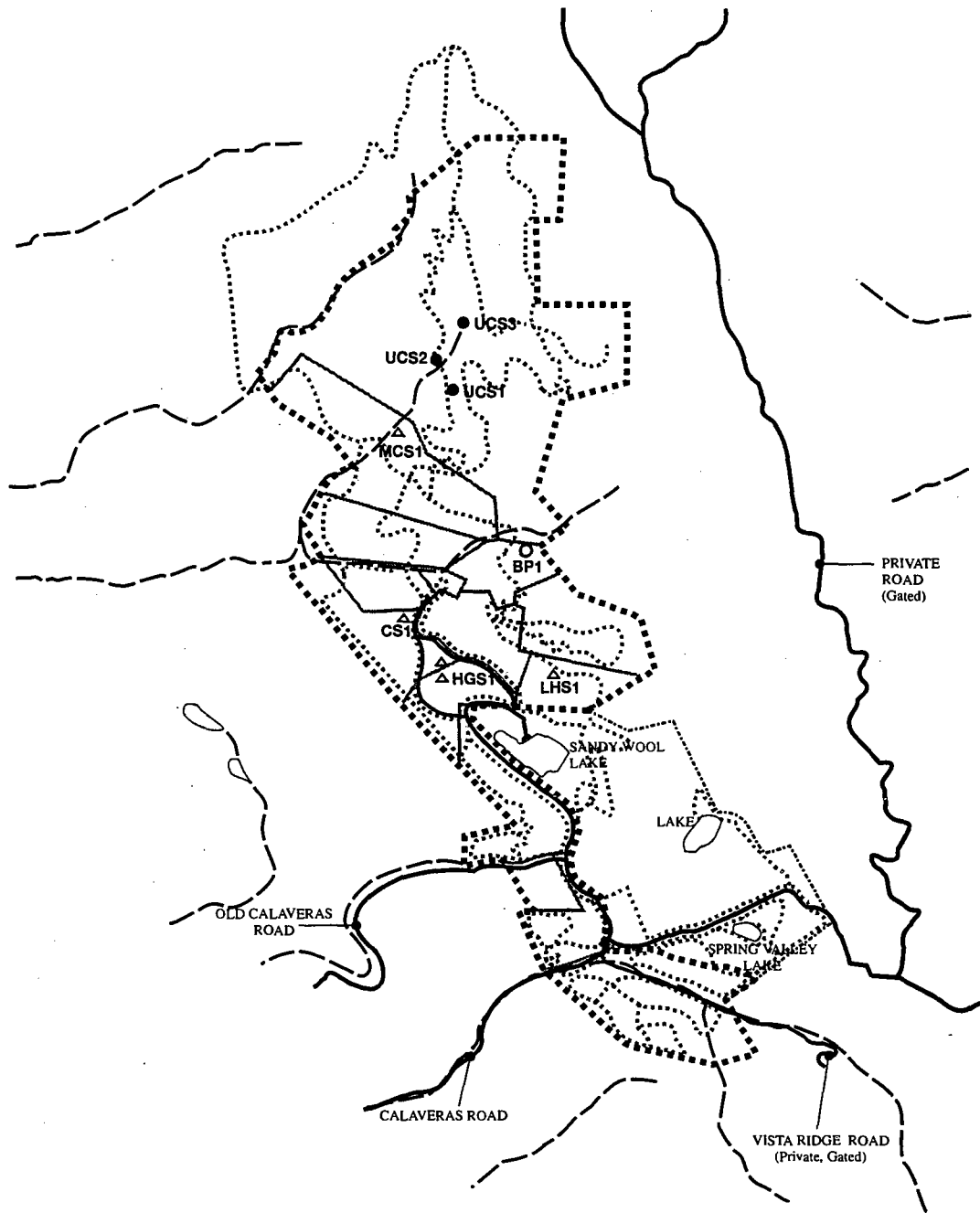


FIGURE C-1

Lakes and Ponds

ED LEVIN COUNTY PARK
 RESOURCE MANAGEMENT PLAN
 Santa Clara County

■ ■ ■

BRADY AND ASSOCIATES, INC.
 PLANNERS AND LANDSCAPE ARCHITECTS



| LEGEND | |
|---------|--------------------------|
| ● | Undeveloped Seep |
| ▲ | Developed Seep |
| ○ | Pond |
| □ | Lake |
| — — — | Stream |
| — — — | Road |
| | Trail |
| — — — | Field Boundary |
| ■ ■ ■ ■ | Park/Study Area Boundary |
| | Park Boundary |

RANGE IMPROVEMENT INVENTORY
SPRINGS

PARK: Ed R. Levin DATE: 5-21-94 OBSERVER: Budzinski

STATUS: Spring Developed X Spring Undeveloped

LOCATION:

USGS Quadrangle Name: Calaveras Reservoir T. N., R. E., SEC.
I.D.# HGS1 Field/Pasture: Hang Glider Field

Descriptive Location: along fence line border of Hang Glider
and Corral Fields

SPRING AREA: Length Width Fenced? (y/n) N
Perennial/Intermittent? P Livestock use? (y/n) Y
Vegetation area around spring box is dry
Condition fair

SPRING BOX: Redwood X Fiberglass Plastic
Metal Culvert Pipe Other
Dimensions 3'x 3' Depth 6' Headwall? (y/n) ?
Gravel Packed? (y/n) ?
Condition good

PIPELINE: PVC Rigid/Flexible? Galvanized X
Diameter 1" Distance from Source to Tank/Trough 120'
Condition good

STORAGE TANKS: Number 0 Wood Metal
Fiberglass Plastic Other
Dimensions
Base
Float Valve (y/n) Type of Overflow
Condition

TROUGHS: Number 2 Wood Metal X Concrete
Fiberglass Plastic Other
Dimensions 9'x 3'x 3'; other trough non-functional
Base 6"x 6" wood ties
Float Valve (y/n) N Type of Overflow onto ground and down
channel for approx. 100 yds. with wetland vegetation of loose-
strife, rabbitsfoot grass, canary grass, meadow barley, watercress.
Adapted for Wildlife Use? (y/n) N
Condition fair; good flow

HISTORY:

Construction: mo. /yr. Reconstruction: mo. /yr.
Major Maintenance: mo. /yr.
By Whom? County Licensee Contractor
Cost \$

COMMENTS: redevelop to make trough more accessible to each field;
install overflow to direct overflow water off-site

RANGE IMPROVEMENT INVENTORY
SPRINGS

PARK: Ed R. Levin DATE: 5-21-94 OBSERVER: Budzinski

STATUS: Spring Developed X Spring Undeveloped

LOCATION:

USGS Quadrangle Name: Calaveras Reservoir T. N., R. E., SEC.
I.D.# LHS1 Field/Pasture: Lower Higuera Loop Field
Descriptive Location: 150 yds. N.E. of white metal entrance gate
to Monument Peak Road

SPRING AREA: Length Width Fenced? (y/n)
Perennial/Intermittent? Livestock use? (y/n)
Vegetation
Condition did not locate; spring source reportedly up drainage
from trough

SPRING BOX: Redwood Fiberglass Plastic
Metal Culvert Pipe Other
Dimensions Depth Headwall? (y/n)
Gravel Packed? (y/n)
Condition did not locate

PIPELINE: PVC Rigid/Flexible? Galvanized X
Diameter 1" Distance from Source to Tank/Trough ?
Condition good

STORAGE TANKS: Number 0 Wood Metal
Fiberglass Plastic Other
Dimensions
Base
Float Valve (y/n) Type of Overflow
Condition

TROUGHS: Number 1 Wood Metal X Concrete
Fiberglass Plastic Other
Dimensions 7'x3'x2'
Base 6"x6" wood ties
Float Valve (y/n) N Type of Overflow onto ground creating
wetland community in channel with watercress, rabbitsfoot grass,
dock, loosestrife, etc.
Adapted for Wildlife Use? (y/n) N
Condition good; good flow

HISTORY:

Construction: mo. /yr. Reconstruction: mo. /yr.
Major Maintenance: mo. /yr.
By Whom? County Licensee Contractor
Cost \$

COMMENTS: install float valve or redirect overflow elsewhere

RANGE IMPROVEMENT INVENTORY
SPRINGS

PARK: Ed R. Levin **DATE:** 5-21-94 **OBSERVER:** Budzinski

STATUS: Spring Developed X Spring Undeveloped

LOCATION:

USGS Quadrangle Name: Calaveras Reservoir T. N., R. E., SEC.
I.D.# CS1 Field/Pasture: Corral Field
Descriptive Location: junction of Monument Peak Road and paved
spur road through Corral and Hang Glider Fields; 100' N. of road

SPRING AREA: Length Width Fenced? (y/n)
Perennial/Intermittent? Livestock use? (y/n)
Vegetation
Condition not located

SPRING BOX: Redwood Fiberglass Plastic
Metal Culvert Pipe Other
Dimensions Depth Headwall? (y/n)
Gravel Packed? (y/n)
Condition not located

PIPELINE: PVC Rigid/Flexible? Galvanized X
Diameter 1" Distance from Source to Tank/Trough ?
Condition fair; apparent break in pipe at trough

STORAGE TANKS: Number 0 Wood Metal
Fiberglass Plastic Other
Dimensions
Base
Float Valve (y/n) Type of Overflow
Condition

TROUGHS: Number 2 Wood Metal X Concrete
Fiberglass Plastic Other
Dimensions 6'x4'x3'
Base eroded concrete
Float Valve (y/n) N Type of Overflow onto ground
Adapted for Wildlife Use? (y/n) N
Condition fair, somewhat rusty; pondweed growing in trough

HISTORY:

Construction: mo. /yr. Reconstruction: mo. /yr.
Major Maintenance: mo. /yr.
By Whom? County Licensee Contractor
Cost \$

COMMENTS: wetland area present around pond from break in pipe
supports watercress, rabbitsfoot grass, duckweed, redtop, loose-
strife, drains into wet channel with similar veg.; recommend
spring redevelopment, wetland protection

RANGE IMPROVEMENT INVENTORY
SPRINGS

PARK: Ed R. Levin **DATE:** 5-21-94 **OBSERVER:** Budzinski

STATUS: Spring Developed X Spring Undeveloped

LOCATION:

USGS Quadrangle Name: Calaveras Reservoir T. N., R. E., SEC.
I.D.# MCS1 Field/Pasture: Middle Calera Field
Descriptive Location: 0.1 mi. N.W. of Monument Peak Rd. along
Agua Caliente Trail

SPRING AREA: Length 60' Width 15' Fenced? (y/n) N
Perennial/Intermittent? P Livestock use? (y/n) Y
Vegetation none
Condition trampled by livestock and wild pigs

SPRING BOX: Redwood Fiberglass Plastic
Metal Culvert Pipe Other
Dimensions Depth Headwall? (y/n)
Gravel Packed? (y/n)
Condition not located

PIPELINE: PVC Rigid/Flexible? Galvanized X
Diameter 1" Distance from Source to Tank/Trough 50'
Condition good

STORAGE TANKS: Number 0 Wood Metal
Fiberglass Plastic Other
Dimensions
Base
Float Valve (y/n) Type of Overflow
Condition

TROUGHS: Number 1 Wood Metal X Concrete
Fiberglass Plastic Other
Dimensions 9'x3'x2.5'
Base 6" x 6" wood ties
Float Valve (y/n) Y Type of Overflow
Adapted for Wildlife Use? (y/n) N
Condition good

HISTORY:

Construction: mo. /yr. Reconstruction: mo. /yr.
Major Maintenance: mo. /yr.
By Whom? County Licensee Contractor
Cost \$

COMMENTS: good functional water development; spring areas above
trough should receive protection

RANGE IMPROVEMENT INVENTORY

RANGE IMPROVEMENT INVENTORY
PONDS

PARK: Ed R. Levin DATE: 5/21/94 OBSERVER: Budzinski

STATUS: Pond in Grazed Area X Pond Not In Grazed Area

LOCATION:

USGS Quadrangle Name: Calaveras Reservoir T. N., R. E., SEC.
I.D.# BP1 Field/Pasture: Barn Field
Descriptive Location: 0.5 miles cross-country and uphill from
barn complex at Minnis Ranch

TYPE: Natural Depression Dammed X Spring Fed X
Runoff Fed X Perennial X Ephemeral
Located In Drainage Located In Uplands X

COMPONENTS: Dam Type (earthen, concrete) E
Overflow or Spillway Type (culvert, spillway, pipe) earth berm
built up around upper and lower ponds; upper pond has old overflow
pipes through dam; dam also leaks
Pond Fenced? (y/n) lower yes Alternate Water Provided? (y/n) N
Aquatic/Emergent Vegetation upper: 80% of pond choked with cat-
tails with mint, sedge, rabbitsfoot grass, nettle, dock; lower:
spike rush is dominant veg. covering 2/3 of pond
Notable Wildlife none seen
Condition fair

DIMENSIONS: Length 100' Width 100' Depth 2' --UPPER
50' 50' 2' --LOWER
Surrounding Drainage Area 5 acres; ponds mostly spring-fed

OVERALL CONDITION:

Excellent Good X Fair Poor
Functional X Non-Functional
Associated Erosion. (y/n) N Describe Erosion Problems:

HISTORY:

Construction: mo. yr. Reconstruction: mo. yr.
Major Maintenance: mo. yr.
By Whom? County Licensee Contractor
Cost \$

COMMENTS: enclosed buffer area of upper pond infested with
thistle, poison hemlock, mustard, yellow starthistle; seepage from
upper pond and spring maintains a wetland community for 1/4 mile
downslope of pond in drainage and diversion channels; water flow
downslope through drainage is very strong; very little water
present in upper pond; recommend redevelopment of ponds to re-
capture spring water

RANGE IMPROVEMENT INVENTORY
PONDS

PARK: Ed R. Levin DATE: 5/21/94 OBSERVER: Budzinski

STATUS: Pond in Grazed Area X Pond Not In Grazed Area

LOCATION:

USGS Quadrangle Name: Calaveras Reservoir T. N., R. E., SEC.
I.D.# UCP1 Field/Pasture: Upper Calera Creek Field
Descriptive Location: at end of road beyond uppermost hang glider
launch site near east boundary

TYPE: Natural Depression Dammed X Spring Fed
Runoff Fed X Perennial Ephemeral X
Located In Drainage X Located In Uplands

COMPONENTS: Dam Type (earthen, concrete) E
Overflow or Spillway Type (culvert, spillway, pipe) earth
spillway
Pond Fenced? (y/n) N Alternate Water Provided? (y/n) N
Aquatic/Emergent Vegetation none

Notable Wildlife none seen
Condition fair

DIMENSIONS: Length 50' Width 20' Depth 3'
Surrounding Drainage Area 40 acres

OVERALL CONDITION:

Excellent Good X Fair Poor
Functional X Non-Functional
Associated Erosion (y/n) N Describe Erosion Problems:

HISTORY:

Construction: mo. yr. Reconstruction: mo. yr.
Major Maintenance: mo. yr.
By Whom? County Licensee Contractor
Cost \$

COMMENTS:

RANGE IMPROVEMENT INVENTORY
PONDS

PARK: Ed R. Levin DATE: 5/21/94 OBSERVER: Budzinski

STATUS: Pond in Grazed Area X Pond Not In Grazed Area

LOCATION:

USGS Quadrangle Name: Calaveras Reservoir T. N., R. E., SEC.
I.D.# UCP2 Field/Pasture: Upper Calera Creek Field
Descriptive Location: 0.3 mi. down Aqua Caliente Trail from
junction with Monument Peak Rd.

TYPE: Natural Depression Dammed X Spring Fed
Runoff Fed X Perennial Ephemeral X
Located In Drainage X Located In Uplands

COMPONENTS: Dam Type (earthen, concrete) E
Overflow or Spillway Type (culvert, spillway, pipe) earth
spillway
Pond Fenced? (y/n) N Alternate Water Provided? (y/n) N
Aquatic/Emergent Vegetation none

Notable Wildlife none seen
Condition fair

DIMENSIONS: Length 60' Width 40' Depth 4'
Surrounding Drainage Area

OVERALL CONDITION:

Excellent Good Fair X Poor
Functional X Non-Functional
Associated Erosion (y/n) N Describe Erosion Problems:

HISTORY:

Construction: mo. yr. Reconstruction: mo. yr.
Major Maintenance: mo. yr.
By Whom? County Licensee Contractor
Cost \$

COMMENTS:

Appendix D
CONFIRMED PLANT LIST FOR GRANT COUNTY PARK

■ ■ ■

FERNS & HORSETAILS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|-------------|-----------------|--------------|------------------------|-----------------|-----|------|
| Adiantum | jordanii | | CALIFORNIA MAIDEN-HAIR | Pteridaceae | N | P |
| Dryopteris | arguta | | COASTAL WOOD-FERN | Dryopteridaceae | N | P |
| Pellaea | andromedaefolia | | COFFEE FERN | Pteridaceae | N | P |
| Pellaea | mucronata | mucronata | BIRD'S-FOOT FERN | Pteridaceae | N | P |
| Pentagramma | triangularis | triangularis | GOLDENBACK FERN | Pteridaceae | N | P |
| Polypodium | californicum | | CALIFORNIA POLYPODY | Polypodiaceae | N | P |

GRASSES & GRASSLIKE

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|------------|--------------|-------------|-----------------------------|------------|-----|------|
| Avena | barbata | | BRISTLE-TIPPED WILD OAT | Poaceae | I | A |
| Avena | fatua | | SHARP-TIPPED WILD OAT | Poaceae | I | A |
| Bromus | carinatus | carinatus | CALIFORNIA BROME GRASS | Poaceae | N | P |
| Bromus | diandrus | | RIPGUT / NEEDLE BROME | Poaceae | I | A |
| Bromus | hordeaceus | | SOFT BROME or SOFT CHEAT | Poaceae | I | A |
| Bromus | japonicus | | JAPANESE BROME GRASS | Poaceae | I | A |
| Bromus | madritensis | madritensis | FOXTAIL CHESS | Poaceae | I | A |
| Bromus | madritensis | rubens | RED BROME | Poaceae | I | A |
| Crypsis | schoenoides | | SWAMP GRASS | Poaceae | I | A |
| Cynosurus | echinatus | | HEDGEHOG DOGTAIL GRASS | Poaceae | I | A |
| Distichlis | spicata | | SALT GRASS | Poaceae | N | P |
| Eleocharis | macrostachya | | COMMON SPIKE-RUSH | Cyperaceae | N | P |
| Elymus | elymoides | elymoides | SQUIRRELTAIL | Poaceae | N | P |
| Elymus | glaucus | glaucus | BLUE WILD-RYE | Poaceae | N | P |
| Festuca | californica | | CALIFORNIA FESCUE | Poaceae | N | P |
| Gastridium | ventricosum | | NIT-GRASS | Poaceae | I | A |
| Glyceria | borealis | | MANNA GRASS | Poaceae | N | P |
| Hordeum | jubatum | | FOXTAIL BARLEY | Poaceae | N | AP |
| Hordeum | marinum | gussoneanum | MEDITERRANEAN BARLEY | Poaceae | I | A |
| Hordeum | murinum | leporinum | SHORT-FLORET FOXTAIL BARLEY | Poaceae | I | A |
| Juncus | bufonius | ? | TOAD RUSH | Juncaceae | N | A |
| Juncus | effusus | pacificus | BOG RUSH | Juncaceae | N | P |
| Juncus | patens | | SPREADING RUSH | Juncaceae | N | P |
| Juncus | xiphioides | | IRIS-LEAVED RUSH | Juncaceae | N | P |
| Koeleria | macrantha | | JUNEGRASS | Poaceae | N | P |
| Lamarckia | aurea | | GOLDENTOP GRASS | Poaceae | I | A |
| Leymus | triticoides | | BEARDLESS WILD-RYE | Poaceae | N | P |
| Lolium | multiflorum | | AWNED ITALIAN RYEGRASS | Poaceae | I | P |

GRASSES & GRASSLIKE

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|-----------|---------------|--------------|-------------------------|------------|-----|------|
| Melica | californica | | CALIFORNIA MELIC | Poaceae | N | P |
| Melica | torreyana | | NARROW 4-MIL MELICGRASS | Poaceae | N | P |
| Nassella | pulchra | | PURPLE NEEDLEGRASS | Poaceae | N | P |
| Phalaris | aquatica | | HARDING GRASS | Poaceae | I | P |
| Poa | annua | | ANNUAL BLUEGRASS | Poaceae | I | A |
| Poa | secunda | secunda | ONE-SIDED BLUEGRASS | Poaceae | N | P |
| Polypogon | monspeliensis | | ANNUAL RABBITFOOT GRASS | Poaceae | I | A |
| Scirpus | acutus | occidentalis | COMMON TULE | Cyperaceae | N | P |
| Scirpus | microcarpus | | PANICLED BULRUSH | Cyperaceae | N | P |

HERBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|-------------|----------------|-------------|--------------------------|------------------|-----|------|
| Achillea | millefolium | | YARROW, MILFOIL | Asteraceae | N | P |
| Achyraea | mollis | | BLOW-WIVES | Asteraceae | N | A |
| Agoseris | retrorsa | | SPEAR-LEAVED AGOSERIS | Asteraceae | N | P |
| Amsinckia | menziesii | intermedia | COMMON FIDDLENECK | Boraginaceae | N | A |
| Anagallis | arvensis | | SCARLET PIMPERNEL | Primulaceae | I | A |
| Anthemis | cotula | | MAYWEED, STINKWEED | Asteraceae | I | A |
| Anthriscus | caucalis | | BUR-CHERVIL | Apiaceae | I | A |
| Aquilegia | formosa | | CRIMSON COLUMBINE | Ranunculaceae | N | P |
| Artemisia | douglasiana | | CALIFORNIA MUGWORT | Asteraceae | N | P |
| Barbarea | orthoceras | | WINTER CRESS | Brassicaceae | N | P |
| Brassica | nigra | | BLACK MUSTARD | Brassicaceae | I | A |
| Brassica | rapa | | COMMON YELLOW MUSTARD | Brassicaceae | I | A |
| Calandrinia | ciliata | | MAGENTA RED MAIDS | Portulacaceae | N | A |
| Callitriche | heterophylla | bolanderi | WATER STARWORT | Callitrichaceae | N | P |
| Calochortus | albus | | WHITE GLOBE LILY | Liliaceae | N | P |
| Calochortus | luteus | | YELLOW MARIPOSA LILY | Liliaceae | N | P |
| Calochortus | venustus | | BUTTERFLY TULIP | Liliaceae | N | P |
| Calystegia | purpurata | purpurata | BRUSH MORNING-GLORY | Convolvulaceae | N | P |
| Calystegia | subacaulis | subacaulis | SHORT-STEM MORNING-GLORY | Convolvulaceae | N | P |
| Capsella | bursa-pastoris | | SHEPHERD'S PURSE | Brassicaceae | I | A |
| Cardamine | californica | californica | SHADE MILK MAIDS | Brassicaceae | N | P |
| Cardaria | draba | | HEART-PODDED HOARY CRESS | Brassicaceae | I | P |
| Carduus | tenuiflorus | | NAPA THISTLE | Asteraceae | I | AB |
| Castilleja | affinis | affinis | INDIAN PAINT BRUSH | Scrophulariaceae | N | P |
| Castilleja | attenuata | | NARROW-LEAF OWL CLOVER | Scrophulariaceae | N | A |
| Castilleja | exserta | exserta | PURPLE OWL'S CLOVER | Scrophulariaceae | N | A |

HERBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|---------------|----------------|---------------|-----------------------------|------------------|-----|------|
| Centaurea | solstitialis | | YELLOW STAR-THISTLE | Asteraceae | I | A |
| Cerastium | glomeratum | | MOUSE-EAR CHICKWEED | Caryophyllaceae | I | A |
| Chamomilla | suaveolens | | PINEAPPLE WEED | Asteraceae | N | A |
| Chenopodium | californicum | | CALIFORNIA SOAP PLANT | Chenopodiaceae | N | P |
| Chlorogalum | pomeridianum | pomeridianum | FIBROUS SOAP ROOT | Liliaceae | N | P |
| Cirsium | vulgare | | BULL THISTLE | Asteraceae | I | B |
| Clarkia | concinna | automixa | SANTA CLARA RED RIBBONS | Onagraceae | N | A |
| Clarkia | purpurea | quadrivulnera | FOUR-SPOT CLARKIA | Onagraceae | N | A |
| Clarkia | rubicunda | | RED-BASED GODETIA | Onagraceae | N | A |
| Claytonia | perfoliata | mexicana | ANGLE-LEAF MINER'S LETTUCE | Portulacaceae | N | A |
| Collinsia | heterophylla | | CHINESE HOUSES | Scrophulariaceae | N | A |
| Conium | maculatum | | POISON HEMLOCK | Apiaceae | I | B |
| Cynoglossum | grande | | HOUND'S TONGUE | Boraginaceae | N | P |
| Delphinium | variegatum | variegatum | ROYAL LARKSPUR | Ranunculaceae | N | P |
| Dichelostemma | capitatum | capitatum | BLUE DICKS | Liliaceae | N | P |
| Dipsacus | fullonum | | WILD TEASEL | Dipsacaceae | I | B |
| Dodecatheon | hendersonii | | SHOOTING STAR, SAILOR CAPS | Primulaceae | N | P |
| Eremocarpus | setigerus | | TURKEY MULLEIN | Euphorbiaceae | N | A |
| Erigeron | philadelphicus | | PHILADELPHIA FLEABANE | Asteraceae | N | BP |
| Eriogonum | nudum | ? | TIBINAGUA/NUDE BUCKWHEAT | Polygonaceae | N | P |
| Eriogonum | sp. | | BUCKWHEAT | Polygonaceae | N | |
| Erodium | botrys | | LONG-BEAKED STORK'S BILL | Geraniaceae | I | A |
| Erodium | cicutarium | | RED-STEM STORK'S BILL | Geraniaceae | I | A |
| Eschscholzia | californica | | CALIFORNIA POPPY | Papaveraceae | N | P |
| Foeniculum | vulgare | | SWEET FENNEL | Apiaceae | I | P |
| Galium | aparine | | BIG STAR-LEAF BEDSTRAW | Rubiaceae | I | A |
| Galium | californicum | californicum | SMALL MATTED BEDSTRAW | Rubiaceae | N | P |
| Galium | porrigens | porrigens | CLIMBING PRICKLEAF BEDSTRAW | Rubiaceae | N | P |
| Geranium | dissectum | | PURPLETIP CUT-LEAF GERANIUM | Geraniaceae | I | A |
| Geranium | molle | | HAIRY GERANIUM | Geraniaceae | I | A |
| Gilia | achilleifolia | achilleifolia | BLUE GILIA | Polemoniaceae | N | A |
| Gilia | tricolor | tricolor | BIRD'S-EYE GILIA | Polemoniaceae | N | A |
| Gnaphalium | palustre | | LOWLAND CUDWEED | Asteraceae | N | A |
| Gnaphalium | purpureum | | PURPLE CUDWEED | Asteraceae | N | A |
| Grindelia | hirsutula | hirsutula | HAIRY GRINDELIA | Asteraceae | N | P |
| Heterotheca | sessiliflora | echioides | HAIRY GOLDEN ASTER | Asteraceae | N | P |
| Hypochoeris | glabra | | SMOOTH CAT'S-EAR | Asteraceae | I | A |
| Iris | longipetala | | COAST IRIS | Iridaceae | N | P |
| Iris | macrosiphon | | BOWL-TUBED IRIS | Iridaceae | N | P |
| Lasthenia | californica | | GOLD FIELDS | Asteraceae | N | A |
| Lasthenia | glaberrima | | VERNAL POOL GOLD FIELDS | Asteraceae | N | A |
| Lathyrus | vestitus | vestitus | PALE PURPLE HILLSIDE PEA | Fabaceae | N | P |
| Lemna | minor | | LESSER DUCKWEED | Lemnaceae | N | P |
| Lepidium | nitidum | nitidum | THREAD-LEAF PEPPERGRASS | Brassicaceae | N | A |
| Lepidium | strictum | | SMALL SPREADING PEPPERGRASS | Brassicaceae | I | A |

HERBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|---------------|---------------|---------------|-----------------------------|------------------|-----|------|
| Limnanthes | douglasii | nivea | PURPLE-VEINED MEADOW FOAM | Limnanthaceae | N | A |
| Linanthus | androsaceus | | FALSE BABY STARS | Polemoniaceae | N | A |
| Linanthus | bicolor | | TWO-COLOR BABY STARS | Polemoniaceae | N | A |
| Linanthus | grandiflorus | | LARGE-FLOWER LINANTHUS | Polemoniaceae | N | A |
| Linanthus | parviflorus | | SMALL-FLOWER LINANTHUS | Polemoniaceae | N | A |
| Lithophragma | affine | | WOODLAND STAR | Saxifragaceae | N | P |
| Lomatium | macrocarpum | | SHEEP PARSNIP | Apiaceae | N | P |
| Lomatium | utriculatum | | YELLOW BLADDER PARSNIP | Apiaceae | N | P |
| Lotus | humistratus | | HILL LOTUS | Fabaceae | N | A |
| Lotus | scoparius | scoparius | DEER WEED, CALIF. BROOM | Fabaceae | N | P |
| Lotus | wrangelianus | | CALF LOTUS | Fabaceae | N | A |
| Lupinus | bicolor | | MINIATURE LUPINE | Fabaceae | N | A |
| Lupinus | luteolus | | BUTTER LUPINE | Fabaceae | N | A |
| Lupinus | succulentus | | ARROYO LUPINE | Fabaceae | N | A |
| Madia | madioides | | WOODLAND TARWEED | Asteraceae | N | P |
| Madia | sativa | | TARWEED | Asteraceae | N | A |
| Marah | fabaceus | | CALIFORNIA MANROOT | Cucurbitaceae | N | P |
| Marrubium | vulgare | | COMMON HOREHOUND | Lamiaceae | I | P |
| Medicago | polymorpha | | CALIFORNIA BURCLOVER | Fabaceae | I | A |
| Micropus | californicus | californicus | SLENDER COTTONWEED | Asteraceae | N | A |
| Microseris | douglasii | douglasii | > 3-MIL-FRUIT SILVER PUFFS | Asteraceae | N | A |
| Mimulus | guttatus | | SEEP-SPRING MONKEY-FLOWER | Scrophulariaceae | N | P |
| Monardella | villosa | globosa | COYOTE MINT | Lamiaceae | N | P |
| Nemophila | heterophylla | | VARI-LEAF NEMOPHILA | Hydrophyllaceae | N | A |
| Nemophila | menziesii | ? | BABY BLUE-EYES | Hydrophyllaceae | N | A |
| Osmorhiza | chilensis | | MOUNTAIN WOOD-CICELY | Apiaceae | N | P |
| Penstemon | heterophyllus | heterophyllus | VARICOLORED PENSTEMON | Scrophulariaceae | N | P |
| Phacelia | breweri | | BREWER'S PHACELIA | Hydrophyllaceae | N | P |
| Phacelia | imbricata | imbricata | ROCK PHACELIA | Hydrophyllaceae | N | P |
| Phacelia | ramosissima | ramosissima | BROWN-MOTTLED PHACELIA | Hydrophyllaceae | N | P |
| Phlox | gracilis | | ANNUAL PHLOX | Polemoniaceae | N | A |
| Phoradendron | villosum | | OAK OR HAIRY MISTLETOE | Viscaceae | N | P |
| Phyla | nodiflora | nodiflora | GARDEN LIPPIA | Verbenaceae | N | P |
| Plagiobothrys | humistratus | | DWARF POPCORN FLOWER | Boraginaceae | N | A |
| Plagiobothrys | nothofulvus | | RUSTY POPCORN FLOWER | Boraginaceae | N | A |
| Plagiobothrys | sp. | | POPCORN FLOWER | Boraginaceae | | |
| Plantago | erecta | | CALIFORNIA DWARF PLANTAIN | Plantaginaceae | N | A |
| Plantago | lanceolata | | ENGLISH PLANTAIN | Plantaginaceae | I | A |
| Plantago | major | | COMMON PLANTAIN | Plantaginaceae | I | AP |
| Plectritis | ciliosa | ? | LONG-SPURRED PLECTRITIS | Valerianaceae | N | A |
| Polygonum | amphibium | stipulaceum | FLOATINGSTEM SWAMP KNOTWEED | Polygonaceae | N | P |
| Polygonum | arenastrum | ? | COMMON KNOTWEED, DOORWEED | Polygonaceae | N | A |
| Potentilla | glandulosa | | STICKY CINQUEFOIL | Rosaceae | N | P |
| Ranunculus | aquatilis | hispidulus | WIDE-LEAF WATER BUTTERCUP | Ranunculaceae | N | P |
| Ranunculus | californicus | | CALIFORNIA BUTTERCUP | Ranunculaceae | N | P |

HERBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|---------------|----------------------|-------------|----------------------------|------------------|-----|------|
| Ranunculus | hebecarpus | | DOWNY BUTTERCUP | Ranunculaceae | N | A |
| Rorippa | curvisiliqua | | WESTERN YELLOW CRESS | Brassicaceae | N | AB |
| Rorippa | nasturtium-aquaticum | | WATER CRESS | Brassicaceae | I | P |
| Rumex | acetosella | | SHEEP SORREL | Polygonaceae | I | P |
| Rumex | crispus | | CURLY DOCK | Polygonaceae | I | P |
| Rupertia | physodes | | CALIFORNIA TEA | Fabaceae | N | P |
| Salvia | columbariae | | CHIA | Lamiaceae | N | A |
| Sanicula | bipinnata | | POISON SANICLE | Apiaceae | N | P |
| Sanicula | bipinnatifida | | PURPLE SANICLE | Apiaceae | N | P |
| Sanicula | crassicaulis | | PACIFIC SNAKEROOT | Apiaceae | N | P |
| Satureja | douglasii | | YERBA BUENA | Lamiaceae | N | P |
| Saxifraga | californica | | CALIFORNIA SAXIFRAGE | Saxifragaceae | N | P |
| Scrophularia | californica | californica | CALIFORNIA FIGWORT | Scrophulariaceae | N | P |
| Senecio | mikanioides | | GERMAN IVY | Asteraceae | I | P |
| Senecio | vulgaris | | COMMON BUTTERWEED | Asteraceae | I | A |
| Silybum | marianum | | MILK THISTLE | Asteraceae | I | AB |
| Sisymbrium | officinale | | HEDGE MUSTARD | Brassicaceae | I | A |
| Sisyrinchium | bellum | | BLUE-EYED GRASS | Iridaceae | N | P |
| Smilacina | stellata | | FALSE SOLOMON'S SEAL | Liliaceae | N | P |
| Sonchus | asper | asper | ROUND-LOBED SOW-THISTLE | Asteraceae | I | A |
| Sonchus | oleraceus | | SHARP-LOBED SOW-THISTLE | Asteraceae | I | A |
| Spergularia | rubra | | PURPLE SAND SPURRY | Caryophyllaceae | I | AP |
| Stachys | ajugoides | rigida | HEDGE NETTLE | Lamiaceae | N | P |
| Stellaria | media | | COMMON CHICKWEED | Caryophyllaceae | I | A |
| Stylomecon | heterophylla | | WIND POPPY | Papaveraceae | N | A |
| Taraxacum | officinale | | COMMON DANDELION | Asteraceae | I | BP |
| Thalictrum | fendleri | polycarpum | FOOTHILL MEADOW RUE | Ranunculaceae | N | P |
| Thermopsis | macrophylla | macrophylla | YELLOW FALSE LUPINE | Fabaceae | N | P |
| Thysanocarpus | curvipes | | CLASPING-LEAF LACE POD | Brassicaceae | N | A |
| Thysanocarpus | laciniatus | | NARROW-LEAF FRINGE POD | Brassicaceae | N | A |
| Torilis | nodosa | | 1/2-BRISTLES HEDGE PARSLEY | Apiaceae | I | A |
| Trifolium | barbigerum | barbigerum | PUNCHBOWL-BRACT CLOVER | Fabaceae | N | P |
| Trifolium | bifidum | deciplens | PINOLE CLOVER | Fabaceae | N | A |
| Trifolium | depauperatum | truncatum | BALLOON CLOVER | Fabaceae | N | A |
| Trifolium | dubium | | SHAMROCK CLOVER | Fabaceae | I | A |
| Trifolium | hirtum | | ROSE CLOVER | Fabaceae | I | A |
| Trifolium | repens | | WHITE CLOVER | Fabaceae | I | P |
| Trifolium | willdenovii | | TOMCAT CLOVER | Fabaceae | N | A |
| Trillium | ovatum | ovatum | WESTERN WAKE ROBIN | Liliaceae | N | P |
| Triphysaria | eriantha | eriantha | JOHNNY-TUCK, BUTTER &-EGGS | Scrophulariaceae | N | A |
| Triphysaria | pusilla | | DWARF OWL'S CLOVER | Scrophulariaceae | N | A |
| Triteleia | laxa | | ITHURIEL'S SPEAR | Liliaceae | N | P |
| Urtica | dioica | holosericea | CREEK STINGING NETTLE | Urticaceae | N | P |
| Veronica | persica | | PERSIAN SPEEDWELL | Scrophulariaceae | I | A |
| Vicia | americana | americana | AMERICAN VETCH | Fabaceae | N | P |

HERBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|----------|--------------|-------------|---------------------------|-------------|-----|------|
| Vicia | benghalensis | | ONE-SIDED PURPLE VETCH | Fabaceae | I | P |
| Vicia | sativa | nigra | SMALL-FLOWER SPRING VETCH | Fabaceae | I | A |
| Vinca | major | | PERIWINKLE | Apocynaceae | I | P |
| Viola | pedunculata | | JOHNNY-JUMP-UP | Violaceae | N | P |
| Wyethia | angustifolia | | NARROW LEAF MULE-EARS | Asteraceae | N | P |
| Wyethia | glabra | | SMOOTH MULE-EARS | Asteraceae | N | P |
| Xanthium | spinosa | | SPINY CLOTBUR | Asteraceae | N | A |

SHRUBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|----------------|----------------|----------------|----------------------------|------------------|-----|------|
| Amelanchier | utahensis | | SERVICE BERRY | Rosaceae | N | P |
| Arctostaphylos | glandulosa | glandulosa | CUSHING MANZANITA | Ericaceae | N | P |
| Artemisia | californica | | CALIFORNIA SAGEBRUSH | Asteraceae | N | P |
| Baccharis | pilularis | | COYOTE BRUSH | Asteraceae | N | P |
| Baccharis | salicifolia | | WATER WALLY | Asteraceae | N | P |
| Eriophyllum | confertiflorum | confertiflorum | GOLDEN YARROW | Asteraceae | N | P |
| Heteromeles | arbutifolia | | CHRISTMAS BERRY or TOYON | Rosaceae | N | P |
| Holodiscus | discolor | | CREAM BUSH or OCEAN SPRAY | Rosaceae | N | P |
| Lonicera | hispidula | vacillans | CALIFORNIA HONEYSUCKLE | Caprifoliaceae | N | P |
| Mimulus | aurantiacus | | BUSH MONKEY-FLOWER | Scrophulariaceae | N | P |
| Oemleria | cerasiformis | | OSO BERRY | Rosaceae | N | P |
| Prunus | ilicifolia | ilicifolia | HOLLY-LEAFED CHERRY, ISLAY | Rosaceae | N | P |
| Prunus | virginiana | demissa | WESTERN CHOKE-CHERRY | Rosaceae | N | P |
| Quercus | berberidifolia | | SCRUB OAK | Fagaceae | N | P |
| Rhamnus | californica | | CALIFORNIA COFFEE-BERRY | Rhamnaceae | N | P |
| Ribes | californicum | californicum | HILLSIDE GOOSEBERRY | Grossulariaceae | N | P |
| Rosa | californica | | CALIFORNIA ROSE | Rosaceae | N | P |
| Rosa | gymnocarpa | | WOOD ROSE | Rosaceae | N | P |
| Rubus | discolor | | HIMALAYAN BLACKBERRY | Rosaceae | I | P |
| Rubus | ursinus | | CALIFORNIA BLACKBERRY | Rosaceae | N | P |
| Salix | lasiolepis | | ARROYO WILLOW | Salicaceae | N | P |
| Salvia | mellifera | | BLACK SAGE | Lamiaceae | N | P |
| Sambucus | mexicana | | BLUE ELDERBERRY | Caprifoliaceae | N | P |
| Symphoricarpos | albus | laevigatus | COMMON SNOWBERRY | Caprifoliaceae | N | P |
| Symphoricarpos | mollis | | CREeping SNOWBERRY | Caprifoliaceae | N | P |
| Toxicodendron | diversiloba | | WESTERN POISON OAK | Anacardiaceae | N | P |

TREES

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|--------------|--------------|-------------|----------------------|------------------|-----|------|
| Acer | macrophyllum | | BIG-LEAF MAPLE | Aceraceae | N | P |
| Aesculus | californica | | CALIFORNIA BUCKEYE | Hippocastanaceae | N | P |
| Alnus | rhombifolia | | WHITE ALDER | Betulaceae | N | P |
| Arbutus | menziesii | | PACIFIC MADRONE | Ericaceae | N | P |
| Cupressus | sargentii | | SARGENT CYPRESS | Cupressaceae | N | P |
| Eucalyptus | globulus | | BLUE GUM | Myrtaceae | I | P |
| Pinus | sabiniana | | DIGGER PINE | Pinaceae | N | P |
| Platanus | racemosa | | WESTERN SYCAMORE | Platanaceae | N | P |
| Populus | fremontii | fremontii | FREMONT COTTONWOOD | Salicaceae | N | P |
| Quercus | agrifolia | agrifolia | COAST LIVE OAK | Fagaceae | N | P |
| Quercus | chrysolepis | | CANYON or MAUL OAK | Fagaceae | N | P |
| Quercus | douglasii | | BLUE OAK | Fagaceae | N | P |
| Quercus | kelloggii | | CALIFORNIA BLACK OAK | Fagaceae | N | P |
| Quercus | lobata | | VALLEY OAK, ROBLE | Fagaceae | N | P |
| Quercus | wislizenii | wislizenii | INTERIOR LIVE OAK | Fagaceae | N | P |
| Salix | babylonica | | WEeping WILLOW | Salicaceae | I | P |
| Salix | laevigata | | RED WILLOW | Salicaceae | N | P |
| Salix | lucida | lasiandra | YELLOW WILLOW | Salicaceae | N | P |
| Sequoia | sempervirens | | COAST REDWOOD | Taxodiaceae | N | P |
| Umbellularia | californica | | BAY LAUREL | Lauraceae | N | P |

Appendix E
CONFIRMED PLANT LIST FOR LEVIN COUNTY PARK

■ ■ ■

GRASSES & GRASSLIKE

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|-----------|-------------|-------------|-----------------------------|---------|-----|------|
| Avena | barbata | | BRISTLE-TIPPED WILD OAT | Poaceae | I | A |
| Avena | fatua | | SHARP-TIPPED WILD OAT | Poaceae | I | A |
| Bromus | diandrus | | RIPGUT / NEEDLE BROME | Poaceae | I | A |
| Bromus | hordeaceus | | SOFT BROME or SOFT CHEAT | Poaceae | I | A |
| Bromus | madritensis | rubens | RED BROME | Poaceae | I | A |
| Hordeum | marinum | gussoneanum | MEDITERRANEAN BARLEY | Poaceae | I | A |
| Hordeum | murinum | leporinum | SHORT-FLORET FOXTAIL BARLEY | Poaceae | I | A |
| Lamarckia | aurea | | GOLDENTOP GRASS | Poaceae | I | A |
| Lolium | multiflorum | | AWNED ITALIAN RYEGRASS | Poaceae | I | P |
| Melica | torreyana | | NARROW 4-MIL MELICGRASS | Poaceae | N | P |
| Nassella | pulchra | | PURPLE NEEDLEGRASS | Poaceae | N | P |

HERBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|-------------|--------------|--------------|---------------------------|------------------|-----|------|
| Achillea | millefolium | | YARROW, MILFOIL | Asteraceae | N | P |
| Amsinckia | menziesii | intermedia | COMMON FIDDLENECK | Boraginaceae | N | A |
| Artemisia | douglasiana | | CALIFORNIA MUGWORT | Asteraceae | N | P |
| Bellardia | trixago | | BELLARDIA | Scrophulariaceae | I | A |
| Brassica | nigra | | BLACK MUSTARD | Brassicaceae | I | A |
| Cardaria | draba | | HEART-PODDED HOARY CRESS | Brassicaceae | I | P |
| Centaurea | calcitrapa | | PURPLE STAR-THISTLE | Asteraceae | I | AB |
| Centaurea | solstitialis | | YELLOW STAR-THISTLE | Asteraceae | I | A |
| Chamomilla | suaveolens | | PINEAPPLE WEED | Asteraceae | N | A |
| Chenopodium | californicum | | CALIFORNIA SOAP PLANT | Chenopodiaceae | N | P |
| Chlorogalum | pomeridianum | pomeridianum | FIBROUS SOAP ROOT | Liliaceae | N | P |
| Cirsium | vulgare | | BULL THISTLE | Asteraceae | I | B |
| Conium | maculatum | | POISON HEMLOCK | Apiaceae | I | B |
| Convolvulus | arvensis | | FIELD BINDWEED | Convolvulaceae | I | P |
| Cynara | cardunculus | | CARDOON/ARTICHOKE THISTLE | Asteraceae | I | P |
| Eriogonum | nudum | ? | TIBINAGUA/NUDE BUCKWHEAT | Polygonaceae | N | P |
| Eriogonum | sp. | | BUCKWHEAT | Polygonaceae | N | |
| Erodium | botrys | | LONG-BEAKED STORK'S BILL | Geraniaceae | I | A |
| Erodium | cicutarium | | RED-STEM STORK'S BILL | Geraniaceae | I | A |
| Erysimum | capitatum | capitatum | WESTERN WALL FLOWER | Brassicaceae | N | B |

HERBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|--------------|----------------------|---------------|---------------------------|------------------|-----|------|
| Eschscholzia | californica | | CALIFORNIA POPPY | Papaveraceae | N | P |
| Foeniculum | vulgare | | SWEET FENNEL | Apiaceae | I | P |
| Galium | aparine | | BIG STAR-LEAF BEDSTRAW | Rubiaceae | I | A |
| Gilia | achilleifolia | achilleifolia | BLUE GILIA | Polemoniaceae | N | A |
| Heterotheca | grandiflora | | TELEGRAPH WEED | Asteraceae | N | AP |
| Hypochoeris | glabra | | SMOOTH CAT'S-EAR | Asteraceae | I | A |
| Lemna | minor | | LESSER DUCKWEED | Lemnaceae | N | P |
| Lepidium | nitidum | nitidum | THREAD-LEAF PEPPERGRASS | Brassicaceae | N | A |
| Lupinus | bicolor | | MINIATURE LUPINE | Fabaceae | N | A |
| Lupinus | succulentus | | ARROYO LUPINE | Fabaceae | N | A |
| Malva | nicaeensis | | BULL MALLOW | Malvaceae | I | A |
| Marrubium | vulgare | | COMMON HOREHOUND | Lamiaceae | I | P |
| Medicago | polymorpha | | CALIFORNIA BURCLOVER | Fabaceae | I | A |
| Mentzelia | lindleyi | | BLAZING STAR | Loasaceae | N | A |
| Mimulus | guttatus | | SEEP-SPRING MONKEY-FLOWER | Scrophulariaceae | N | P |
| Phacelia | imbricata | imbricata | ROCK PHACELIA | Hydrophyllaceae | N | P |
| Phacelia | ramosissima | ramosissima | BROWN-MOTTLED PHACELIA | Hydrophyllaceae | N | P |
| Ranunculus | californicus | | CALIFORNIA BUTTERCUP | Ranunculaceae | N | P |
| Rorippa | nasturtium-aquaticum | | WATER CRESS | Brassicaceae | I | P |
| Rumex | crispus | | CURLY DOCK | Polygonaceae | I | P |
| Salvia | columbariae | | CHIA | Lamiaceae | N | A |
| Sanicula | crassicaulis | | PACIFIC SNAKEROOT | Apiaceae | N | P |
| Scrophularia | californica | californica | CALIFORNIA FIGWORT | Scrophulariaceae | N | P |
| Silybum | marianum | | MILK THISTLE | Asteraceae | I | AB |
| Sisymbrium | officinale | | HEDGE MUSTARD | Brassicaceae | I | A |
| Sisyrinchium | bellum | | BLUE-EYED GRASS | Iridaceae | N | P |
| Sonchus | asper | asper | ROUND-LOBED SOW-THISTLE | Asteraceae | I | A |
| Sonchus | oleraceus | | SHARP-LOBED SOW-THISTLE | Asteraceae | I | A |
| Stachys | ajugoides | rigida | HEDGE NETTLE | Lamiaceae | N | P |
| Stellaria | media | | COMMON CHICKWEED | Caryophyllaceae | I | A |
| Trifolium | hirtum | | ROSE CLOVER | Fabaceae | I | A |
| Trifolium | willdenovii | | TOMCAT CLOVER | Fabaceae | N | A |
| Triteleia | laxa | | ITHURIEL'S SPEAR | Liliaceae | N | P |
| Urtica | dioica | holosericea | CREEK STINGING NETTLE | Urticaceae | N | P |
| Urtica | urens | | DWARF STINGING NETTLE | Urticaceae | I | A |
| Vicia | americana | americana | AMERICAN VETCH | Fabaceae | N | P |
| Vicia | sativa | nigra | SMALL-FLOWER SPRING VETCH | Fabaceae | I | A |

SHRUBS

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|----------------|-------------|-------------|-----------------------|------------------|-----|------|
| Artemisia | californica | | CALIFORNIA SAGEBRUSH | Asteraceae | N | P |
| Lupinus | albifrons | collinus | SILVER BUSH LUPINE | Fabaceae | N | P |
| Mimulus | aurantiacus | | BUSH MONKEY-FLOWER | Scrophulariaceae | N | P |
| Rubus | discolor | | HIMALAYAN BLACKBERRY | Rosaceae | I | P |
| Rubus | ursinus | | CALIFORNIA BLACKBERRY | Rosaceae | N | P |
| Salix | lasiolepis | | ARROYO WILLOW | Salicaceae | N | P |
| Sambucus | mexicana | | BLUE ELDERBERRY | Caprifoliaceae | N | P |
| Symphoricarpos | albus | laevigatus | COMMON SNOWBERRY | Caprifoliaceae | N | P |
| Symphoricarpos | mollis | | CREEPING SNOWBERRY | Caprifoliaceae | N | P |
| Toxicodendron | diversiloba | | WESTERN POISON OAK | Anacardiaceae | N | P |

TREES

| Genus | Species | Variety/ssp | Common Name | Family | N/I | Long |
|--------------|--------------|-------------|--------------------|------------------|-----|------|
| Acer | macrophyllum | | BIG-LEAF MAPLE | Aceraceae | N | P |
| Aesculus | californica | | CALIFORNIA BUCKEYE | Hippocastanaceae | N | P |
| Eucalyptus | globulus | | BLUE GUM | Myrtaceae | I | P |
| Platanus | racemosa | | WESTERN SYCAMORE | Platanaceae | N | P |
| Populus | alba | | WHITE POPLAR | Salicaceae | I | P |
| Quercus | agrifolia | agrifolia | COAST LIVE OAK | Fagaceae | N | P |
| Quercus | lobata | | VALLEY OAK, ROBLE | Fagaceae | N | P |
| Salix | babylonica | | WEeping WILLOW | Salicaceae | I | P |
| Salix | laevigata | | RED WILLOW | Salicaceae | N | P |
| Umbellularia | californica | | BAY LAUREL | Lauraceae | N | P |

Appendix F
WILDLIFE SPECIES OBSERVED OR
PREDICTED TO OCCUR IN GRANT AND LEVIN COUNTY PARKS

■ ■ ■

Key:

- O** - wildlife species or their signs observed in Grant County Park during field surveys conducted May 9, and 24, and June 9, 1994 by Habitat Restoration Group personnel
- R** - wildlife species observed in Grant County Park and reported by Eric Remington (pers. comm.)
- F** - wildlife species observed in Grant County Park and reported by Reid Freeman (pers. comm.)
- C** - occurrences listed in Santa Clara County natural resource sensitive areas base maps for Grant County Park
- L** - birds observed in Levin County Park during the 1992 Christmas Bird Count (Santa Clara Valley Audubon Society records)

Other references for species predicted to occur:

- E** - wildlife species listed in the final EIR for Grant County Park Master Plan (1993)
- A** - wildlife species listed in the Anderson Reservoir report (Habitat Restoration Group 1989)
- W** - species' range and habitat information from the California Wildlife Habitat Relationships Data Base (Zeiner et al. 1988)
- S** - species' range and habitat information from Stebbins (1985)
- N** - from National Geographic Society field guide to birds (1987)

The U.S. Fish and Wildlife Service provided a list dated December 15, 1995 of federally listed and candidate species which may occur on Levin or Grant Parks. Most of the candidate species on that list have been added to our table of special status wildlife species which may potentially occur on the parks. However, seven species on their list are not expected to occur in the parks for the following reasons. Bay checkerspot butterfly (*Euphydryas editha bayensis*) is associated with serpentine soils, which do not occur on either Levin or Grant Park. Delta smelt (*Hypomesus transpacificus*) and Sacramento splittail (*Pogonichthys macrolepidotus*) are both fish limited to the lower and

middle Delta region and the lower Sacramento and San Joaquin Rivers. The San Joaquin kit fox (*Vulpes macrotis mutica*) is believed to be extirpated from Santa Clara County. Santa Clara County is outside of all known historical or current records for the San Joaquin whipsnake (*Masticophis flagellum ruddocki*) as per recent distribution studies by Jennings and Hayes (1994). The northwestern pond turtle (*Clemmys marmorata marmorata*) generally occurs north of San Francisco, but some intergradation with the southwestern subspecies may occur in Santa Clara County. Riparian brush rabbit (*Sylvilagus bachmani riparius*) are currently know only from the Sacramento area.

**Table F-1
SPECIAL STATUS WILDLIFE SPECIES
OBSERVED OR PREDICTED TO OCCUR
IN GRANT OR LEVIN COUNTY PARKS**

| Species | Status ¹ | Park ² |
|---|---------------------|-------------------|
| Proposed and Listed Species: | | |
| California Red-Legged Frog | FE, CSC | G,L |
| Alameda Whipsnake (= Striped Racer) | ST, FPE | G,L |
| Bald Eagle | SE, FT | G,L |
| Swainson's Hawk | ST | G |
| American Peregrine Falcon | SE, FE | G,L |
| Candidates for Listing and Species of Special Concern: | | |
| Opler's Longhorn Moth | CSC,2 | G |
| Ricksecker's Water Scavenger Beetle | CSC,2 | G |
| California Tiger Salamander | CSC,1 | G,L |
| Western Spadefoot Toad | CSC,2 | G,L |
| Foothill Yellow-Legged Frog | CSC,2 | G,L |
| Southwestern Pond Turtle | CSC, 2 | G,L |
| California Horned Lizard | CSC,2 | G |
| Silvery Legless Lizard | CSC,2 | G,L |
| Western Grebe | * | G,L |
| Double-Crested Cormorant | CSC | G,L |
| Great Blue Heron | * | G,L |
| Great Egret | * | G,L |
| Snowy Egret | * | G,L |
| Black-Crowned Night-Heron | * | G,L |
| Golden Eagle | CSC | G,L |
| Ferruginous Hawk | CSC,2 | G |
| White-Tailed Kite | * | G,L |
| Northern Harrier | CSC | G,L |
| Sharp-Shinned Hawk | CSC | G |
| Cooper's Hawk | CSC | G,L |
| Osprey | CSC | G,L |
| Merlin | CSC | G,L |
| Prairie Falcon | CSC | G,L |
| California Gull | CSC | G,L |
| Caspian Tern | * | G,L |
| Forster's Tern | * | G,L |
| Burrowing Owl | CSC,2 | G,L |

| Species | Status ¹ | Park ² |
|------------------------------------|---------------------|-------------------|
| Little Willow Flycatcher | CSC,2 | G |
| California Horned Lark | CSC, 2 | G,L |
| Loggerhead Shrike | CSC, 2 | G,L |
| Yellow Warbler | CSC | G |
| Yellow-Breasted Chat | CSC | G |
| Tricolored Blackbird | CSC, 2 | G,L |
| Bell's Sage Sparrow | CSC,2 | G |
| Pallid Bat | CSC | G,L |
| Small-Footed Myotis bat | CSC,2 | G |
| Long-Eared Myotis Bat | CSC,2 | G |
| Fringed Myotis Bat | CSC,2 | G |
| Long-Legged Myotis Bat | CSC,2 | G |
| Yuma Myotis Bat | CSC,2 | G |
| Townsend's Western Big-Eared Bat | CSC,2 | G,L |
| California Mastiff Bat | CSC,2 | G,L |
| San Francisco Dusky-Footed Woodrat | CSC,2 | G |
| American Badger | CSC | G |

Key:

- ¹ FPE = proposed for Federal listing as endangered, threatened;
 FE = Federally listed as endangered or threatened;
 SE = State listed as endangered;
 ST = State listed as threatened;
 1 = Federal Category 1 candidate;
 2 = Federal Category 2 candidate;
 CSC = California Department of Fish and Game "species of special concern";
 * = taxa that are rare, restricted distribution, declining throughout range, peripheral populations threatened with extirpation, or closely associated with a declining habitat.
- ² G = Grant County Park
 L = Levin County Park.

| SPECIES | KEY |
|---|------------|
| CLASS: AMPHIBIA | |
| ORDER: CAUDATA (Salamanders) | |
| FAMILY: AMBYSTOMATIDAE (Mole Salamanders and Relatives) | |
| California Tiger Salamander (<i>Ambystoma tigrinum californiense</i>) | O, R, E, C |
| FAMILY: SALAMANDRIDAE (Newts) | |
| Rough-skinned Newt (<i>Taricha granulosa</i>) | E |
| California Newt (<i>Taricha torosa</i>) | O, E, R |
| FAMILY: PLETHODONTIDAE (Lungless Salamanders) | |
| Ensatina (<i>Ensatina eschscholtzi</i>) | E, R |
| California Slender Salamander (<i>Batrachoseps attenuatus</i>) | E, R |
| Arboreal Salamander (<i>Aneides lugubris</i>) | E, R |
| ORDER: SALIENTIA (Frogs and Toads) | |
| FAMILY: PELOBATIDAE (Spadefoot Toads) | |
| Western Spadefoot Toad (<i>Scaphiopus hammondi</i>) | E |
| FAMILY: BUFONIDAE (True Toads) | |
| Western Toad (<i>Bufo boreas</i>) | O, E, R |
| FAMILY: HYLIDAE (Treefrogs and Relatives) | |
| Pacific Treefrog (<i>Hyla regilla</i>) | O, E, R |
| FAMILY: RANIDAE (True Frogs) | |
| California Red-legged Frog (<i>Rana aurora draytoni</i>) | O, R, E |
| Foothill Yellow-legged Frog (<i>Rana boylei</i>) | R, E |
| Bullfrog (<i>Rana catesbeiana</i>) | O, E, R |
| CLASS: REPTILIA | |
| ORDER: TESTUDINESS (Turtles) | |
| FAMILY: EMYDIDAE (Pond and Marsh Turtles) | |
| Western Pond Turtle (<i>Clemmys marmorata</i>) | O, E, R |
| ORDER: SQUAMATA (Lizards and Snakes) | |
| SUBORDER: SAURIA (Lizards) | |
| FAMILY: IGUANIDAE (Iguanids) | |
| Western Fence Lizard (<i>Sceloporus occidentalis</i>) | E, R |
| Sagebrush Lizard (<i>Sceloporus graciosus</i>) | S |

| SPECIES | KEY |
|---|---------|
| Side-blotched Lizard (<i>Uta stansburiana</i>) | E |
| Coast Horned Lizard (<i>Phrynosoma coronatum</i>) | E, R |
| FAMILY: SCINCIDAE (Skinks) | |
| Western Skink (<i>Eumeces skiltonianus</i>) | E, R |
| Gilbert's Skink (<i>Eumeces gilberti</i>) | A, W, R |
| FAMILY: TEIIDAE (Whiptails and Relatives) | |
| Western Whiptail (<i>Cnemidophorus tigris</i>) | E, R |
| FAMILY: ANGUIDAE (Alligator Lizards and Relatives) | |
| Southern Alligator Lizard (<i>Gerrhonotus multicarinatus</i>) | S, R |
| Northern Alligator Lizard (<i>Gerrhonotus coeruleus</i>) | E, R |
| FAMILY: ANNIELLIDAE (California Legless Lizards) | |
| Silvery Legless Lizard (<i>Anniella pulchra pulchra</i>) | E, S, W |
| SUBORDER: SERPENTES (Snakes) | |
| FAMILY: BOIDAE (Boas) | |
| Rubber Boa (<i>Charina bottae</i>) | E, R |
| FAMILY: COLUBRIDAE (Colubrids) | |
| Ringneck Snake (<i>Diadophis punctatus</i>) | E, R |
| Sharp-tailed Snake (<i>Contia tenuis</i>) | E, R |
| Racer (<i>Coluber constrictor</i>) | E, R |
| Alameda Whipsnake (= Striped Racer) (<i>M. lateralis euryxanthus</i>) | R, W, S |
| Glossy Snake (<i>Arizona elegans</i>) | A, W |
| Gopher Snake (<i>Pituophis melanoleucus</i>) | E, O, R |
| Common Kingsnake (<i>Lampropeltis getulus</i>) | E, R |
| California Mountain Kingsnake (<i>Lampropeltis zonata</i>) | E, R |
| Common Garter Snake (<i>Thamnophis sirtalis</i>) | E, R |
| Western Terrestrial Garter Snake (<i>Thamnophis elegans</i>) | E |
| Western Aquatic Garter Snake (<i>Thamnophis couchi</i>) | E, O, R |
| California Black-headed Snake (<i>Tantilla planiceps</i>) | E, R, C |
| Night Snake (<i>Hypsiglena torquata</i>) | E |
| FAMILY: VIPERIDAE (Vipers) | |
| Western Rattlesnake (<i>Crotalus viridis</i>) | E, R |

| SPECIES | KEY |
|---|------------------|
| CLASS: AVES | |
| ORDER: PODICIPEDIFORMES (Grebes) | |
| FAMILY: PODICIPEDIDAE (Grebes) | |
| Pied-billed Grebe (<i>Podilymbus podiceps</i>) | E, F, R, L |
| Horned Grebe (<i>Podiceps auritus</i>) | A, F, W |
| Eared Grebe (<i>Podiceps nigricollis</i>) | E, F |
| Western Grebe (<i>Aechmophorus occidentalis</i>) | E, R |
| ORDER: PELECANIFORMES (Tropicbirds, Pelicans, and Relatives) | |
| FAMILY: PELECANIDAE (Pelicans) | |
| American White Pelican (<i>Pelecanus erythrorhynchos</i>) | F |
| FAMILY: PHALACROCORACIDAE (Cormorants) | |
| Double-crested Cormorant (<i>Phalacrocorax auritus</i>) | E, F, R, L |
| ORDER: CICONIIFORMES (Hérons, Storks, Ibises, and Relatives) | |
| FAMILY: ARDEIDAE (Hérons and Bitterns) | |
| Great Blue Heron (<i>Ardea herodias</i>) | E, F, O, R, C, L |
| Great Egret (<i>Casmerodius albus</i>) | E, F, O, R, L |
| Snowy Egret (<i>Egretta thula</i>) | E, R, L |
| Cattle Egret (<i>Bubulcus ibis</i>) | A |
| Green Heron (<i>Butorides striatus</i>) | E, F, O, R |
| Black-crowned Night-heron (<i>Nycticorax nycticorax</i>) | E, R, L |
| ORDER: ANSERIFORMES (Screamers, Ducks, and Relatives) | |
| FAMILY: ANATIDAE (Swans, Geese, and Ducks) | |
| Greater White-fronted Goose (<i>Anser albifrons</i>) | A, F |
| Canada Goose (<i>Branta canadensis</i>) | E, F, O, R, L |
| Wood Duck (<i>Aix sponsa</i>) | E, R |
| Green-winged Teal (<i>Anas crecca</i>) | E, R |
| Mallard (<i>Anas platyrhynchos</i>) | E, F, O, R, L |
| Northern Pintail (<i>Anas acuta</i>) | E, R |
| Cinnamon Teal (<i>Anas cyanoptera</i>) | E, R |
| Northern Shoveler (<i>Anas clypeata</i>) | E, L |
| Gadwall (<i>Anas strepera</i>) | F, O, R, L |

| SPECIES | KEY |
|--|------------------|
| American Wigeon (<i>Anas americana</i>) | E, R |
| Canvasback (<i>Aythya valisineria</i>) | E, F, L |
| Ring-necked Duck (<i>Aythya collaris</i>) | F, L |
| Greater Scaup (<i>Aythya marila</i>) | E, R |
| Lesser Scaup (<i>Aythya affinis</i>) | A, W |
| Bufflehead (<i>Bucephala albeola</i>) | E, F, R, L |
| Hooded Merganser (<i>Lophodytes cucullatus</i>) | A, W, R |
| Common Merganser (<i>Mergus merganser</i>) | A, W, R, L |
| Ruddy Duck (<i>Oxyura jamaicensis</i>) | E, F, O, R, L |
| ORDER: FALCONIFORMES (Vultures, Hawks, and Falcons) | |
| FAMILY: CATHARTIDAE (American Vultures) | |
| Turkey Vulture (<i>Cathartes aura</i>) | E, F, O, R, L |
| California Condor (<i>Gymnogyps californianus</i>) [last sighted 1970] | R |
| FAMILY: ACCIPITRIDAE (Hawks, Old World Vultures, and Harriers) | |
| Golden Eagle (<i>Aquila chrysaetos</i>) | E, F, O, R, C, L |
| Bald Eagle (<i>Haliaeetus leucocephalus</i>) | E, R, C |
| White-tailed Kite (= Black-shouldered Kite) (<i>Elanus caeruleus</i>) | E, F, O, R |
| Northern Harrier (<i>Circus cyaneus</i>) | E, R |
| Sharp-shinned Hawk (<i>Accipiter striatus</i>) | E, F, R, L |
| Cooper's Hawk (<i>Accipiter cooperii</i>) | E, F, O, R, L |
| Red-shouldered Hawk (<i>Buteo lineatus</i>) | E, F, R |
| Red-tailed Hawk (<i>Buteo jamaicensis</i>) | E, F, O, R, L |
| Swainson's Hawk (<i>Buteo swainsoni</i>) | O, R |
| Rough-legged Hawk (<i>Buteo lagopus</i>) | A |
| Osprey (<i>Pandion haliaetus</i>) | C |
| FAMILY: FALCONIDAE (Caracaras and Falcons) | |
| American Kestrel (<i>Falco sparverius</i>) | E, F, O, R, L |
| Merlin (<i>Falco columbarius</i>) | A, F, R |
| American Peregrine Falcon (<i>Falco peregrinus anatum</i>) | A, R |
| Prairie Falcon (<i>Falco mexicanus</i>) | E, R, O |

| SPECIES | KEY |
|---|---------------|
| ORDER: GALLIFORMES (Megapodes, Currassows, Pheasants, and Relatives) | |
| FAMILY: PHASIANIDAE (Quails, Pheasants, and Relatives) | |
| Wild Turkey (<i>Meleagris gallopavo</i>) | E, F, O, R |
| California Quail (<i>Callipepla californica</i>) | E, F, O, R, L |
| Ring-necked Pheasant (<i>Phasianus colchicus</i>) | L |
| ORDER: GRUIFORMES (Cranes, Rails, and Relatives) | |
| FAMILY: RALLIDAE (Rails, Gallinules, and Coots) | |
| Virginia Rail (<i>Rallus limicola</i>) | R |
| Sora (<i>Porzana carolina</i>) | R |
| Common Moorhen (<i>Gallinula chloropus</i>) | E, R |
| American Coot (<i>Fulica americana</i>) | E, F, O, R, L |
| ORDER: CHARADRIIFORMES (Shorebirds, Gulls, and Relatives) | |
| FAMILY: CHARADRIIDAE (Plovers and Relatives) | |
| Killdeer (<i>Charadrius vociferus</i>) | E, F, O, R, L |
| FAMILY: SCOLOPACIDAE (Sandpipers and Relatives) | |
| Greater Yellowlegs (<i>Tringa melanoleuca</i>) | E, R |
| Spotted Sandpiper (<i>Actitis macularia</i>) | E, R |
| Common Snipe (<i>Gallinago gallinago</i>) | E, R |
| FAMILY: LARIDAE (Gulls and Terns) | |
| Ring-billed Gull (<i>Larus delawarensis</i>) | A, L |
| Mew Gull (<i>Larus canus</i>) | L |
| California Gull (<i>Larus californicus</i>) | E, R |
| Herring Gull (<i>Larus argentatus</i>) | A |
| Caspian Tern (<i>Sterna caspia</i>) | E, R |
| Forster's Tern (<i>Sterna forsteri</i>) | E, F |
| ORDER: COLUMBIFORMES (Pigeons and Doves) | |
| FAMILY: COLUMBIDAE (Pigeons and Doves) | |
| Band-tailed Pigeon (<i>Columba fasciata</i>) | E, R |
| Rock Dove (<i>Columba livia</i>) | F, L |
| Mourning Dove (<i>Zenaida macroura</i>) | E, F, O, R, L |

| SPECIES | KEY |
|--|---------------|
| ORDER: STRIGIFORMES (Owls) | |
| FAMILY: TYTONIDAE (Barn Owls) | |
| Barn Owl (<i>Tyto alba</i>) | E, R |
| FAMILY: STRIGIDAE (Typical Owls) | |
| Western Screech-Owl (<i>Otus kennicotti</i>) | E, R |
| Great Horned Owl (<i>Bubo virginianus</i>) | E, R |
| Burrowing Owl (<i>Athene cunicularia</i>) | E, R |
| Northern Pygmy-owl (<i>Glaucidium gnoma</i>) | R |
| ORDER: CAPRIMULGIFORMES (Goatsuckers and Relatives) | |
| FAMILY: CAPRIMULGIDAE (Goatsuckers) | |
| Lesser Nighthawk (<i>Chordeiles acutipennis</i>) | A, W, R |
| Common Poorwill (<i>Phalaenoptilus nuttallii</i>) | A, W, R |
| ORDER: APODIFORMES (Swifts and Hummingbirds) | |
| FAMILY: APODIDAE (Swifts) | |
| Vaux's Swift (<i>Chaetura vauxi</i>) | R |
| White-throated Swift (<i>Aeronautes saxatalis</i>) | A, R, L |
| FAMILY: TROCHILIDAE (Hummingbirds) | |
| Black-chinned Hummingbird (<i>Archilochus alexandri</i>) | A, W |
| Rufous Hummingbird (<i>Selasphorus rufus</i>) | R |
| Anna's Hummingbird (<i>Calypte anna</i>) | E, F, R, L |
| Allen's Hummingbird (<i>Selasphorus sasin</i>) | E, F, R |
| ORDER: CORACIIFORMES (Kingfishers and Relatives) | |
| FAMILY: ALCEDINIDAE (Kingfishers) | |
| Belted Kingfisher (<i>Ceryle alcyon</i>) | E, O, R, L |
| ORDER: PICIFORMES (Woodpeckers and Relatives) | |
| FAMILY: PICIDAE (Woodpeckers and Wrynecks) | |
| Lewis' Woodpecker (<i>Melanerpes lewis</i>) | F, R, C |
| Acorn Woodpecker (<i>Melanerpes formicivorus</i>) | E, F, O, R, L |
| Red-breasted Sapsucker (<i>Sphyrapicus ruber</i>) | A, F, W, R, L |
| Nuttall's Woodpecker (<i>Picoides nuttallii</i>) | E, F, R, L |
| Downy Woodpecker (<i>Picoides pubescens</i>) | E, F, R |

| SPECIES | KEY |
|---|---------------|
| Hairy Woodpecker (<i>Picoides villosus</i>) | E, R |
| Northern Flicker (<i>Colaptes auratus</i>) | E, F, O, R, L |
| ORDER: PASSERIFORMES (Perching Birds) | |
| FAMILY: TYRANNIDAE (Tyrant Flycatchers) | |
| Western Wood-pewee (<i>Contopus sordidulus</i>) | A, W, R |
| Pacific-slope Flycatcher (<i>Empidonax difficilis</i>) | A, F, W, R |
| Black Phoebe (<i>Sayornis nigricans</i>) | E, F, R, L |
| Say's Phoebe, (<i>Sayornis saya</i>) | E, F, R, L |
| Ash-throated Flycatcher (<i>Myiarchus cinerascens</i>) | E, F, R |
| Western Kingbird (<i>Tyrannus verticalis</i>) | E, F, R |
| FAMILY: ALAUDIDAE (Larks) | |
| Horned Lark (<i>Eremophila alpestris</i>) | E, O, R |
| FAMILY: HIRUNDINIDAE (Swallows) | |
| Purple Martin (<i>Progne subis</i>) | A, W |
| Tree Swallow (<i>Tachycineta bicolor</i>) | E, F, O, R |
| Northern Rough-winged Swallow (<i>Stelgidopteryx serripennis</i>) | F, R |
| Violet-green Swallow (<i>Tachycineta thalassina</i>) | A, F, W, R |
| Cliff Swallow (<i>Hirundo pyrrhonota</i>) | E, F, R |
| Barn Swallow (<i>Hirundo rustica</i>) | E, F, R |
| FAMILY: CORVIDAE (Jays, Magpies, and Crows) | |
| Steller's Jay (<i>Cyanocitta stelleri</i>) | E, F, R, L |
| Scrub Jay (<i>Aphelocoma coerulescens</i>) | E, F, O, R, L |
| Yellow-billed Magpie (<i>Pica nuttalli</i>) | E, F, O, R, L |
| American Crow (<i>Corvus brachyrhynchos</i>) | E, F, O, R, L |
| Common Raven (<i>Corvus corax</i>) | A, W, R, L |
| FAMILY: PARIDAE (Titmice) | |
| Chestnut-backed Chickadee (<i>Parus rufescens</i>) | E, F, R, L |
| Plain Titmouse (<i>Parus inornatus</i>) | E, F, R, L |
| FAMILY: AEGITHALIDAE (Bushtit) | |
| Bushtit (<i>Psaltriparus minimus</i>) | A, F, W, R, L |

| SPECIES | KEY |
|---|------------|
| FAMILY: SITTIDAE (Nuthatches) | |
| Red-breasted Nuthatch (<i>Sitta canadensis</i>) | R, L |
| White-breasted Nuthatch (<i>Sitta carolinensis</i>) | E, F, R |
| FAMILY: CERTHIIDAE (Creepers) | |
| Brown Creeper (<i>Certhia americana</i>) | E, F, R |
| FAMILY: TROGLODYTIDAE (Wrens) | |
| House Wren (<i>Troglodytes aedon</i>) | R |
| Winter Wren (<i>Troglodytes troglodytes</i>) | R |
| Bewick's Wren (<i>Thryomanes bewickii</i>) | E, F, R |
| FAMILY: MUSCICAPIDAE (Old World Warblers, Gnatcatchers, Kinglets, Thrushes, Bluebirds, and Wrenit) | |
| Wrenit (<i>Chamaea fasciata</i>) | F |
| Golden-crowned Kinglet (<i>Regulus satrapa</i>) | R |
| Ruby-crowned Kinglet (<i>Regulus calendula</i>) | E, F, R, L |
| Blue-gray Gnatcatcher (<i>Polioptila caerulea</i>) | A, W, R |
| Western Bluebird (<i>Sialia mexicana</i>) | E, F, R |
| Mountain Bluebird (<i>Sialia currucoides</i>) | R |
| Swainson's Thrush (<i>Catharus ustulatus</i>) | F |
| Hermit Thrush (<i>Catharus guttatus</i>) | E, F, R, L |
| Varied Thrush (<i>Ixoreus naevius</i>) | R, L |
| American Robin (<i>Turdus migratorius</i>) | E, F, R, L |
| FAMILY: MIMIDAE (Mockingbirds and Thrashers) | |
| Northern Mockingbird (<i>Mimus polyglottos</i>) | E, F, L |
| California Thrasher (<i>Toxostoma redivivum</i>) | E, F, O, R |
| FAMILY: MOTACILLIDAE (Wagtails and Pipits) | |
| American Pipit (<i>Anthus rubescens</i>) | A, W, R, L |
| FAMILY: BOMBYCILLIDAE (Waxwings) | |
| Cedar Waxwing (<i>Bombycilla cedrorum</i>) | A, W, R |
| FAMILY: PTILOGONATIDAE (Silky Flycatchers) | |
| Phainopepla (<i>Phainopepla nitens</i>) | A, W, R, C |

| SPECIES | KEY |
|---|------------------|
| FAMILY: LANIIDAE (Shrikes) | |
| Loggerhead Shrike (<i>Lanius ludovicianus</i>) | A, W, R, L |
| FAMILY: STURNIDAE (Starlings) | |
| European Starling (<i>Sturnus vulgaris</i>) | E, F, R, L |
| FAMILY: VIREONIDAE (Typical Vireos) | |
| Solitary Vireo (<i>Vireo solitarius</i>) | A, F, W, R |
| Hutton's Vireo (<i>Vireo huttoni</i>) | E, F, R |
| Warbling Vireo (<i>Vireo gilvus</i>) | A, F, W, R |
| FAMILY: EMBERIZIDAE (Wood Warblers, Sparrows, Blackbirds, and Relatives) | |
| Orange-crowned Warbler (<i>Vermivora celata</i>) | A, F, W, R |
| Nashville Warbler (<i>Vermivora ruficapilla</i>) | F |
| Yellow Warbler (<i>Dendroica petechia</i>) | E, R, L |
| Yellow-rumped Warbler (<i>Dendroica coronata</i>) | E, F, R |
| Black-throated Gray Warbler (<i>Dendroica nigrescens</i>) | A, F, W, R |
| Townsend's Warbler (<i>Dendroica townsendi</i>) | A, F, W, R |
| MacGillivray's Warbler (<i>Oporornis tolmiei</i>) | A, F, W, R |
| Common Yellowthroat (<i>Geothlypis trichas</i>) | A, F, W, R |
| Hermit Warbler (<i>Dendroica occidentalis</i>) | R |
| Wilson's Warbler (<i>Wilsonia pusilla</i>) | A, F, W, R |
| Yellow-breasted Chat (<i>Icteria virens</i>) | A, W, R |
| Black-headed Grosbeak (<i>Pheucticus melanocephalus</i>) | E, F, R |
| Lazuli Bunting (<i>Passerina amoena</i>) | A, F, W, R |
| Rufous-sided Towhee (<i>Pipilo erythrophthalmus</i>) | E, F, R, L |
| California Towhee (<i>Pipilo fuscus</i>) | A, F, W, R, O, L |
| Rufous-crowned Sparrow (<i>Aimophila ruficeps</i>) | A, W, R |
| Chipping Sparrow (<i>Spizella passerina</i>) | A, W, R |
| Black-chinned Sparrow (<i>Spizella atrogularis</i>) | A, W, R |
| Lark Sparrow (<i>Chondestes grammacus</i>) | E, F, R |
| Sage Sparrow (<i>Amphispiza belli</i>) | A, W, R |
| Savannah Sparrow (<i>Passerculus sandwichensis</i>) | A, F, W, R |
| Fox Sparrow (<i>Passerella iliaca</i>) | E, R, L |

| SPECIES | KEY |
|--|---------------|
| Song Sparrow (<i>Melospiza melodia</i>) | E, F, R |
| Lincoln's Sparrow (<i>Melospiza lincolni</i>) | A, W, R |
| White-throated Sparrow (<i>Zonotrichia albicollis</i>) | A, N |
| Golden-crowned Sparrow (<i>Zonotrichia atricapilla</i>) | E, F, R, L |
| White-crowned Sparrow (<i>Zonotrichia leucophrys</i>) | E, F, R, L |
| Dark-eyed Junco (<i>Junco hyemalis</i>) | E, F, R, L |
| Yellow-headed Blackbird (<i>Xanthocephalus xanthocephalus</i>) | R, O |
| Red-winged Blackbird (<i>Agelaius phoeniceus</i>) | E, F, O, R, L |
| Tricolored Blackbird (<i>Agelaius tricolor</i>) | E, F, R |
| Western Meadowlark (<i>Sturnella neglecta</i>) | E, F, R, L |
| Brewer's Blackbird (<i>Euphagus cyanocephalus</i>) | E, F, O, R, L |
| Brown-headed Cowbird (<i>Molothrus ater</i>) | A, F, W, R |
| Northern Oriole (<i>Icterus galbula</i>) | E, F, R |
| Hooded Oriole (<i>Icterus cucullatus</i>) | R |
| FAMILY: FRINGILLIDAE (Finches) | |
| Purple Finch (<i>Carpodacus purpureus</i>) | A, W, R, O, L |
| House Finch (<i>Carpodacus mexicanus</i>) | E, F, L |
| Pine Siskin (<i>Carduelis pinus</i>) | A, F, W, R, L |
| Lesser Goldfinch (<i>Carduelis psaltria</i>) | E, F, R, L |
| Lawrence's Goldfinch (<i>Carduelis lawrencei</i>) | E, R, C |
| American Goldfinch (<i>Carduelis tristis</i>) | A, F, W, R, L |
| FAMILY: PASSERIDAE (Weaver Finches) | |
| House Sparrow (<i>Passer domesticus</i>) | E, R, L |
| CLASS: MAMMALIA | |
| ORDER: MARSUPIALIA (Opossums, Kangaroos, and Relatives) | |
| FAMILY: DIDELPHIDAE (Opossums) | |
| Virginia Opossum (<i>Didelphis virginiana</i>) | E, R |
| ORDER: INSECTIVORA (Shrews and Moles) | |
| FAMILY: SORICIDAE (Shrews) | |
| Ornate Shrew (<i>Sorex ornatus</i>) | E, R |

| SPECIES | KEY |
|--|---------|
| FAMILY: TALPIDAE (Moles) | |
| Broad-footed Mole (<i>Scapanus latimanus</i>) | E, R |
| ORDER: CHIROPTERA (Bats) | |
| FAMILY: VESPERTILIONIDAE (Vespertilionid Bats) | |
| Little Brown Myotis (<i>Myotis lucifugus</i>) | E |
| Yuma Myotis (<i>Myotis yumanensis</i>) | A, W, R |
| Long-eared Myotis (<i>Myotis evotis</i>) | E |
| Fringed Myotis (<i>Myotis thysanodes</i>) | A, W |
| Long-legged Myotis (<i>Myotis volans</i>) | E |
| California Myotis (<i>Myotis californicus</i>) | E, R |
| Western Pipistrelle (<i>Pipistrellus hesperus</i>) | E, R |
| Big Brown Bat (<i>Eptesicus fuscus</i>) | E, R |
| Silver-haired Bat (<i>Lasionycteris noctivagans</i>) | E |
| Red Bat (<i>Lasiurus borealis</i>) | E, R |
| Hoary Bat (<i>Lasiurus cinereus</i>) | A, W, R |
| Townsend's Western Big-eared Bat (<i>Plecotus townsendii townsendii</i>) | E, R |
| Pallid Bat (<i>Antrozous pallidus</i>) | A, W, R |
| FAMILY: MOLOSSIDAE (Free-tailed Bat) | |
| Brasilian Free-tailed Bat (<i>Tadarida brasiliensis</i>) | E, R |
| California Mastiff Bat (<i>Eumops perotis californicus</i>) | E, R |
| ORDER: LAGOMORPHA (Rabbits, Hares, and Pikas) | |
| FAMILY: LEPORTIDAE (Rabbits and Hares) | |
| Brush Rabbit (<i>Sylvilagus bachmani</i>) | E, O, R |
| Audubon's Cottontail (<i>Sylvilagus audubonii</i>) | E |
| Black-tailed Hare (<i>Lepus californicus</i>) | E, R |
| ORDER: RODENTIA (Squirrels, Rats, Mice, and Relatives) | |
| FAMILY: SCIURIDAE (Squirrels, Chipmunks, and Marmots) | |
| Merriam's Chipmunk (<i>Tamias merriami</i>) | E, R |
| California Ground Squirrel (<i>Spermophilus beecheyi</i>) | E, O, R |
| Western Gray Squirrel (<i>Sciurus griseus</i>) | E |
| Fox Squirrel (<i>Sciurus niger</i>) | A, W, R |

| SPECIES | KEY |
|---|---------|
| FAMILY: GEOMYIDAE (Pocket Gophers) | |
| Botta's Pocket Gopher (<i>Thomomys bottae</i>) | E, R |
| FAMILY: HETEROMYIDAE (Pocket Mice and Kangaroo Rats) | |
| California Pocket Mouse (<i>Perognathus californicus</i>) | E, R |
| Heermann's Kangaroo Rat (<i>Dipodomys heermanni</i>) | A, R |
| Narrow-faced Kangaroo Rat (<i>Dipodomys venustus</i>) | E |
| FAMILY: CRICETIDAE (Deer Mice, Voles, and Relatives) | |
| Western Harvest Mouse (<i>Reithrodontomys megalotis</i>) | E, R |
| California Mouse (<i>Peromyscus californicus</i>) | E, R |
| Deer Mouse (<i>Peromyscus maniculatus</i>) | E, R |
| Brush Mouse (<i>Peromyscus boylii</i>) | E, R |
| Pinyon Mouse (<i>Peromyscus truei</i>) | A, W |
| Dusky-footed Woodrat (<i>Neotoma fuscipes</i>) | E, R |
| FAMILY: ARVICOLIDAE (Voles and Allies) | |
| California Vole (<i>Microtus californicus</i>) | E, R |
| FAMILY: MURIDAE (Old World Rats and Mice) | |
| Norway Rat (<i>Rattus norvegicus</i>) | R |
| House Mouse (<i>Mus musculus</i>) | E, R |
| ORDER: CARNIVORA (Carnivores) | |
| FAMILY: CANIDAE (Foxes, Wolves, and Relatives) | |
| Coyote (<i>Canis latrans</i>) | E, R, O |
| Gray Fox (<i>Urocyon cinereoargenteus</i>) | E, R |
| FAMILY: PROCYONIDAE (Raccoons and Relatives) | |
| Ringtail (<i>Bassariscus astutus</i>) | E, R |
| Raccoon (<i>Procyon lotor</i>) | E, R |
| FAMILY: MUSTELIDAE (Weasels, Badgers, and Relatives) | |
| Long-tailed Weasel (<i>Mustela frenata</i>) | E, R |
| American Badger (<i>Taxidea taxus</i>) | E, R |
| Western Spotted Skunk (<i>Spilogale gracilis</i>) | E, R |
| Striped Skunk (<i>Mephitis mephitis</i>) | E, R |

| SPECIES | KEY |
|--|------------|
| FAMILY: FELIDAE (Cats) | |
| Mountain Lion (<i>Felis concolor</i>) | E, R, C |
| Bobcat (<i>Lynx rufus</i>) | E, O, R |
| ORDER: ARTIODACTYLA | |
| FAMILY: SUIDAE (Pigs) | |
| Wild Pig (<i>Sus scrofa</i>) | E, F, O, R |
| FAMILY: CERVIDAE (Deer, Elk, and Relatives) | |
| Tule Elk (<i>Cervus nannodes</i>) | C |
| Black-tailed Deer (<i>Odocoileus hemionus</i>) | E, O, R |



Appendix G
PLANT SPECIES OF CONCERN

■ ■ ■

The records of the California Natural Diversity Data Base (CNDDDB) (1990) and the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California, 5th edition (Skinner and Pavlik, 1994) indicate that a total of 64 plant species of concern (rare, threatened, or endangered) have the potential to occur in Santa Clara County. These species were screened by assessing habitat and substrate requirements to determine which ones are likely to occur at Grant and Levin County parks. The screening assumes that no serpentine soil occurs at the parks, and therefore species requiring this soil type have been omitted from the list. Species requiring coastal habitats have also been omitted. The screening resulted in 44 plant species of concern. Table G-1 summarizes the status, habitat preference, and bloom period of these species. Two of these species have known occurrences at Grant County Park: South Bay clarkia (*Clarkia concinna* ssp. *automixa*) and large-flowered linanthus (*Linanthus grandiflorus*) (pers. comm. Ray Budzinski).

In addition to the rare, threatened, and endangered species, there are species which are considered to be locally unique according to the local chapter of the California Native Plant Society (CNPS). Blazing star (*Mentzelia lindleyi*) has been observed at Levin County Park, whereas the following locally unique species have been observed at Grant County Park (CNPS local chapter): spear-leaved agoseris (*Agoseris retrorsa*), service berry (*Amelanchier utahensis*), crimson columbine (*Aquilegia formosa*), blue gilia (*Gilia achilleifolia* ssp. *achilleifolia*), lowland cudweed (*Gnaphalium palustre*), vernal pools gold fields (*Lasthenia glaberrima*), foothill penstemon (*Penstemon heterophyllus* var. *heterophyllus*), brown-mottled phacelia (*Phacelia ramosissima* var. *ramosissima*), water smartweed (*Polygonum amphibium* var. *stipulaceum*), western choke cherry (*Prunus virginiana* var. *demissa*), scrub oak (*Quercus berberidfolia*), chinquapin (*Quercus chrysolepsis*), valley oak (*Quercus lobata*), western yellow cress (*Rorippa curvisiliqua*), false lupine (*Thermopsis macrophylla* var. *macrophylla*), punchbowl-bract clover (*Trifolium barbigerum* var. *barbigerum*), and western trillium (*Trillium ovatum*).

Table G-1
Observed and Potential Rare, Threatened and Endangered Species
of Joseph D. Grant Ranch and Ed Levin County Parks

| Species Name Common Name | STATUS CODES** | | | Habitat | Blooming Period | Park ¹ |
|---|----------------|------|---------|---|-----------------|-------------------|
| | USFWS | CDFG | CNPS | | | |
| <i>Acanthomintha lanceolata</i> Santa Clara thorn-mint | - | - | List 4 | Chprl,serpentine CoScr | March-June | G |
| <i>Atriplex joaquiniana</i> San Joaquin spearscale | C2 | - | List 1B | ChScr,Medws, VFGrs/alkaline | April-Sept | G,L |
| <i>Azolla mexicana</i> Mexican mosquito fern | - | - | List 4 | MshSw(ponds,slow water) | Aug (fertile) | G,L |
| <i>Balsamorhiza macrolepis</i> var. <i>macrolepis</i> big-scale balsamroot | - | - | List 1B | CmWld,VFGrs/ sometimes serpentine | March-June | G,L |
| <i>Calandrinia breweri</i> Brewer's calandrinia | - | - | List 4 | Chprl,CoScr/disturbed sites,burns | March-June | G |
| <i>Calochortus umbellatus</i> Oakland star-tulip | - | - | List 4 | BUFrS,Chprl,LCFrS, VFGrs/serpentine | March-May | G |
| <i>Calyptridium parryi</i> var. <i>hesseae</i> Santa Cruz Mtns. pussypaws | - | - | List 3 | Chprl,CmWld | June-July | G |
| <i>Cirsium fontinale</i> var. <i>campylon</i> Mt. Hamilton thistle | C2 | - | 1B | Chprl,CmWld,VFGrs/ serpentine seeps | April-Oct | G |
| <i>Clarkia breweri</i> Brewer's clarkia | - | - | List 4 | Chprl,CmWld,CoScr/ often serpentine | April-May | G,L |
| <i>Clarkia concinna</i> ssp. <i>automixa</i> Santa Clara red ribbons * | C2 | - | List 1B | CmWld | April-July | G,L |
| <i>Coreopsis hamiltonii</i> Mt. Hamilton coreopsis | C2 | - | List 1B | CmWld(rocky) | March-May | G,L |
| <i>Cypripedium fasciculatum</i> clustered lady's-slipper | C2 | - | List 4 | LCFrS,NCFrS/ usually serpentine seeps & streambanks | March-July | G |
| <i>Delphinium californicum</i> ssp. <i>interius</i> Hospital Canyon larkspur | C2 | - | List 1B | CmWld(mesic) | April-June | G,L |
| <i>Dirca occidentalis</i> western leatherwood | - | - | List 1B | BUFrS,CCFrS,Chprl, CmWld,NCFrS,RpFrS, RpWld/mesic | Jan-April | G,L |
| <i>Eriophyllum jepsonii</i> Jepson's woolly sunflower | - | - | List 4 | Chprl,CmWld,CoScr/ sometimes serpentine | April-June | G,L |

| Species Name Common Name | STATUS CODES** | | | Habitat | Blooming Period | Park ¹ |
|---|----------------|------|---------|---|-----------------|-------------------|
| | USFWS | CDFG | CNPS | | | |
| <i>Eryngium aristulatum</i> var. <i>hooveri</i> Hoover's button-celery | C1 | - | List 4 | VnPls | July | G |
| <i>Fritillaria falcata</i> talus fritillary | C2 | - | List 1B | Chprl, CmWld,LCFrS,often on talus,serpentine | March-May | G |
| <i>Fritillaria liliacea</i> fragrant fritillary | C2 | - | List 1B | CoPrr,CoScr,VFGrs/ often serpentine | Feb-April | G,L |
| <i>Hemizonia parryi</i> ssp. <i>congdonii</i> Congdon's tarplant | C1 | - | List 1B | VFGrs(alkaline) | June-Nov | G |
| <i>Lasthenia conjugens</i> Contra Costa goldfields | PE | - | List 1B | VFGrs(mesic),VnPls | March-June | G,L |
| <i>Lessingia holoeuca</i> woolly-headed lessingia | - | - | List 3 | CoScr,LCFrS, VFGrs/ clay,serpentine | June-Oct | G |
| <i>Linanthus grandiflorus</i> large-flowered linanthus * | - | - | List 4 | CBSCr,CCFrS, CmWld,CoDns, CoPrr,CoScr,VFGrs | April-July | G,L |
| <i>Perideridia gairdneri</i> ssp. <i>gairdneri</i> Gairdner's yampah | C2 | - | List 4 | BUFrS,Chprl,VFGrs, VnPls/mesic | June-Oct | G,L |
| <i>Phacelia phacelioides</i> Mt. Diablo phacelia | C2 | - | List 1B | Chprl, CmWld/rocky | April-May | G |
| <i>Plagiobothrys glaber</i> hairless popcorn-flower | C3a | - | List 1A | Medws(alkaline),CSMsh | April-May | G,L |
| <i>Plagiobothrys myosotoides</i> forget-me-not popcorn-flower | - | - | List 4 | Chprl | April-May | G |
| <i>Plagiobothrys uncinatus</i> hooked popcorn-flower | C2 | - | List 1B | Chprl(sandy), CmWld,VFGrs | May | G,L |
| <i>Potamogeton filiformis</i> slender-leaved pondweed | - | - | List 2 | MshSw(shallow freshwater) | May-July | G,L |
| <i>Psilocarphus brevissimus</i> var. <i>multiflorus</i> delta woolly-marbles | - | - | List 4 | VnPls | May-June | G |
| <i>Ranunculus lobbii</i> Lobb's aquatic buttercup | - | - | List 4 | CmWld,NCFrS, VFGrs,VnPls | March-May | G,L |
| <i>Sanicula saxatilis</i> rock sanicle | C2 | CR | List 1B | BUFrS,Chprl, VFGrs/rocky | April-May | G,L |
| <i>Senecio aphanactis</i> rayless ragwort | - | - | List 2 | CmWld,CoScr/ alkaline | Jan-April | G |

| Species Name Common Name | STATUS CODES** | | | Habitat | Blooming Period | Park ¹ |
|---|----------------|------|---------|--|-----------------|-------------------|
| | USFWS | CDFG | CNPS | | | |
| <i>Sidalcea malachroides</i> maple-leaved checkerbloom | - | - | List 1B | BUFRs, CoPrr, NCFrs/ often in disturbed areas | May-Aug | G |
| <i>Streptanthus albidus</i> ssp. <i>albidus</i> Metcalf Canyon jewel-flower | PE | - | List 1B | VFGrs (serpentine) | April-July | G |
| <i>Streptanthus albidus</i> ssp. <i>peramoenus</i> most-beautiful jewel-flower | C1 | - | List 1B | Chprl, VFGrs/ serpentine | April-June | G |
| <i>Streptanthus callistus</i> Mt. Hamilton jewel-flower | FE | - | List 1B | ChPrI, CmWld | April-May | G |
| <i>Trifolium amoenum</i> showy Indian clover | C2* | - | List 1B | VFGrs (sometimes serpentine) | April-June | G, L |

* = Observed at Grant County Park.

** = Status codes are per the "Special Plants List" CDFG Natural Heritage Division, March 1995.

"USFWS" = Federal listed species

"CNPS" = California Native Plant Society listed species

CT=Threatened;

"CDFG" = State listed species

State Listings: CE=Endangered, CR=Rare,

¹ G = Grant County Park; L = Levin County Park

Federal Listings: FE=Endangered, FT=Threatened, PE=Federally proposed endangered, PT=Federally proposed threatened, C1=Enough data on file to support listing, C1*=Enough data to support listing but plant presumed extinct, C2=threat and/or distribution data insufficient to support listing, Threat and/or distribution data are insufficient to support federal listing, C2*=threat and/or distribution data insufficient to support listing, presumed extinct, C3a=Extinct; C3b=Taxonomically invalid; C3c= Too widespread and/or not threatened; CNPS Listing¹: List 1A=Plants presumed extinct, List 1B=Plants rare throughout their range and considered vulnerable due to limited habitat or low numbers individuals per population, List2=Rare, threatened or endangered in California, but common elsewhere, List3=Review list of species which may be rare, threatened or endangered but additional data is needed, List4=A watch list of species with a limited distribution which are not currently threatened.

¹ Species on List 1A, List 1B and List 2 are protected by Section 1901, Chapter 10 of the California Department of Fish and Game Code (Native Plant Protection).

Key to Habitat Abbreviations

| | | | |
|-------|-----------------------------|-------|------------------------------|
| CoDns | coastal dunes | MshSw | marshes & swamps |
| CBScr | coastal scrub | CSMsh | coastal salt marsh |
| ChScr | chenopod scrub | RpFrs | riparian forest |
| CoScr | coastal scrub | RpWld | riparian woodland |
| Chprl | chaparral | CmWld | cismontane woodland |
| CoPrr | coastal prairie | BUFRs | broadleaved upland forest |
| VGFrs | valley & foothill grassland | LCFRs | lower montane conifer forest |
| VnPls | vernal pools | NCFrs | north coast conifer forest |
| Medws | meadows and seeps | CCFRs | closed-cone conifer forest |

Appendix H
WILDLIFE SPECIES OF SPECIAL STATUS

■ ■ ■

1. California Tiger Salamander

The California tiger salamander is a State species of special concern. This salamander is a permanent resident of annual grasslands, foothill-valley woodlands, and is occasionally found along streams. Adults spend most of the year underground in mammal burrows, coming out at night to forage. The first heavy rains of winter initiate the migration of adults to permanent and temporary ponds, where breeding takes place from December to February (Stebbins 1985). Agricultural and urban development have reduced much of the former habitat of this species. Introduction of non-native fish which prey on the salamander larvae has devastated local populations.

The larvae of California tiger salamanders were found by HRG personnel in May 1994 in a pond near the intersection of the Dairy and Heron trails in Grant Park. Eric Remington (pers. comm., 1994) has also reported occurrences of this species in the wet meadow area of Deer Valley. Several other small ponds on Grant Park which are free of non-native fish provide suitable breeding habitat for the tiger salamander. The occurrence of this species in Levin Park is limited by lack of suitable breeding ponds and the highly disturbed nature of existing oak woodlands where this animal usually spends the non-breeding season.

2. Western Spadefoot Toad

The western spadefoot toad is a State species of special concern. It prefers areas of open vegetation in valley and foothill grasslands, open chaparral and pine-oak woodlands at elevations mostly below 3,000 feet (Stebbins 1985). Breeding occurs from January through May in slow, shallow streams and temporary pools formed by winter rains. The eggs are attached to plant stems or small rocks. Newly transformed juveniles hide near the breeding ponds in cracks and under any surface material, including cow dung (Weintraub 1980). The adults spend much of their time in burrows which they construct with their the sharp "spade" on their hind feet. They are active at night or during

rainy periods. There is competition for space and food with tadpoles of other amphibians, and predators include wading birds and some mammals.

Although appropriate habitat exists at Grant Park for this species, there are no sighting records. Occurrence of this toad in Levin Park is limited by the highly disturbed habitat and lack of suitable breeding ponds.

3. California Red-legged Frog

The California red-legged frog is a State species of special concern and has a Federal listing as threatened. This species is found in quiet pools along streams, in marshes, and ponds. Red-legged frogs are closely tied to aquatic environments, and favor intermittent streams which include some areas with water at least 0.7 meters deep, a largely intact emergent or shoreline vegetation, and a lack of introduced bullfrogs and non-native fishes. They are generally found on streams having a small drainage area and low gradient (Hayes and Jennings 1988). The red-legged frog occurs west of the Sierra Nevada-Cascade crest and in the Coast Ranges along the entire length of the state. Much of its habitat has undergone significant alterations in recent years, leading to extirpation of many populations. Other factors contributing to its decline include its former exploitation as food, water pollution, and predation and competition by the introduced bullfrog and green sunfish (Moyle 1973, Hayes and Jennings 1988). This species' breeding season spans January to April (Stebbins 1985). Females deposit 1000-4000 eggs on submerged vegetation at or near the surface.

Grant Park provides suitable breeding habitat for the red-legged frog in many of the stock ponds and springs which are too small to support bullfrogs and where non-native fish do not exist. Red-legged frog tadpoles were observed by HRG personnel in several ponds on the southern and southwestern portions of Grant Park in May 1994. Portions of all three of the major creeks in Grant Park provide excellent habitat for adult red-legged frogs. Potential habitat in Levin Park includes Calera, Scott, and Arroyo de los Coches creeks, although optimal breeding ponds are limited.

4. Foothill Yellow-legged Frog

The foothill yellow-legged frog is a State species of special concern. It is found in or near rocky streams in a variety of habitats, including valley-foothill and riparian, coastal scrub, mixed conifer, mixed chaparral, and wet meadows (CDFG 1986). This species is very closely tied to its aquatic habitat, and is rarely found far from perennial or intermittent streams (Stebbins 1985). Foothill yellow-legged frogs are typically found in shallow water of partly

shaded streams. They prefer sites with riffles and at least cobble-sized substrates (Hayes and Jennings 1988). Adults seek moving but usually not swiftly flowing water (Stebbins 1985). Pools are used on intermittent streams during the dry season (Hayes and Jennings 1988). Breeding takes place from mid-March to early June. The female attaches grape-like clusters of eggs to gravel or rocks in moving water near stream margins.

San Felipe, Aguague, and Smith creeks and their watersheds provide good habitat for the foothill yellow-legged frog. Eric Remington (pers. comm.) has observed this species in these areas of Grant Park. The creeks in Levin Park may also provide habitat for the yellow-legged frog.

5. Southwestern Pond Turtle

The Southwestern pond turtle is a Federal Candidate 1 species and a State species of special concern. This aquatic turtle inhabits ponds, lakes, streams, marshes, and other permanent waters located in woodland, grassland, and open forests below 6,000 feet (Stebbins 1985). Pond turtles can often be seen basking in the sun on partially submerged logs, rocks, mats of floating vegetation or mud banks. During cold weather, they hibernate in bottom mud. The diet of these turtles consists of aquatic vegetation, insects, fish, worms, and carrion. Females dig soil nests in or near stream banks (Nussbaum, *et al.*, 1983). Eggs are deposited between April and August. One factor in the decline of this species is the introduction of non-native fish which prey on hatchlings and juveniles.

In May 1994, southwestern pond turtles were observed by HRG personnel basking on logs in Grant and McCreery lakes. Successful breeding at these lakes is limited by the presence of bass which prey on young turtles. Turtle nests with eggs were observed in 1994 at Turtle Pond, a small stock pond upstream of McCreery Lake (E. Remington, pers. comm.). Pig and Eagle lakes (which are not stocked with fish) and several creeks on Grant Park provide suitable habitat for this species. Pond turtles may occur at Sandy Wool Lake in Levin Park, although this lake is also stocked with non-native fish.

6. Silvery Legless Lizard

The silvery legless lizard is a State species of special concern. This snake-like lizard burrows in loose, damp soil located in chaparral, coastal scrub, valley-foothill woodland, riparian and coastal dune habitats. They forage on insects and spiders in the leaf litter under bushes, trees, driftwood, or rocks. Legless lizards bear 1-4 live young between September and November (Stebbins 1985).

Ample habitat among the oak woodlands, sycamores, and chaparral habitats exists at Grant Park for the silvery legless lizard. The extensive rooting by pigs around the bases of shrubs and trees may be detrimental to this species. Because of the secretive nature of this lizard, it is rarely observed, and no sighting records were found for these two parks.

7. Alameda Whipsnake (= Striped Racer)

The Alameda whipsnake is proposed for Federal listing as endangered, and is currently State listed as threatened. The distribution of this snake is irregular within the valleys, foothills and low mountains from just north of San Francisco Bay to the Monterey vicinity. Recent studies indicate that the Alameda whipsnake prefers areas of coastal scrub bordering riparian woodland where its favorite prey of western fence lizards are abundant (McGinnis 1985). Barren and heavily grazed grasslands are not suitable for this species because its conspicuous orange stripes make it vulnerable to predation by raptors. A clutch of 6-11 eggs is laid between May and July (Stebbins 1985). Urbanization has greatly reduced the habitat for the Alameda whipsnake.

Eric Remington (pers. comm.) reported occurrences of the Alameda whipsnake in the far northeastern portion of Grant Park, along a ridge near Pala Seca Trail. There are many other possibly suitable areas for this snake in Grant Park, where the scrub-riparian ecotone exists. However, grazing in many areas and rooting by pigs may cause localized disturbances that make the habitat unsuitable. The extensive grazing and lack of scrub at Levin Park limits the potential habitat for this whipsnake.

8. Western Grebe

The western grebe is listed as a "sensitive" species by CDFG. These grebes are common winter residents along the coast, in bays, and large inland lakes. They build floating platform nests anchored to emergent marsh vegetation along lakeshores. Western grebes have an elaborate courtship display, and carry their chicks around on their backs. This species suffered population declines from plume hunters (Ehrlich, *et al.* 1988).

Western grebes are expected to be a regular visitor to both Sandy Wool Lake in Levin Park and Grant Lake in Grant Park. However, these lakes are not large enough to support breeding populations.

9. Double-crested Cormorant

The double-crested cormorant is a State species of special concern (rookery sites). It frequents fresh water of lakes, rivers, and large ponds, as well as the inshore coastal waters. This species occurs in Santa Clara County as a fairly common year-round non-breeding visitor to inland lakes, local ponds, and estuaries. They feed mainly on fish, but also on amphibians and crustaceans. Reasons for this species' population decline in California include habitat destruction, human disturbance at rookeries, DDE contamination, and over-fishing of the sardine fishery (Remsen 1978).

This species may occur around Grant and Sandy Wool lakes which offer suitable foraging, bathing, and resting opportunities.

10. Great Blue Heron

The great blue heron is designated a "sensitive" species by CDFG. It is a fairly common permanent resident along rivers, freshwater marshes and ponds, and estuaries. Great blue herons are colonial nesters, placing their stick nests high in the canopy of tall trees. These herons require nest trees near water where they can forage for fish.

There were 4-5 great blue heron nests with chicks in 1994 in a eucalyptus grove near Grant Lake (D. Bland, pers. obs.). They forage at Grant Lake and other smaller lakes and ponds in Grant Park. There is also a eucalyptus grove near Sandy Wool Lake in Levin Park which provides potential habitat for nesting of this species.

11. Great Egret

The great egret is listed as a "sensitive" species by CDFG. They are uncommon winter residents of freshwater marshes, and uncommon permanent residents of coastal estuaries. Nesting colonies often share a site with great blue herons, although egrets are not restricted to tall trees for suitable nest sites. This species is increasing in numbers statewide, recovering from the effects of plume hunters and DDT (Ehrlich, *et al.* 1988).

Suitable nesting habitat to support a small colony of great egrets exists at both parks. A great egret was observed foraging at Grant Lake (D. Bland, pers. obs.) and they are expected to occur at other ponds and lakes at this park. This species is also expected to occur at Levin Park, probably around Sandy Wool Lake.

12. Snowy Egret

The snowy egret is designated a "sensitive" species by CDFG. They are common in marshes, ponds and shallow waters of coasts. They nest in colonies in shrubs. Snowy egrets eat mostly crustaceans, and actively stir the mud with their feet to flush prey. Populations of this species are recovering and expanding after plume hunting pressure and DDT contamination (Ehrlich, *et al.* 1988).

Suitable foraging habitat exists for snowy egrets around Sandy Wool Lake in Levin Park, and at Grant Lake and other smaller lakes and ponds in Grant Park. This species is not expected to breed at either park.

13. Black-crowned Night-heron

Black-crowned night-herons are listed as "sensitive" species by CDFG. These herons are common permanent residents, although colonies are localized. They nest in shrubs in marshes, swamps, ponds, lakes, lagoons, mangroves, and occasionally in rice fields. They forage at dawn, dusk and night, eating mainly fish, but also a wide variety of other prey such as insects, eggs and young birds, small mammals, and amphibians. The numbers of this heron have recently been increasing (Ehrlich, *et al.* 1988).

Nesting by this species is not known on either park. They may occasionally be seen foraging at both parks.

14. Golden Eagle

The golden eagle is a State species of special concern. Golden eagles require large expanses of habitat as territory for feeding and nesting. Grasslands and open wooded habitats are needed for hunting, with ground squirrels and jackrabbits being the primary prey species of golden eagles. Nests are built at sites with a good view of the surrounding area, and are usually placed on cliffs, in trees, or occasionally on transmission towers. Golden eagles are very sensitive to human disturbance at nest sites. Agricultural and urban development of grasslands, as well as human persecution, has led to this species' decline in California (Remsen 1978, Clark and Wheeler 1987).

Eric Remington (pers. comm.) reported three active golden eagle nests in Grant Park in the spring of 1994. HRG personnel observed two adult eagles flying in the vicinity of one nest in May 1994. Two golden eagles were observed in Levin Park by HRG personnel in June 1994, soaring, displaying,

and perching together in a large buckeye tree on adjacent private property. Another soaring golden eagle was chased off by the pair.

15. Bald Eagle

The bald eagle is both federally and state listed as endangered. This species breeds in coastal southern California and inland in northern counties. In addition to the resident populations, there are occasional winter migrants which favor large inland lakes and rivers. Bald eagles primarily feed on fish, but also eat waterbirds, small mammals, and carrion. They perch on snags, large rock outcrops, or on tops of large trees which overlook foraging areas (primarily water). They swoop down from their perch to catch fish, and regularly steal food from other raptors. Bald eagles build large stick nests in or on top of large trees. They breed from February to July, and the usual clutch is two eggs. At 4-6 years of age bald eagles mature sexually, and they are monogamous unless a mate dies.

Bald eagles suffered dramatic population declines from egg failure caused by DDE, a metabolite of the pesticide DDT. Human disturbance of nests, logging, recreational developments, and shooting of birds, combined with the pesticide-induced egg problems, have extirpated bald eagles from much of their historic range in California. Captive breeding and release of young into the wild has restored these birds to some of their former territories.

Sightings were recorded of a bald eagle wintering in Grant Park in 1973 to 1975, but no bald eagles have been reported in more than 5 years (EIP 1993). Bald eagles may also occasionally be observed soaring or foraging in Levin Park.

16. White-tailed Kite

The white-tailed kite is designated a "sensitive" species by the CDFG. It is an uncommon permanent resident in grasslands, marshes, riparian woodland, and agricultural areas. Nesting white-tailed kites usually require densely canopied trees, preferably in or near riparian woodland adjacent to grassland or agricultural fields for hunting. Eggs are laid in April and May, and for the two months during which the female incubates the eggs and cares for the brood, she is fed by the male (Dixon, *et al.* 1957). After the breeding season, kites form communal roosts in the fall and winter. This species' population was greatly reduced by shooting prior to 1960, but has since increased significantly (Eisenmann 1971). In fact, this bird has the distinction of being the only raptor in California to benefit from expansion of agriculture, probably because the associated increase in its favorites prey, voles.

The white-tailed kite is a year-round resident in the study areas, and is most numerous during winter when migrant populations arrive. They can regularly be seen hovering over grassland by Habitat Restoration Group staff at Grant County Park, and suitable nesting habitat exists there. A pair was observed at Levin County Park, and may have been nesting in a very dense oak tree on the upper portion of the park in one of the Calera Creek drainages.

17. Northern Harrier

The northern harrier is a State species of special concern (breeding population). This species flies low over grassland and marshes foraging for small mammals and other prey. For foraging, they require open habitats, preferably near water, with nearby shrubs for cover. Northern harriers nest in grassland and marsh habitats, constructing their nests on the ground. Breeding is confined to the margins of San Francisco Bay in Santa Clara County, but this species may occur as a rare fall and winter visitor elsewhere in the county. This species is threatened by destruction of marsh habitats, the spread of urban and agricultural development, and grazing of livestock in grassland habitats (Remsen 1978).

The grassland and marsh habitats in both parks offer suitable foraging sites for this species. The northern harrier is expected to occur in the parks only as a rare visitor, due to the limited size of the marsh habitats which it prefers.

18. Sharp-shinned Hawk

The sharp-shinned hawk is a State species of special concern. This species is an uncommon migrant and winter visitor in Santa Clara County, and is very rare and locally distributed during the breeding season. This species' breeding status in the Diablo Range is poorly known. These hawks frequent a variety of habitats, but appear to favor woodland and forest habitats. Breeding birds are expected to favor forested, mountainous terrain. Sharp-shinned hawks prefer to build their stick nests in conifers in thick cover (Ehrlich, *et al.* 1988). Sharp-shinned hawks prey mostly on small song birds. The local breeding season spans April to July. This species is uncommon throughout the study region from September to early May.

Potentially suitable wintering and foraging habitat for this species occurs in both parks, but not suitable breeding habitat.

19. Cooper's Hawk

The Cooper's hawk is a State species of special concern. Like the sharp-shinned hawk, this species is a rare breeder in Santa Clara County, and an uncommon migrant and winter visitor. Migrants and wintering hawks occur in a variety of habitats, including oak woodland, conifer and mixed broadleaf forests, grasslands, residential areas, riparian woodland, and marshes. Breeding pairs prefer forested habitats in mountainous regions, but also use riparian woodlands. Cooper's hawks build stick nests in a variety of trees, but stands of live oak may be preferred. The local breeding season probably spans March/April through July. This hawk feeds primarily on small birds, but also takes small mammals, reptiles, and amphibians. Foraging occurs in both dense cover and open habitats. Habitat destruction and falconry practices have been attributed to this species' decline in California (Remsen 1978).

Potentially suitable wintering and breeding habitat for Cooper's hawks occurs in both parks.

20. Swainson's Hawk

Swainson's hawks are state listed as threatened. This bird is a summer inhabitant of the central California valley and adjacent foothills. They migrate to Argentina for the winter. Swainson's hawks feed primarily on small mammals and insects such as grasshoppers. They hunt from perches and from a soar or glide, and sometimes in flocks while migrating (Clark and Wheeler 1987). They favor large trees or open groves surrounded by grassland. Breeding occurs in California from March to August, peaking in May-July. They build platform nests of sticks and leaves in trees, bushes or on utility poles (Bloom 1980). Usual clutch size is 2-3 eggs (Beebe 1974). Destruction of suitable nesting habitat and shooting by humans are some of the reasons known for this species' decline in California.

A Swainson's hawk was sighted near McCreery Lake in Grant Park in May 1994. These birds are primarily inhabitants of the central valley, but also occupy areas on the valley periphery. Grant and Levin parks provides suitable habitat for this species, although they are expected to be only occasional visitors.

21. Osprey

The osprey is a State species of special concern (breeding population). They require clear open bodies of water to forage for fish, and may be found along rivers, lakes, bays, or reservoirs. Osprey often perch in snags and large trees

near water. They are not known to nest south of Marin County in coastal central California, but they do occur in small numbers during all months of the year. Osprey are most frequently seen from February to May and August to November, during spring and fall migrations, but also may be regular visitors to some localities during the winter months. Nearby Anderson Reservoir is known to be a wintering area for the species (Harvey and Stanley Assoc. 1979).

Osprey have been sighted at Grant Lake in Grant Park. Because of the comparatively small size of the lakes and limited foraging opportunities in Grant Park, this species is only expected to occur here as an occasional migrant. Suitable habitat for osprey exists at Sandy Wool Lake in Levin Park and they are expected to use this lake occasionally, particularly on their way to the larger, nearby Calaveras Reservoir.

22. Merlin

The merlin is a State species of special concern (wintering population). This species apparently does not breed in California; however, severe declines in the number of wintering individuals have occurred within the last two decades (Remsen 1978). Migrant and wintering individuals favor coastlines where their primary prey is shorebirds. They also frequent grasslands, open savannah, edges of forests, lakes and marshes. Because this species preys mainly on other birds, pesticide contamination (DDE) has been attributed to their decline in California.

Merlins occur as rare but regular fall and winter visitors in the study area. The lakes and grasslands on Grant and Levin parks provide suitable foraging habitat for this species.

23. American Peregrine Falcon

The peregrine falcon is a Federal and State endangered species. It is a very rare breeding and winter inhabitant in California; spring and fall migrants occur more widely throughout the state. They use a variety of habitats, but are most frequently encountered along the coast and in the vicinity of wetlands habitats where prey (i.e., ducks and shorebirds) is abundant. Peregrines are noted for their high-speed stoops and chasing prey from flight. Nests are on ledges along steep, high cliffs and on man-made platforms. Breeding takes place from March to August, and the usual clutch size is 3-4 eggs.

This species' population declined drastically throughout California in the 1970s and early 1980s due to eggshell-thinning caused by DDT and DDE. The Predatory Bird Research Group in Santa Cruz conducted a captive breeding and release program that successfully reintroduced peregrines to much of their historical breeding territory. Populations are now thought to be stable and able to reproduce on their own.

Peregrine falcons formerly bred in Santa Clara County, but are currently known only as rare winter visitors and spring and fall migrants, mostly near San Francisco Bay. They may occur occasionally between October and March in Grant and Levin parks, around Grant and Sandy Wool lakes where their favorite prey of waterbirds congregate.

24. Prairie Falcon

The prairie falcon is a State species of special concern (breeding population). It frequents interior areas, and requires open country for foraging and sheltered cliffs for nesting. Breeding season is from February to September; most eggs are laid in April (Walton 1977). Mean clutch size is five eggs. Prairie falcons are most frequently encountered in dry areas with extensive grassland or scrub habitat. Their main prey is small mammals, but they also take birds and snakes. Prairie falcons are vulnerable to DDE-induced eggshell thinning, and suffer nesting predation from mammalian predators, great horned owls, and golden eagles (Remsen 1978).

Prairie falcons are expected to occur in Grant and Levin parks as an occasional visitor, probably using the study areas' habitats for foraging. No suitable nesting habitat exists in the parks, but prairie falcons were observed nesting in 1994 near Grant Park at Master's Hill (E. Remington, pers. comm.).

25. California Gull

The California gull is a State species of special concern (nesting colony). They are abundant visitors to coastal and inland areas during the non-breeding season. The only breeding site in central coastal California occurs at Alviso in Santa Clara County. Wintering and non-breeding California gulls use marine habitats, beaches, estuaries, freshwater lakes, developed areas, and agricultural fields. This bird is omnivorous, and is frequently seen at landfills. Breeding occurs from April to August, and they nest in scrapes on the ground usually in colonies with other waterbirds (Harrison 1978). California gulls require isolated islands for successful nesting. The largest breeding colony of this species which was located on an island in Mono Lake was destroyed by

predators because diversions lowered water levels, creating a land bridge to the island.

Wintering California gulls are expected to occur in Grant Park, most likely around Grant Lake, and around Sandy Wool Lake in Levin Park.

26. Caspian Tern

The Caspian tern is a State "sensitive" species (nesting colony). They forage in inshore waters, lagoons, and estuaries, and use shores of the water bodies for roosting, bathing, and resting. They nest in colonies on islands and semi-islands in marshes, lakes, sloughs and occasionally on beaches. Eggs are laid April to June, and parents continue to care for their young 5-7 months after fledging (Ehrlich, *et al.* 1988). This species is most susceptible to egg predation by mammals, especially the introduced red fox, which has eliminated many colonies around San Francisco Bay. Also, if human disturbance is persistent, adults will abandon their nests.

Caspian terns have been observed at Grant Lake, and are expected to occur at Sandy Wool Lake in Levin Park. Suitable breeding habitat for this species does not occur in either park.

27. Forster's Tern

The Forster's tern is a State "sensitive" species (nesting colony). It is a common migrant and summer visitor in the study area. They nest in fresh and saltwater marshes, and marshy borders of ponds and lakes, most often on floating vegetation mats. Forster's terns primarily eat fish, but also insects caught while flying over marshes (Ehrlich, *et al.* 1988). Like the Caspian tern, they are vulnerable to egg predation by red fox.

Grant Lake and Sandy Wool Lake offer suitable foraging, bathing, and roosting sites for this species. Forster's terns are expected to be common, but not abundant, at the study areas in spring, summer, and fall.

28. Burrowing Owl

The burrowing owl is a State species of special concern (breeding population). Burrowing owls use open grassland habitats with low-growing vegetation. They prefer areas interspersed with bare ground, and raised areas used as rest/perch sites. Small mammals and insects are their primary prey. Abandoned burrows, especially of ground squirrels, are used as roost and nest sites. Breeding occurs from March to August, and clutches average 5-6 eggs.

Agricultural, industrial, and urban development have resulted in a significant decline of suitable habitat for this species throughout California (Remsen 1978). Programs to control burrowing mammals with poison and burrow destruction have also reduced owl populations (Zarn 1974).

Eric Remington (pers. comm.) has observed burrowing owls on Grant Park along Canada de Pala Trail. Potentially suitable habitat for this owl occurs in the grasslands at Levin Park.

29. California Horned Lark

The California horned lark is a federal candidate 2 and a State species of special concern. They inhabit open fields where they walk along the ground in search of insects and seeds. Breeding activity peaks in May, and the season extends from March to July. Nests are grass-lined cups on open ground. The average clutch is 3-4 eggs, and two broods per breeding season is common (Bent 1942). After breeding, horned larks form large flocks that forage and roost together.

Horned larks were observed by HRG personnel along the Canada de Pala Trail in May 1994 on Grant Park. Good foraging areas exist through the grasslands in both Grant and Levin parks, but grazing may interfere with successful nesting.

30. Loggerhead Shrike

The loggerhead shrike is a federal candidate 2 and a State species of special concern. Common residents of lowlands and foothills, this species prefers open habitats with scattered shrubs, trees, fences, or other lookout posts. They hunt insects, snakes, small birds, and rodents which they often impale on thorns or barbed wire to hold it while they eat. Eggs are laid from March to May, with a clutch size of 4-7 eggs, in shrubs and trees with dense vegetation for concealment.

There is ample habitat for foraging and breeding of this species on Grant Park. There is good foraging habitat for loggerhead shrikes at Levin Park, but lack of shrubs limits the potential breeding habitat.

31. Yellow Warbler

The yellow warbler is a State species of special concern (breeding population). They are common summer residents of riparian woodlands, where they feed on insects and spiders. Breeding pairs are closely associated with open canopy

riparian habitat along major streams and lakes; cottonwood/willow habitats seem to be favored. The cup-like nests are built in the middle-story or understory growth. The breeding season extends from April to August; clutch size is usually 4-5 eggs. Yellow Warblers are threatened by loss of riparian habitat and nest parasitism by the brown-headed cowbird (Remsen 1978).

Yellow warblers are fairly common in Santa Clara County, but are localized breeders. Habitat exists for this species on Grant Ranch. Habitat at Levin Park is limited by lack of understory.

32. Yellow-breasted Chat

The yellow-breasted chat is a State species of special concern (breeding population). They require dense, brushy thickets near water and dense riparian understory for breeding and foraging. Insects are the mainstay of their diet, but they also eat fruit and berries. Chats breed from April to August, building their nest low in the brush; clutch size is usually 3-4 eggs. Habitat destruction and cowbird parasitism have contributed to this species decline in California (Remsen 1978).

Yellow-breasted chats occur as rare to uncommon spring and fall migrants and as rare, localized breeders in Santa Clara County. Suitable habitat for this species may occur along portions of Smith and San Felipe creeks on Grant Park. Habitat for chats at Levin Park is limited by lack of understory.

33. Tricolored Blackbird

The tricolored blackbird is a State species of special concern and a Federal Candidate 2 species for listing. It is a colonial-nesting species, restricted in distribution primarily to California. They are locally distributed during the breeding season, occurring at ponds, lakes or marshes with dense growths of tules or cattails. They are more widespread during the non-breeding season, when large flocks gather in agricultural fields and pastures. Numbers significantly increase during fall and winter when migrants from the Central Valley supplement the existing population. Over the past 50 years, the population of tricolored blackbirds has declined by 90% throughout California because the drainage of marshes for agricultural and urban development has resulted in a loss of breeding habitat (Beedy, *et al.* 1991).

Tricolored blackbirds have been reported nesting on the island in Grant Lake (R. Freeman, pers. comm.), and suitable nesting habitat exists at Sandy Wool Lake in Levin Park.

34. Pallid Bat

The pallid bat is a State species of special concern. Pallid bats are found in a variety of habitats. This species moves about locally on a seasonal basis, but is not considered to be migratory (Jameson and Peeters 1988). During the day pallid bats roost in buildings, crevices, caves, mines, and hollow trees (CDFG 1986). Maternity roosts are colonial, while males and feeding bats roost singly. This species is very sensitive to disturbances at roost sites. During the night, pallid bats glean moths from leaves and forage on the ground for invertebrates, especially Jerusalem crickets.

The oak trees and annual grassland on the project sites provide foraging habitat for the pallid bat, while abandoned buildings provide potential roost sites.

35. Townsend's Western Big-eared Bat

The Townsend's western big-eared bat is a federal Candidate 2 species for listing as threatened or endangered, and a state species of special concern. Big-eared bats occur in a variety of plant communities throughout California, including coastal conifer and broad-leaf forests, oak and conifer woodlands, arid grasslands and high elevation forests (Williams 1986). In coastal California, the big-eared bat is primarily associated with riparian forests, where it gleans insects from leaf surfaces. Roosting sites for Townsend's big-eared bat include limestone caves, lava tubes, mine tunnels, buildings, and other human-made structures within 100 meters of riparian habitat (Williams 1986, Pierson 1988). Townsend's big-eared bats are extremely sensitive to human disturbances at roost sites.

Townsend's big-eared bats may roost in abandoned buildings in Grant Park, and have been identified from mist-netting studies on the adjacent Blue Oak Ranch (E. Remington, pers. comm.). Foraging habitat occurs along the creeks and larger lakes in Grant Park. There is potential habitat for this species at Levin Park, although roost sites are more limited.

36. California Mastiff Bat

The California mastiff bat is a federal candidate 2 and a State species of special concern. It is the largest of the North American bats; its long, narrow wings adapted for sustained flights over open habitats. These bats feed primarily on night-flying moths, and have a long foraging period, about 6.5 hours per night. Mastiff bats breed in early spring, with one baby produced per year. Nursery roosts occur in tight rock crevices or in crevices in

buildings. These bats enter a period of daily torpor in the winter, but still actively forage at night. A majority of historical roosts in California are no longer used; reasons may include habitat destruction and pesticide contamination.

The Snell and White barns on Grant Park are known to provide roosts to many bats. The California mastiff bat has been identified in mist-net studies on the adjacent Blue Oak Ranch (E. Remington, pers. comm.). The grasslands at Levin Park provide potential foraging areas for this bat, but roost sites are limited.

37. American Badger

The American badger is a State species of special concern. This species primarily occurs in grassland and savannah habitats with friable soils. However, a variety of other habitats are utilized including shrub and open stages of forests. The abundant supply of prey species (especially fossorial mammals) is an essential habitat requirement. Badgers excavate burrows for denning sites, and dig for ground squirrels, gophers, and other prey species. Once fairly widespread, this species has declined or disappeared over large areas of the state, due to agriculture and urban development (Williams 1986). Predator control programs using indiscriminate trapping and certain poisons may have detrimental effects on badger populations.

The grasslands in Grant Park may support denning and foraging sites for badgers. Eric Remington (pers. comm.) has sighted badgers in the Pala Seca Field at Grant Park. Badger habitat is limited at Levin Park.

Appendix I
RANGE ANALYSIS

■ ■ ■

A. Range Analysis

1. Range Analysis

A range analysis was prepared for Grant and Levin County Parks as an element of this Resource Management Plan. To understand some of the terms used in describing range practices, a glossary is provided at the end of this section of the report. The range analysis identified areas on the two parks that were suitable for grazing and provided an estimate of the forage production and carrying capacity of these areas consistent with resource management plan objectives. Land available for livestock use was generally limited by accessibility, terrain, vegetation density, distance to water, and land management concerns. Resource management and recreational considerations often precluded livestock from using certain areas. The land available for grazing, therefore, amounted to less than the total acreage, and carrying capacity was adjusted to reflect existing conditions.

a. Methodology. A soils and plant community based method was used to determine livestock carrying capacity. This method involved ranking plant communities on the basis of their forage producing capability and suitability for grazing. The Santa Clara County Soil Survey was used to provide information on forage production for the two parks. Livestock carrying capacity was derived from those lands that produced forage and were otherwise available for grazing. The results provided a starting point from which additional adjustments were made to account for existing conditions in the field that limit or preclude grazing use, such as brushy conditions, steep terrain, or the lack of available drinking water.

b. Vegetation Mapping and Acreage Calculation. The overall suitability of the land for grazing was evaluated by conducting an assessment of the vegetative cover. Natural plant communities were mapped in the field using aerial photographs and 7.5 minute, U.S. Geological Survey quadrangle maps at a scale of 1:24,000 (Figures 12 and 13 in the body of the report). A five acre minimum was used in mapping the various vegetation units. Plant communities were mapped and named according to Holland's Description of

the Terrestrial Natural Communities of California (1986), where applicable. Those plant communities that did not correspond to descriptions found in Holland were named after the dominant plant(s) occurring in the stand. The acreage occupied by the different plant communities within each field unit was calculated using a computer aided design (CAD) program. The results are summarized in Table 1 in the body of this report (Grant County Park) and Table 2 in the body of this report (Levin County Park).

c. Residual Dry Matter Standards. A determination was made as to the amount of residual dry matter (RDM) that should remain on the ground at the end of the grazing season. Residual dry matter is a measurement in pounds per acre or kilograms per hectare of air-dried plant material that represents vegetation that is to be left ungrazed. RDM is subtracted from the total amount of herbaceous vegetation the land produces to indicate how much forage is available for livestock to consume.

Research indicates that the amount of residual dry matter remaining in any one year can influence plant productivity and plant composition the following growing season. In general, low amounts of RDM tend to favor the growth of undesirable, opportunistic, early-successional plant species. A diverse mixture of desirable, native and non-native plant species results on grassland and woodland grass areas where, depending on terrain, 600 to 1000 pounds per acre are left. Too much RDM results in a thatch, which favors non-native grasses and inhibits the growth of forbs.

The minimum amount of residual dry matter required to remain on the ground at the end of the grazing season was established by the Santa Clara County Parkland Range Management Policy, which is as follows:

Less than 30 percent slope: leave 600 lbs/acre
Alert level: 800 lbs/acre
30 percent to 50 percent slope: leave 800 lbs/acre
Alert level 1,000 lbs/acre
Greater than 50 percent slope: leave 1,000 lbs/acre
Alert level: 1,200 lbs/ acre

d. Livestock Carrying Capacity Determination. The vegetation map was used to determine areas considered suitable or unsuitable for grazing on the basis of their forage producing capability. Plant communities producing little or no forage, such as dense woodlands and brushlands, were subtracted from the total acreage of the park. Areas from which livestock were currently excluded for recreation or resource protection reasons were also omitted from the total land area. Livestock carrying capacity estimates were subsequently

assigned only to those lands that provided forage and were otherwise available for grazing.

The areas considered suitable for grazing within each field were allocated a carrying capacity in animal unit months (AUMs) based on a value of 1 acre/AUM for grassland and savanna plant communities, and 0.4 acre/AUM for open deciduous woodland plant communities.¹ An animal unit month is the amount of forage necessary to sustain an adult cow or a cow and her calf on an acre of land for one month. Conversion factors or animal unit equivalents (AUE) contained in the County of Santa Clara Parks and Recreation Department Cattle Grazing License compensate for the fact that young weaner and yearling animals consume lesser amounts of vegetation, and are considered a corresponding fraction of an AUM. Animal unit equivalents are shown on Table I-1.

The livestock carrying capacity values were determined to be consistent with forage production information contained in the Santa Clara County Soil Survey. Adjustments to AUMs were made taking forage and soil conditions into account. Soil surveys are studies prepared for each county by the USDA Soil Conservation Service in cooperation with the University of California Agricultural Experiment Station. The surveys provide useful information about the kind, location, productivity, and suitability of soils for various engineering and agricultural uses, including livestock grazing. The soil survey groups soils that share similar characteristics into designations called range sites. Forage production estimates in pounds per acre for favorable and unfavorable rainfall years is provided for each range site. The range sites were identified and mapped for both parks and forage production was calculated utilizing the information provided in the county soil survey. (See Soil Conservation Service Range Analysis (1994) for further information on this topic.)

e. Water Resource Inventory. A water resource inventory was conducted to document the location and status of all developed and undeveloped springs and ponds on the two parks. The availability of water and the travel conditions to and from water to surrounding forage areas influences the extent to which livestock utilize the land. Adjustments in carrying capacity are often necessary to compensate for the lack of available drinking water. Water sources were identified on a map and provided with identification numbers. Detailed information on the condition and components (troughs, storage

¹ The 0.4 acre/AUM carrying capacity allocation is based upon a figure used by the East Bay Park District to determine forage potential of woodlands. The district has found this number to be a reasonable approximation of the lesser forage value of woodlands for cattle.

**Table I-1
 ANIMAL UNIT EQUIVALENTS**

| Type of Animal | Animal Unit Equivalent |
|--|------------------------|
| Brood Cow (mature female, two (2) years old and above) | 1.00 |
| Brood Cow with Calf at side (not to exceed eight (8) months old) | 1.00 |
| Bull (mature male, two (2) years old and above) | 1.50 |
| Replacement Cattle (eight (8) to twelve (12) months old) | 0.50 |
| Replacement Cattle (one (1) to two (2) years old) | 0.75 |
| Horse | 1.25 |

tanks, plumbing fixtures, dam and spillway type, etc.) of all of the water resources located on the two parks was collected and summarized on forms (Appendices B and C). The carrying capacity of certain fields on the two parks was adjusted downward, where necessary, to compensate for a lack of available livestock water.

f. Results. The grasslands along the ridges, in the valleys, and on the flats and terraces comprise the majority of the available grazing land preferred by livestock. These areas within the two parks were assigned a carrying capacity of one animal unit month. The various oak woodland communities of Grant County Park generally occupy the steeper slopes and drainages and are a secondary source of forage for grazing animals. These areas were assigned a value reflective of 40 per cent of the forage production of grasslands because of their secondary importance as a forage resource and their relative inaccessibility as determined by vegetation and slope maps. The dense coast live oak and live oak/bay woodlands on Grant and Levin County Park have sparse herbaceous understory vegetation and the forage provided by these areas is negligible. These areas were afforded zero carrying capacity. The areas considered suitable for grazing, therefore, included accessible grasslands and adjacent woodlands supporting an herbaceous understory.

Tables I-2 and I-3 provide a summary of the acreages occupied by grassland, woodland, and shrubland plant communities on the two parks, the total land available for grazing, and an approximate carrying capacity in AUMs for each field within the parks. The shaded blocks in the tables indicate areas that are either unsuitable for or are currently excluded from grazing.

Table I-2
JOSEPH D. GRANT COUNTY PARK
PLANT COMMUNITY ACREAGE PER FIELD, SUITABLE ACRES, AND CARRYING CAPACITY

| Field | Plant Community Type | | | | | | | | | | | | | Suitable Acres and Carrying Capacity | | | | | |
|--------------------|----------------------|------------|-----------|------------|--------------|------------|-----------|-----------|--------------|--------------|-----------|--------------|-----------|--------------------------------------|----------------------|-----------------------------|----------------|----------------|---------------|
| | A | B | C | D | G | K | L | M | O | P | R | S | V | Total Acres | Total Land Available | Total Grassland and Savanna | Total Woodland | Available AUMs | Adjusted AUMs |
| Alfalfa | | 5 | | | 59 | | 2 | | 2 | | 2 | | | 70 | 0 | 0 | 0 | 0 | 0 |
| Barn North | | 26 | | | 98 | 2 | | | 8 | | | | | 134 | 108 | 98 | 10 | 102 | 102 |
| Barn South | | | | | 27 | | | | 9 | | | | | 36 | 0 | 0 | 0 | 0 | 0 |
| Big Washburn | | 15 | | 64 | 85 | | | | 347 | | | 374 | | 885 | 806 | 459 | 347 | 598 | 526 |
| Brush | | 19 | 6 | | 65 | | 79 | | 76 | | | 55 | | 300 | 0 | 0 | 0 | 0 | 0 |
| Corral | | 13 | | | | | | | 8 | | | 337 | | 358 | 345 | 337 | 8 | 340 | 332 |
| Dairy | | | | | 43 | | | | 61 | | | | | 104 | 104 | 43 | 61 | 67 | 67 |
| Dutch Flat East | | 143 | | | 211 | 37 | 1 | | 79 | | | 48 | | 519 | 375 | 259 | 116 | 305 | 177 |
| Dutch Flat West | | 124 | 21 | | 31 | 254 | 13 | | 3 | | | 222 | | 668 | 510 | 253 | 257 | 213 | 356 |
| Edwards | | | | 5 | 325 | 18 | | | 120 | | | | | 468 | 463 | 325 | 138 | 380 | 380 |
| Hall Valley | 4 | 13 | | 33 | 80 | 87 | 10 | | 270 | 41 | | 314 | | 852 | 751 | 394 | 357 | 537 | 537 |
| Hotel East | 17 | 37 | | | 82 | | | | 26 | 667 | | 155 | | 984 | 930 | 237 | 693 | 514 | 466 |
| Hotel West | | 225 | | 31 | | | | | 162 | 39 | | 417 | | 874 | 618 | 417 | 201 | 497 | 447 |
| Lake | | 7 | | | 131 | 23 | 3 | | 25 | | | 114 | | 303 | 0 | 0 | 0 | 0 | 0 |
| Lower Snell | | 5 | | | 51 | 13 | | | 7 | | | 16 | | 92 | 0 | 0 | 0 | 0 | 0 |
| Middle Snell | | | | | 110 | 1 | 2 | | 4 | | 2 | | | 119 | 0 | 0 | 0 | 0 | 0 |
| North | 39 | 12 | | 6 | 344 | 38 | | | 202 | 193 | | 184 | | 1,018 | 768 | 528 | 240 | 624 | 624 |
| Pala Seca Dropping | | | | | 18 | | | | | | | | | 18 | 18 | 18 | 0 | 18 | 18 |
| Pala Seca East | 90 | | | | 473 | | | | 1 | 446 | | 57 | | 1,067 | 531 | 531 | 1 | 530 | 371 |
| Pala Seca West | | | | | 93 | 132 | | 31 | 2 | | | 54 | 36 | 348 | 0 | 0 | 0 | 0 | 0 |
| Pig/Eagle Lakes | | | | | | | | | | | | 73 | | 75 | 0 | 0 | 0 | 0 | 0 |
| Stockyard | | | | | 43 | | 1 | | 41 | | 1 | | | 86 | 0 | 0 | 0 | 0 | 0 |
| Tiernan | | | | 1 | 28 | | | | 13 | | | 22 | | 64 | 63 | 50 | 13 | 55 | 46 |
| Valley | | | | | 72 | | | | | | | 8 | | 80 | 0 | 0 | 0 | 0 | 0 |
| Totals | 150 | 644 | 27 | 140 | 2,469 | 605 | 11 | 31 | 1,466 | 1,386 | 13 | 2,444 | 36 | 9,522 | 6,390 | 3,948 | 2,442 | 4,923 | 4,449 |

Key: A = Alder/Maple Riparian; B = Live Oak/Bay Woodland; C = Coyote Brush/Poison Oak Scrub; D = Diablan Sage Scrub; G = Non-native Grassland; K = Black Oak Woodland; L = Coast Live Oak Woodland; M = Meadow; O = Mixed Oak Woodland; P = Mixed Oak/Foothill Pine Woodland; R = Ephemeral Willow Riparian; S = Oak Savanna; V = Valley Oak Woodland.
 Note: Shaded areas indicate acreages excluded from or unsuitable for rotational grazing.

Table I-3
ED R. LEVIN COUNTY PARK
PLANT COMMUNITY ACREAGE PER FIELD, SUITABLE ACRES AND CARRYING
CAPACITY

| Field | Plant Community Type | | | Suitable Acres and Carrying Capacity | | | |
|--------------------|----------------------|------------|------------|--------------------------------------|----------------------|----------------|---------------|
| | Domestic | Grassland | Woodland | Total Acres | Total Land Available | Available AUMs | Adjusted AUMs |
| Arroyo | | 20 | 66 | 86 | 0 | 0 | 0 |
| Barn | | 33 | 2 | 35 | 33 | 33 | 33 |
| Calaveras North | | 63 | | 63 | 63 | 63 | 63 |
| Calaveras South | | 17 | | 17 | 0 | 0 | 0 |
| Corral | | 43 | 2 | 45 | 43 | 43 | 43 |
| Hang Glider | | 47 | | 47 | 47 | 47 | 47 |
| Home Ranch | 5 | | 2 | 7 | 0 | 0 | 0 |
| Homestead | | 32 | 2 | 34 | 0 | 0 | 0 |
| Lower Calera | | 56 | 4 | 60 | 56 | 56 | 56 |
| Lower Higuera Loop | | 24 | | 24 | 24 | 24 | 24 |
| Middle Calera | | 80 | 10 | 90 | 0 | 0 | 0 |
| Ranch | | 29 | | 29 | 29 | 29 | 29 |
| Upper Calera | | 437 | 84 | 521 | 0 | 0 | 0 |
| Upper Higuera Loop | | 31 | 1 | 32 | 31 | 31 | 31 |
| Water Tank | | 70 | | 70 | 0 | 0 | 0 |
| Totals | 5 | 982 | 173 | 1,160 | 326 | 326 | 326 |

Note: Shaded areas indicate acreages excluded from or unsuitable for rotational grazing.

2. Grant County Park

As shown on Table I-2, of the 9,522 total acres of park land, 6,390 acres were classified as suitable for grazing, consisting of 3,948 acres of grassland and open oak savanna and 2,442 acres of woodland. The grasslands and the woodlands provide a combined total of 4,923 AUMs.

a. Adjustments. Some adjustments were made in the total acres available for grazing (6,390 acres) and the resulting carrying capacity of 4,923 AUMs. These adjustments were made to account for areas excluded from grazing, steep terrain, and brush and weed encroachment. The areas to be removed from the grazing acreage total included the following:

- Fields currently removed from grazing that support wetland, lake, and riparian habitats (including Halls Valley);
- Buffer zones along San Felipe Creek;
- Lake, Brush North and Pala Seca west fields;
- Plant communities unsuitable for grazing because of a lack of available forage consisting of coast live oak woodland, live oak/bay woodland, coyote brush/poison oak scrub, and Diablan sage scrub;
- The acreage comprising the steep east-facing slopes above Smith Creek in the Pala Seca, Halls Valley, and North fields were considered unsuitable grazing land due to excessively steep terrain, which mostly precluded effective livestock use of this area
- Approximately 35 acres of grassland and 110 acres of oak woodland in the Big Washburn Field that were added to the Pala Seca West Field.
- The grassland area around Pig and Eagle lakes and Bass Lake to be fenced as a recommendation of this plan, consisting of approximately 75 acres of oak savanna and oak woodlands in Hotel and Corral fields.
- Exclusion of one half the carrying capacity of the 373 acres of woodland in the Dutch Flat and Brush fields to account for encroaching brush (75 AUMs); a reduction of one half the carrying capacity of the 263 acres of oak savanna in the Dutch Flat and Brush fields because of encroaching brush (131 AUMs); and a reduction of one third the carrying capacity of the 211 acres of grassland in the Dutch Flat Field due to diminished forage productivity caused by the dominance of yellow starthistle (70 AUMs).

Based on the discussion above, the adjusted number of AUMs totals 4,449 as shown in Table I-2. These adjustments bring the total adjusted AUMs available into close conformance with the historical grazing use of 4,800 AUMs. The analysis essentially verifies the appropriateness of current stocking levels. This is evident in the relatively good diversity of native plants found throughout the park, and the lack of serious grazing-related erosion problems and terracing of the hillsides, which is indicative of long-term responsible management.

Some areas that have been removed from the rotational grazing program are still considered for short-term intensive grazing (also called spot grazing) when necessary to meet vegetation management objectives. Table I-4 provides the potential carrying capacity of those fields considered for a spot grazing program.

3. Levin County Park

Of the 1,160 total acres of undeveloped park land, 326 acres of grassland are classified as suitable for a rotational grazing program, resulting in an available carrying capacity of 326 AUM for this program. Fields recommended for the rotational grazing program include Barn, Calaveras North, Corral, Hang Glider, Lower Calera Creek, Lower Higuera Loop, Ranch, and Upper Higuera Loop. These fields are located in the lower elevations of the park which need to be more intensively managed than the upper portions due to increased problems with fire risk and exotic weed infestations. Water Tank Field, which is also located in the lower central area of the park, has not been included in the rotational grazing program because of a lack of developed water. Should the necessary water resources be developed, Water Tank Field could be added to the rotational program at a carrying capacity of 70 AUM. It also should be noted that the non-native weed infestations in Calaveras North Field should be brought under control before it can be added to the rotational program.

A total of 586 acres of grassland are classified as suitable for a spot grazing program, resulting in an available of carrying capacity of 586 AUM and an adjusted carrying capacity of 367 AUM. Fields recommended for the spot grazing program include Arroyo, Calaveras South, Homestead, Middle Calera Creek and Upper Calera Creek. These fields are located in the steeper elevations of the park and the west side of the park.

The higher elevation fields, Middle and Upper Calera, have traditionally been grazed lightly due to the steep terrain and relative lack of water and should be grazed on a less frequent basis than the lower fields. Because of the steep

Table I-4
JOSEPH D. GRANT COUNTY PARK
SPOT GRAZED AREAS - ACREAGES AND LIVESTOCK CARRYING CAPACITY IN ANIMAL UNIT MONTHS

| Field | Plant Community Type | | | | | | | | | | | | | Suitable Acres and Carrying Capacity | | | | |
|-----------------|----------------------|-----------|----------|----------|------------|------------|-----------|-----------|------------|----------|-----------|------------|-----------|--------------------------------------|----------------------|-----------------------------|----------------|----------------|
| | A | B | C | D | G | K | L | M | O | P | R | S | V | Total Acres | Total Land Available | Total Grassland and Savanna | Total Woodland | Available AUMs |
| Alfalfa | | 5 | | | 59 | | 2 | | 2 | | 2 | | | 70 | 61 | 59 | 2 | 60 |
| Barn South | | | | | 27 | | | | 9 | | | | | 36 | 36 | 27 | 9 | 31 |
| Brush | | 19 | 6 | | 65 | | 79 | | 76 | | | 55 | | 300 | 196 | 120 | 76 | 150 |
| Lake | | 7 | | | 131 | 23 | 3 | | 25 | | | 114 | | 303 | 293 | 245 | 48 | 264 |
| Lower Snell | | 5 | | | 51 | 13 | | | 7 | | | 16 | | 92 | 87 | 67 | 20 | 75 |
| Middle Snell | | | | | 110 | 1 | 2 | | 4 | | 2 | | | 119 | 115 | 110 | 5 | 112 |
| Pala Seca West | | | | | 93 | 132 | | 31 | 2 | | | 54 | 36 | 348 | 348 | 178 | 170 | 246 |
| Pig/Eagle Lakes | | | | | | | | | | | | 75 | | 75 | 75 | 75 | 0 | 75 |
| Stockyard | | | | | 43 | | 1 | | 41 | | 1 | | | 86 | 84 | 43 | 41 | 59 |
| Valley | | | | | 72 | | | | | | 8 | | | 80 | 72 | 72 | 0 | 72 |
| Totals | 0 | 36 | 6 | 0 | 651 | 169 | 87 | 31 | 166 | 0 | 13 | 314 | 36 | 1,509 | 1,367 | 996 | 371 | 1,144 |

Key: A = Alder/Maple Riparian; B = Live Oak/Bay Woodland; C = Coyote Brush/Poison Oak Scrub; D = Diablan Sage Scrub; G = Non-native Grassland; K = Black Oak Woodland; L = Coast Live Oak Woodland; M = Meadow; O = Mixed Oak Woodland; P = Mixed Oak/Foothill Pine Woodland; R = Ephemeral Willow Riparian; S = Oak Savanna; V = Valley Oak Woodland.

Note: Shaded areas indicate acreages excluded from or unsuitable for grazing.

slopes in Upper Calera Field, the available capacity (437 AUM) of this field is adjusted downward to 218 AUM. These fields can be spot grazed in conjunction with the rotational grazing program.

Calaveras South and Homestead fields are separated by roads from the grazed areas of the parks and do not have developed water resources. However, these fields contain forage suitable for grazing and could be managed through a spot grazing program with the adjacent neighbor who currently grazes within the park under an informal arrangement. Efforts should be made to formalize an agreement with the neighbor for this program. Arroyo Field has more limitations for grazing due to remote location, difficult access and lack of water resources. Spot grazing is an option for this field if these limitations can be overcome.

The timing for areas to be spot grazed would be determined on an as-needed basis by County staff through consultation with range management experts. Areas to be spot grazed should be identified well in advance of implementation to allow sufficient notice to grazing permittees. The potential carrying capacity of those fields on Levin Park that are considered for spot grazing is provided in Table 1-5.

The remaining acreage is to be excluded from grazing and includes five acres within the Minnis Ranch area and 173 acres of oak/bay/sycamore woodlands.

B. Grazing Management Recommendations

1. Livestock Management

a. Background. The licensees on Joseph D. Grant and Ed R. Levin County Parks maintain cow-calf operations, in which a base herd of mother cows are retained throughout their reproductive life, and the calves are sold or kept as replacement animals. The number of animals allowed to graze on the two parks is determined by estimating the amount of vegetation that will be available for livestock to consume in any given year, and then allocating an appropriate number of animals for the intended season of use.

The movement of animals in and out of the two parks is cyclic and conforms to seasonal changes in plant production, flowering period, and the operational considerations of the rancher and park staff. Plant growth on non-native grasslands is dependent upon and responsive to weather conditions, with vegetation production and composition varying from year to year in response

Table I-5
ED R. LEVIN COUNTY PARK
POTENTIAL CARRYING CAPACITY FOR AREAS TO BE SPOT GRAZED

| Field | Plant Community Type | | | Suitable Acres and Carrying Capacity | | | Adjusted AUM |
|-----------------|----------------------|------------|------------|--------------------------------------|----------------------|----------------|--------------|
| | Domestic | Grassland | Woodland | Total Acres | Total Land Available | Available AUMs | |
| Arroyo | | 20 | 66 | 86 | 20 | 20 | 20 |
| Calaveras South | | 17 | | 17 | 17 | 17 | 17 |
| Homestead | | 32 | 2 | 34 | 32 | 32 | 32 |
| Middle Calera | | 80 | 10 | 90 | 80 | 80 | 80 |
| Upper Calera | | 437 | 84 | 521 | 437 | 437 | 218 |
| Totals | | 586 | 162 | 748 | 586 | 586 | 367 |

to temperature differences and the timing and amount of rainfall during the growing season. As a result, some adjustments in stocking levels are usually necessary every year to assure that forage utilization standards are achieved.

The October through May grazing season established for Grant Park should be considered flexible, in that circumstances may require it to be shorter or begin later than prescribed, depending upon weather factors and the resulting availability of forage. For example, in a below-average rainfall year, the cattle may need to leave the park earlier, and so forth.

b. Mechanics of Grazing. The land is managed to allow for adequate plant residue to remain at the end of each grazing season to protect the soil against erosion, encourage nutrient recycling, and promote plant regrowth. This residue also provides forage for grazing animals that return to the parks in October prior to the start of the rainy season. Plant regrowth begins with the arrival of rain and the emergence of new seedlings in the fall. The emergent vegetation continues to develop slowly throughout the cool, wet, winter months, although the amount produced exceeds the rate at which grazing animals are able to consume it under moderate use levels.

A rapid growth in the vegetation occurs in the early spring months in response to rising temperatures and lengthening days, culminating in a diverse floral display of native and non-native herbaceous plants. A majority of the annual plants reach maturity and die by mid-spring as soil moisture is depleted, whereas native perennial grasses, where present, persist into the mid-summer before becoming dormant. The remnant stems, leaves, fruits, and seeds are a

main source of forage for grazing animals and wildlife using the parks over the remainder of the season.

c. Placement and Movement of Animals. Most of the vegetation management objectives of the County could probably be accomplished through use of a non-rotational grazing system, whereby animals would be allowed to range widely throughout the two parks over the course of the growing season. There are certain advantages, however, to be achieved from rotational grazing. This method of grazing simulates the migratory grazing patterns established in the past by herds of wild herbivores, and is believed to benefit the native vegetation, which evolved under the influences of high intensity-short duration grazing and fire.

The practice of rotating livestock through the various fields on each of the two parks provides the fields with alternating periods of grazing and rest during the growing season. This method of grazing management allows time for the land and vegetation to recover and regrow prior to the next grazing cycle. Certain fields containing riparian, wetland, or other sensitive resources are permanently or intermittently excluded from grazing. The concentration of animals into a single herd confined to grazing one field at a time also allows gates to other fields to be locked open, which would provide more freedom of movement for park recreationists.

(1) Joseph D. Grant County Park. Grant County Park is best suited to a primarily seasonal grazing operation whereby most livestock are removed from the park by late spring or early summer, with the option of allowing a portion of the herd to remain behind to achieve specific fire and vegetation management objectives in selected fields if required. The overall goal is to utilize grazing as a resource management tool to reduce herbaceous vegetation growth to levels consistent with providing fire protection and maintaining plant and animal biodiversity. This is best accomplished through grazing the vegetation from October through May, after which time the animals are moved out of the park to summer pasture. Summer grazing by the small herd that may remain in the park is intended to be of a more surgical nature (spot grazing), with the animals being used for specific purposes, such as weed control and fire hazard reduction. Summer grazing will only be allowed as per prior agreement from the County.

Livestock returning to Joseph D. Grant County Park in October are divided into two herds for distribution between the northeast and southwest halves of the park. Over half of the animals are placed in the pasture fields northeast of Mt. Hamilton Road, and the remainder are located in the fields southwest of the road. The herds are then rotated en masse through the various pasture

fields over the course of the grazing season. Some animals, such as heifers and bulls, must be segregated into separate fields of their own for practical reasons. The Dairy Field, for example, is used to pasture bulls when they are not associating with the cow herd.

Park land is used in conjunction with leased private land. This land provides summer pasture to which all, or a majority, of the lessee's permitted animals are moved at the end of the regular grazing season around late May. The number of animals that remain behind throughout the summer and early fall, if any, as well as those allowed on the park initially, may differ from year to year depending on the availability of forage and water, and the condition of the range.

(a) *General Use of Fields.* The various fields on the park are utilized on the basis of their location, geographic proximity to one another, and their relative utility for different purposes. These fields are organized into logical subunit groupings. The northwest half of the park contains the Barn North/Tiernan subunit and the Big Washburn/Pala Seca East/Hall Valley/North subunit; the southwest half of the park includes the Edwards/Dairy subunit and the Dutch Flat/Hotel/Corral subunit. A number of fields within Halls Valley and some of its associated uplands -- the Lake, Alfalfa, Valley, Stockyard, Barn South, Brush North, Middle Snell and Lower Snell and Deer Valley -- are currently excluded from regular seasonal grazing, and may be managed under a high intensity-short duration grazing regime, referred to in this document as spot-grazing.

Tables I-6 and I-7 provide a preliminary schedule outlining when and where livestock are to be moved among the fields and the amount of time they are to spend in each. The proposed amount of livestock use for each field is consistent with carrying capacity estimates. This schedule may differ somewhat from year to year depending upon forage availability and other operational or resource management considerations.

(b) *Use of Fields - Northeast Portion of Park.*

Barn North/Tiernan Fields. The 134-acre Barn North Field serves as an initial holding area when livestock are returned to the northeast half of the park in October. The 64 acre Tiernan Field southeast of the Barn Field is used as a gathering area for cattle during shipping, weaning, and branding operations that take place at the corral in the Barn North Field. Livestock grazing the Big Washburn, Pala Seca East, Hall Valley, and North Fields are channeled through these fields to be processed in the corral. The Barn North

Table I-6
JOSEPH D. GRANT COUNTY PARK
PROPOSED LIVESTOCK ROTATION - NORTHEAST SECTION^a

| Field | Dates Used | Duration | AUMs |
|--------------------|------------------------------|----------|------|
| Barn North/Tiernan | Oct. 01 - Oct. 07 | 1 week | 50 |
| Big Washburn | Oct. 08 - Nov. 07 | 4 weeks | 260 |
| Pala Seca East | Nov. 08 - Nov. 30 | 3 weeks | 185 |
| Hall Valley | Jan. 16 - Feb. 21 | 5 weeks | 390 |
| North | Dec. 01 - Jan. 15 | 6 weeks | 475 |
| Barn North/Tiernan | Feb. 22 - Mar. 01 | 1 week | 50 |
| Big Washburn | Mar. 02 - Mar. 21 | 3 weeks | 200 |
| Hall Valley | Mar. 22 - Apr. 07 | 2 weeks | 150 |
| North | Apr. 08 - Apr. 21 | 2 weeks | 150 |
| Pala Seca East | Apr. 22 - May 15 | 3 weeks | 185 |
| Big Washburn | May 16 - May 21 | 1 week | 65 |
| Barn North/Tiernan | May 22 - May 31 ^b | 1 week | 50 |

^a Based on grazing use by approximately 275 head of cattle.

^b Approximately 1,500 AUMs are available in fields that are considered for spot grazing (i.e., Lake, Pala Seca, Tiernan and a portion of Big Washburn fields). If a portion of the herd is diverted to those fields, more than enough AUMs are available to keep the cattle on the northeast section of the park through May.

Table I-7
JOSEPH D. GRANT COUNTY PARK
PROPOSED LIVESTOCK ROTATION - SOUTHWEST SECTION^a

| Field | Dates Used | Duration | AUMs |
|--------------------------|-------------------|----------|------|
| Edwards ^b | Oct. 01 - Oct. 31 | 4 weeks | 380 |
| Corral | Nov. 01 - Nov. 21 | 3 weeks | 200 |
| Hotel East and West | Nov. 22 - Dec. 31 | 5 weeks | 305 |
| Dutch Flat East and West | Jan. 01 - Feb. 21 | 7 weeks | 600 |
| Corral | Feb. 22 - Mar. 15 | 2 weeks | 135 |
| Hotel East and West | Mar. 16 - May 31 | 10 weeks | 610 |

^a Based on grazing use by approximately 275 head of cattle.

^b See Item (d) page I-16 for explanation of use.

Note: The time periods and AUMs shown on Table I-6 and I-7 represent estimates that are subject to modifications based on field monitoring.

and Tiernan Fields are reserved primarily for this purpose and are virtually unused at other times of the year.

Big Washburn/Pala Seca East/Hall Valley/North Fields. These fields together constitute the largest land area (3,822 acres) within the park and comprise 47 percent of the total land available for grazing and 46 percent of the carrying capacity. Grasslands occur along the main ridge and associated spur ridges. Oak savanna extends along the slopes, with oak woodlands occupying the steeper drainages. The plant composition of these areas is rich with native wildflowers.

Livestock are moved initially into the Big Washburn Field in early October, because of its proximity to the Barn North/Tiernan Fields where cattle are first introduced into the park. Livestock are then rotated through the Pala Seca East, North, and Hall Valley Fields before returning to the Barn North and Tiernan Fields for processing at the corral.

Following processing, the cattle are moved into the adjacent Big Washburn Field, and are subsequently rotated through the Hall Valley, North, and Pala Seca East Fields. They are eventually rotated back into the Big Washburn Field in preparation for their removal from the park along with the animals gathered from the fields in the southwest portion of the park. The majority of the livestock are then transported out of the park elsewhere to summer pasture.

(c) Use of Fields - Southwest Portion of Park.

Edwards/Dairy Fields. The Edwards and Dairy Fields contain large areas of open grassland and have adequate water for livestock. Plant diversity is somewhat less impressive as in other areas of the park, which may be attributed, in part, to resident wild pigs, as their familiar rooting is evident everywhere throughout the grasslands and woodlands. The Edwards Field is the first location southwest of Mt. Hamilton Road into which livestock are introduced upon their reintroduction to the park in October.

The corrals located nearby at the ranch headquarters west of Mt. Hamilton Road are used to process livestock that are consequently placed in the Edwards Field. The relatively small 104-acre Dairy Field is used almost exclusively as a segregated pasture for bulls. The 468-acre Edwards Field is located directly south across Mt. Hamilton Road from the corral in the Barn North Field, and while generally too large for this purpose, is sometimes used as a holding area for cattle being processed in the corral. The Edwards Field also may be used as a location in which to segregate heifer cattle, which are

young cows that have not yet given birth to a calf. The Edwards Field is managed to ensure that surplus vegetation remains available for these contingencies.

The corral at the ranch headquarters is the only location from which cattle can be loaded into cattle trucks for shipping. Cattle using the northeast and southwest portions of the park must be respectively gathered at the Barn North Field and Circle Corrals and must be herded to the ranch headquarters corral for removal from the park. The Circle Corral, located in the Corral Field, is used as a collection point for livestock using the southwest half of the park. A small holding area north of the Circle Corral, and sometimes the Corral Field itself is used to contain livestock for processing in the corral.

Dutch Flat East and West/Hotel East and West/Corral Fields. These fields comprise the second largest complex of pastures in the park for a combined total of 3,403 acres. They contribute 42 percent of the total grazing land, but only 35 percent of the total carrying capacity due to a diminished availability of forage in the Dutch Flat East and Dutch Flat West Fields caused by the prevalence of yellow starthistle in the grasslands of the former and active brush encroachment in the latter. The grasslands, woodlands, and oak savannas of the Hotel East and West and Corral Fields provide the majority (80 percent) of the carrying capacity, and exhibit the best diversity of native plants of all the fields within this complex. The mixed oak/foothill pine woodland in the Hotel Field supports the highest concentration of native grasses on the park. Livestock from the Edwards Field are moved into this complex of fields and the animals are rotated according to the grazing schedule outlined in Table I-7.

(2) Ed R. Levin County Park.

(a) Use of Fields. For grazing purposes, Levin County Park could be thought of as being divided into an upper and a lower section. The lower section includes many relatively small-sized fields, some of which are regularly used by hang gliding enthusiasts. One of the objectives of the grazing program is to reduce the amount of vegetation in these fields to accommodate this use. Some of the lower fields are in close proximity to a high recreational use area (Sandy Wool Lake), and others are used extensively by the public. Consequently, grazing for fire hazard reduction is a main consideration in these fields. The upper section of the park includes the Upper Calera and Middle Calera fields which are characterized by steep terrain and a scarcity of natural water resources.

(b) Lower Calera, Upper and Lower Higuera Loop, Hang Glider, Corral, Barn, Ranch, and Water Tank Fields. An annual grazing program with a flexible season (from January to July) is proposed for these fields. The dates of use and rotational program will be determined on an annual basis by park staff in consultation with range management experts. Generally, when livestock are moved into the park, they would be distributed among the various lower fields to accomplish resource management and fire prevention goals, and enhance the recreational value of fields for hang gliding activities by reducing the vegetative cover. Cattle would be rotated among the fields during the season to maintain desired vegetative conditions. The Lower Calera Field is generally reserved as a holding area for use during branding and shipping operations. Branding is conducted around March and April. Livestock from the lower fields of the park are gathered into the Lower Calera Field and funneled into the Barn Field where they are worked in the corral. First-calf heifers would be introduced into the Barn and Ranch fields until they have become acclimated to the area and have calved. Mowing is also used in Hang Glider Field to keep grass short in the spring. Over time, as the monitoring program is established and initial results have been determined as to the best use of fields, this grazing program may change in order to meet resource management objectives.

(c) Upper and Middle Calera Fields. Upper and Middle Calera fields are proposed for spot grazing to achieve park vegetation management objectives and recreation objectives. These fields will be monitored by park staff and cattle will be introduced as necessary. For spot grazing, Upper Calera Field is best used during the early part of the grazing season because livestock tend to scatter and use the vegetation more widely and effectively during the late fall, winter, and early spring months as a large part of their water requirements are derived from the green vegetation.

(d) Calaveras North, Calaveras South, Homestead and Arroyo Fields. The grassland areas of the Calaveras North, Calaveras South, and Homestead Fields in the uplands west of the Spring Valley Golf Club have been excluded from grazing for many years. The vegetation here, with the exception of the Calaveras South Field, has become rank and infested with black mustard, *Brassica nigra*, and bull thistle, *Cirsium vulgare*, among other weedy species. Grasslands within the Calaveras South Field have remained relatively weed-free as a result of unauthorized grazing of park land by the adjacent landowner to the west.

All of these fields are proposed for spot-grazing to achieve park vegetation management objectives. The Calaveras North Field could be incorporated into the seasonally grazed portion of the park, and used as an extension of the

Hang Glider Field. The Calaveras South and Homestead Fields south of Old Calaveras Road are small, isolated parcels of land without developed water. These two fields could be used for grazing in association with adjacent private land to the west. The Calaveras South Field currently serves as an extension of private pasture land and is being grazed on an annual basis. The Homestead and Arroyo Fields could be used in a similar fashion. New fence construction or maintenance of existing fencing will be necessary to contain livestock within these fields.

(e) Use of Fields by Small Herd of Livestock Remaining on Park.

Following the established grazing season, livestock are removed from park land and relocated to private leased land until the following fall. Depending upon the type of year, forage availability, and park fire and resource management objectives, a portion of the livestock herd may remain to achieve spot-grazing objectives.

d. Range Improvements. Range improvements are any developments or treatments undertaken for the purpose of facilitating improved management. Improvements such as water developments, wetland enclosures, fencing, salting, supplemental feeding, fertilizing, seeding, stock trail construction and herding are practices that are used to control or influence the movement of grazing animals within a given area.

(1) Management Recommendations.

- Range improvements should be installed, where necessary, to restore or conserve park resources, enhance rangeland condition, and/or promote more uniform livestock distribution.
- Project planning should involve consideration of the proper design, size, location, and installation methods to advance the intended purpose of the improvement and maintain harmony with other uses, values, and activities. Construction and installation should be in accordance with County specifications and instructions.
- Where natural water sources have been used for grazing use, alternative water storage facilities (i.e., troughs) should be provided and located on dry ground away from wetland areas. In addition, these natural water sources should be protected by fencing. The enclosed areas should include a buffer zone incorporating the entire riparian wetland plant community and associated ecotone.

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- Grazing lessees should be responsible for maintaining and repairing in good order and condition all buildings, structures and improvements related to grazing use found on the parks.
 - All range improvement work should be authorized by park staff.

e. Supplemental Feeding. At certain times of the grazing season domestic livestock often are unable to derive adequate nutrition from the natural forage. This deficiency may be offset by feeding grains, molasses, or hay. Supplemental feeding of domestic livestock is a practice used to maintain animals in a healthy and economically viable condition, and to facilitate improved animal distribution and encourage more uniform use of the forage resource.

(1) Management Recommendations.

- Supplemental feeding of domestic livestock on park land should not be permitted to prolong grazing use in areas where established forage utilization levels have been reached or exceeded.
 - Supplements should not be placed adjacent to roads, trails, public use areas, within established native grass habitat, in heavily utilized areas of the range, or near water sources.
 - Supplemental feeding sites should be moved regularly to minimize the potential for resource damage from congregating animals.
 - In the event of unusual or emergency circumstances, such as drought or the loss of vegetation by wildfire, park staff should have the discretion to allow short-term supplemental feeding until arrangements can be made to remove domestic livestock from park land. This situation may require confining animals to restricted locations within the parks to minimize resource impacts.
 - Supplemental feeding areas should be monitored for non-native weed infestations. If new infestations occur as a result of supplemental feeding, the licensee should confine feedings to specified areas and monitor and remove weed species.
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2. Range Monitoring and Inspections

Monitoring is a practice used for observing or recording current and long-term conditions and trends to determine how well objectives are being met.

Monitoring measures change in the status of resources over time through repeated measurements on selected areas. Monitoring efforts may range from simple observations to establishing detailed plots and transects. Monitoring and inspection activities should involve observing, collecting, classifying, evaluating, and cataloging data and information pertinent to management of the parks' rangeland resources.

There are several different monitoring and inspection activities employed in the evaluation of rangelands. These are carried out to assess range condition, document livestock use levels, monitor vegetation, verify compliance to established standards for grazing on park land, and to insure conformity to lease provisions. The information and data collected is used to improve management.

Monitoring and inspections may be performed together, or in conjunction with other visits to the parks. The lessee, ranch managers, and other specialists should be invited to participate. Each monitoring and inspection activity should be documented, and subsequent action should be taken when and where appropriate. The following provides background information and a methodology for conducting various monitoring and inspection activities on the parks.

a. Monitoring for Residual Dry Matter. Forage utilization by grazing animals is regulated to assure that appropriate amounts of residual dry matter remain on the ground to achieve desired resource objectives. Residual dry matter is the amount of ungrazed, dried vegetation left behind at the end of the grazing season that acts as a protective layer over the soil to guard against erosion, encourage nutrient recycling, and provide a suitable microclimate for plant regrowth. Visual observations or scientific measurements involving clipping and weighing vegetation from small sample plots can determine the degree of forage utilization at different times during the season.

(1) Management Recommendations.

- Clipping and weighing vegetation in sample plots should be used to forecast the amount of plant material remaining, or to measure residual dry matter when forage utilization appears to be approaching or exceeding established standards. Data should be taken from random sample areas that reflect the prevailing

effects of current grazing management practices, and the results should be extrapolated over the entire grazing unit upon which the data is taken. A visual estimate of the vegetation can be made in lieu of clipping and weighing when residual dry matter levels appear adequate.

- The amount of residual dry matter on the ground at the end of the grazing season should exceed the standards indicated below. These standards generally translate into 4 to 6 inches of standing vegetation at the end of the grazing season.
 - Less than 30 percent slope, leave 600 lbs/acre
 - 30 percent to 50 percent slope, leave 800 lbs/acre
 - >50 percent slope, leave 1000 lbs/acre
- Forage utilization should be monitored periodically to insure that the lessee receives advance notice when or before residue levels reach 200 lbs/acre above the minimum standards to allow ample time to decrease herd size or remove livestock.
- Photographs should be taken to provide visual examples of vegetative cover, and illustrate how the vegetation and landscape appear when different amounts of residual dry matter are present.
- The parks should be mapped into regions or classes indicating high, moderate, and low residual dry matter levels. These maps are a graphic representation of livestock distribution problems, areas where stocking levels may need to be adjusted, and situations where management can be improved.

b. Determining Range Readiness. Range readiness is a factor in determining when residual dry matter and/or green forage is sufficient to graze the allowable number of livestock at the start of a new grazing season. Most ranchers prefer to leave behind considerably more than the minimum amount of residual dry matter following grazing to provide carry-over feed for their livestock upon returning to the range in October or January. A portion of this plant material dries out, crumbles, and is carried off by the wind to some extent during the late summer and early fall. On land where a minimal amount of residual dry matter is left at the end of the grazing season, the leftover, ungrazed vegetation may be inadequate to provide carry-over forage and soil protection. The inspection to determine range readiness, therefore, is an important initial step to establish whether or not the land can sustain grazing.

(1) Management Recommendations.

- In the case where livestock traditionally return to the range prior to the onset of fall rains, the range should be inspected to insure that there is adequate dry plant material available to support permitted numbers into the late fall when green forage begins to provide sufficient vegetative cover.
- Land that has been grazed to within or beyond acceptable residual dry matter standards cannot support livestock until sufficient plant regrowth has occurred to provide adequate forage and soil protection. Ordinarily, the green annual grasses should be at least 2 to 4 inches high on fertile, productive soils, and 1 to 3 inches on shallower soils and exposed areas prior to allowing grazing. Grazing in these areas should be deferred until these conditions are achieved.
- The County should make an annual assessment of early rainfall patterns to determine whether precipitation is adequate or significantly different than the norm. If early rainfall patterns portend a below normal year, then the objective should be to delay, reconsider, or modify, if necessary, the schedule for introducing livestock to the parks and animal stocking levels commensurate with forage availability and other resource management considerations.

c. Verification of Actual Livestock Use. The purpose of this inspection is to verify that the number of livestock present on the parks at any given time conforms to the AUMs allowed in the lease, or is otherwise consistent with specific direction from park staff to graze an area lighter or heavier. The objective is to insure that livestock numbers do not exceed those permitted, or that stocking density is adequate to meet resource conservation or fire hazard reduction goals.

(1) Management Recommendations.

- Park land should be examined periodically to ensure that lessees are grazing the authorized or specified number of animals. Park staff may accept the lessee's accounting of the number of cattle on the parks or employ other methods, which may include using truck bills of lading to determine the number of cattle shipped to the parks, counting animals as they enter or leave the parks and individual fields, counting animals on travels through the parks, aerial surveys, and/or in extreme cases, special roundups.

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- All livestock under permit and their offspring should be branded or marked with the brand or mark of the lease holder; under certain conditions, it may be desirable to identify permitted livestock with distinctive eartags in order to prevent or detect trespass by unauthorized animals.
 - Verification of livestock numbers should be documented and should include the date, location, and total number of livestock counted; ongoing records of actual use should be maintained for the parks.

d. Evaluation of Soil and Vegetation Conditions. A regular evaluation of rangeland condition and trend is necessary to determine the effect land management practices are having on soil, water quality, vegetation, and wildlife. Condition is the state of the resources, and any sign of change in that condition is indicative of the trend, which can be characterized as good, bad, or static. Condition and trend can be inferred from certain recognizable signs or indicators of soil and vegetation conditions. These indicators are a reflection of natural events and/or past land use practices, and reveal changes that are taking place in the present. An interpretation of these indicators is useful for determining appropriate management direction for the future.

In general, maintenance of a proper cover of vegetation and plant residue is the most successful long-term approach to controlling soil erosion. The use of wildlands by terrestrial vertebrate wildlife species is mostly dependent on the structure of the vegetative cover, as well. The California Wildlife Habitat Relationships (WHR) database indicates that moderately grazed grassland and woodland grass communities provide potential habitat for a number of different wildlife species by encouraging a greater diversity of forbs, which are used by animals that require these plants as a food source. Consequently, an adequate and intact plant cover will provide for basic soil protection and maintain adequate wildlife habitat conditions.

Consistent with these principles, Tables I-8, I-9 and I-10 provide some indicators of vegetation conditions in grassland and woodland grass communities, wetland condition and soil conditions.

e. Measuring Plant Diversity. The most common method of sampling vegetation is the use of a transect, which is defined as a line through vegetation, whereby a measuring tape is stretched from one point to another, and the vegetation encountered at established intervals along the tape is recorded. The transect provides a cross section of the existing vegetation, which can be used as a measure of range condition on different sites.

Table I-8
INDICATORS OF GRASSLAND AND WOODLAND GRASS CONDITION

| Poor or Unsatisfactory Vegetative Condition | Fair or Satisfactory Vegetative Condition | Good Vegetative Condition |
|---|---|--|
| Plant composition of limited diversity and overwhelmingly comprised of "weedy" non-native grasses and forbs; various thistles and summer annuals often conspicuously present. | Plant composition a relatively diverse mixture of native and non-native forbs and a small percentage of native grasses; various thistles and summer annuals uncommon or conspicuously absent. | Plant composition a diverse mixture of native and non-native grasses and forbs with native grasses well represented; various thistles and summer annuals largely absent. |
| Reproduction of native grasses, wildflowers, and shrubs inhibited by excessive grazing. | Reproduction of native grasses, wildflowers, and shrubs occurring in the presence of livestock. | Reproduction of native grasses, wildflowers, and shrubs widespread and uninhibited by grazing. |
| Forage utilization does not meet residual dry matter standards; standing vegetation and plant litter insufficient to protect the soil from erosion. | Forage utilization routinely meets residual dry matter standards; standing vegetation and plant litter sufficient to protect the soil from erosion throughout the majority of the area. | Forage utilization meets or exceeds residual dry matter standards; standing vegetation and plant litter sufficient to protect the soil from erosion. |
| Cow dung and small ground objects are visible through the plant cover and litter from a short distance; cow dung is conspicuously distributed and prevalent. | Cow dung and small ground objects somewhat visible through the plant cover and litter from a short distance; cow dung is widely dispersed. | Cow dung and small ground objects not visible through the plant cover and litter from a short distance; cow dung is scattered and mostly inconspicuous. |
| Most vegetation in partially protected places in and under brush and around rocks depleted. | Vegetation existing in partially protected places in and under brush and around rocks lightly grazed. | Vegetation unused in partially protected places in and under brush and around rocks. |
| Shrubs or portions of shrubs, young trees, and overhanging branches within reach of livestock noticeably overbrowsed and excessively defoliated. | Shrubs or portions of shrubs, young trees, and overhanging branches within reach of livestock moderately browsed. | Shrubs or portions of shrubs, young trees, and overhanging branches within reach of livestock lightly browsed. |
| Woodland litter, leafmold, and duff wanting, except under low shrubs; small twigs, leaves, etc. on ground trampled and shattered; native perennial grasses lacking in understory. | Woodland litter, leafmold, and duff layer evident; small twigs, leaves, etc. on ground are intact; native perennial grasses are present in the understory. | Woodland litter, leafmold, and duff layer evident; small twigs, leaves, etc. on ground are intact; native perennial grasses are common in the understory. |

Table I-9
INDICATORS OF WETLAND CONDITION

| Poor or Unsatisfactory Wetland Condition | Satisfactory Wetland Condition |
|--|--|
| Soil surface appears uneven and pockmarked due to past trampling of wet soil by livestock; soil may be compacted in spots; wet areas are freshly trampled and muddy; plant cover is discontinuous with plants often pedestaled as a result of prior disturbance. | Soil continuous and unbroken except where natural water courses cross the surface; little or no evidence of trampling or soil compaction; plant cover intact. |
| Wetland vegetation closely cropped to near ground level; woody vegetation, if present, is heavily used and exhibits a well-defined browse line. | Wetland vegetation largely undisturbed and in various stages of growth; shrubs, where present, without a noticeable browse line; grazing use random to non-existent. |
| Soil surface may be dry due to lowering of the water table from gully erosion; gully head-cuts actively advancing. | Surface water present throughout. |
| Streams exhibit active cutting, their steep banks support little or no vegetation; exposed banks crumbling or sloped back and trampled; water in slow-moving streams is muddy or cloudy. | Streams have stable bottoms and sides; banks undamaged and vegetated; running water in slow-moving streams generally clear. |

**Table I-10
 INDICATORS OF SOIL CONDITION**

| Poor of Unsatisfactory Soil Condition | Fair or Satisfactory Soil Condition | Good Soil Condition |
|--|--|---|
| Extensive areas of bare soil evident through the vegetation; roots of some herbaceous plants, shrubs and trees exposed. | Few areas of bare soil evident through the vegetation; plant litter increasing and revegetation occurring in exposed areas. | Naturally occurring base spots small and well-dispersed; vegetative cover and plant litter uniformly distributed. |
| Presence of rills and/or gullies, and continued head cutting; gullies show recent active bottom cutting; gully sidewalls with insufficient vegetative cover to protect the soil. | Rills and/or gullies stabilized, head cutting contained; gully sidewalls and bottoms with sufficient vegetative cover to protect the soil. | Rills and/or gullies mostly absent. |
| Sunken, multiple and abandoned stock trails present; displaced and pockmarked soil from hoofprints widespread; terrace trails on hillsides level and well-defined. | Stock trails apparent but unobtrusive; displaced and pockmarked soil from hoofprints uncommon; terrace trails on hillsides stable and healing. | Stock trails inconspicuous, except at close range; displaced and pockmarked soil from hoofprints and terrace trails on hillsides uncommon and sporadic. |
| Perennial plants, small rocks and pebbles on pedestals. | Perennial plants, small rocks and pebbles flush with soil surface. | Perennial plants, small rocks and pebbles flush with soil surface. |
| Lichen lines (abrupt bare area between soil surface and boundary of lichen growth) evident on the shaded side of rocks. | Lichen lines (abrupt bare area between soil surface and boundary of lichen growth) absent on the shaded side of rocks. | Lichen lines (abrupt bare area between soil surface and boundary of lichen growth) absent on the shaded side of rocks. |
| Accumulation of alluvial material on the upslope side of rocks and plants evident and widespread. | Accumulation of alluvial material on the upslope side of rocks and plants insignificant. | Little or no accumulation of alluvial material on the upslope side of rocks and plants. |
| Plant litter on soil surface limited; plant material in transition to organic matter sparse; abnormal amount of subsurface decay evident. | Adequate plant litter on soil surface; plant material in transition to organic matter and subsurface decay evident. | Abundant plant litter on soil surface without forming thatch layer; remnant plant material converting to ample surface and subsurface organic matter. |

Transects can be used to determine species composition (mixture), frequency (relative occurrence), and density (space occupied) within a plant community. Transect measurements should be taken by someone with a knowledge of plant taxonomy to ensure that the vegetation found along the transect line is correctly identified and documented. Plant composition, however, may vary from year to year in response to weather and rainfall patterns over the course of the growing season, and it is often necessary to acquire several years of data before arriving at any conclusions.

Another type of transect is the photo point, which could be established separately, or in conjunction with the transect, to provide a broader, visual representation of a given area. The photograph can be taken down the line of sight of a transect, or can focus on a particular landscape feature. Photos are taken at the same exact spot at regular intervals so as to record changes, if any, over time. Volunteers or educational institutions can be contacted to help augment staff time and resources when preparing transects.

These monitoring activities, while useful, are often difficult for certain agencies to perform because of time constraints, inadequate funding or the lack of experienced staff. Trained volunteers, resource management students, botanical society members, or wildflower enthusiasts can be recruited to contribute their services in this regard. Generally, overall plant diversity can be maintained and enhanced over time through vegetation management activities that involve the use of moderate grazing, mowing, and/or prescribed burning, thereby minimizing or eliminating the need for extensive monitoring of this type.

(1) Management Recommendations.

- The relative presence, abundance, dominance, and composition of native herbaceous plant species should be evaluated periodically as an indicator of range condition on various sites throughout the parks.
- Permanent vegetation transects and photo points should be established in representative and problem areas to assess changes in plant composition and/or landscape features over time, and to evaluate the effects of grazing management and grazing exclusion on native herbaceous plants.

f. Range Improvement Inspections. The purpose of these inspections is to ensure that the maintenance of range improvements by the lessee is ongoing and meets park standards. Range improvements, such as fencing and water developments, when properly and regularly maintained, can serve to

contain animals in the park and the fields in which they are placed, and encourage more uniform livestock distribution over the grazing area.

(1) Management Recommendations.

- All structural improvements should be regularly inspected to ensure that they are properly maintained, functional, and compatible with park aesthetics and operations.

g. Documentation of Other Resource and Management Issues.

Observations of various occurrences and day to day problems and events that occur on the land can provide an insight into the implications of current management or the lack thereof. The objective is to gather data and make a record of relevant issues and events requiring corrective action so they can be documented and later acted upon. The following is a list of some of the items that should be documented on maps along with a short narrative:

- the presence of noxious weeds;
- ground squirrel or wild pig activity;
- incidences of vandalism;
- notable wildlife observances;
- areas supporting exceptional stands of native grasses and wildflowers;
- other.

(1) Long-Term Monitoring. Long-term monitoring is conducted to obtain specific information and data from careful observations, measurements, and evaluations over an extended period to assess the prolonged effect or influence of a particular action on the environment. Certain long-term monitoring borders on scientific research and is beyond the scope and limited resources of government agencies to perform. However, park land can be made available for research undertaken by local universities. Some realistic long-term monitoring goals for the parks may include:

- The establishment of scientifically established plots and transects to evaluate the effect of various management treatments on soils, vegetation, wildlife, pest plants, water quality, etc;
- Ongoing vegetation and wildlife inventories that document changes and fluctuations in plant and animal populations correlated with environmental influences and park management practices;

-
- Studies related to oak regeneration and seedling survival of protected and unprotected oaks in grazed and ungrazed woodlands;
 - Ongoing evaluations of special status plant and animal populations occurring on the parks.

C. Range Monitoring Plan

The following is a summary of monitoring recommendations outlined in the Grazing Management Plan for Joseph D. Grant and Ed R. Levin County Parks. Related tasks that should be performed are listed and assigned to ranchers, park staff, and consultants. Standards are included as criteria to guide monitoring actions.

1. Monitoring Residual Dry Matter

a. Tasks.

- Visually estimate the vegetation in lieu of clipping and weighing when residual dry matter levels appear adequate.
- Clip and weigh vegetation in sample plots to forecast the amount of plant material remaining, or to measure residual dry matter (see Clipping and Weighing Process at the end of this Monitoring Plan).
- If necessary, extrapolate over the entire grazing unit the results of data taken from random sample areas that reflect the prevailing effects of current grazing management practices.
- Monitor forage utilization to insure that the lessee receives advance notice when or before residue levels reach 200 lbs/acre above the minimum standards to allow ample time to decrease herd size or remove livestock.
- Map the park into regions or classes indicating high, moderate, and low residual dry matter levels that graphically represent livestock distribution problems, areas where stocking levels may need to be adjusted, and situations where management can be improved.

b. Who Performs. Consultants and trained park staff.

c. When Conducted. Monitoring for residual dry matter conducted monthly over the course of the grazing season, then every other week or weekly when forage utilization begins to approach established standards to ensure that livestock are removed in a timely manner. Forage utilization maps completed at the end of each year's grazing season to record actual use.

d. Standards. The amount of residual dry matter on the ground at the end of the grazing season must exceed 600 lbs/acre on slopes less than 30 percent, 800 lbs/acre on 30 percent to 50 percent slopes, and 1000 lbs/acre on slopes greater than 50 percent. These standards generally translate into 4 to 6 inches of standing vegetation at the end of the grazing season.

Optional residual dry matter standards that require more or less plant material to remain on the ground following grazing are often necessary to promote soil stability, maintain the productivity of desirable plants, enhance visual and recreational values, conserve wildlife habitat, or reduce fire hazards.

Residual dry matter levels observed in the field can be determined by comparing various areas against photographs that illustrate how the vegetation and landscape appear when different amounts of residual dry matter are present.

2. **Determining Range Readiness**

a. Tasks.

- Inspect areas where livestock traditionally return to the park prior to the onset of fall rains to insure that there is adequate dry plant material available to support permitted numbers into the late fall when green forage will begin to provide sufficient cover.
- Monitor early rainfall patterns to determine whether precipitation is adequate or significantly different than the norm, and conclude whether or not livestock numbers or season of use need to be modified, should the results portend a below normal year.

b. Who Performs. Consultants and trained park staff.

c. When Conducted. Prior to the beginning of the new grazing season in early autumn to assure the presence of adequate amounts of residual dry matter for providing carry-over forage and soil protection, and during the early months of the rainy season to ensure that green forage is sufficient to graze the allowable number of livestock.

d. Standards. Land onto which livestock typically return prior to the grazing season must have enough residual dry matter to sustain grazing until sufficient plant regrowth has occurred to provide adequate forage and soil protection.

Stocking levels and/or season of use must be reduced or modified to remain commensurate with forage availability and other resource management considerations.

3. **Verification of Actual Livestock Use**

a. Tasks.

- Examine park land to ensure that lessees are grazing the authorized or specified number and kind of animals.
- Inspect the brands, marks and documentation of all livestock and their offspring to verify their ownership and authorization to graze on park land and to verify the livestock do not carry infectious diseases.
- Document all inspections and include the date, the total number of livestock counted, the brands, ear tags, and identifying marks noted, and the location where the animals were observed. Maintain ongoing records of actual use for the park.

b. Who Performs. Park staff.

c. When Conducted. When livestock are moved on to the park, and periodically throughout the grazing season.

d. Standards. Park staff may accept the lessee's accounting of the number of cattle on the park or employ other methods, which may include using truck bills of lading to determine the number of cattle shipped to the park, counting animals as they enter or leave the park, counting animals on trips through the grazing units, and/or in extreme cases, special roundups.

In addition to the tasks listed above, Licensees should continue testing livestock for diseases, especially those that are transmitted to wildlife, such as blue tongue disease.

4. Evaluation of Soil and Vegetation Conditions

a. Tasks.

- Evaluate rangeland condition and trend to determine the effect land management practices are having on soil, water quality, vegetation, and wildlife.

b. Who Performs. Park staff and consultants.

c. When Conducted. Throughout the course of the grazing season.

d. Standards. See Tables I-9, I-10, and I-11.

5. Measuring Plant Diversity

a. Tasks. Evaluate the relative presence, abundance, dominance, and composition of native herbaceous plant species as an indicator of range condition on various sites throughout the park.

Establish permanent vegetation transects and photo points in representative and problem areas of the park to assess changes in plant composition and landscape features over time.

b. Who Performs. Consultants, trained park staff, volunteers, and graduate students.

c. When Conducted. Ideally, transect measurements should be carried out once in early spring, once in middle to late spring, and once in mid-summer to ensure that all plants that occur on the site are encountered at some point during their growing seasons. A minimum of one transect reading should be made in the spring at the height of the flowering season.

d. Standards. The measurement of plant diversity is conducted using transects to determine species composition (mixture), frequency (relative occurrence), and density (space occupied) within the plant community. Transect measurements should be taken by someone with a knowledge of plant taxonomy to ensure that the vegetation found along the transect line is correctly identified and documented.

Photopoints are established separately, or in conjunction with transects. Photographs should be taken down the line of sight of a transect, or can focus

on a particular landscape feature. Photos should be taken at the same exact spot at regular intervals to record changes, if any, over time.

6. Range Improvement Inspections

- a. Tasks. Inspect all structural improvements to ensure that they are properly maintained, functional, and compatible with park aesthetics and operations.
- b. Who Performs. Licensee and park staff.
- c. When Conducted. Prior to and throughout the grazing season.
- d. Standards. Range improvements must meet proper design, size, location, and installation standards and maintain harmony with other park uses, values, and activities. Construction and installation must be in accordance with park specifications and instructions.

Where natural water sources have been developed for grazing use, water storage facilities must be located on dry ground away from wetland areas, which should be protected by fencing. The enclosed areas should include a buffer zone incorporating the entire wetland plant community and associated ecotone.

7. Documentation of Other Resource and Management Issues

- a. Tasks.
 - Document for future reference relevant issues or occurrences requiring attention or corrective action on the park, such as the presence of noxious weeds, ground squirrel or wild pig activity, incidences of vandalism, notable wildlife observances, or areas supporting exceptional stands of native grasses and wildflowers.
- b. Who Performs. Park staff, consultants, and volunteers.
- c. When Conducted. Ongoing effort.
- d. Standards. None.

D. Glossary

The following is a glossary to assist in describing terms used in range practices.

Animal Unit. Considered to be one mature cow with calf or their equivalent. Abbreviation AU.

Animal Unit Month. 1,000 pounds of live animal(s), or one AU grazing for 30 days. In the plural, a multiple of AU x Months (AUMs).

Annual Grassland. Grassland on which the principal plants are annual grasses.

Annual Plant. A plant that completes its life cycle and dies in one year or less.

Annual Range. Range on which the principal plants are self-perpetuating annual grasses and forbe.

Archeology. The scientific study of the life and culture of ancient peoples, usually by excavation of settlements, artifacts, etc.

Aspect. The direction in which a slope of land faces (e.g., southern).

Association. See Plant Association.

Biomass. The amount of living matter per unit area of habitat.

Biotic. Refers to living components of an ecosystem (e.g., plants and animals).

Broadleaf. Having leaves that are broad and flat, rather than needlelike or grasslike.

Browse. That part of current leaf and twig growth of shrubs, woody vines and trees available for animal consumption.

Browsing. The act of eating leaf and twig growth of shrubs, woody vines, and trees.

Brush. Shrub vegetation.

Brushland. An area covered primarily with brush; shrubland.

Bunch Grass. A grass so-called because of its characteristic growth habit of forming a basal bunch or tuft.

Canopy. The upper or aerial portions of vegetation. Usually refers to trees, tall shrubs and vines.

Canopy Cover. The percentage of ground covered by a vertical projection of the overhanging plant foliage.

Carrying Capacity. The maximum number of specific kinds and classes of animals that can graze a unit of land for a specified time.

Chaparral. A plant community consisting of thickets of low-growing, drought-resistant, evergreen shrubs.

Climax (Community). A final, self-perpetuating community of plants and/or animals that persists under stable conditions.

Coastal Scrub. A plant community consisting of low shrubs intermixed with grassy meadows in a maritime climate.

Community. An assemblage of plants and/or animals in a given area in which the various species are more or less interdependent upon each other.

Community (Plant Community). An association of plants occurring together at any point in time. A unit of vegetation, (e.g., annual grassland community, chaparral community).

Coniferous Forest. A forest dominated by evergreen, cone-bearing trees and shrubs (e.g., pines, spruces, firs, etc.).

Continuous Grazing. Grazing on an area throughout the grazing season.

Cover. The plants or plant parts, living or dead, on the surface of the ground.

Cover Type. The existing vegetation of an area.

Crown. The leafy upper portion of a shrub or tree. Deciduous (Plants). Plants having leaves that are shed at a certain stage of development in the life cycle.

Deferred Grazing. The delay of livestock grazing on a specific management unit for an adequate period of time to provide for plant reproduction, recovery or establishment.

Ecosystem. The complex of a community and its environment functioning as an ecological unit in nature.

Ecotone. A transitional zone between two adjacent plant communities.

Edge Effect. The result of the presence of two adjoining plant communities on the number and kinds of animals present in the immediate vicinity.

Endangered Species. A native species whose prospects of survival and reproduction are in immediate jeopardy from one or more causes.

Endemic. Native to or restricted to a particular area or region.

Erosion. Detachment and movement of soil or rock fragments by water, wind, ice, or gravity.

Evergreen (plant). A plant that retains green leaves indefinitely.

Exclosure. An area fenced to exclude animals, such as livestock.

Exotic. An organism or species which is not native to the region in which it is found.

Firebreak. A temporary barrier used to prevent or retard the spread of fire, usually created by the removal of vegetation.

Flora. The plant species of an area.

Forage. All browse and herbaceous food that is available to livestock or wildlife.

Forage Production. The amount of forage produced on a given area within a growing season.

Forb. Any broadleaf herbaceous plant other than those in the grass (Poaceae), sedge (Cyperaceae) or rush (Juncaceae) families.

Fuel. Flammable vegetation.

Fuel Break. A block or strip of land on which flammable vegetation has been permanently replaced by vegetation with a lower fuel volume and/or flammability, and subsequently maintained to help control fire.

Genus. A classification of plants and animals with common characteristics, divided into subordinate species.

Grassland. Land on which the vegetation is dominated by grasses.

Grazing Capacity. The number of livestock a range unit will support each season over a period of years without injury to resources.

Grazing Distribution. The locating of livestock over the range to obtain uniform use.

Grazing Management Plan. A program of action designed to secure the best practicable control of the forage resources using grazing or browsing animals.

Grazing Pressure. The degree of grazing use on a land area.

Grazing Season. The period of time for which livestock are allowed to graze within any given year.

Grazing System. A specialization of grazing management which defines the periods of grazing and non-grazing.

Grazing Unit. An area of rangeland which is managed as an entity for livestock grazing.

Groundwater. Water within the earth that supplies wells and springs.

Growing Season. The portion of the year when the temperature and the availability of moisture permit plant growth.

Habitat. The natural abode of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting life.

Herb. Any flowering plant whose stem withers away to the ground after each season's growth.

Herbaceous. Having little or no woody tissue and persisting usually for a single growing season.

Herbage. Total amount of living herbaceous plants above ground.

Herbicide. A chemical used for killing or inhibiting the growth of plants.

Host-specific Biological Agent. An organism used for killing or inhibiting the growth of one specific pest.

Indigenous. Born, growing or produced naturally in an area or region; native.

Integrated Pest Management. A management approach that incorporates the use of ecologically compatible treatment strategies to control or eradicate plant and animal pests.

Introduced (Species). A species not a part of the original plants or animals of an area.

Invasive (Plant). Plants that move into and establish themselves in another area.

Key Area. A portion of range, which because of its location, grazing value, and/or use, serves as an indicative sample of range conditions or trends.

Litter. The top layer of dead vegetation on the soil surface.

Livestock. Domestic animals kept or raised for use, pleasure, or profit.

Livestock Management. Application of technical principles and business methods to livestock production.

Monitoring. The orderly collection, analysis, and interpretation of data to evaluate progress toward meeting management goals.

Mulch. A layer of dead plant material on the soil surface.

Native (Species). A species which is one of the original plants or animals in a particular locality.

Naturalized (Species). A species not native to an area, which has adapted to the area and has established a stable or growing population.

Overgrazing. A condition whereby animals graze to the point of damaging vegetation and soil.

Overstory. The upper canopy of plants, especially trees, tall shrubs and vines.

Overuse. The harvesting of an excessive amount of the current year's plant growth, which, if continued, will result in overgrazing.

Palatability. The relish that an animal shows for a particular species, plant or plant part.

Pasture. A grazing area enclosed and separated from other areas by fencing or other barriers.

Perennial (Plant). A plant that has a lifespan of 3 or more years.

Pest. Any unwanted, destructive plant or animal.

Plant Association. A plant community characterized by essential uniformity in terms of its dominant species.

Plant Reserves. Energy stored by a plant for future growth and reproduction.

Prescribed Burning. The use of fire as a management tool under specified conditions for burning a predetermined area.

Productivity. The rate of vegetative production per unit area (e.g., pounds per acre).

Range. Land grazed by livestock.

Range Analysis. A study used to determine the productivity of an area of rangeland.

Range Condition. The existing status of the range brought about by climate, grazing, and all other factors that influence soil and vegetation.

Range Improvement. Any structure or practice used to improve the management or conservation of range resources by livestock (e.g., gates, fences, stock trails, water developments, seeding).

Range Inventory. An itemized list of resources of a management area.

Range Management. A land management discipline that applies an organized body of knowledge known as range science to renewable natural resource

systems for two purposes: (1) protection, improvement, and continued welfare of the basic range resource, which may include soils, vegetation, and animals; and (2) optimum production of goods and services in combinations needed by humankind.

Range Site. An area of land having a combination of edaphic, climatic, topographic and natural biotic factors that is significantly different from adjacent areas.

Rangeland. Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs that provides forage for livestock and wildlife.

Rare Species. A native species, which although not presently threatened with extinction, is in such small numbers throughout its range that it may become endangered if its present environment worsens.

Relict. A remnant or fragment of a climax plant community that remains from a former period when it was more widely distributed.

Remnant Population See Relict.

Residual Dry Matter. The amount of dried, dead plant matter left on the soil at the end of the grazing season.

Residual Mulch. The amount of dead plant matter left on the soil at the end of the grazing season.

Rest. Leaving an area ungrazed, usually for one full growing season.

Riparian Vegetation. Plant communities dependent upon the presence of free water near the ground surface, especially along streams and rivers.

Rotational Grazing. A system of grazing where animals are moved between two or more separate pastures on a predetermined schedule. Salting. Providing salt as a mineral supplement for animals. Also, placing salt on the range in such a manner as to improve distribution of livestock.

Savanna. Grassland with scattered trees, either as individuals or as clumps, often a transitional zone between true grassland and forest.

Scrub. Vegetation consisting mainly of shrubs.

Seep. Wet area, normally not flowing, arising from an underground water source.

Sensitive Species. A native species considered a viable candidate for classification as rare, threatened, or endangered.

Short Term Grazing. Grazing an area for a short period of time to achieve management objectives.

Shrub. A low-growing, woody plant with several permanent stems as opposed to a single trunk

Shrubland. Any land on which shrubs dominate the vegetation.

Species. The fundamental classification of plants and animals, a subdivision of a genus, consisting of organisms with many persistent, common characteristics and generally capable of interbreeding only among themselves.

Spot Grazing. Bringing cattle in to an area not grazed in an annual program to meet specific management objectives.

Spring. An isolated source of surface water originating from an underground aquifer.

Stand. A relatively uniform group of plants growing in a continuous area.

Stocking Rate. The number of specific kinds and classes of animals grazing or using a unit of land for a specified period of time.

Subshrub. A low plant with several permanent woody stems that annually grow new, non-woody shoots that die back at the end of the growing season.

Succession. The progressive replacement of one plant community with another on a site until a stable or climax community is established.

Successional Stage. One of the plant communities that occurs during succession on a particular site.

Supplemental Feeding. The practice of supplying concentrated or harvested feed to correct deficiencies of the range diet. Thatch. A matted layer of accumulated, partially decayed plant material covering the soil.

Threatened Species. A native species, which although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts.

Understory. Plants growing beneath the canopy of other plants, usually referring to grasses, forbs and low shrubs under trees or tall shrubs.

Use (grazing). The proportion of the current year's forage production that is consumed or destroyed by grazing animals.

Use Standards. An established basis of comparison in measuring the amount of use.

Utilization. See Use (grazing).

Vegetation Type. A distinctive stand of plant species or combinations of species which dominate a given area.

Water Table. The upper limit of a portion of the ground saturated with water.

Watershed. The area drained by a stream or river system.

Weed. Any plant growing where unwanted.

Wetland. An area with soils that are usually saturated with water, and support mostly water-loving plants.

Wetland Community. Plant community that occurs on sites with soils typically saturated with or covered with water most of the growing season.

Wildlife. Wild vertebrate animals, not including fish.

Woodland. A land area occupied by trees; a forest or woods.

Appendix J
CONTROL OF SELECTED INVASIVE
NON-NATIVE PLANTS

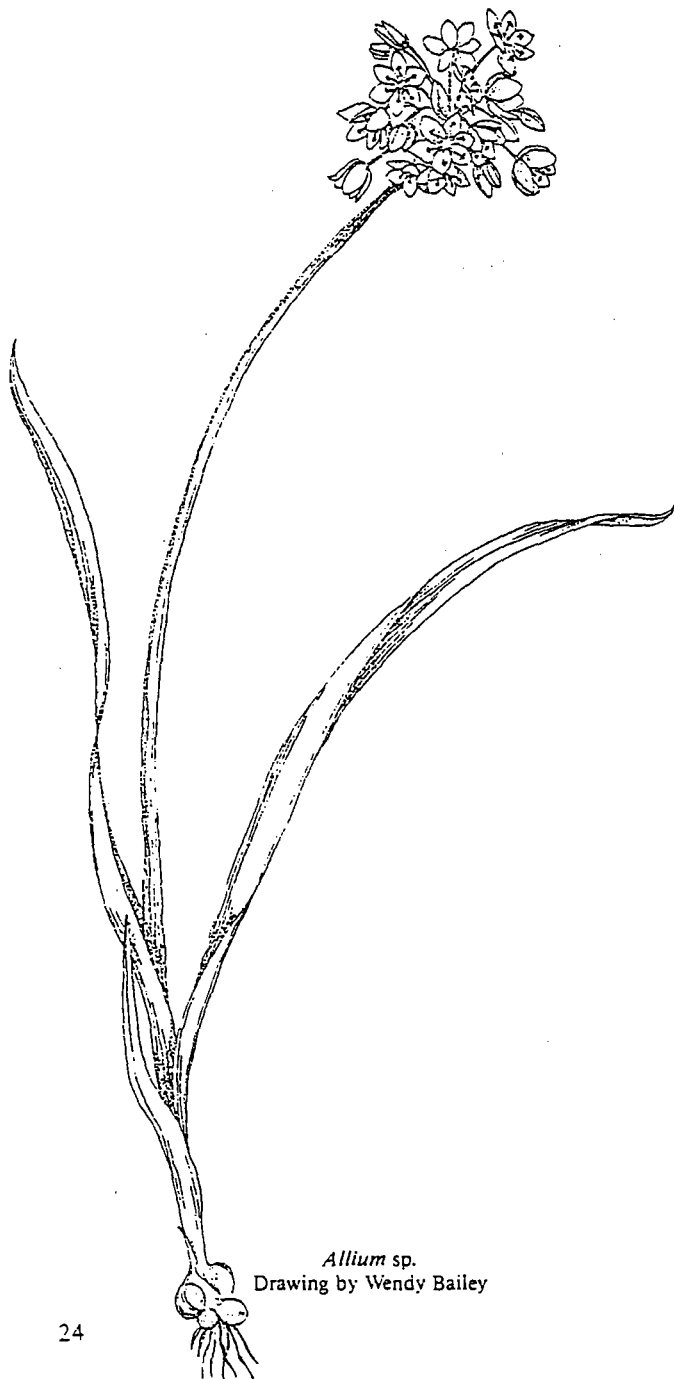
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The Bradley Method of Eliminating Exotic Plants
(From Fuller and Barbe, 1985)

THE BRADLEY METHOD OF ELIMINATING EXOTIC PLANTS FROM NATURAL RESERVES

by T. C. Fuller and G. Douglas Barbe

A method of weed control in natural areas, developed at Sydney, Australia, by Joan Bradley and her sister, has been so successful that a summary of their method is presented here with the thought that similar endeavors in California would result in better weed control where such methods might be appropriate.



Allium sp.
Drawing by Wendy Bailey

The Bradley method makes practical use of well-known ecological principles. The method consists of hand weeding, without replanting, selected small areas of vegetation in such a manner that after weeding, each area will be promptly re-inhabited and stabilized by the regeneration of native plants.

If the weeding is approached as a conventional gardening operation, in which large areas are cleared and burned or the debris carted away, the effort will fail because large exposed and disturbed areas will become re-colonized by new weeds. The Bradley method urges a naturalist's approach by encouraging the native vegetation to become reestablished. The Bradleys used their method to successfully rid a forty-acre woodland reserve of weeds so that the reserve needed slight attention only once or twice a year, mainly in vulnerable spots such as creek banks, roadsides, and clearings, to be maintained weed-free. They summarize their activities as follows:

"We are regenerating bush with conspicuous success over a total area of about forty acres, and our results are plain to see, both in Ashton Park and on nearby Chowder Head. We have also taken care of the weeds induced by a six-acre "silvicultural" winter burn, and about four or five acres of other fires. We have not overworked at it. We are both over fifty, able-bodied but by no means Amazonian. My sister takes the dog for a walk on most mornings, and I do the same in the afternoons. On these walks we might average, between the two of us, about three-quarters of an hour spent actually pulling up weeds.

"Done in our way, the regeneration of weed-infested bushland is an easy and fascinating part-time occupation. We are still forging ahead, my sister mainly on a dry ridge, myself mainly in a damp gully, faster than we should have thought possible. . . . We hope that this outline of our methods will encourage and help you to do the same."

Preliminaries

Permits and Permission. Initially, of course, permission must be obtained from a landowner, whether a public park or private reserve, to carry out the weed control program. If necessary, a permit to collect plant specimens for identification must also be secured from the appropriate authorities.

Plant Identification. Although it is not necessary to know every species in an area, it is essential to be sure that no natives are pulled up and no weeds are left behind. The Bradleys maintain a collection of dried specimens, which had been identified at the National Herbarium in Sydney, for every plant species in their working area.

Labor. The Bradleys emphasize that a single person, working intelligently, will do more good than many persons crashing through a project area.

Strategy. The basis of this method is the native species' ability to recolonize by tipping the ecological balance away from the weeds and toward the native plants. If one begins by clearing the weeds out of the most heavily infested areas, the weeds will come right back because they are now given ideal conditions: bare, disturbed soil, exposed to full sunlight. But by working a little at a time, from the strongholds of natural vegetation towards the weeds, the native vegetation is favored and its natural regenerative power will prevail over the weeds.

In undisturbed vegetation, soils are often covered with a litter of decaying plant material. This natural mulch, when present, will permit very few weed seedlings to come through. Since disturbed soil favors the weeds over the natives, and weeding disturbs the soil, all natural litter possible should be replaced over the spots that are weeded. Also, wherever possible, the weeds themselves should be used as a mulch, except that such things as seeds, bulbs, rhizomes or other parts that might sprout should be removed.

Plan of Work

In this sequence the Bradleys designed work for one person to follow, working from the best stand of native vegetation to the worst infestation of weeds. By keeping the sequence always the same, it can be followed by any number of people in any number of places.

1. Prevent Deterioration of Good Areas. Start by getting rid of weeds that occur singly or in groups of four or five. Check once or twice a year for missed weeds.

2. Improve the Next Best. Choose a place that you can visit easily and often, where the native vegetation is pushing against a mixture of weeds and natives, preferably not worse than one weed to two natives. Start with a strip about 12 feet wide and no longer than you can cover about once a month during the growing season. If this boundary is on a steep slope that might erode, clear a number of patches instead, but still no more than 12 feet from the vigorous native vegetation. Let a few months go by before you lengthen the strip. Your experience will dictate whether to make the strip longer or shorter.

3. Hold the Advantage Gained. Resist the temptation to push deeper into the weeds before the regenerating natives have stabilized each cleared area. The natives need not be very tall but should form a dense ground cover. The Bradleys think excluding light from the ground is very important since weed seedlings consistently appear in bare soil at the edges of paths and clearings even when relatively undisturbed and surrounded by dense native vegetation.

4. Cautiously Move into the Really Bad Areas. When the new growth consists almost entirely of native species with only a few weeds, it is safe to move further into the weeds. *Don't start to clear a block of solid weeds until you have brought the good native vegetation right up to that area.* Solid infestations of weeds can be worked on at the edges by forming peninsulas of weeds, small clearings less than six feet in diameter. Also, spot weeding, removing a single large weed plant next to a native plant in the middle of a solid weed infestation, will bring remarkable results by allowing the native plant to grow much faster. There is no reason to hurry this process; much more is gained by allowing the native plant to grow well before removing another adjacent weed.

Records

The Bradley sisters keep general written records, make periodic surveys, and map the weed infestations. They find it much easier than relying on memory of past infestations. Also, the mapping is useful to show local authorities the progress of the work. Their work has been so successful, and the regenerated native vegetation looks so good, that it is difficult to show people what has been done. Wouldn't it be nice if all our parks and reserves were that weed-free?

Reference

Bradley, Joan. 1971. *Bush Regeneration: The Practical Way to Eliminate Exotic Plants from Natural Reserves.* The Mosman Parklands and Ashton Park Association, Mosman (Sydney), New South Wales. 15 pp.



Exotic Plant Control Methods for Specific Species

PERIWINKLE

Vinca major

Dogbane family (*Apocynaceae*)

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|-------------------------|--|
| ORIGIN: | Europe, Mediterranean region |
| OTHER NAMES: | Myrtle, vinca |
| GROWTH HABIT: | Non-native, perennial herb with erect flowering stems and trailing non-flowering stems. Stems have a milky latex. Plants can form extensive, low-growing patches. |
| LEAVES: | Dark green and oval, 1" - 2" long. Leaves are arranged alternately along the stem. |
| FLOWERS: | Flowers are solitary in the leaf axils and periwinkle blue in color. The corolla is divided into 5 lobes about 1/4" long. |
| BLOOMING PERIOD: | March through July |
| LIFE HISTORY: | It spreads vegetatively by arching stolons that root at the tips. It is frequently found as a garden escape in moist or wooded areas. Not known to reproduce from seed as the seeds rarely mature. |
| INVASIVENESS: | Periwinkle is very invasive and forms dense patches to the exclusion of other vegetation including native flora. Although susceptible to dry weather and frost, it can quickly resprout, especially in moist, shady areas. |

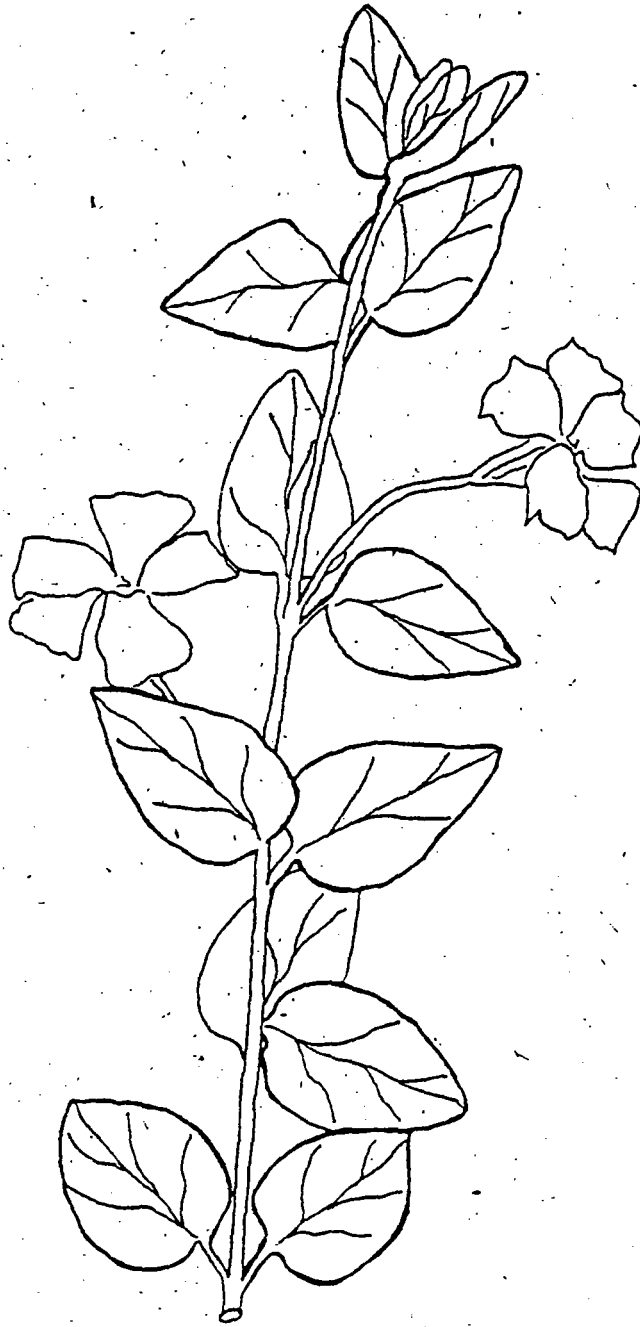
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| BENEFITS: | Has been used as an ornamental groundcover. |
| LIABILITIES: | Its rapid spreading habit can out-compete native flora thus disrupting natural plant communities such as riparian areas. |

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| PREFERRED CONTROL: | Mow, then spray cut surfaces immediately with 5% glyphosate. Do not disc or till. Reseed large areas with appropriate native plants. |
| ALTERNATIVE CONTROL: | Spray entire plant with 5% glyphosate using extra surfactant. |
| DISPOSAL: | Leave in place. |

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| INFORMATION SOURCES: | The Nature Conservancy Element Stewardship Abstract (1986); Robbins, Bellue, and Ball (1970). |
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PRELIMINARY

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Source: The Habitat Restoration Group

Figure 12. PERIWINKLE
Vinca major
Scale: 3/4

MILK THISTLE
Silybum marianum
Sunflower family (*Asteraceae*)

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|-------------------------|--|
| ORIGIN: | Mediterranean region. |
| OTHER NAMES: | White thistle |
| GROWTH HABIT: | Erect annual or biennial weed with simple or branching stems 2' - 6' tall. |
| LEAVES: | The lobed leaves bear yellow prickles and are 1' - 2' long and half as wide. The lower leaves are larger than those farther up the stem. The upper leaf surface is shiny dark green with white or milky netting. |
| FLOWERS: | The flowers are purple and showy. The 1" - 2" flowering head is roughly spherical. The heads are surrounded by bracts that are tipped with long stiff spines. |
| BLOOMING PERIOD: | May through July |
| LIFE HISTORY: | Milk thistle reproduces by one-seeded fruits called achenes that have bristles or plumes that facilitate wind dispersal. Also dispersed by animals. |
| INVASIVENESS: | Milk thistle is very invasive, especially in disturbed areas such as roadsides, cultivated fields, and pasture lands. |

BENEFITS: The edible seeds provide food for wildlife. The roots and flower buds are also edible and the seeds are medicinal.

LIABILITIES: Pest in cultivated croplands. Indicator of overgrazing in pastures, fields, and meadows. Milk thistle's large size and spiny nature make it disruptive to revegetation maintenance work.

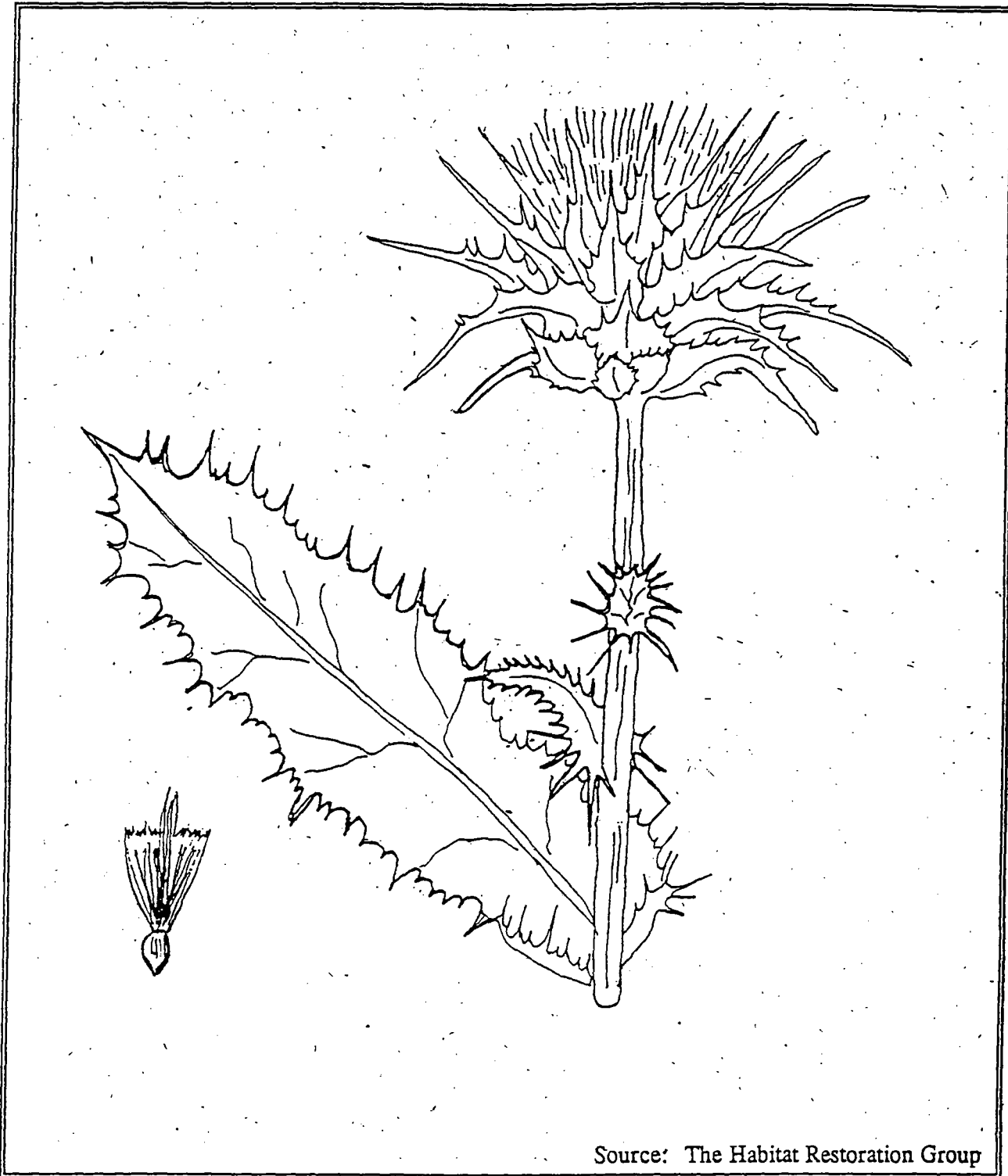
PREFERRED CONTROL: Hoe 2 inches below ground level or uproot while plant is a rosette.

ALTERNATIVE CONTROL: 1. Hoe 2 inches below ground level before plant flowers.
2. Repeated mowing.

DISPOSAL: Remove seed and flower heads from site. Immature flowers will ripen and set seed even after plant is cut.

INFORMATION SOURCES: Robbins, Bellue, and Ball (1970); Thomas (1961); University of California (1978).

PRELIMINARY



Source: The Habitat Restoration Group

Figure 24. **MILK THISTLE**

Silybum marianum

Scale: variable

BRISTLY OX-TONGUE

Picris echioides

Sunflower family (*Asteraceae*)

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|-------------------------|--|
| ORIGIN: | Mediterranean region and Southwestern Asia |
| OTHER NAMES: | Bugloss, bugloss-picris |
| GROWTH HABIT: | Annual, biennial, or short-lived perennial. Mature plant is coarsely branched and 2'- 3' tall. The stems are angled and covered with barbed hairs that make the plant painful to the touch. |
| LEAVES: | The basal and lower leaves are 2"- 6" long and approximately 1" wide. They are oblong in shape with shallowly scalloped margins. The upper leaves are smaller, and clasp the stem. All of the leaves are rough to the touch due to the barbed bristles that arise from blister-like swellings. |
| FLOWERS: | The yellow flowers are dandelion-like and are about 1/2" across. The flowers are borne singly or in clusters above 4-5 modified leaves (bracts). |
| BLOOMING PERIOD: | April through December |
| LIFE HISTORY: | Reproduction is by one-seeded fruits (achenes). The achenes bear feathery bristles that facilitate wind dispersal. |
| INVASIVENESS: | Bristly oxtongue is a common invasive weed of disturbed habitats such as ditches, fallow fields, and roadsides. It also infests cultivated croplands, orchards, and vineyards. |

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| BENEFITS: | Unknown |
| LIABILITIES: | Agricultural pest that can invade large areas and can overwhelm groundcovers in revegetation sites. |

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| PREFERRED CONTROL: | Pull or uproot when soil is moist. |
| ALTERNATIVE CONTROL: | 1. Hoe 2 inches below ground level, before flowering. 2. Repeated mowing. |
| DISPOSAL: | Remove flower parts from site. |

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| INFORMATION SOURCES: | Robbins, Bellue, and Ball (1970); Thomas (1961); University of California (1978). |
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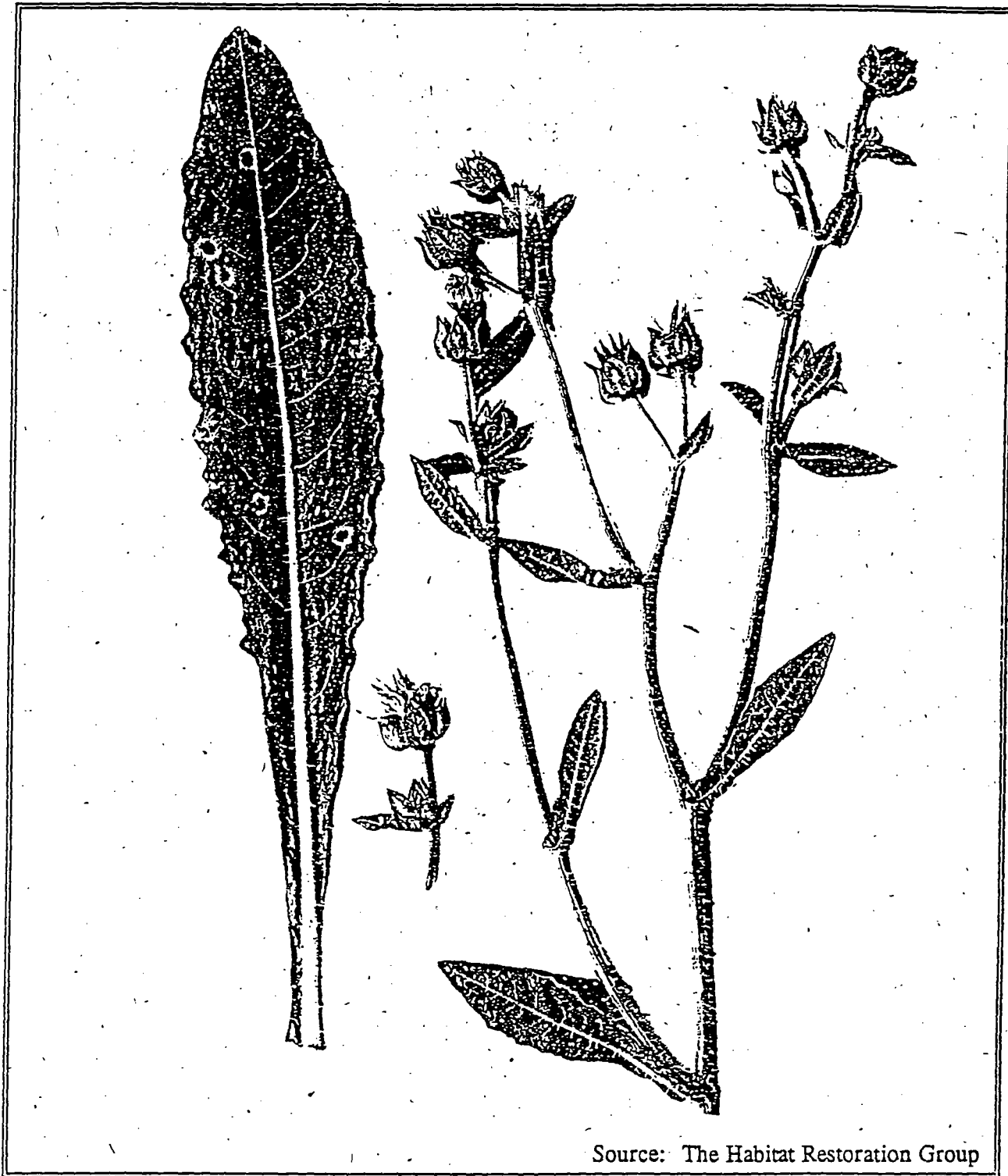


Figure 22. BRISTLY OX-TONGUE

Picris echioides

Scale: 1/1

POISON HEMLOCK
Conium maculatum
Carrot Family (*Apiaceae*)

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|-------------------------|---|
| ORIGIN: | Eurasia and North Africa |
| OTHER NAMES: | Snake weed, poison parsley, deadly hemlock |
| GROWTH HABIT: | Tall biennial with long white taproot. Stems are erect and branching. Stems are hollow and marked with purple dots. Mature plants are 3'-10' tall. |
| LEAVES: | Leaves are arranged alternately along the stem and are pinnately compound with finely cut leaflets. The lower leaves have short stalks that are flattened at the base and partially envelop the stem. |
| FLOWERS: | Numerous, small white flowers are borne in large umbrella-shaped clusters. |
| BLOOMING PERIOD: | April through August |
| LIFE HISTORY: | Poison hemlock reproduces by seed and is water dispersed. |
| INVASIVENESS: | Poison hemlock is a very invasive weed, especially in disturbed areas such as pastures, roadsides, creeks, meadows, and waste places. |

BENEFITS: Dead stalks provide nesting location for birds.

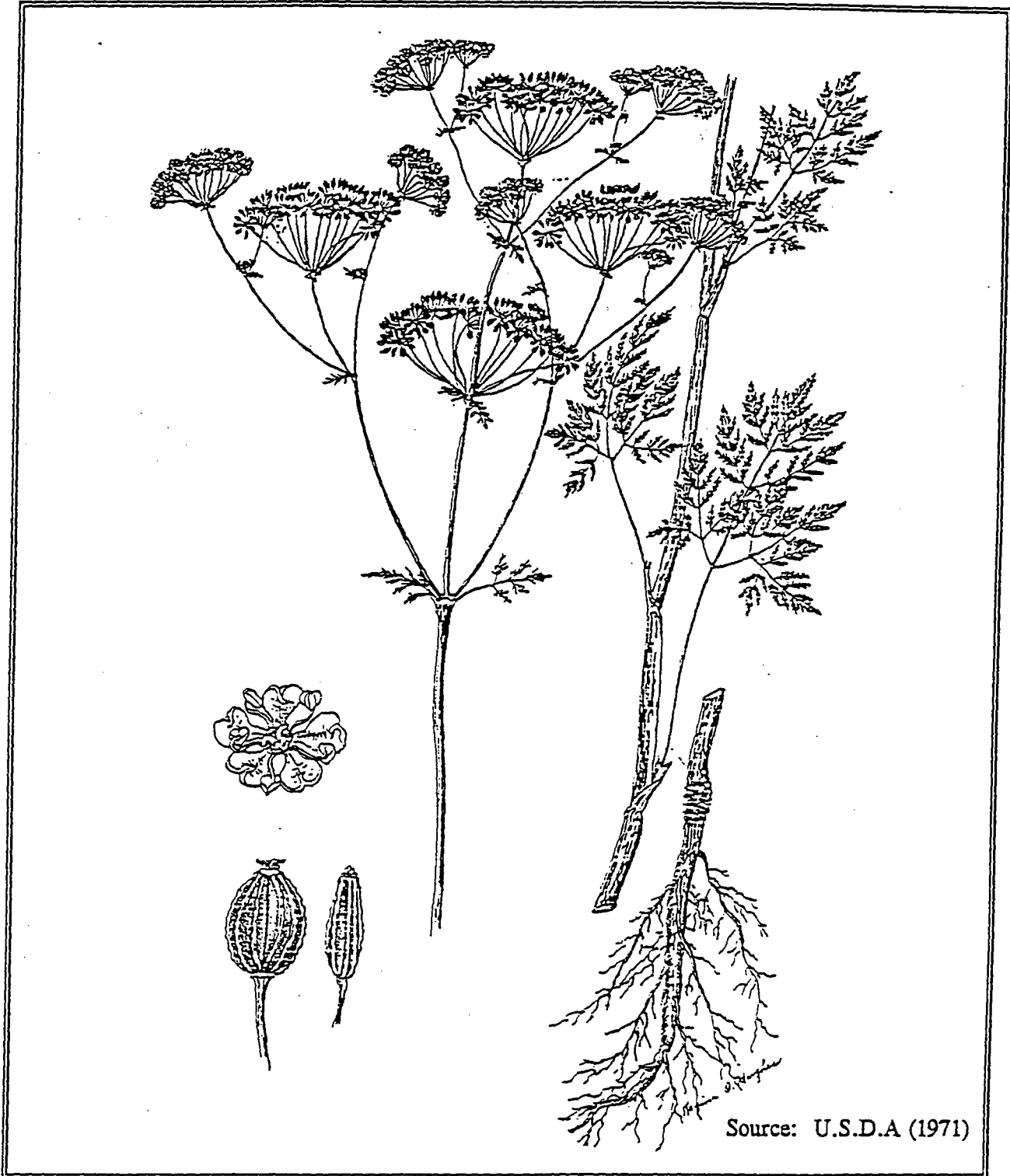
LIABILITIES: All of the plant parts contain poisonous alkaloids. The plants are usually avoided by livestock. Wear gloves when handling. Poison hemlock makes revegetation site maintenance difficult due to its rapid growth and size. Dense stands can shade out smaller native plants.

PREFERRED CONTROL: Pull or uproot when soil is moist.

ALTERNATIVE CONTROL: 1. Hoe 2 inches below ground level, before flowering.
2. Repeated mowing.

DISPOSAL: Remove from site if mature or nearly mature seed is present.

INFORMATION SOURCES: Robbins, Bellue, and Ball (1970); University of California (1978); U.S.D.A. (1971).



Source: U.S.D.A (1971)

Figure 16. POISON HEMLOCK

Conium maculatum

Scale: variable

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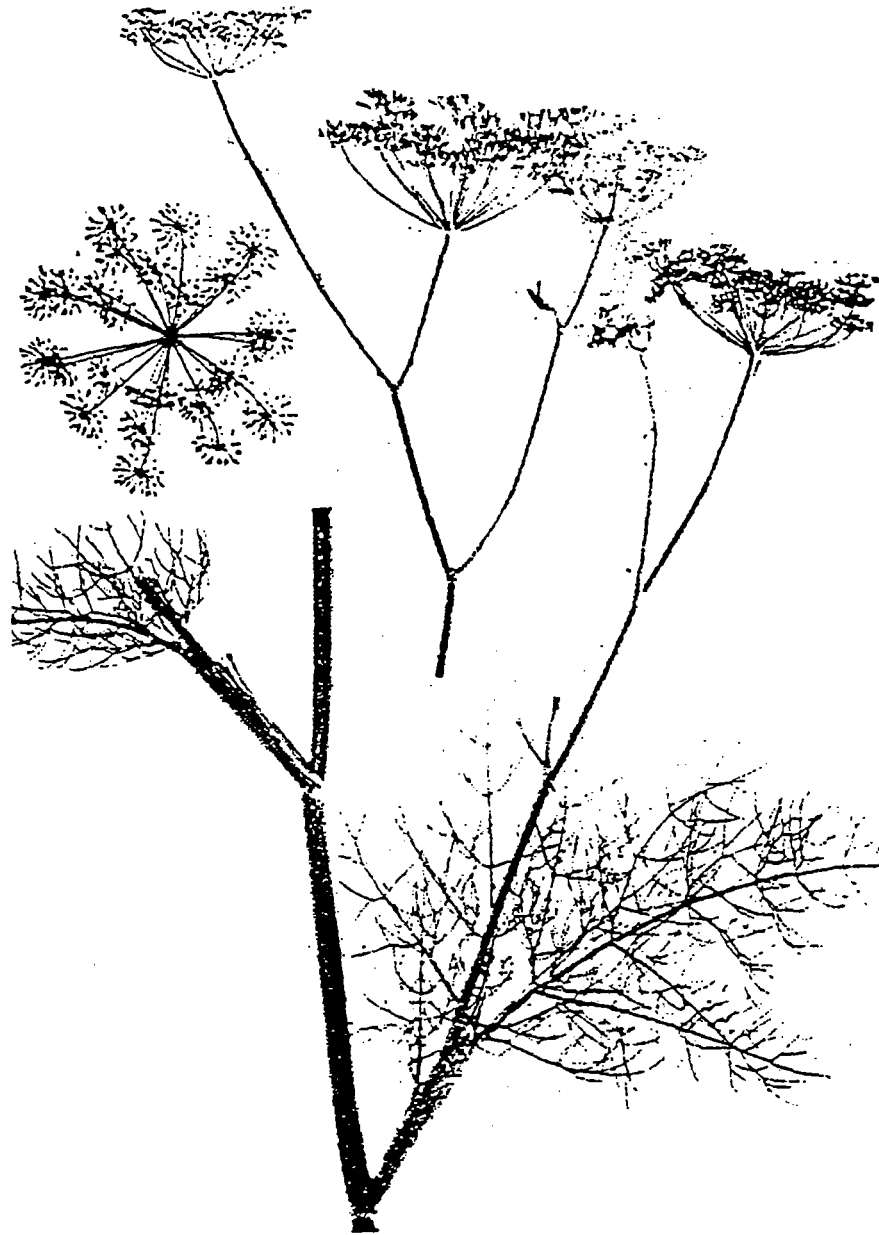
FENNEL
Foeniculum vulgare
Carrot Family (*Apiaceae*)

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|-------------------------|---|
| ORIGIN: | Mediterranean region |
| OTHER NAMES: | Sweet fennel, anise, wild licorice |
| GROWTH HABIT: | Stout, upright perennial with dark green aromatic foliage that resembles feathers. Mature plants can reach 8 feet in height. |
| LEAVES: | The leaves are finely dissected into many thread-like segments. The leaf stalks are sheath-like and clasp the stem. |
| FLOWERS: | The numerous, small flowers are yellow and are grouped into umbrella-shaped terminal clusters. |
| BLOOMING PERIOD: | May through October |
| LIFE HISTORY: | Fennel reproduces by seed. The seeds are enclosed in oblong fruits that have prominent ridges. |
| INVASIVENESS: | Fennel is very invasive and spreads rapidly by seed. Common in waste places, especially in southern and central California. It has become a weed of concern because of its size and aggressiveness and because it is a perennial. |

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| BENEFITS: | Both the seed and foliage are used for culinary purposes. The seeds also provide food for birds such as finches. |
| LIABILITIES: | Fennel has become a troublesome weed in waste places and along roadsides. Fennel's size and rapid spread make it threatening to revegetation sites. |

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| PREFERRED CONTROL: | 1. Cut at ground level, apply 50% glyphosate immediately to cut surface. 2. Spray entire plant with 5% glyphosate solution. |
| ALTERNATIVE CONTROL: | 1. Pull or uproot. 2. Hoe 2 inches below ground level. Repeated hoeing may be necessary. |
| DISPOSAL: | Remove all plant parts that have set seed from site. |

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| INFORMATION SOURCES: | Munz and Keck (1970); Robbins, Bellue, and Ball (1970); Thomas (1961). |
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Source: Robbins, Bellue, and Ball (1970)

Figure 18. FENNEL
Foeniculum vulgare
Scale: 1/4

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BULL THISTLE
Cirsium vulgare
Sunflower Family (*Asteraceae*)

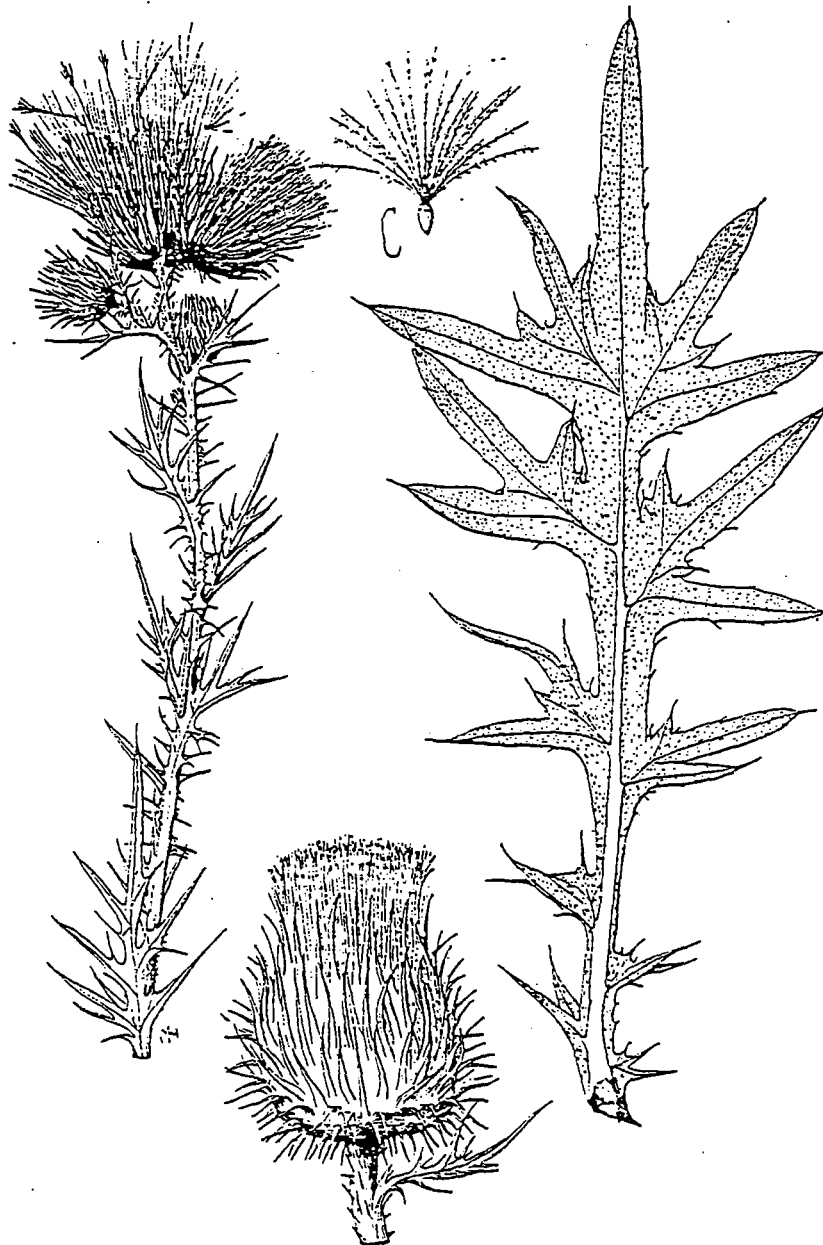
| | |
|-------------------------|---|
| ORIGIN: | Europe and Asia |
| OTHER NAMES: | Spear thistle, plume thistle, common thistle |
| GROWTH HABIT: | Biennial herb 3'- 4' tall with stout branching stems. During the first year the plant can have a rosette-like appearance. |
| LEAVES: | The leaves are arranged alternately along the stem and are lance shaped. The leaves are coarsely toothed or deeply lobed almost to the midrib. The teeth or lobes bear long needle-pointed tips. The lower leaves are from 6"- 1' long and 2 1/2"- 4" wide. The upper leaves are not stalked but attach at the base of the blade. |
| FLOWERS: | The flower heads are 1 1/2"- 2" high in clusters of 4 or 5 at the tips of the flowering stalks. Flowers are deep purple to rose in color. |
| BLOOMING PERIOD: | June through October |
| LIFE HISTORY: | Reproduction is by one-seeded fruits (achenes). The achenes bear feathery bristles that facilitate wind dispersal. |
| INVASIVENESS: | Bull thistle is an aggressive weed that has become common in waste places and disturbed habitats such as fields and pastures. |

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| BENEFITS: | Seeds provide food for seed-eating birds. |
| LIABILITIES: | Bull thistle makes revegetation site maintenance difficult due to its size, spines and rapid spread. Troublesome weed in pastures, fields and waste places in general. It does not provide good fodder for livestock. |

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| PREFERRED CONTROL: | Uproot or pull while plant is a rosette. |
| ALTERNATIVE CONTROL: | 1. Hoe 2 inches below ground level before plant flowers. 2. Repeated mowing. |
| DISPOSAL: | Remove flowering plants from site. Immature flowers ripen and set seed after plant is cut. |

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| INFORMATION SOURCES: | Robbins, Bellue, and Ball (1970); U.S.D.A. (1971); Munz and Keck (1970). |
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PRELIMINARY



Source: Robbins, Bellue, and Ball (1970)

Figure 15. BULL THISTLE

Cirsium vulgare

Scale: variable

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Appendix K
CONTROL OF STARHISTLE

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1. Control of Yellow Starthistle in Conjunction with the Establishment of Perennial Grassland

The following summary for a 3-year management plan for star thistle is in accordance with successful methods that have been implemented in the Sacramento area by Dr. John Anderson. The steps listed have been refined per personnel communications between Valerie Haley, Botanist with The Habitat Restoration Group and Dr. Anderson. The management involves a combination of approaches (burning, mowing, and herbicide treatment) with the establishment of native perennial grassland to fill the area once occupied by star thistle.

YEAR 1:

Fall - Prepare restoration area by conducting a controlled burn in fall to remove standing vegetation and to kill seed in upper seed bank. After the controlled burn, disk 2-3 times. Disking can occur any time after burn. Disking brings more weed seeds to surface after rains. After disking is deemed complete, drill-seed native perennial grass species. Prior to the germination of these species, the area will be treated with the herbicide Round-Up® (glyphosate) to remove weed seedlings. One herbicide treatment is probably enough provided that the application is performed after the majority of the weed seed has germinated.

Spring - In February/March the restoration area will be sprayed with herbicide for emerging broad-leaf weeds. The herbicide treatment uses a 50:50 mix of MCPA and Buctril. This combination does not kill grass seedlings. Both of these herbicides are applied a rate of 1 pint per acre. MCPA is similar to 2,4-D in its chemical properties. A second application in May/June may be required if star thistle continues to germinate.

In late spring, if non-native grasses such as wild oat or rip gut brome are a problem, a mowing should be performed before the non-native grasses have

set seed and when the star thistle is in early flower. Note that the mowing should not be performed too early (prior to flowering of star thistle), as early mowing has been found to create denser populations of star thistle (pers. comm. Carla Bossard, 1994 CalEPPC Conference).

Summer - In midsummer, the restoration area should be mowed when the star thistle is in flower to prevent seed set. In theory, if proper herbicide treatment was implemented, there should be little star thistle present for mowing.

YEAR 2:

Fall - In fall, the restoration area should be prepared by removing standing vegetation. There should not be a controlled burn the first fall as the planted native, perennial grasses may be damaged with a hot burn.

Spring - In February/March the restoration area will be sprayed with herbicide. The herbicide treatment uses a 50:50 mix of 2,4-D and Buctril. Both of these herbicides are applied a rate of 1 pint per acre. A second spring application of herbicide may be required in May/June, if weedy species continue to be a problem. As described for Year 1, weedy grasses should be mowed prior to seed set.

Summer - In midsummer, the restoration area should be mowed when the star thistle is first flowering in order to prevent seed set.

YEAR 3:

Fall - By Year 3, the native grasses should be established and it may be possible to do a broadcast seeding of other species that are components of native perennial grassland such as California buttercup, lupine, blue-eyed grass, California poppy, checkerbloom, and owl's clover. If weeds are still a problem a pre-emergent herbicide such as Telar may be applied.

Spring - In February/March the restoration area may require weed control. Manual or mechanical methods should be used since an herbicide treatment would damage the planted wildflower species listed above.

Summer - In midsummer, the restoration area should be mowed when the star thistle is in flower to prevent seed set.

General Recommendations

Mowing - Various types of mowing equipment may be used as long as the mower is set high to leave 3-4 inches of standing vegetation.

Disking - When preparing the seed bed for the restoration area (Fall Year 1), it is best to disk as deep as possible, at least 6-8 inches.

Drill Seeding - A Truax range drill for seeding native grass seed is recommended. Paul Kephart at Elk Horn Ranch in Moss Landing may be contracted for the use of this equipment 408-722-5889.

Controlled Burns - Controlled burns should be coordinated with local fire departments, the air quality board. The California Department of Forestry may also be of assistance, and should be contacted.



RANGE SCIENCE REPORT

Agricultural Experiment Station

Cooperative Extension

No. 33

January 1994

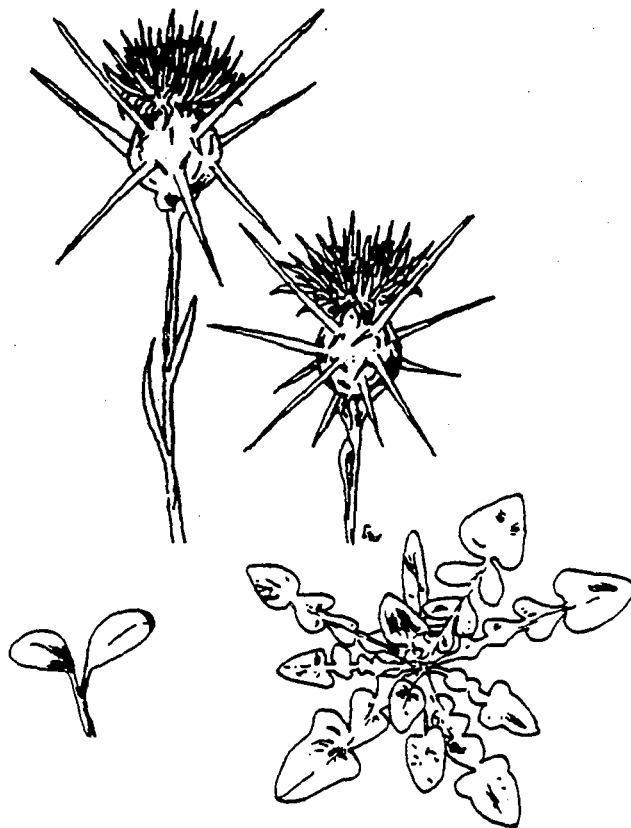
Yellow Starthistle Control

C.D. Thomsen, W.A. Williams, M. Vayssieres, and F.L. Bell

Yellow starthistle, *Centaurea solstitialis*, is a plant of Old World origin that probably arrived in California in the mid-1800s as a contaminant in alfalfa seed. Since its accidental introduction, it has steadily spread and now inhabits about 8 million acres statewide (Maddox and Mayfield 1985). It is one of California's worst noxious weeds, infesting parks and rangelands, pastures, hayfields, orchards, vineyards, roadsides, and irrigation banks. The presence and tenacity of starthistle on these lands has led to increased vegetation management costs and many inquiries on methods of control.

Life Cycle and Plant Description

Understanding yellow starthistle's biology is basic to developing a successful control program. Starthistle has a very long life cycle for an annual plant. Germination is initiated by autumn rains, but plants mature long after most other annuals have completed their life cycle, sometimes not completing their life cycle until the following fall or winter. The seedling stage is the most difficult time to identify the plants. One way is to locate seedlings under last year's skeletons. The winter and spring rosettes produce many deeply-lobed leaves. The size, number, and lobing pattern of the rosette leaves are variable, but a good diagnostic character is the large, triangular lobe at the tip of each leaf. In general, the rosettes tend to grow close to the ground in open places but they assume an upright habit at high densities.



During May and June the plant 'bolts' and sends up elongated stalks that produce the spiny flower heads. The grey- to bluish-green stems of the mature plant are ridged and widely branched, and the entire plant is covered with soft, appressed hairs. The bracts that surround the bright yellow flowers produce the characteristic rigid spines. The seed maturation stage can be recognized by the loss of the bright yellow pigment that characterizes the younger flowers. At this stage the seeds mature quickly. Two types of seed are produced. The lighter-colored seeds are located in the central (disk) portion of the flowerhead, contain short bristly hairs (pappus), and disperse quickly after maturity. Darker seeds occur in a circle around the disk seeds, usually lack hairs, and persist in the flowerhead until harsh weather or other disturbances break them up. After dispersal seeds become part of the soil's "seed bank" where they remain until conditions become favorable for germination, or are eliminated through natural means.

The number of seeds produced by individual plants varies widely according to environmental conditions and genetic factors. In a study of starthistle populations from Hopland, Woodland, and Concord, Maddox (1981) reported a range of 700 to 10,000 seeds per plant. Thomsen (unpublished data) followed an individual plant that had been sprayed with an herbicide during the bolting stage. The upper portion of the plant died back but regrew vigorously the next growing season from the taproot and produced an estimated 170,000 seeds.

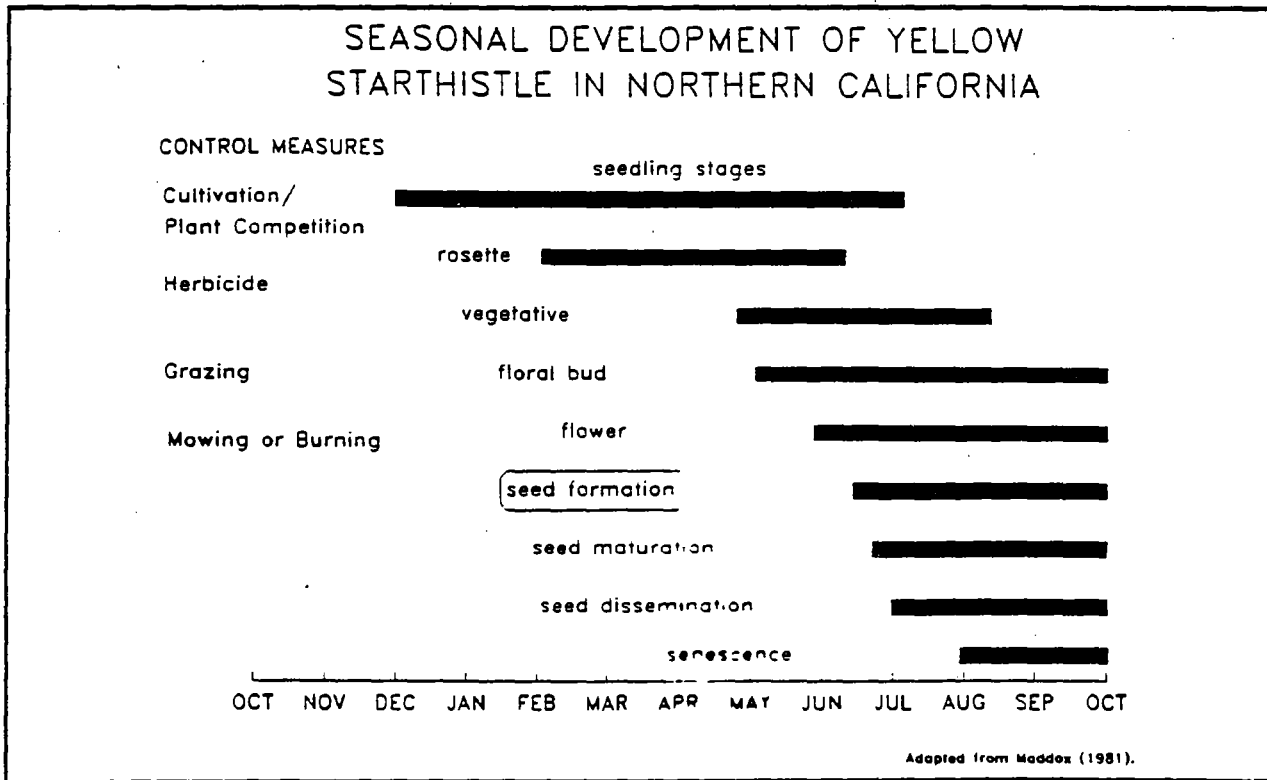
Control Considerations

Controlling yellow starthistle on infested lands will require a systematic and persistent effort that may take many years. In many cases it will be an ongoing land management activity that will need to be continued on a more or less permanent basis. Various approaches can be taken, but the degree of control possible will depend on the size and density of the infestation, terrain, tools or equipment available, and planned use for the site.

When planning a control program one should decide if the aim is to eradicate, manage, or contain yellow starthistle. Eradication is the elimination of starthistle from the site, and requires that all seed production is halted and the seed bank in the soil from previous years is depleted. Eradication of large

infestations is not practical but small infestations often can be successfully eliminated with diligence. Large infestations can usually be managed in ways that reduce starthistle to tolerable levels. Suitable management aims are to decrease plant densities, seed production, or plant height and canopy size, or use it as a feed resource for ruminants. Containment is attempted by delineating boundaries around large infestations and concentrating control efforts on the smaller patches that exist outside of the contained areas. By controlling isolated plants or small patches that are the "pioneers" of new infestations, the larger infestation is contained and the likelihood of invasion into new areas is reduced. As information and experience is gained from controlling small outlying infestations, better decisions can be made about whether larger areas can also be successfully controlled.

Timing control efforts to various stages of plant growth is essential. Figure 1 suggests the timing of some control measures according to specific stages of starthistle growth. Some measures can be used during several growth stages, but all of them should occur before seed set. The duration of life cycle stages depicted by the bars will vary considerably due to weather patterns, site differences, and genetic variation. Thus, on-site monitoring is necessary to determine exactly when a particular stage is occurring and control activities should be adjusted accordingly.



Control Methods

The methods of control include mechanical (tillage, mowing, and removal with hand tools), biological (insects, livestock grazing, and plant competition), fire, chemical, and prevention. In general the most effective control is achieved when two or more methods are used in combination. The methods discussed below are based on research, established principles of weed control, and anecdotal information. Research is incomplete, but studies are underway to fill some of the information gaps.

Mechanical Methods. Cultivation with appropriate tools as the seedlings emerge after autumn rains is an excellent means of removing young plants. On sites where irrigation is available, infested areas can be pre-irrigated prior to autumn rains and then disked to remove germinating seedlings. If cultivation is repeated after rains begin and a new flush of germinating seedlings has emerged, the seed bank can be reduced in a short time. When cultivation is done in the spring, plants will have well developed taproots and tillage should be deeper. Any tillage will also bring deeply buried seeds to the surface where they will have more favorable conditions for germination. If follow-up measures are not taken to also remove these seedlings, the infestation could get worse.

Mowing is a useful method for managing yellow starthistle stands, provided it is well-timed and repeated one to two times. Mowing will be most effective when soil moisture is low and no irrigation or rainfall follows. Under low soil moisture conditions a single mowing may be sufficient, but plants should be monitored for regrowth and mowed again if significant growth and flowering occurs. In most situations, one or two "follow-up" mowings will be necessary and should be done once flowering resumes, approximately four to six weeks later. Research at the UC Agronomy Farm demonstrated that mowing during the early flowering stage (before seed formation) reduced canopy size, seed production, and live plant density when compared to controls (unmowed) and plots mowed at earlier stages of development. Mowing too early appears to encourage its growth.

Ideally, all mowing should be done just prior to seed formation. Flower pigmentation is a good way to monitor whether seed development has commenced. When the flowers are bright yellow and have not begun fading, seed maturation has not occurred. If in doubt open a flower and check for mature seeds. Mowing after seeds have been

produced removes the spiny canopies but does not diminish the seed bank and may aid in seed dispersal.

Manual weeding with hoes, weedeaters, or scythes is often a practical way to control small infestations or is useful as an adjunct to other methods. Hand-held equipment can be ideal for spot weeding plants that survived from other weed control activities.

Biological Control

Biological control involves the use of any biological organism such as insects, livestock grazing, and competitive plants that aid in starthistle suppression.

Insects

Several insects are being evaluated to determine their effectiveness in controlling starthistle populations. Field releases have been made throughout the state and some candidates appear promising, but additional time is needed to assess the long-term effects of these biocontrol agents.

Livestock Grazing

Controlled grazing has been demonstrated to be an effective method for managing large stands of yellow starthistle in annual grassland (Thomsen et al. 1993). Livestock will graze yellow starthistle before it becomes spiny, and studies have shown that it is an acceptable component of a ruminant's diet (Cordy 1978; Thomsen et al. 1989). Over a period of several years cattle, sheep, and goats were tested separately as biocontrol agents in densely infested grassland using intensive grazing management, i.e., high stocking densities and short grazing periods, timed to specific stages of starthistle development. Grazing while starthistle was in the rosette stage (March through April) did not suppress starthistle, but grazing during the bolting stage (May through June) reduced plant densities, height, and seed production. Grazing during the rosette stage avored yellow starthistle relative to other herbaceous vegetation. Along with yellow starthistle, neighboring plants were also defoliated, and the competition they provided was largely eliminated, since starthistle's ability to regrow following defoliation was much greater than the associated vegetation. When grazing was deferred until bolting, most other associated annual species had a chance to complete their life cycle and produce seed. Animals selectively grazed starthistle since it was still green and made use of it as a forage. Since most defoliated plants recovered quickly animals were brought back to the paddocks one to three times at about two week intervals. The

actual number of grazings required for suppression varied according to rainfall patterns and soil moisture levels.

Grazing yellow starthistle should not be attempted with horses. Prolonged ingestion by horses (86-200% of the horse's body weight) can lead to a fatal nervous disease called equine nigropallidal encephalomalacia or "chewing disease" (Cordy 1978). Horses are the only animal known to be affected by this disease, most cases occurring during October/November or June/July. Donkeys and mules are probably susceptible, but there are no documented poisonings (Fowler, per. comm.). The majority of cases that have been reported are with horses that are under two years old.

Plant Competition

Establishing competitive plants such as well-adapted grasses, legumes, or other appropriate plant materials should be considered as part of any control program. If starthistle is controlled, but the ecological niche that it occupied remains unfilled, reinvasion by starthistle will be easier or invasion by another undesirable species is likely. In most cases, a two-step approach is effective with some initial control work done prior to seeding desirable plants as the first step. Using a no-till drill allows seeding without turning the soil, and helps to keep deeply buried starthistle seeds from germinating.

The choice of plant materials should reflect the site conditions, type of management required to establish and maintain the plantings, and planned use of the site. If a large and potentially costly seeding is planned, some initial on-site small scale plantings should be done to evaluate which plants are best suited for your site and whether they are truly competitive against starthistle under the prevailing land use.

Both annual and perennial grasses have potential to compete against starthistle but will be most effective when combined with other methods such as a broad-leaved herbicide application. The timing of rainfall has an important influence on the competitive outcome. If late-season rains (during April through June) recharge soil moisture, starthistle will be favored. Since most annuals complete their life cycle long before starthistle, there will often be sufficient soil moisture remaining to support starthistle growth. Also, starthistle has a long taproot that grows much deeper than annual grasses, so it can obtain soil resources even in dense stands of grass. Nevertheless, if grass stands are dense and tall, competition for space and for light can be a contributing factor that helps suppress starthistle.

Most dryland perennial grasses will require at least two years to gain enough stature to provide competition and dense stands are required. Once established, some perennial grasses do have late spring and summer growth similar to starthistle, and with their vigorous root systems there is greater potential to remove soil moisture that would otherwise be used by starthistle. However, perennial grasses should not be expected to suppress starthistle when grazed by livestock unless they are part of a well-managed irrigated pasture.

Vigorous stands of annual legumes have the potential to suppress yellow starthistle. Drake (per. comm.) reported that a dense stand of rose clover Trifolium hirtum eliminated yellow starthistle in a Siskiyou County trial. Lana vetch Vicia villosa ssp. varia, a vigorous and sprawling vetch that forms a dense spring canopy has been reported to suppress starthistle (Roan, per. comm.). Other annual legumes such as some subterranean clover cultivars, have also been observed to suppress starthistle, particularly when combined with mowing or grazing. Research to examine this more closely is underway, supported by UC IPM. To obtain competitive stands it is advisable to use high seeding rates and to make sure that the seeds are properly inoculated with the host-specific nitrogen-fixing bacteria, Rhizobia spp. Fertilization with phosphorus or sulphur should be considered on range soils since they are often deficient in these nutrients.

Prescribed Burns. In some situations prescribed burns may be an appropriate management tool. The best time to burn is probably the same as for mowing, when plants are in the early flowering stage just prior to seed formation. Since starthistle is still green during this period, there must be enough dry biomass from other annual plants to carry a fire. Research using prescribed fire is being conducted at Sugarloaf Ridge State Park in Sonoma County, but it is inconclusive at present. Prior to conducting a burn on small acreages your local fire station should be contacted to obtain information on safe practices, designated burn days, and permits. For large acreages, the California Department of Forestry and Fire Protection Vegetation Management Program may offer some assistance and cost-sharing, particularly when the burn is part of an overall vegetation management plan that reduces the fire hazard of an area.

Chemical Control. There are many types of herbicides available, most requiring a permit from your County Agricultural Commissioner. If you are not familiar with herbicide use, refer to UC

Cooperative Extension publication No. 1919, *Selective Chemical Weed Control* for specific information (Ashton 1987). Before using any chemical, carefully read and follow precautions on the label. Like any other control method, the use of herbicides must be properly timed and more than one application per growing season may be necessary. Interference from surrounding vegetation might prevent uniform application and leave some starthistle unaffected. Another complicating factor is the successive germination in starthistle populations that occurs long into the growing season, often associated with rainfall. When herbicides are applied before all germination has occurred new seedlings will emerge and develop into adult plants. Foliar-applied, postemergent herbicides are most effective when temperatures are warm, soil moisture is high, and plants are actively growing. Post-emergent herbicides are most effective in seedling and rosette stages prior to any bolting.

Non-selective herbicides, like glyphosate, are effective for spot treatments. However, since glyphosate kills nearly all other vegetation, treatment with this chemical is not usually suited for use over large areas. Broadleaved herbicides such as Banvel, triclopyr, or 2,4-D will help control yellow starthistle and leave grasses unaffected. Care should be taken because these materials will also partially control legumes and other broadleaf plants that may provide competition against starthistle or may be useful to the ecosystem by providing soil cover, forage, biological diversity, or wildlife habitat.

Broadcast spraying in an infested area is not always necessary. Starthistle stands are often patchy and known starthistle areas can be marked with irrigation flags months before spraying and then specifically targeted at the proper time. The grey starthistle skeletons with heads resembling Q-tips that remain in the winter from previous growth are also good markers for locating patches of new seedlings.

Prevention. Preventive weed control measures consist of preventing the introduction or spread of starthistle to uninfested areas. As in containment programs, this includes detection and control of "pioneer" plants before they go to seed along roadsides, in fields, pastures, etc., and develop into larger infestations. Because spot occurrences and small colonies seem harmless, the tendency is to overlook them; however, this is the way most large infestations begin. Even though yellow starthistle is widespread, there are still many areas where it is adapted but has yet to invade or fully establish.

Combining Control Methods

The most effective way to control yellow starthistle is to use a combination of control methods. There are many possible combinations that can be used and tailored according to the site. On arable land good control of starthistle is obtained by using a combination of cultivation, herbicides, irrigation, and crops. On pastures the use of adapted plant materials combined with controlled grazing, well-timed mowing, or herbicides can lead to reduced populations. Perennial grasses in combination with herbicides, cultivation, and burning have been used effectively to suppress starthistle in drainage ditches, along roadsides, and on the borders of agricultural lands (Brown, Bugg and Anderson 1993.). These researchers are using a phased approach to vegetation management of rural landscapes. They begin with intensive weed control to reduce the soil's seed bank. Grasses are planted and herbicides are still used but are reduced as the deep-rooted grasses become well-established and competitive. When herbicide use subsides, broad-leaf plants such as lupines, poppies, and other native forbs are incorporated into the system. The investigators view this not only as a means to control weeds, but also to create wildlife habitat for game and nongame species, improve the aesthetics of the rural landscape, integrate biological diversity onto agricultural lands, and reduce the \$40,000 a year (\$100.00 per mile) spent on roadside weed control in Yolo County (Anderson 1993; Bugg, et al., 1991). These are a few of the many possible combinations of methods for controlling starthistle. But regardless of what methods are used together, effective long-term control requires that 1) seed production is halted, 2) plants emerging from the seed bank are eliminated, and when possible that 3) other, more competitive plants be permanently established that fit in the ecological niche once filled by starthistle to prevent reinvasion and to suppress other undesirable species.

Discussion

Although yellow starthistle is a troublesome weed, it does have some useful properties. Starthistle is a valuable source of summer nectar for bees, and honey produced from it of premium quality. Yellow starthistle's early and late-season growth, palatability, and resilience make it a useful forage plant to ruminant animals before it becomes spiny. In nutritional studies, crude protein levels were recorded from as high as 28% in the rosette stage to 13% in the bolting stage. At one site during bolting starthistle was estimated to exceed 4,000 lbs/acre of dry

matter in early June. Starthistle provides food and cover to wildlife, especially insects, small mammals, and some birds. As a colonizing species, it rapidly covers and helps stabilize unprotected soil.

But, despite these qualities, yellow starthistle remains a significant pest for many ranchers, landowners, and resource managers. Starthistle's invasiveness, stout spines, and hedge-like stands make controlling it a necessary task. Yellow starthistle will continue to increase statewide and is likely to be particularly prominent in years with abundant late-season rainfall.

Some ongoing research that we are involved with or aware of include timed mowing experiments and seed bank studies at the UC Davis Agronomy Farm; combining subterranean clover establishment with sheep grazing and mowing at the Bio-integral Resource Center near Winters; using perennial grasses along roadsides in Yolo County; prescribed burning and timed mowing at Sugarloaf State Park, Sonoma County; and biological control with insects and rusts at USDA-ARS, West Regional Research Center, Albany, California and at the Division of Biological Control, California Department of Food and Agriculture.

The authors would like to thank David Chaney, UC SAREP, for providing the starthistle calendar graphic, Colin Walsh, student assistant, for his illustrations, and W. Thomas Lanini, UC Weed Ecologist, for his helpful comments.

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Appendix L
GENE CONSERVATION

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Reprinted from *Grasslands* Vol. 3 No. 1, 1993
Newsletter published by the California Native Grass Association

STRATEGIES FOR ESTABLISHING NATIVE GRASSES

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The ideal situation for establishing any perennial grass from seed is to have well-tilled, weed seed-free soil with moisture and temperature appropriate for germination, growth, and establishment. Unfortunately, the usual scenario is a non irrigated weed-infested field or roadside. Here summarized are techniques used to establish native grasses in the Sacramento Valley and adjacent foothills north of Winters in Yolo County. Average yearly rainfall is about 17 inches. Soil types vary from class 1 silty clay loam to class 4 gravelly clay loam with underlying hardpan. All areas have undergone continuous or intermittent tillage over the past 20 years. Many of the techniques used follow basic agronomic principles used to establish other perennial plantings such as permanent pasture and sod. The following is a compilation of techniques found to be effective by the author; these are not necessarily recommendations for individual situations, but may serve as guidelines.

Before discussing techniques, it is important to stress the necessity of selecting appropriate species and, perhaps, even species accessions for the site. Over 30 species of native grasses are now available from commercial growers. Soil type, rainfall, exposure, and heat, cold, and flooding tolerance are some of the environmental and climatic factors that dictate where grasses grow. Sites with poor soil are the most critical in species selection with regard to survival. Species originally on the site would be the best choices. An adaptability guide is being prepared by CNGA; this will provide essential information. A first draft should be included in an issue of *Grasslands* this year. A number of consultants as well as past articles can aid in making appropriate recommendations.

Establishment characteristics of drought-tolerant perennial grasses, both native and non native, are important to consider in order to appreciate and understand the steps required for a successful outcome. Equally important are the characteristics of the weedy annuals which, above all, are responsible for establishment failure of native grasses from seed. Seedlings of many native grasses have low vigor and slow germination and growth; this is especially true of the long-lived and highly desirable *Stipa*, *Melic*, and *Festuca* species. Some species also have a prolonged germination time. By contrast, weedy annuals have short germination time, high seedling vigor and rapid growth following the first germinating rains in the fall. Additionally, seed density of weeds is usually very high, with some estimates as high as 10,000 plants/meter². Due to these characteristics weedy annuals overwhelm the hardiest of the natives even when densely seeded. In large acreages, high-rate seeding can be prohibitively expensive. In short, the slow-growing native seedling needs time, moisture, and nutrients to mature into a perennial plant. Standard agricultural techniques provide the methods and tools to accomplish these goals.

Establishment from seed is not a "quick fix". Two to three years are required to develop a mature stand. In weedy areas intensive or spot management for weed control is required beyond the third year. Finally, the reader is reminded of transplant technology which will not be discussed further in this article. Small restoration sites in which rapid results are desired can be effectively planted with transplants on 12-24 inch centers as an alternative to seeding. Transplants are now available at very cost-effective prices and the results when done properly are rewarding. A list of sources is available from CNGA, and will be included in our information packet soon to be completed and mailed to all members.

HERBICIDES

Many of the management strategies described in this article involve the use of herbicides. Herbicides can provide real and cost-effective solutions to serious weed problems that plague the grassland restorationist. They should be viewed as one of the important technological advances that will help restore many altered and exotic-infested ecosystems. Integration of all available technology will be essential to achieve a goal of widespread balanced and self sustaining environments.

Proper, knowledgeable, and safe use of herbicides should always be observed. Precautions include both safety to humans and to the environment. Use herbicides according to labels and observe all restrictions in accordance with county, state, and federal regulations. Permits are required for all large scale use. Information is readily available from county agricultural commissioners' offices and agricultural extension agents. In as much as this may sound like an unrealistic ordeal, it is entirely feasible and easy for an inexperienced person to acquire the knowledge and professional assistance to use herbicides. Licensed Pest Control Advisors (PCA) and licensed Pesticide Control Operators (PCO) can be contacted through local agricultural chemical distributors. Many landscape contractors can also perform the necessary services.

SEED BED PREPARATION AND INITIAL STRATEGIES TO REDUCE WEED COMPETITION.

The goals of seedbed preparation are to decrease the weed seed bank and till the soil for seeding. Starting one year prior to seeding is ideal. A controlled burn in summer or fall decreases surface weed seeds and litter. This is followed by spring disking or tilling (March-April) before winter-growing weeds set seed. The area should be left fallow during summer and tilled or herbicided as necessary to eliminate late-germinating weeds. Another advantage of this spring-summer fallow technique is that deep soil moisture is conserved for the following fall planting. Finally, seedbed preparation may require smoothing with a land plane or scraper and roller if soil clods are large. Rolling with a ring roller provides compaction that will maintain good soil moisture following the first rains.

The seedbed is now physically ready to be seeded but control of a huge reservoir of weed seeds near the soil surface may be necessary. After germinating rains in October or November, weeds can be eliminated with glyphosate at 8 oz/acre, very shallow harrowing or flaming. The goal is to reduce immediate weed competition without bringing weed seeds to the surface. Herbicide use or flaming is most effective. Glyphosate is cost effective on large acreages and can be used for as little as \$10/acre when applied with standard agricultural sprayers. If germinating rains are late, it may be necessary to plant before weeds have emerged, i.e. 7-10 days after germinating rains. In this case, seed can be incorporated and weed seedlings herbicided with glyphosate prior to grass seed emergence. Germination of native grasses takes at least two weeks in late October or early November and up to 4 weeks if planted later. Planting an earlier "test" plot allows one to predict emergence of natives and thereby, timing of spray operations.

Weed identification on the site is important in planning management strategies. Annual grasses such as wild oat (*Avena fatua*), riggut brome (*Bromus rigidus*) and annual ryegrass (*Lolium multiflorum*) are some of the most widespread and troublesome. They germinate early and grow very rapidly. High densities of other annual grasses such as soft chess (*Bromus mollis*) and annual or rattail fescue (*Vulpia myuros*), can be equally aggressive and suppressive. Selective herbicide for weed grass control is limited during establishment as native perennial grasses will also be susceptible; when grasses predominate the weed flora it is very important to adhere to the preplant strategies. Broadleaf weeds can be managed with a wide variety of selective herbicides that do not affect the grasses. Yellow starthistle (*Centaurea solstitialis*), prickly lettuce (*Lactuca serriola*), mustards (*Brassica* spp.), knotweed (*Polygonum aviculare*, *P. erectum*), and many more can be effectively managed with broadleaf herbicides such as 2,4-D, MCPA, dicamba (Banvel), and triclopyr (Garlon).

SEEDING TECHNIQUES AND TIMING

The "best" time to seed is not well understood. The standard is to seed prior to mid November to maximize growth before summer dormancy, which may not occur if rains are late. In 1991 and 1992, several late December and January seedings were successful, especially on good soils. One advantage of later seeding is better control of weeds. With a later planting date, more surface weeds will germinate prior to seeding. In late December, 1991, two sites in Yojo County were seeded either by drill or broadcast-and-harrow; glyphosate was applied 20 days later, just prior to native grass seedling emergence. Monitoring by digging up weed seeds and watching for germination is critical; as soon as a radicle begins to emerge from the native seed, it is time to spray.

Seeding between November and late December is not without risks. Wet, cold soil conditions can rot seed and a hard freeze can cause high mortality in young seedlings. This past wet winter *Stipa cernua* and *S. lepida* failed after being seeded in late November into heavy, class 1 soil. On the same site, seeded at the same time, *S. pulchra*, *Melica californica*, *Elymus glaucus*, and *Hordeum brachyantherum* germinated and were actively growing as of late February. *Poa scabrella* and *Festuca idahoensis* had intermediate success due to damp-off. The last two weeks in January are probably the best time to seed, but wet conditions may prevent access to the fields. Another risk of late seeding is the potential cessation of rains before the grass has enough growth to establish. If an area can be irrigated in the spring or soil will hold deep moisture well into June,

a late January or early February seeding may be best. Newly-germinated seedlings will not be subject to a slow growth phase in December when significant mortality occurs.

Seeding techniques depend on terrain, size of the area and seeding equipment available. The two basic techniques we use are broadcast seeding and precision drilling. Hydroseeding and spreading of native grass straw can be effective. The details of seeding techniques will be covered in a subsequent issue. Long awns of many native grass seeds (*Stipa*, *Hordeum*, *Elymus*, *Bromus*, *Aristida*) may cause bridging in standard seeding equipment. Many standard range drills as well as broadcast seeders are not satisfactory unless additional mechanical agitation is supplied. Equipment designed to handle fluffy, "chaffy" seeds is available for most large acreage seeding (Truax, Inc., Great Plains Manufacturing, Inc.). For small areas, hand-broadcasting, followed by shallow harrowing or chiselpacking is effective. No-till technology will dominate large-scale seeding in the near future. No-till drills are designed to seed directly into untilled soil, providing that compaction isn't significant. Ground work cost and soil erosion are reduced and precision drills plant more accurately, requiring less seed.

A CASE STUDY

A no-till planting was performed this year in a Central Valley, retired agricultural field dominated by wild oat, foxtail barley (*Hordeum leporinum*), and brome. The soil had not been tilled or grazed for more than 10 years and a deep layer of thatch was present. A hot late summer burn removed the thatch and glyphosate was applied after the first germinating rains. A Truax drill was used to plant in late November, followed by a second glyphosate spray before native seeds germinated. As of late February there was a good stand of native seedlings and few weeds. A heavy layer of charred wild oat seed provided evidence of the burn's effectiveness. Native *Brodiaea* in many swales had not been affected.

An alternative method used in the Carmel Valley (Stromberg, Menke and Kephart), employed a sprayer directly mounted on the drill. Planting and spraying were performed simultaneously. An advantage to this method is that the herbicide spray pattern can be adjusted to narrow bands covering the drilled seed, eliminating weed competition for the native seedlings. Unsprayed bands can conserve desirable seed banks, provide livestock forage that would decrease grazing pressure on native seedlings, and might provide a microclimate enhancing seedling survival. Initial results of this trial will be available this summer.

CONTINUED WEED MANAGEMENT

YEAR 1: By March, grass seedlings should be up and growing but so will a new flush of weeds. Many of these weeds may be insignificant or, perhaps, even be desirable forbs, but others could pose threats to establishment. Starthistle, bull thistle (*Cirsium vulgare*), and mustard will grow quickly and if abundant, can overtop and eliminate slow-growing perennials. Knotweed is a very common low-growing annual that starts germinating in late February. If not controlled, it may smother perennial seedlings by June. Late-germinating grasses such as annual ryegrass, oats, canary grass (*Phalaris minor*), and others can do the same. The management options include selective herbicides, wick herbicides, and mowing. In range situations grazing is also an option.

Selective herbicide spraying for broadleaf weeds is most

effective when the weeds are small, generally by mid March. Perennial grasses must be past the 3-leaf stage before application. Most effective broadleaf herbicides are restricted-use chemicals. Wick application of glyphosate consists of wiping a concentrated solution on the tops of tall weeds while leaving shorter perennials untouched. The wick is an absorbent material or rope that is in contact with a reservoir of herbicide solution. This technique works especially well with weedy grasses but can also be used for broadleaf weeds. Hand-held wick applicators are available through many garden suppliers. Tractor-mounted wick applicators for large acreages are available from distributors of agricultural spray equipment.

Mowing, either alone or in combination with herbicides, can give excellent control of late-season weeds, depending on weed type, density and location. Some species, such as annual ryegrass, starthistle, and introduced annual wild barley can produce seed heads low to the ground following mowing. Mowing alone has been successful in cooler coastal areas (Kephart and Kaplow, personal communication), but we have experienced mixed results in the Central Valley, and little success when weeds are dense. Mowing in late March and April reduces the height of weeds, giving young perennials access to light. Mowing should not be lower than 3-4 inches. If mowing alone is used, a second mowing is usually needed in May or early June. Haying (cutting and baling) the site removes annual weed seed that would contribute to the soil seed bank as well as biomass that would shade growing perennials.

Grazing the establishing grassland in spring of the first year can help reduce fast-growing competitive annual grasses. It both mows and removes potential thatch and when animals are managed properly, results can be very successful.

YEAR 2: Second-year management is still a battle against annual weeds. Weed seeds remain in the soil and many are viable for many years. Yearling native grasses don't yet have the competitive biomass to inhibit weed growth. Management practices include pre-emergent herbicides, post-emergent herbicides, mowing, grazing, and, possibly, fire. Pre-emergents prevent seed germination and seedling establishment. Applied in fall to a first-year stand of native grasses, pre-emergents can aid weed control. Pre-emergent use is especially important where annual ryegrass, ripgut brome, foxtail barley, and wild oat have been previously present in high density for a number of years. There are many pre-emergents available and we are in the process of testing their efficacy for native grasses. First-year native grasses, unlike second- and third-year stands can be easily injured and it is important to use the proper material. Oryzalin (Surflan) has been used successfully in many of our trials and we are comfortable recommending its use at 2#/acre for the native species listed in this article. First-year *P. scabrella* and *M. californica* demonstrate reduced tolerance to Surflan, but will grow through it. Chlorsulfuron (Telar) is another useful product that is effective for annual ryegrass control even after germination. *H. brachyantherum* and *H. californicum* are sensitive to Telar; do not use it if these species are in a seed mix. *Stipa*, *Elymus*, *Aristida*, and *Agropyron* are very tolerant of Telar. Seedling *Melica* and *Poa* sustain some injury, but second-year plants are minimally affected. Telar is a potent broadleaf agent, and although useful for controlling many broadleaf weeds such as starthistle and mustard, should not be used adjacent to desirable woody vegetation.

Pre emergent herbicide use has tradeoffs that need to be considered, especially when using those with activity over a wide range of species, such as Oryzalin. Seed that is produced by the establishing native grasses will not germinate and gaps in the

planting will remain. Similarly, reseeding or additional seeding will not be possible. If the restoration site has a seed bank of native annuals, pre emergents may be contraindicated. Every site and project needs to be evaluated in order to decide what practices are appropriate.

Post emergent herbiciding, mowing, and grazing during the second year are similar to the first. Trained persons with 4 gallon backpack sprayers can cover large areas and eliminate hot spots of weeds while not effecting surrounding flora. Warm season perennial weeds such as Johnsongrass (*Sorghum halepense*) and bermudagrass (*Cynodon dactylon*) can be controlled by spot spraying.

Fire is a post establishment management tool that has exceptional value. Our native grasslands evolved with fire and established perennial grasses rebound after fire while weed seed is destroyed. Midwestern prairie restorationists rely heavily on fire as a management tool. Frequency and timing are important questions to answer in our California bioregions. We have burned stands of *Elymus glaucus*, *Hordeum brachyantherum*, and *Stipa pulchra* in September. Young *Hordeum* plants may have been damaged in some of the hottest areas. Established plants of all 3 species rebounded with what appeared to be enhanced vigor. The burn research at Jepson Prairie clearly illustrates the value of fire. We plan to use fire regularly in many of our established plantings.

YEAR 3: A frequently-asked question is how long newly established, weedy sites require intensive management before they become self-sustaining. Right now we don't know, but a reasonable guess would be 3-6 years. Periodic management will always be required. Certainly, intensive herbicide use will not be necessary over time, but grazing, mowing, and burning will always be essential.

Species used in the Central Valley in the author's studies included: *Elymus glaucus*, *Hordeum brachyantherum*, *H. californicum*, *Stipa pulchra*, *S. cernua*, *Poa scabrella*, *Melica californica*, *Leymustriticoides*, *Aristida hamulosa*, *Festuca idahoensis*, *Agropyron trachycalum* var. *majus*, *Sitanion jubatum*, and *Bromus carinatus*.

The author wishes to acknowledge significant contributions to this work by Robert L. Bugg, David Amme, Wendy S. Halverson, and W. Thomas Lanini.

Suggested Native Grass Seed Mix for Farmland Habitat Corridors in the Central Valley

High statured mix - good soil

| | | <u>lbs / acre</u> | <u>estimated seeds ft²</u> |
|-------------------------|--|-------------------|---------------------------------------|
| Purple needlegrass | <i>Stipa pulchra</i> | 4 | 4 |
| Blue wildrye | <i>Elymus glaucus</i> | 1 | 2.5 |
| Yolo slender wheatgrass | <i>Agropyron trachycaulum</i> var. <i>majus</i> | 1 | 2 |
| Creeping wildrye | <i>Leymus triticoides</i> | .5 | 1 |
| Meadow barley | <i>Hordeum brachyantherum</i> | 2 | 6 |
| California oniongrass | <i>Melica californica</i> | .5 | 5 |
| | Total | 9 | 20.5 |

Low statured mix - dry sites, poorer soils

| | | <u>lbs / acre</u> | <u>estimated seeds ft²</u> |
|-----------------------|-----------------------------|-------------------|---------------------------------------|
| Purple needlegrass | <i>Stipa pulchra</i> | 4 | 4 |
| Pine bluegrass | <i>Poa scabrella</i> | 1 | 15 |
| California oniongrass | <i>Melica californica</i> | .5 | 5 |
| California barley | <i>Hordeum californicum</i> | 2 | 6 |
| | Total | 7.5 | 30 |

These are minimum seeding rates for optimum seeding conditions. Doubling the rates would be appropriate.



United States
Department of
Agriculture

Forest Service

Rocky Mountain
Forest and Range
Experiment Station

Fort Collins,
Colorado 80526

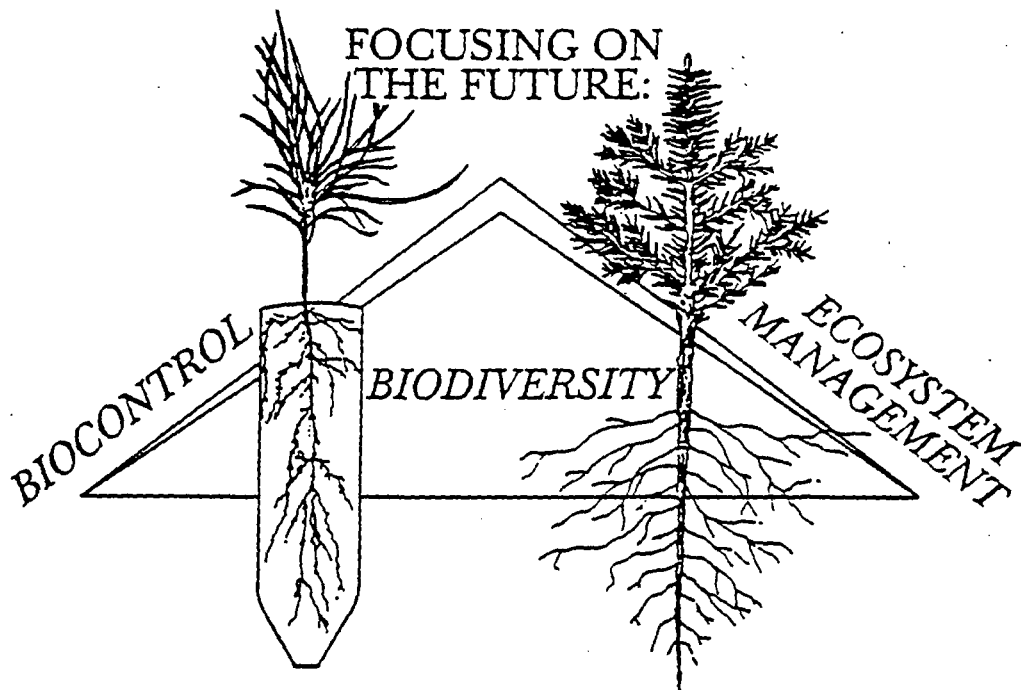
General Technical
Report RM-221



Proceedings,

Western Forest Nursery Association

September 14-18, 1992
Fallen Leaf Lake, CA



Promoting Gene Conservation through Seed and Plant Procurement¹

Marylee Guinon²

Abstract: Genetic conservation is the protection and preservation of the genetic raw materials of adaptation and evolution. The need to account for genetic conservation, coupled with the significant increase in demand for a plethora of native species, presents new challenges to the nursery industry. General seed and plant procurement guidelines are provided for conservation of genetic resources on public and private lands. The genetic implications of seed and plant procurement are discussed, and current and needed information is identified. Guidelines for the propagation of species of known genetic architecture, species of unknown genetic architecture, narrowly endemic species, and rare and endangered species are presented. The guidelines are intended to assist land managers in making informed decisions about genetic conservation.

Retrieval Terms: genetics, conservation, land management

Introduction to Genetic Conservation Guidelines

Biodiversity exists at many levels, including the gene, individual, population, ecotype or geographic variant level, and also the species, community or ecosystem level. Accounting for biodiversity in plantings presents a unique challenge; however, ignoring the conservation of biodiversity can have disastrous ecological consequences. A critical focus in the conservation of biodiversity involves the genetic diversity of species being managed. While diligently planting species, irreplaceable genetic resources are capable of being destroyed. Species and ecosystems, relying on the evolutionary process for long-term survival, depend on appropriate genetic diversity. Plants, unlike *Homo sapiens*, cannot move from or modify their environments and must contend with all physical and biological factors. For some species this means for decades, even centuries. Plants accomplish this by accumulating genetic variations that are appropriate to the environments in which their ancestors evolved. Therefore, an enormous diversity of adapted genes is necessary to counter successfully the inevitable environmental hardships over the lifetime of the plant.

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Decades of research, primarily in commercial forest species, has provided several insights into the importance of genetic variation and local adaptation. Research has demonstrated that the use of genotypes that are not locally adapted can result in immediate mortality, delayed mortality, and poor growth and reproduction performance. Genetic contamination propagates outward from non-local genotypes, moving undetected and irreversibly into wild populations. If stock originates from a few closely-related parents, inbreeding may result, at a cost to growth performance and the genetic integrity of the gene pool.

Forestry research has also taught us that species are genetically structured. In most cases, their genetic structure is hierarchical. The total genetic variation is organized as: variation among physiographic regions within the species, variation among populations within region, variation among stands within populations, variation among families within stands, and variation among siblings within families. The arrangement of genetic variation differs with each species and knowledge of its structure is useful in defining plant procurement requirements that account for genetic conservation.

Historically, plantings and management of natural ecosystems favored particular species or species-groups to the exclusion of others. The nursery industry was able to keep up with the demand for these plants, and account for the genetic architecture of the many forest species. Recently however, plantings in natural areas include a broader range of native

species to meet ecological restoration goals, creating unique and difficult demands on the nursery industry. A native plant nursery might need to inventory as many as 300-400 native species, for which little or no propagation information is available, to meet restoration demands in their bioregion. The large number of restoration projects requiring site collections requires redoubling of effort for commonly used species. Ecological restoration is the process of intentionally altering a site to establish a defined, indigenous, historic ecosystem. The goal of restoration is to emulate the structure, function, diversity and dynamics of the specified ecosystem. Restoration should assist nature in restoring natural processes including natural regeneration, succession and co-evolution. Ecological restoration in the state of California alone potentially deals with over 7,000 species. Because insufficient knowledge is available about the genetic architecture and horticultural requirements of these non-commercial species, genetic conservation programs for each species are virtually impossible to provide. In response to the need for genetic guidelines, the author has prepared seed and plant collection guidelines that integrate genetic conservation principles.

Due to an increased awareness, managers are beginning to emphasize an ecosystem orientation to land management. Thus, plants and animals are considered in the context of dynamic interactions with their physical and biotic environments, and as continually evolving systems. Ideally, these natural processes would proceed unimpeded, but because lands have been modified and natural processes interrupted, managers often choose to actively intervene and restore, where possible, ecological integrity altered by human activity. The genetic conservation guidelines presented here assume that resource management goals focus on not merely random collections of plants and animals, but interconnected associations of communities and processes. Managers should recognize that genetic resources are affected through changes in ecological conditions, such as plant diversity and reproduction regimes. Fundamental to the dynamic communities and processes are the genetic components of the ecosystem.

The genetic conservation guidelines provided here are intended to assist land managers and growers in procuring plant materials. The genetic conservation implications, and current and needed information, are discussed. Guidelines are then presented for species of unknown genetic architecture, species of known genetic architecture, narrowly endemic species, and rare and endangered species. Narrowly endemic species are defined as plants with very limited geographic range or of highly specific habitat characteristics. The procurement guidelines provided for species of unknown genetic architecture are most appropriate to outcrossing species. Because of their limited genetic base and vulnerability to extirpation, rare and endangered species are recognized as a special case, even if the genetic architecture is known or the species is a narrow endemic. Therefore, implications, needed information, and guidelines, are presented separately for rare and endangered species.

a. Genetic Conservation Implications

Revegetation projects rely on techniques that encourage natural regeneration or use more intensive methods such as planting, seeding, transplanting, and salvaging. The species selected in a planting program, and the source of seed and plants, have tremendous genetic implications. The genotype of plants or seeds in the planting program should be assessed. Non-local planting stock, especially of native species, can introduce novel, undesirable or maladapted genotypes into the ecosystem. Use of non-local stock may result in mortality in the short-term, delayed death, or problems with growth and reproduction. If planting stock originates from a few related parents, inbreeding in subsequent generations may result in inbreeding depression and population decline. Thus, both the source location of the planting stock and the number of parents that contribute to the planting stock influence genetic structure.

b. Current and Needed Information

1. What species are native to, and compatible with, the ecological and genetic requirements of the revegetation site? What populations are native to the local gene pools of the revegetation site? How have Euroamerican influences changed species composition, distribution, and regeneration patterns?

2. Evaluate or infer the genetic architecture of those species that may be considered for inclusion in the revegetation program. Of the populations of native species present, are these populations genetically distinct and vulnerable to genetic contamination? Are there populations of genetic significance that need a recovery program? Are there populations that have reduced genetic vigor due to human activities? To increase the genetic vigor of these populations, is revegetation with stock from outside of the project area warranted?

3. What native species or genetic populations have been extirpated or substantially diminished from the project area by Euroamerican influences? What was the reason for the species/population disappearance, and would this reason make the reintroduction of this species unsuccessful? Do subspecies exist in or near the project area that approximate the depleted species; are the two populations genetically similar?

4. Are genetically unique populations, or plant species that provide critical resources for rare and endangered wildlife, either a component of the revegetation project or likely to be affected by it?

5. For those species being considered for revegetation, several elements should be considered. What is the preferred method of revegetation, (i.e., seed, cuttings, poles, whips, container plants, bare root stock, transplants, or site manipulations that encourage natural regeneration), and what are the genetic consequences for each species? How are the species currently regenerating? How amenable are these species to custom collections or site manipulations? Are the species early or late successional? Are the species long- or short-lived?

6. Once the taxa for revegetation are determined, the source of plant materials must be identified. If custom collections are prescribed, the range from which to collect plant propagules should be defined. Can the collections and revegetation sites be matched for soils, elevation, aspect, slope, rainfall, annual temperature patterns, frost dates and associated vegetation? Are there comparable sites slated for destruction, from which stock can be salvaged? What is the genetic condition of donor plants and their populations? Are donor plants growing in isolation or near genetic exotics?

7. Donor stands should be evaluated for their ability to provide sufficient numbers within the criteria set forth in the guidelines.

8. Are seed or hedge orchards necessary and feasible to provide sufficient propagules for revegetation? Who will provide the horticultural expertise in establishment and management of the orchard?

9. What steps are necessary to ensure plant and seed materials are available on schedule?

10. What state-of-the-art revegetation techniques are applicable to the proposed revegetation in the project area? Is there a need to test available techniques or experiment with others? Is there sufficient time to include a pilot project in the phasing of the revegetation program?

11. Can a pilot project be structured to accommodate the need for expansion of plant propagules by establishment of seed or hedge orchards?

Genetic Guidelines for Species of Unknown Genetic Architecture

a. General

1. Revegetation in natural zones should be accomplished using seeds, cuttings, or transplants of species and gene pools that are native to the revegetation site. This does not mean that collections should be restricted to project boundaries. Manmade boundaries, such as project or county lines, are not ecological boundaries.

2. If a species was extirpated or substantially diminished as a direct or indirect result of human activities, the manager should strive to restore the native species, where possible, if adequate habitat to support the species exists or can be reasonably recreated, and if other sensitive or high priority taxa will not be disturbed. The genetic source used in the revegetation should most nearly approximate the extirpated subspecies, race or ecotype.

3. Native plants should be introduced from populations as closely related genetically and ecologically as possible to the project area populations, except in the rare cases where the management goal is to increase the variability of the local gene pool to mitigate for past human-induced loss of genetic variability. Such introductions should only be done with guidance from a population geneticist. Managers are cautioned against introducing new genetic strains or land races to natural populations.

4. The need to maintain adequate genetic diversity should guide decisions concerning management of isolated populations or enhancement of populations of sensitive species. All resource management actions involving planting or relocating species, subspecies or varieties, should be guided by knowledge of local adaptations, ranges, and habitat requirements, and detailed knowledge of the ecological history of the site.

5. Every effort should be made to extend the lives of specimen trees dating from the historic period. An individual tree of historic value that poses a safety hazard or is diseased beyond recovery should be removed and replaced, preferably by its own progeny. Where unique trees or shrubs are still healthy, plans should be made to eventually replace them with their own progeny grown from seeds or propagated vegetatively.

b. Plant Palette

1. The plant palette lists those species included in the revegetation program and their propagule type (seeds, cuttings, poles, whips, container plants, bare root stock and transplants). The manager should include genetic criteria in the development of a plant palette.

2. The plant palette does not necessarily include all plant species in the community. Emphasis should be on species amenable to genetically appropriate propagule collections and other genetic conservation considerations. Plantings should represent species and gene pools that are native to the revegetation site and compatible with the ecological and genetic requirements of the site. Expansion of certain species can be accomplished by site manipulations that favor regeneration, while revegetation efforts concentrate on establishing genetically appropriate stock from species critical to habitat values.

3. Any species that have special regeneration requirements should receive special consideration. Some species already established in the project area may be extended by simple management activities such as exotic eradication, clearing, or tillage.

4. The plant palette should reflect not only currently existing native species, but potential vegetation of the plant association represented in the revegetation area.

5. Although emphasis should be placed on using genetically local stock, site circumstances and revegetation goals may justify inclusion of non-local species. Species native to the

general region, but not local to the project area may be assumed to be the closest living relative of a extirpated species, and justifiable for inclusion. If no populations of a species occur in the project area, introductions should be from a region most ecologically similar to the project area. Self-pollinating species, native to the region but not the project area, also cannot contaminate local stands and may be desirable to include in the plant palette.

6. Any planting or seeding included in erosion control repairs should also meet genetic criteria.

7. In ornamental landscaping around historic cultural areas, non-natives may be used if they are non-invasive. Non-invasive exotics are favored to non-local natives that may contaminate wild populations. All non-local plantings should be evaluated for their potential negative impacts, as pests or contaminants to the genetic composition of neighboring plant communities.

c. Seed and Plant Procurement

1. Revegetation in natural zones should use species and gene pools native to the revegetation site. This does not mean that collections should be restricted to project boundaries. Manmade boundaries, such as project or county lines, are not ecological boundaries. The overriding criteria are *genetic diversity* safeguarded by minimum number of widely-spaced donors, and *local adaptations* maintained by matching site characteristics of project and donor sites and collecting propagules in the project vicinity. If sufficient numbers of widely-spaced donor plants are not available on the project site, collections should be made beyond the project boundaries, while matching donor and collection site characteristics.

2. If a commercial operation collects the plants for revegetation, requirements for procedures, labeling and record-keeping should be clearly specified. The sampling and handling procedures, and compliance monitoring should be prescribed. Both the appropriate range of collection sites and the propagule type should be determined for each species in the plant palette. Since significant variation can occur over short distances, guidelines based on geographic distance are not reliable. Collections in the near vicinity of the revegetation site are preferred. When adequate numbers of widely-spaced donors are not available on site, additional collection sites should be identified. Genetically appropriate sites will supply the revegetation program with genetically local stock.

3. If the breeding range of stands is known or can be inferred, it can be useful in designing collections. Collection within the same local watershed as the project site, even for distances up and downstream, are preferred to jumping to adjacent watersheds, where gene flow with the project site is unlikely.

4. Under unusual circumstances, mature specimen trees or shrubs may be transplanted. For example, mature plants may be transplanted to revegetation sites when an immediate revegetation

is needed for a sensitive species. Although such a program is costly, it may be required as mitigation for habitat impacts. Other situations may call for the removal and mitigation of a specimen tree. Depending upon mitigation requirements, it is feasible that transplanting the specimen is less expensive than guaranteeing the survival of multiple seedlings to maturity. Transplantation to an appropriate site protects genetic integrity and may in some instances cost less than other revegetation scenarios.

5. In addition to seed collected from donor plants, seed banks in the soil are an important source of viable propagules (top soil salvaged from the donor site is spread over the revegetation site). The composition of the seed bank should be confirmed, since seeds of exotic species may remain in soil for decades. Species composition may be determined by testing germination at several locations. This method can also be used to conserve the genetic resources of an area designated for construction.

6. In addition to ensuring geographic proximity, the revegetation and donor sites should be matched for soil, elevation, aspect, slope, rainfall, annual temperature patterns, frost dates and associated vegetation.

7. Where necessary, collections should be done in a way that protects the vigor of the donor plants and their ability to regenerate. Although many species (such as *Populus* spp. and *Salix* spp.) readily provide many cuttings (pruning stimulates them to grow), care must still be taken to prevent excessive harvesting of all species. When seed banks are salvaged from top soil, the donor site should be protected from excessive depletion.

8. Donor plants growing in isolation, or near genetic exotics (such as highway plantings, ornamental landscapes or gardens) should be avoided.

9. To maintain an equal representation of the donor genes, collections should sample equally among the donor plants. An effort should be made to collect from donor plants spaced equally throughout the collection range and at sampling distances appropriate to the genecology of the species. Generally, donors should be in large natural populations and donor individuals sampled with adequate spacing between them. A minimum spacing of 100 meters between donors may be used as a guide in the absence of genecology information. If feasible, wider spacing should be employed. Collection should be designed to locate donors throughout the entire collection area.

10. The number of donor plants sampled depends on the scale of the revegetation project and the species being revegetated. In general, the number of donors should be large (e.g., 50-100), with the range depending on the genecology of each species. If insufficient donor plants are found on site, adjacent sites with genetically similar populations should be used. In the event only a limited number of local donor plants are available, wider-ranging donors may be accepted after consideration of the consequences. The criteria for matching ecological condi-

tions of the collection site to the revegetation site apply strictly. Different criteria apply for the establishment of seed and hedge orchards.

11. Seed and hedge orchards provide propagules for revegetating large areas or for long time periods. The number of donor genotypes in the orchards depends on the scale of the revegetation program. Establishment of seed and hedge orchards requires the expertise of a population geneticist in selecting donor materials and the expertise of a horticulturalist in managing the orchard for propagule production. Correct establishment and use of these seed and hedge orchards is vital, as incorrect establishment and usage can adversely affect genetic integrity.

12. The genetic origin of propagules should be safe-guarded with conscientious labeling, storage and handling. Labels should record the species, date of collection, and donor location.

13. If propagules of known origin cannot be used, the manager should seriously consider removing the species from the plant palette. As a last resort, if plants or seeds of unknown origin are used, the manager should purchase from several suppliers in an attempt to increase genetic variation. In addition, accurate records should document the non-local origin of the plants.

d. Recordkeeping

1. The genetic origins of the propagules should be safe-guarded with conscientious labeling, storage, and handling. Labels should record the species, collector, date of collection, and donor location.

2. Information about the genetic make-up of a revegetation project should be documented and archived. The geographic origin of the stock should be documented, and nurseries and suppliers should be encouraged to track the origin of all collections. All plants and seeds purchased should be stock certified by the supplier to originate from the appropriate region to the project area. As no centralized archive for genetic information currently exists, records of genetic origin should be stored by the manager and with an appropriate agency. An example of a standard form for recording information on genetic resources is provided herein.

Genetic Guidelines for Species of Known Genetic Architecture

a. General

1. If the genetic architecture of a species is known the manager will be able to tailor a procurement program to that species, while accounting for genetic conservation. The genetic architecture of many of the conifers is known, such as Douglas fir, Monterey pine, Torrey pine, ponderosa pine and Jeffery pine. Some managers may base a collection program on inferences made about genetic structure, although the expertise

of a population geneticist should be included in such decisions. Inferences made about the distribution of genetic variation should be made in part based on correlation work of Hamrick and Godt (1990) from 449 species. Managers are cautioned that numerous exceptions exist to these correlations.

2. Revegetation in natural zones should use species and genotypes native to the revegetation site. This does not mean that collections should be restricted to project boundaries. Manmade boundaries, such as project or county lines, are not ecological boundaries. The overriding criteria are: *genetic diversity* safeguarded by minimum number of donors, and *local adaptations* maintained by matching site characteristics of project and donor sites, and collecting propagules in the project vicinity. If sufficient numbers of widely-spaced donor plants are not available on the project site, collections should be made beyond the project boundaries, while matching donor and collection site characteristics.

3. The guidelines for species of unknown genetic architecture are appropriate to species of known architecture, except that locations of donor plants can be better defined to match the structure of genetic variation. Collection design depends on the purpose of the revegetation program. Several examples of situations that may be encountered are provided below.

b. Specific Examples of Collection Design

1. If among-population genetic variation is high and stand variation is low, the manager may collect more freely throughout the population. Collections should be stratified throughout the population to capture the genetic diversity. Collections should remain within the same population(s) as the project. In a small revegetation project, one population may be collected. In a large revegetation project, several populations may be collected.

2. If among-stand genetic variation is high and population variation is low, the manager must identify and respect the stands, by collecting from only those stands where planting will occur. Collections should be spread throughout the stand(s) to capture the genetic diversity. In a small revegetation project, one stand may be collected. In a large revegetation project, several stands may be collected.

3. If sampling an entire population, the manager should identify the stands and strive to sample stands equally. Priority should be given to stands in the central range; stands at the extremes should be collected if feasible.

4. If the breeding range of stands is known or can be inferred, it can be useful in designing collections. Collection within the same local watershed as the project site, even for distances up and downstream, are preferred to jumping to adjacent watersheds, where gene flow with the project site is unlikely.

5. The collection guidelines discussed up to this point are primarily appropriate to revegetation projects, however,

nurseries may procure plants to meet the demand for plants in their bioregion. Managers should not sample a single stand thinking it is representative of the entire population. If stand variation is high, the collection will not represent the population and will be missing a significant amount of variation available in the other stands. If population variation is high, the collection could be depauperate in variation because that variation must be captured throughout the population.

6. If sampling an entire species, managers should identify the populations and stands and strive to sample equally. A greater priority is given to populations and stands in the central range than those occurring at extremes. In order to capture the population and stand variation, sampling should be stratified.

7. Where there is less genetic variation, higher sampling numbers are required. Managers should design collections according to population and stand structure. Hamrick and Godt correlations show that higher species diversity is associated with higher among-stand genetic variation, and lower species diversity is associated with higher among-population genetic variation.

c. Recordkeeping

1. The genetic origins of the propagules should be safeguarded with conscientious labeling, storage, and handling. Labels should record the species, date of collection, and donor location.

2. Information about the genetic make-up of a revegetation project should be documented and archived. The geographic origin of the stock should be documented, and suppliers should be encouraged to track the origin of all collections. All plants and seed purchased should be stock certified by the supplier to originate from the appropriate region to the project area. As no centralized archive for genetic information currently exists, records of genetic origins should be stored by the manager and with an appropriate agency. An example of a standard form for recording information on genetic resources is provided herein.

Genetic Guidelines for Narrowly Endemic Species

a. General

1. Narrowly endemic species are frequently found growing in unusual or adverse site conditions. Unusual soils (such as serpentine), and specific topographic or climatic circumstances are known to contribute to narrow endemism in plants. Ecotypic variation in these species is the result of adaptation to specific site conditions. The genetic structure of ecotypes of the same species should be expected to be very different from ecotypes growing in different conditions.

2. Narrowly endemic species may be indicators of similarly unusual and site-specific plant communities. Managers should be aware if endemic plant species of interest are members of such communities, and should design collection and plantings that reflect this level of endemism.

b. Seed and Plant Procurement

1. When procuring narrow endemics for restoration, managers should recognize that physical distance does not equal ecological distance. The overriding criteria should emphasize matching project and donor sites for soil, elevation, aspect, slope, rainfall, annual temperature patterns, frost dates and associated vegetation.

2. Where the causes of endemism are identifiable (or where specific landscape features are highly correlated with endemism of a species), priority should be given to those features in selecting suitable donor sites. This overriding criteria can be integrated into the guidelines for species of unknown genetic architecture.

3. Many species in the vicinity of a narrow endemic species may closely associated with it, forming a particular plant community. The distribution of the community may also be of very limited range or explained by particular environmental features (for instance, soil type). The association of plant species observed in natural settings will probably have the greatest success growing together in planted situations, rather than growing with species not part of the natural plant community.

4. Many common species in the vicinity may actually be excluded from growing in close association with the narrow endemic species, such as by a sharp boundary between soil types. These species should not be part of the plant palette if the site to be planted has environmental characteristics that match those of the endemic plant site.

5. Knowledgeable individuals familiar with the distribution and identification of the endemic species and its close relatives should be consulted before collections are made. Many narrow endemic species have very narrow ranges of distribution, yet appear very similar to closely related species, subspecies or ecotypes growing nearby. Hybridization may not occur in nature. Care must be taken not to mix closely-related species, subspecies or ecotypes, which would result in potentially damaging genetic contamination.

Genetic Guidelines for Rare and Endangered Species

a. Genetic Conservation Implications

The special case of rare and endangered species is considered separately. Because of their narrow distribution, rare and

endangered plants are often quite vulnerable to stochastic (random) events. Small populations may suffer from past bottleneck effects and ongoing genetic drift or inbreeding. Species distributed in only a few populations are vulnerable to catastrophic events (fire, insects or disease) that may significantly reduce genetic diversity if one or more whole populations is eliminated. In addition, certain populations of wide-spread or sensitive species not listed as rare or endangered may merit protection similar to that given to listed species because of their threatened genetic structure. Recovery programs designed to restore genetic diversity must be specific to the species, the population, and the threat they face.

b. Seed and Plant Procurement

Any procurement of rare or endangered species should be conducted under the supervision of the state and federal agencies with jurisdiction over the species, as stated in the federal and state endangered species acts. In propagating rare and endangered species, several factors must be considered. Conservation collections are only as good as the diversity they contain. Only a small portion of seeds or cuttings of the species may be viable. The appropriate horticultural and storage techniques may be unknown. Geographically isolated populations may, in fact, be fragmentary remains of the original breeding gene pools, and treating each site as a population may enshrine an unnatural distribution of the species, although a large sample size can avert intensification of founder and drift effects. Large collection sizes are preferable to the risk of missing components important to the genetic vigor of the species, since under-representation of genetic diversity can severely cripple the vigor of the species. Species are not static entities and collections are important in so far as they further the maintenance of natural populations exposed to ecological and evolutionary forces.

c. Current and Needed Information

1. What is the location of all rare and endangered species (RES) populations? What is the total geographic range of the RES within the project area? Are the populations within the area near the limits of their range? What is the distribution of the populations: several lone individuals, a few small groups, or one large group?

2. What are the ecological requirements of the RES? These requirements include slope, aspect, soil, elevation, rainfall, annual temperature pattern, frost dates, and associated vegetation.

3. What is the age structure of the populations, and the species as a whole? Are the populations, and the RES as a whole, successfully reproducing? If the RES is not reproducing, is the reason for this inability known? Are methods to encourage reproduction known? For example, is fire necessary to the RES's reproductive cycle?

4. What are the threats to the genetic diversity of the RES? These include impacts that increase inbreeding, decrease gene flow, or increase genetic contamination, as well as threats to population stability, e.g., excessive herbivory, human impacts (trails, structures, fences, leaching from mine tailings), disease, insect infestation, or habitat fragmentation and destruction.

5. Evaluate the genetic architecture of any rare, endangered, or keystone species growing in the project area. Of the populations of native species present, are these populations genetically distinct and vulnerable to genetic contamination? Are there populations of genetic significance that need a recovery program? Are there populations that have reduced genetic vigor due to human activities? To increase the genetic vigor of these populations, is revegetation with stock from outside of the project area warranted?

6. Are there species within the project area which, although not listed by federal or state agencies as rare, threatened or endangered, will be considered for listing if their populations continue to decline?

d. Genetic Conservation Guidelines

1. When inventories are made of RES, data should include aspects relevant to genetic diversity, such as population size and demography, flowering conditions, hemiparasitic associations, plant community structure, etc. Many RES species cannot be successfully recovered without including hemiparasites. Management and revegetation plans should specifically address means of improving and maintaining genetic diversity.

2. Prior to any potentially deleterious activity, including site-specific development, trail or facilities construction or relocation, or prescribed burns, additional surveys for rare or endangered plants should be made during the appropriate flowering season in the areas that will be affected.

3. The need to maintain appropriate levels and natural structures of genetic diversity should guide decisions concerning the enhancement of a rare, threatened, or endangered species' population. All resource management actions involving planting or relocating species, subspecies, or varieties should be guided by knowledge of local adaptations, ranges and habitat requirements, and site-specific ecological histories. When the management goal is to increase the variability of the gene pool of a rare or endangered species, importation of propagules may be appropriate but should be carried out in consultation with a population geneticist who would evaluate the compatibility of the foreign genotypes.

4. Collections of rare and endangered species should receive the approval of the state and federal agencies with jurisdiction over the species. Collection of rare and endangered plant material may require a state or federal permit, or a Memorandum of Understanding.

5. Collections of rare, threatened and endangered species should be carefully monitored and restricted, to prevent

damaging local populations or donor plants. Ensure that propagule collection does not interfere with the donor site's reproductive abilities. The level of appropriate collection should be determined by a trained ecologist, population biologist, or demographer. Collectors should be carefully trained to protect against damage to donor plants. If the collectors are not trained by the regulating agency, they should be required to provide qualifications.

6. Consult collection guidelines for rare and endangered species, such as those provided by the Center for Plant Conservation. Sample size within each sample population varies with relevant life history characteristics, population history, the degree of endangerment, potential consequences of introducing an artificial founder effect and prospects for the revegetation site to be used as a seed or hedge orchard for future projects. All of these reasons may require a larger collection. If no such considerations apply, the Center for Plant Conservation recommends sampling 10-50 individuals within each population, following a stratified sampling regime.

7. An adequate number of propagules should be collected from each individual to insure that at least one representative

of each genotype remains after normal attrition. In the absence of other information, the Center for Plant Conservation suggests predicting 10% survival. The reproductive characteristics of the species should also be taken into account: self-incompatible species, for example, require a doubling of the sample size to achieve the minimum effective breeding population size.

8. If a population is threatened with extirpation, e.g., due to fire suppression, pending sale and development of the property, or other reasons, that population should be included in the collection sample.

9. Where possible and appropriate, back-up collections of germplasm (ex-situ collections) should be made from a large sample (or all) of the RES. Seed or pollen banks, or plantations of live plants (including contributions to botanical gardens) should be established and documented.

10. Recordkeeping should follow agency requirements. A documentation form is provided herein, if needed. (See Figures One and Two.)

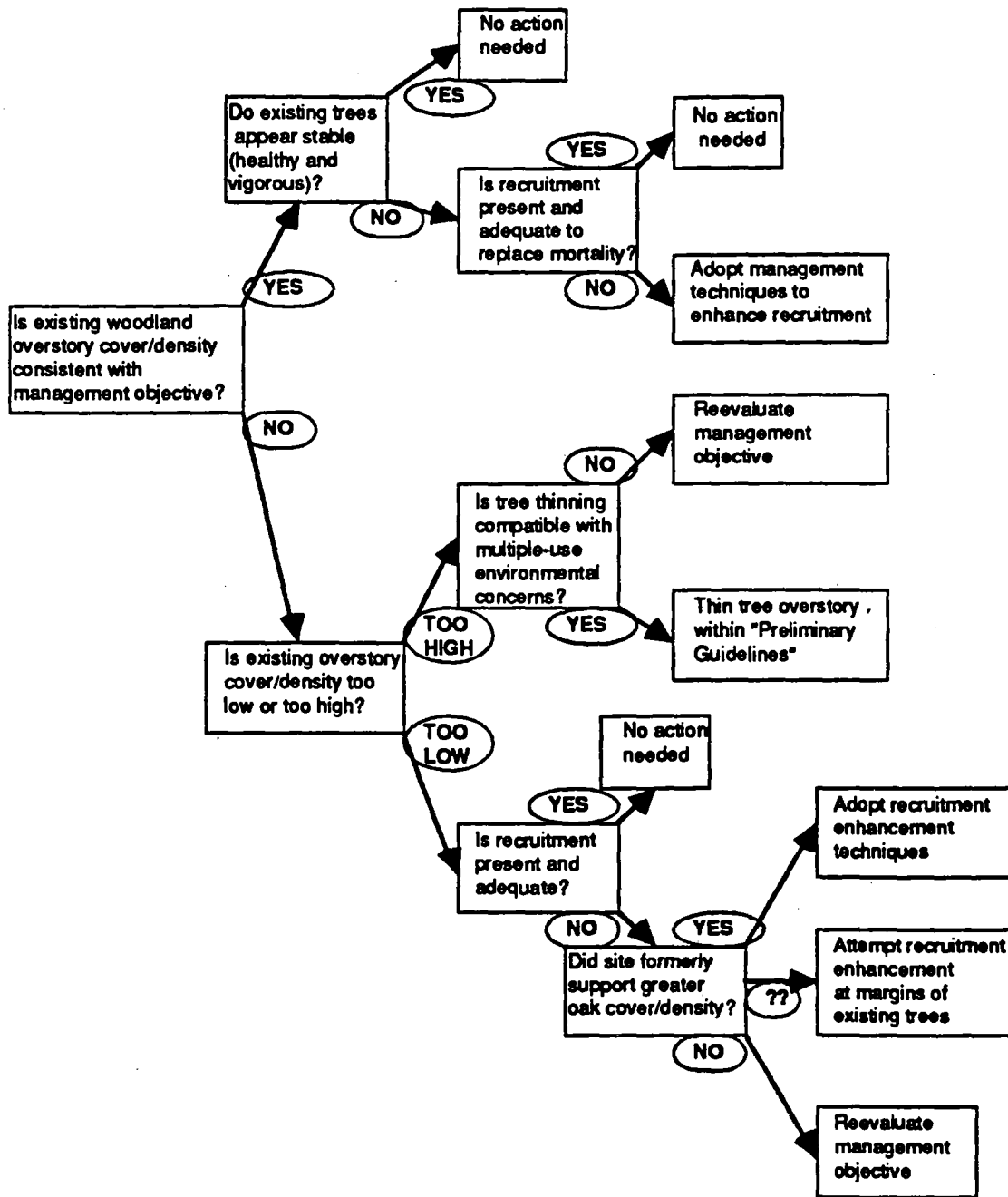
Figure One

| DOCUMENTATION OF GENETIC RESOURCES | | | | | | | | | |
|--|-----|-----------------|--|------------------------------|---------------------------------------|--|-----|----|--|
| PROJECT NAME | | | | | | | | | |
| LOCATION <small>(GENERAL DESCRIPTION)</small> | | | | | | | | | |
| TOWNSHIP | | RANGE | | SECTION | | | | | |
| LAT. | | LONG. | | UTM | | | | | |
| SIZE | ac. | USGS QUAD | | | | | | | |
| DATE OF RESTORATION | | HABITAT TYPE(S) | | | | | | | |
| LANDOWNER/MANAGER | | | | | RESTORATION DESIGN MANAGER | | | | |
| <small>(NAME, ADDRESS, PHONE)</small> | | | | | <small>(NAME, ADDRESS, PHONE)</small> | | | | |
| SITE OWNERSHIP | | | | | MONITORING PROGRAM MANAGER | | | | |
| PUBLIC | | | | | <small>(NAME, ADDRESS, PHONE)</small> | | | | |
| PRIVATE | | | | | | | | | |
| NON-PROFIT | | | | | | | | | |
| LAND USE | | | | | | | | | |
| LEAD AGENCY | | | | | | | | | |
| EVALUATION OF PLANT'S GENETIC INTEGRITY PRIOR TO RESTORATION | | | | | | | | | |
| NATIVE TO SITE | | EXOTIC TO SITE | | NATIVE BUT PLANTED OR SEEDED | | | | | |
| CERTAINTY OF EVALUATION | | | | | | | | | |
| PLANT MATERIALS COLLECTED FROM GENETICALLY LOCAL STOCK? | | | | | | | YES | NO | |
| FINAL PLANTING PLAN ATTACHED? | | | | | | | YES | NO | |
| GENETIC INTEGRITY OF PLANT MATERIALS SPECIFIED ON PLAN? | | | | | | | YES | NO | |
| OTHER ATTACHMENTS | | | | | | | | | |

Appendix M
OAK REGENERATION ASSESSMENT KEY

■ ■ ■

FIGURE 1. Decision key for oak regeneration assessment.



Adapted from: Lang, F.J. 1988. Oak regeneration assessment - a problem analysis. (JSA 86-72) Jones & Stokes Associates, Inc. Sacramento, CA. Prepared for: California Dept. of Forestry and Fire Protection, Forest and Rangeland Resources Assessment Program, Sacramento, CA.

Appendix N
SURVEY TECHNIQUES FOR PLANT AND WILDLIFE
SPECIES OF CONCERN

■ ■ ■



EDITED BY

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RARE PLANT FIELD SURVEY GUIDELINES

By

James R. Nelson

The following recommendations, adopted by the California Native Plant Society and the California Department of Fish and Game, are intended to help those who prepare environmental documents to determine when a botanical survey is needed, who should be considered qualified to conduct such surveys, how field surveys should be carried out, and what information should be contained in the survey report.

1. Botanical surveys that are conducted to determine the environmental impacts of developmental activities should be directed to all rare, threatened, and endangered plants and plant communities. The plants are not necessarily limited to those that have been "listed" by state and federal agencies, but include any species that, based upon all available data, can be shown to be rare and/or endangered.
2. It is appropriate to conduct a botanical field survey to determine if, or the extent to which, rare plants will be affected by a proposed project when:
 - a. based upon an initial biological assessment, it appears that the project may damage potential rare plant habitats;
 - b. rare plants have historically been identified on the project site and adequate information for impact assessment is lacking; or
 - c. no initial biological assessment has been conducted and it is not known whether rare plant habitats exist on the site.
3. Botanical consultants should be selected on the basis of possessing the following qualifications, in order of importance:
 - a. experience as a botanical field investigator, with a background in field sampling design and field methods;
 - b. taxonomic experience and a knowledge of plant ecology;
 - c. familiarity with the plants of the area, including the rare species; and
 - d. familiarity with the appropriate state and federal statutes related to rare plants and botanical surveys.
4. Field searches should be conducted in such a manner that they will locate any rare or endangered plants that may be present. Specifically, such investigations should be:
 - a. conducted at the proper time when rare or endangered plants are both evident and identifiable. Field surveys should be scheduled to coincide with known flowering periods, and/or during periods of phenological development that are necessary to identify plants of concern.
 - b. floristic in nature. Predictive surveys, which predict the presence of rare plants based upon the occurrence of habitats or other physical features, rather than actual field inspection, should be reserved for studies of a single species; not for impact assessment (see Goff et al., 1982). Every species noted in the field should be identified to the extent necessary to ensure that it is neither rare nor endangered.
 - c. conducted in such a manner that they are consistent with conservation ethics. Collections of voucher specimens or rare (or suspected rare) plants should be made only when such actions do not jeopardize the continued existence of the population and in accordance with applicable state and federal regulations. Voucher specimens should be deposited at recognized public herbaria for future reference. Photography should be used to document plant identifications and habitat whenever possible, especially when rare plant populations cannot withstand collection of vouchers.
 - d. conducted using systematic field techniques in all habitats of the site to ensure a reasonably thorough coverage of potential impact areas.
 - e. well-documented. When rare or endangered plants or unusual plant communities are located, a California Native Plant Field Survey Form or its equivalent should be completed and sent to the Natural Diversity Data Base.
5. Reports of botanical field surveys should be included in or with environmental impact reports and should contain the following information:
 - a. project description, including a detailed map of the project location and study area;
 - b. a written description of the biological setting, referencing the plant community nomenclature used and a vegetation map;
 - c. a detailed description of the survey methodology;
 - d. the dates of field visits;
 - e. the results of the survey, including detailed maps;
 - f. an assessment of potential impacts;
 - g. a discussion of the importance of rare plant populations, with consideration of those nearby, and total species distribution;
 - h. recommended mitigation measures to reduce impacts;
 - i. a list of all species identified;
 - j. copies of all Field Survey Forms or Natural Community Field Survey Forms, when unusual communities are found;
 - k. the name(s) of the field investigator(s); and
 - l. a list of references cited, persons contacted, herbaria visited, and the location of voucher specimens.

James R. Nelson is a botanist with the California Energy Commission, 1516 Ninth St., Sacramento 95814.

California Native Species Field Survey Form

Mail to:
Natural Diversity Data Base
California Dept. of Fish and Game
1416 Ninth Street, 12th Floor
Sacramento, CA 95814

| | |
|---------------------|-------------------|
| For office use only | |
| Source Code _____ | Quad Code _____ |
| Elm Code _____ | Occ # _____ |
| Copy to _____ | Map Index # _____ |

Date of field work: / /
no day year

Scientific Name (no codes): _____

Species Found? [] [] [] _____
yes no If not, why?

Total # Individuals: _____ Subsequent visit? []yes []no

Compared to your last visit: []more []same []fewer

Is this an existing NDDDB occurrence? [] [] [] [] [] []
Yes, Occ. # no unk.

Collection? If yes: _____
number Museum/Herbarium

Reporter: _____

Address: _____

Phone: () _____

Other knowledgeable individuals (name/address/phone): _____

Plant Information:

Phenology: _____
% vegetative % flowering % fruiting

Animal Information:

Age Structure: _____
adults # juveniles # unknown

Site Function: [] [] [] [] [] [] []
breeding foraging wintering roosting burrow site other

Location: (Please also attach or draw map on back.)

County: _____ Landowner/Mgr: _____

Quad Name: _____ Elevation: _____ UTM: _____

T _____ R _____ 1/4 of _____ 1/4 Sec _____ T _____ R _____ 1/4 of _____ 1/4 Sec _____

Habitat Description: (Plant communities, dominants, associates, substrate/soils, aspect/slope)

Other rare spp.? _____

Site Information: Current/surrounding land use: _____

Visible disturbances, possible threats: _____

Overall site quality: []Excellent []Good []Fair []Poor Comments: _____

Determination: (Check one or more, fill in the blanks)

_____ Keyed in a site reference: _____

_____ Compared with specimen housed at: _____

_____ Compared with photo/drawing in: _____

_____ By another person (name): _____

_____ Other: _____

Photographs: (Check one or more) **Slide** **Print**

Plant/animal _____ _____

Habitat _____ _____

Diagnostic Feature _____ _____

Other _____ _____

May we obtain duplicates at our expense? []yes []no

California Natural Community Field Survey Form

Mail to:
 Natural Diversity Data Base
 California Dept. of Fish and Game
 1416 Ninth Street
 Sacramento, CA 95814
 (916) 324-6857

| | |
|----------------------|------------------------|
| For office use only | |
| Source Code _____ | Quad Code _____ |
| Community Code _____ | Occ # _____ |
| Map Index # _____ | Update Y _____ N _____ |

Please provide as much of the following information as you can. Please attach a map (if possible, based on the USGS 7.5 minute series) showing the site's location and boundaries. Use the back if needed.

Community name: _____

Reporter: _____ Phone _____

Affiliation and Address _____

Date of field work: _____ County: _____

Location: _____

Quad name: _____ T _____ R _____ ¼ of _____ ¼ sec _____ Meridian _____

UTM Zone _____ Northing _____ Easting _____

Landowner/Manager: _____ Photographs: Slide Print

Elevation: _____ Aspect: _____ Slope (indicate % or °) _____ Drainage: _____

Site acreage: _____ Evidence of disturbance/threats: _____

Current land use: _____

Substrate/Soils: _____

General description of community: _____

Any Special Plants or Animals present: _____

Successional status/Evidence of regeneration of dominant taxa: _____

Overall site quality: Excellent ___ Good ___ Fair ___ Poor ___ Comments: _____

Basis for report: Remote image ___ Binocular/Telescopic survey _____

Windshield survey ___ Brief walk-thru ___ Detailed survey ___ Other _____

Relevé: In the space below, indicate each species cover % within the following growth form categories:

| | | |
|--------------|---------------|-------------------------|
| <u>Trees</u> | <u>Shrubs</u> | <u>Herbs/Graminoids</u> |
|--------------|---------------|-------------------------|

Continue on back if needed. Thank you for your contribution.

Focused Species Surveys - California Tiger Salamander

The California tiger salamander spends most of the year in burrows located in grasslands. On rainy nights, they migrate to ponds to lay their eggs in the winter. The initial surveys will identify suitable upland habitat for this species and determine best placement of sampling stations. A series of drift fences with pitfall traps will be used to determine the direction of salamander movement to and from the pond located on site. A maximum of 8 traplines, 100 m long, with traps located every 7.5 m will be constructed in late December or early January. The number of traplines necessary to adequately cover the suitable habitat will be determined in consultation with experts from the California Department of Fish and Game (CDFG). Traps will be checked for a minimum of 8 rainy nights, or if it does not rain that many nights, until the end of the breeding season (February). Salamanders caught in the traps will be toe-clipped to identify individuals and released on the opposite side of the fence line. Movement patterns of individual salamanders can then be determined by recapture in the series of traplines.

In addition to traplines, potential salamander burrows will be marked with flags during the installation of the drift fences. These burrows will then be visited at night to search for salamanders emerging from their burrows to forage or migrate. The number of night surveys necessary to adequately cover the suitable habitat will be determined in consultation with experts from the CDFG.

If no California tiger salamanders are caught in traps or seen in burrows, dip nets will be used to seine the pond in the spring for presence of salamander larvae. Initially one day of dip netting will be scheduled. If unsuccessful in locating any larvae, an additional day of dip netting will be conducted.

Focused Species Surveys - California Red-legged Frog

California red-legged frogs inhabit small streams and lay their eggs in ponds or marsh areas. Evening and night surveys of riparian, marsh and pond areas on the site will be conducted to listen for vocalizations of breeding males. In addition, spotlights or flashlights may be used to search for the unique eyeshine of the California red-legged frog. These surveys will be performed in conjunction with other wildlife sampling, such as surveys for California tiger salamander burrows (December and January). If no California red-legged frogs are detected by vocalizations or spotlighting, the pond will be dip netted for larvae during one day in the spring.

DRAFT
BURROWING OWL MITIGATION GUIDELINES

Prepared by:

BURROWING OWL CONSORTIUM MITIGATION COMMITTEE

30 October 1992

Introduction

The objective of these mitigation guidelines is to minimize impacts to burrowing owls and the resources that support viable owl populations. These guidelines are intended to provide a decision-making process that should be implemented wherever there is potential for an action or project to impact burrowing owls or their resources. The process begins with a four-step survey protocol (see *Burrowing Owl Survey Protocol*, October 1992) to document the presence of burrowing owl habitat, and evaluate burrowing owl use of the project site and a surrounding buffer zone. When surveys confirm occupied habitat, the mitigation measures described below are followed to minimize impacts to burrowing owls, their burrows and foraging habitat on the site. These guidelines emphasize maintaining burrowing owls and their resources in place rather than minimizing impacts through displacement of owls to an alternate site.

Mitigation actions must be carried out prior to the burrowing owl breeding season (February 1 through August 31). Project sites and buffer zones should be resurveyed to ensure no burrowing owls have occupied them in the interim period between the initial surveys and ground disturbing activity. Repeat surveys should be conducted not more than 60 days prior to initial ground disturbing activity.

Definition of Impacts

1. Disturbance or harassment within 50 meters (150 feet) of occupied burrows.
2. Destruction of burrows and burrow entrances. Burrows include structures such as culverts, concrete slabs and debris piles that provide shelter to burrowing owls.
3. Degradation of foraging habitat adjacent to occupied burrows.

General Considerations

1. Occupied burrows should not be disturbed during the nesting season, from February 1 through August 31 or until the Department of Fish and Game verifies that the juveniles are foraging independently and capable of independent survival.
2. A minimum of 6.5 acres of foraging habitat should be maintained per pair (or unpaired resident single bird) contiguous with burrows occupied within the last five years. Ideally, foraging habitat should be retained in a long-term conservation easement.

3. When destruction of occupied burrows is unavoidable, burrows should be enhanced or created in a ratio of 1:1 in nearby suitable habitat that is contiguous with foraging habitat of the affected owls.

4. If owls must be moved away from the disturbance area, passive relocation is preferable to trapping. A time period of at least one week is recommended to allow the owls to move and acclimate to alternate burrows.

5. The burrowing owl mitigation committee recommends establishing a monitoring program after mitigation implementation, and encourages research that contributes to scientific knowledge of burrowing owl ecology.

Required mitigation measures

1. *Avoid occupied burrows.* Avoidance, the preferred mitigation measure, requires that no permanent impacts occur within a 50-meter radius of occupied burrows, including non-breeding burrows, breeding burrows and satellite burrows. No temporary disturbance should occur within 50 meters of occupied burrows during the non-breeding season of September 1 through January 31 or within 75 meters during the breeding season of February 1 through August 31. Avoidance also requires that a minimum of 6.5 acres of foraging habitat be preserved contiguous with occupied burrow sites, for each pair of breeding burrowing owls (with or without dependent young) or single unpaired resident adult.

OR

2. *Passively relocate owls.* On-site passive relocation should be implemented if the above avoidance requirements cannot be met. Passive relocation is defined as providing alternate natural or artificial burrows beyond 50 meters from the impact zone and containing a minimum of 6.5 acres of contiguous foraging habitat for each pair of relocated owls. Owls should be excluded from burrows in the immediate impact zone and within a 50 meter buffer zone, using one-way doors in burrow entrances to encourage the owls to move to alternate natural or artificial burrows. One alternate natural or artificial burrow should be provided for each burrow that will be excavated in the project impact zone. The project area should be monitored daily for one week to confirm owl use of alternate burrows before excavating burrows in the immediate impact zone. Whenever possible, burrows should be excavated using hand tools. Sections of flexible plastic pipe or burlap bags should be inserted into the tunnels during excavation to maintain an escape route for any animals inside the burrow.

AND

3. *Mitigate habitat off-site.* When a project involving relocation also causes a long-term loss of burrowing owl foraging habitat, but does not reduce foraging habitat below the threshold level of 6.5 acres per pair or single resident adult, then habitat impacted should be replaced off-site, at a ratio of 1 acre of replacement habitat for each acre of impacted habitat. Off-site habitat

must be suitable burrowing owl habitat as defined in the Survey Protocol. Land must be purchased and placed in a conservation easement either in perpetuity or for a period of time equivalent to recovery of the project site to pre-project conditions.

If the action will reduce foraging habitat below a threshold level of 6.5 acres per pair, then apply the following ratios:

1. When replacing occupied habitat with occupied habitat, 1.5 acres of replacement to 1 acre impacted.

2. When replacing occupied habitat with habitat adjacent to occupied habitat, 2 acres of replacement to 1 acre impacted.

3. When replacing occupied habitat with suitable but unoccupied habitat, $\frac{3}{2}$ acres of replacement to 1 acre impacted.

Appendix O
WILD PIGS IN CALIFORNIA AND THEIR
MANAGEMENT ON PUBLIC LANDS

■ ■ ■

**WILD PIGS IN CALIFORNIA AND
THEIR MANAGEMENT ON PUBLIC LANDS
Background Information**

Compiled by John Stanley and Dana Bland
The Habitat Restoration Group

INTRODUCTION

Origin

In the United States, wild pigs (*Sus scrofa*) are called many names, and this reflects their mixed ancestry. Wild pigs are not native to North America and should not be confused with the collared peccary (*javelina*) of the Southwest. Swine first came to this continent in 1539, when the Spanish explorer Hernando de Soto brought them to Florida. It was common practice for settlers to allow their domestic swine to roam freely (USDA 1992).

The wild pigs in California today are the result of interbreeding between stocks of feral pigs and European wild boar. The feral pig is defined as those which at some time had domesticated ancestors. It has been present in California since 1769 (Barrett 1993). Post gold rush settlers further established the feral pig population of the State by releasing their domestic pigs to feed on acorns throughout the hardwood rangelands of California (Barrett 1977; 1993).

The European wild boar ancestry includes no history of domestication. It was brought to the United States in 1912 by George G. Moore of New York, backed by a group of English sportsmen (Stegeman 1938). Approximately 15 animals were brought to Hooper Bald, North Carolina, where they were kept in an enclosure until 1920. At that time, an estimated 100 animals escaped into the surrounding mountains where they have since spread and crossbred with feral pigs. The origin of the imported stock has not been ascertained, but both Stegeman (1938) and Bratton (1977) suggest that the Harz Mountains of northern Germany is a likely site.

Twelve European wild boar were brought to California from North Carolina in 1925, and were released on the San Francisquito Ranch (presently named Rancho San Carlos) in the Carmel Valley area of Monterey County. A second group of 24 animals was released in the same region in 1932 (Pine and Gerdes 1973). The range of the European wild pigs in California has been expanded by people who have caught wild pigs and relocated them in various areas throughout the state.

Distribution

Free-ranging populations of wild pigs are present in at least 18 states in this country. Wild pigs occur in 40 counties of California. They are abundant, non-native animals of central coast

forests, oak woodlands, and chaparral. Wild pigs have been widespread in the central coast of California since about 1970.

Wild pigs occur in riparian areas, mature conifer and hardwood forests with moderate to high canopy closure, chaparral, and other brush types. Production of mast crops is an important factor influencing their distribution. Adjacent agricultural lands also enhance the value of the pigs' habitat.

Status

Wild pigs were designated as game mammals by the California legislature in 1957. The California Fish and Game Commission encourages their conservation and maintenance for the benefit of all citizens of the state.

A new law, effective July 1, 1992, requires sport hunters to buy and attach a pig tag to every wild pig they take. Data from the tags and funds from tag sales will be used to prepare a pig management plan for the state.

Abundance

Since the late 1950's, hunting effort, pig harvest, and trends in wild pig distribution have been monitored through an annual hunter's survey. Results of this survey indicate significant increases in hunting effort, wild pig harvest, and distribution, with peaks occurring in the 1980's. In 1992, state law was amended to require hunters to possess, complete, and return tags for wild pigs. This requirement was intended to allow the Department to obtain basic wild pig populations information and, more specifically, to document hunting harvest and generate funding to collect the baseline information necessary to prepare a wild pig management program. This information has been used to develop additional management actions including adjusting hunting bag limits and more effectively using recreational hunting in controlling wild pig populations.

In 1977, it was estimated that more than 30,000 wild pigs probably occurred in California, making it the second most important big game species in the state (Barrett 1977). Today, it is estimated that approximately 80,000 wild pigs occur in California (Tietje 1993). Between 1956 and 1991, approximately 750,000 wild pigs have been harvested in California; the trend in annual kill continues upward except for small declines during periods of drought. California Department of Fish and Game (CDFG) estimates that approximately 24,000 wild pigs were killed in California by sport hunters in 1992; however, the estimated total pig harvest peaked at 58,000 in 1988.

GENERAL BIOLOGY OF WILD PIGS

The "wild pig" in California is a cross between the pure-strain European wild boar introduced to the state in Monterey County during the mid-1920's and the free-roaming swine released by

early settlers. Some wild pigs have the classic "wild boar" appearance while others resemble common domestic pigs in body shape and color. It is often difficult to distinguish wild pigs from free-ranging domestic swine based solely on appearance. Wild boar readily hybridize with feral pigs, but natural selection may favor wild boar traits. These traits (e.g., 36 chromosomes, striped young, agouti pelage, woolly undercoat, long legs, greater agility, and lower reproductive rates) continue to be artificially dispersed throughout the state (Barrett 1993).

Size and Weight

In the central coast area, wild pigs weigh about 150 pounds at 3 years of age. Wild pigs can reach 6 years of age and weigh as much as 250 pounds. Wild pigs weighing more than 300 pounds are unusual in California (Nee 1992).

In Tehama County, California, the typical adult boar weighed 176 pounds and a typical adult sow weighed about 165 pounds (Barrett 1978).

HABITAT REQUIREMENTS

The minimum requirements for good wild pig habitat are escape cover of dense vegetation (e.g., chaparral and forest) and surface water distribution of at least one source per square mile (Nee 1992). Wild pigs thrive where they have (1) permanent water, (2) an adequate food supply including acorns, bulbous plants, clover, and soils animals, and (3) security from hunting or human harassment.

Feeding

Wild pigs are omnivorous, their diet changing with the season. During the dry summer months pigs eat green plants; in the autumn they consume acorns, walnuts, and fruit when these nutritious foods are available; during winter, when rains soften the soil, wild pigs eat roots, bulbs, insects, and worms that they locate by plowing or "rooting" the ground with their tough snouts; in the spring, as the soil dries, they gradually shift back to green plant parts. In some agricultural areas, barley and alfalfa are preferred foods. Small animals and carrion form a minor part of the pig's diet year-round. Wild pigs feed at dusk, night, and dawn if the weather is hot or they are harassed; or they feed both day and night, if the days are overcast and cool (Nee 1992).

Pigs forage on ground surface, root beneath the ground surface, and forage up to about 2 feet above the ground. They locate food by scent and may root in rotted logs.

Cover

Pigs require dense brush for escape, resting and shade cover. Dense brush areas are also required for farrowing (Zeiner *et al.* 1990).

Water

Pigs probably need water at least every two days when feeding on dry forage. Mean consumption is 9-10 pounds of water per day for domestic pigs 150 pounds in weight. Water consumption varies with age, ambient temperature, ambient humidity, and moisture content of food (Zeiner *et al.* 1990). Barrett (1971) estimated that pigs need water twice per day during the dry season. Research on Santa Catalina Island indicated that wild pigs moved approximately 0.2 mile to obtain water (Baber and Coblenz 1986). Based on these water needs and movement patterns, pigs would rarely occupy an area where a water source was greater than one mile away (LCA 1987).

Pattern

Suitable habitat consists of a mixture of dense brush and mature forest habitats for cover and reproduction. Also, oak forests, herbaceous/forb openings and agricultural lands are used for foraging (Zeiner *et al.* 1990).

Predators

Human predation is probably the primary mortality factor for adult pigs, although the puma (*Felis concolor*) may also be important in some areas of the state (Barrett, 1993). Bears may prey on pigs in Humboldt County (Zeiner *et al.* 1990).

Niche

Non-native wild pigs occupy an ecosystem niche that was apparently under-utilized by the surviving large animal fauna of California. Formerly, this niche may have been partly occupied by grizzly bears (*Ursus arctos*). The niche is that of the roter, although the pig is both an omnivorous and opportunistic feeder that utilizes seeds, acorns, and the green parts of plants (Chipping 1993).

LIFE HISTORY

Activity Patterns

The wild pig is active year-long, mostly crepuscular and nocturnal, but also diurnal when weather is cool and when they are not subject to other disturbances (Zeiner *et al.* 1990).

Seasonal Movements/Migration

The wild pig is non-migratory (Zeiner *et al.* 1990).

Home Range

In Tehama County, home ranges of males averaged about 52 km² (20 mi²), and of females averaged about 13 km² (5 mi²) (Pine and Gerdes 1973; Barrett 1978). Densities of 5-8 pigs per km² (14-20 per mi²) were reported in Tehama County; about 0.5-0.8 per km² (1.3-2.1/mi²) in Monterey County; and 29-39 per km² (75-100/mi²) in the southeastern United States (Zeiner *et al.* 1990).

Territory

In Tehama County, Barrett (1978) reported that groups or "sounders" were formed by a sow and 1-3 generations of offspring. Barrett (1978) noted that boars usually were solitary except to breed or feed on a clumped food resource (Zeiner *et al.* 1990).

Reproduction

The wild pig population has the potential to double every year. Domestic sows have been observed to first breed at 3-13 months of age (Barrett 1978) and may produce two litters of up to 14 piglets per year (Duncan and Lodge 1960; Epstein 1969; Wrathall 1971; Barrett 1978). European wild boar sows generally breed later at approximately 18-21 months of age, and give birth (farrow) once a year with an average litter of 4-6 piglets (Haber 1969). Although farrowing may occur at any time during the year, a majority of the piglets are born in the spring (Barrett and Spitz 1991). Since feral domestic pigs and the European wild boar have interbred, these specific reproductive traits vary.

Under ideal conditions, in the central coast area, wild pigs first breed when 6 or 7 months of age and produce 1-2 litters per year with up to 10 piglets each. Females typically produce one litter per year with a litter size of 4-6 piglets (Nee 1992). The number of offspring declines during times of drought or reduced food supply. When conditions improve, pigs can repopulate an area very quickly. Wild pigs have greater reproductive success in years of large acorn crops. Wild pig reproduction increases significantly when they have access to irrigated pasture and other crops.

Environmental factors (i.e., drought, crop failure, and predation) may cause high piglet mortality, thus reducing the wild pig's reproductive potential and stabilizing the population (CDFG 1992). In California, acorn production is the key determinant of carrying capacity for wild pigs (Barrett 1993).

Disease

Wild pigs carry parasites and diseases that are potentially transmittable to livestock, pets, wildlife, and humans. In California, the following parasites and diseases have been isolated in wild pig: trichinella, brucellosis, Q fever, pseudorabies, leptospirosis, avian tuberculosis, toxoplasmosis, and plague (Clark *et al.* 1983; Drew *et al.* 1992).

In the central coast, brucellosis, trichinosis, and leptospirosis are three pig diseases of special public health concern. The brucellosis bacterium affecting pigs also occurs in other domestic animals and man. The disease is spread mainly by animal-to-animal contact and is spread to humans by contact with the blood of infected animals. Trichinosis is a parasitic disease normally transmitted to humans through the consumption of infected, insufficiently cooked meat. The presence of trichinosis appears to be low in central coast wild pigs. Leptospirosis is a bacterial disease of pigs transmitted to nearby wild animals when pigs urinate in their wallows and then other animals drink from those basins (Nee 1992). See Clark *et al.* (1983) and Drew *et al.* (1992) for more information about zoonotic diseases in wild pigs in California.

WILD PIG BEHAVIOR

Rooting

Rooting by pigs in moist or irrigated soil is normally quite visible. Sometimes only a few small sites are rooted, or the disturbed area may cover several hundred square feet or more. Rooted fields look like they have been rototilled. Rooting can harm pasture, crops, and native plants, and may cause soil erosion. Pig rooting can alter the relative abundance of different plant species at the site, and can change the functioning of natural ecosystems. Damaged grasslands usually revegetate in 1-2 years, but sometimes with less desirable plants (e.g., thistles) (Nee 1992).

Wallowing

Wild pigs have no sweat glands, so they cool themselves by digging bowl-like depressions in marshes and riparian areas, and then rolling in the water and mud.

Tusking and Rubbing of Trees

Wild pigs often "tusk" the lower 3 feet of tree trunks near wallows with their large canine teeth and then rub their mud-caked shoulders on the tusked area. Tusking has damaged knob-cone pine trees. Douglas fir and willow trees are sometimes tusked. Probably any tree near a wallow is subject to tusking. Repeated tusking can girdle the tree. The purpose of tusking and rubbing by pigs is unknown, but may be an attempt to coat their shoulders with armoring pine pitch, control ectoparasites, or may act as a territorial marker (Nee 1992).

Public Safety

Normally, people need not worry about being attacked by wild pigs. Since pigs are usually nocturnal, people seldom see them. Also, when wild pigs are encountered in open terrain, the pigs generally flee. Wild pigs have a keen sense of smell, but poor eyesight. A pig's attempt to escape from a human intruder may be misinterpreted as a "charge." However, a severely injured pig or one startled by the sudden appearance of a human, may attack to defend itself.

People on horseback should be extra cautious around wild pigs because the horse may be frightened, possibly throwing the rider (Nee 1992).

IMPACT OF WILD PIGS ON NATURAL ECOSYSTEMS

Impact on Native Vegetation and Wildlife

Few scientific studies have documented the effects of wild pigs on their habitat or native flora and fauna.

Concern has been expressed by the California Native Plant Society (CNPS) that pigs may be adversely impacting populations of native plants, in particular bulbs which did not evolve with intensive pressure from rooting. The rare Calypso orchid (*Calypso bulbosa*) in Marin County is one such species which has been severely impacted. Other major concerns to the CNPS are impacts from pigs wallowing and rooting in fragile wet meadows and wetlands, poor recruitment of oak saplings possibly due to consumption of acorns and trampling by pigs, possible negative impacts to native grasses, girdling of pine trees by tusking of pigs, and impacts to complex ecosystem linkages from predation by pigs on native fauna (Chipping 1993).

Vegetation plots were established in Almaden County Park in 1987, and revisited in 1988 to compare rooted vs. unrooted areas over one growing season (Schauss 1988). Several trends in the short-term recovery of rooted plots were observed: 1) less cover by grasses in the rooted plots than in the unrooted plots; 2) higher forb coverage in the rooted plots; 3) percent of bare ground was higher in the rooted plots; 4) coverage of exotic forb species was higher in the rooted plots (conversely, percent of native forb species were highest in unrooted plots); and 5) coverage by exotic forb species was greater than native forb species in both rooted and unrooted plots.

In 1992 a vegetation study was also conducted at Calaveras Reservoir (Schauss and Correlli 1992). Most of the same observations were noted after one year at Calaveras as were made at Almaden County Park, with the most notable difference being that the percent of native forbs was higher in rooted plots. However, the dominant native forb found on these rooted plots was a species of doveweed (*Eremocarpus* sp.) which is associated with disturbed areas.

In years of acorn shortage, when competition is most likely to occur, wild pigs may compete with wild turkeys, mule deer, squirrels, and black bears. Destruction by pigs of native vegetation and nests of ground-nesting birds by pigs may also be a serious problem (Wood and Barrett 1979).

Soil Erosion

Erosion plots set up in the Calaveras Reservoir study (Schauss and Corelli 1992) compared rooted and unrooted areas. On a steep, sandy site, the amount of sediment collected below the

rooted plot was significantly higher (10 times) than the unrooted plots. On a gentler slope with clay soils, the amount of sediment from the rotted plot was about three times as high, compared to the unrooted, but the difference was not statistically significant (Schauss 1994).

CONTROLLING PIG DAMAGE

Pig control measures are most effective if intensively applied when the animals are under stress (e.g., during a drought, in the late fall or winter after a poor acorn crop when other foods are unlimited, or when pig numbers are already reduced by heavy hunting).

Sport Hunting

Recreational hunting is the primary method recommended by the CDFG for controlling wild pig populations and associated damage. This control method utilizes licensed hunters who are allowed to kill and keep one pig per day year-round in most areas of the state. Sport hunting with dogs is the most effective hunting method. Population models predict that in normal years at least 70% of a wild pig population must be cropped annually to result in a stable population for the following year (Nee 1992).

Fencing

For areas a few acres in size, fencing can often solve wild pig problems most economically by excluding the pigs. Regular inspection and maintenance of the fence is essential to its continued effectiveness. To fully protect larger areas, landowners should first build exclusionary fencing and then, by legal means, eradicate the pigs within the fenced area.

Pig fencing should be about 40 inches high and must be made of heavy wire and strong, deep-set posts. The bottom wire must be firmly anchored to the ground, since wild pigs are adept at going under normally installed fences. One strand of electrically-charged wire can be added to the fence, if placed 1-12 inches above the ground. A barbed-wire top strand is not needed unless cattle use the area. This top strand of barbed wire should be at least 12 inches above the next highest wire in areas frequented by deer. To minimize the environmental impact of the fence, it should have grid openings large enough to pass small mammals (Nee 1992).

Harassment

In rural homesite areas frequented by wild pigs, keeping a pet dog outside on the property at night can usually discourage pig use. This technique is impractical when large areas need protection.

Repellants/Toxicants

There are presently no repellants or toxicants registered in the U.S. for controlling wild pigs.

Trapping and Shooting

Intensive trapping and shooting of pigs can be an effective control measure. Pigs are attracted to the traps with bait. Trapping may be less effective during the fall and winter when acorns and other foods are readily available, or when pig numbers are low (which requires more intensive trapping effort).

WILD PIG CONTROL PERMITS

The CDFG can approve one of three types of animal control permits to reduce damage from wild pigs.

Depredation Permit

Upon verification of pig damage, a local CDFG warden can issue a Depredation Permit to a property owner to take a specified number of depredating animals during a specified time period by prescribed means. The intention is to allow the property owner to eliminate the offending animals. Among the possible methods of take are night shooting by spotlight, as well as live trapping with in-trap humane dispatch.

Under a Depredation Permit, if the animal taken is in good condition, the permit holder must field dress the pig carcass and arrange for transportation of the animal to a charitable institution approved by CDFG. The permittee is not required to take the field-dressed carcass to the charitable organization. Wanton waste of game meat is prohibited by Fish and Game Commission regulations. However, in special circumstances (e.g., remoteness of the carcass from vehicle access or an obviously diseased animal), the game warden can authorize the permittee to leave the carcass in the field.

A portable cage trap with a drop door has been used effectively on pigs and can be moved fairly easily from place to place. Grain such as corn or barley is a good bait. Wild pigs can only be legally live-trapped by authorization of the CDFG, after a Depredation Permit is obtained.

Damage Relief Tags

Where a property owner is willing, a CDFG warden can issue a Depredation Permit with Damage Relief Tags. A landowner issued damage relief tags selects licensed hunters to enter the damaged property during legal hunting hours to take two pigs per day (double the daily bag limit). These hunters can keep the pig carcasses for their own use.

Special Wild Pig Sport Hunt

The third alternative authorized by the 1992 law allows the Fish and Game Commission, with landowner consent, to declare a special wild pig sport hunt on lands severely damaged by pigs. CDFG issues to hunters as many pig hunting permits as are needed to stop the damage.

MEMORANDA OF UNDERSTANDING

Several agencies and organizations have negotiated Memoranda of Understanding (MOU) with the CDFG for the implementation of wild pig control programs on public lands. There is a statewide MOU between the California Department of Parks and Recreation (CDPR) and CDFG regarding the procedures to be followed in removing wild pigs from state park property.

CONTROL EFFORTS ON PUBLIC LANDS

Annadel State Park, Jack London State Historic Park, Sugarloaf Ridge State Park, CDPR, Silverado District, Sonoma County

During 1985 in Sonoma County, at Annadel State Park and Jack London State Historic Park, a pig control program was initiated with studies conducted by University of California (UC) Berkeley Professor Dr. Reginal Barrett. Dr. Barrett evaluated the pig populations, their habits, and recommended eradication techniques. Control activities were focused on Annadel. Seven miles of pig proof fencing were installed along the Annadel boundary. Hunting and trapping conducted over 3 years completely removed the animals from the park by 1988. No sign was observed within the park until summer 1993. Five pigs were taken from the park in August 1993. The park is routinely checked for additional pig activity.

Also during summer 1993, a District-wide MOU for a wild pig control program was negotiated between the CDPR and CDFG, and detailed pig removal programs were developed for Jack London and Sugarloaf Ridge State Park. This work was pursued in both of these locations due to a dramatic increase in pig-related damage, especially at Jack London. Total pig removal has not been the goal in these parks, but a reduction in damage is sought until fencing and cooperative liaisons with adjacent landowners can be developed. Sixty-eight pigs were taken from these two locations between August and December, 1993, and a substantial reduction in pig sign is obvious.

One and a half miles of pig fencing is currently being installed at Jack London State Park. A funding request for an additional 4 miles of fencing has been submitted. It is anticipated that, once the fencing is complete, a continued hunting presence will be required until no pig activity remains.

Sugarloaf Ridge State Park presents additional pig control problems. The topography and vegetation complexes preclude fencing. Since fencing is not possible, a cooperative liaison will be developed between adjacent landowners to reduce the pigs and pig damage. Recurrent hunting efforts will keep the populations at a level where damage is limited.

Traditionally, contracting has been the most effective means of trapping and hunting the pigs on CDPR lands. During 1993, a State park employee was hired to accomplish the hunting because the program is anticipated to be long-term, with continued hunting required in all three parks. This relationship is anticipated to continue indefinitely (Hastings 1994).

Pepperwood Ranch Natural Preserve, California Academy of Sciences, Sonoma County

A four-year feral pig population control program was conducted at the California Academy of Sciences, Pepperwood Ranch Natural Preserve. Pepperwood is a 3,117-acre preserve located northeast of Santa Rosa in Sonoma County. Between 1988 and 1992, 211 pigs were removed from the preserve, some during each month of the year. The stomach contents of 99 of these animals was examined. These included animals of both sexes and all age classes. Diet was composed of roughly 45% acorns (*Quercus* spp.), 40% grasses (*Poaceae* spp.), and 15% manzanita (*Arctostaphylos* spp.) berries. Minor components included lily bulbs (*Liliaceae* spp.), (14% of stomachs), earthworms (5% of stomachs), and centipedes (5% of stomachs). One alligator lizard (*Gerrhontus multicarinatus*) and one ringneck snake (*Diadophis punctatus*) were found. No evidence of ground-nesting birds or their eggs was encountered (DeNevers 1993).

Santa Cruz Island Preserve, The Nature Conservancy

Santa Cruz Island, the largest of the California Channel Islands, is now a Nature Conservancy Preserve. Over 600 species of plants in 10 different plant communities inhabit this island; eight of the species are endemic to Santa Cruz Island. For more than 100 years, this island was a cattle ranch with feral populations of sheep, pigs and goats, all of which altered the native vegetation patterns. Wild pigs still inhabit the island; they compete with native mammal and bird species for limited food resources, and their habit of rooting impacts native plants. One of these impacts is believed to be the destruction of the seedlings of woody species under the coast live oak canopy by eating the acorns and trampling of fragile young shoots of woody species including coast live oak (*Quercus agrifolia*), either by direct predation (upon the acorns of oak species), or by trampling of fragile young shoots of woody species such as island cherry (*Prunus ilicifolia* s. *lyonii*), sugar bush (*Rhus ovata*), lemonade berry (*Rhus integrifolia*), and toyon (*Heteromeles arbutifolia*).

Pairs of plots were established in 1989 to monitor the impact of pigs on seedlings of woody species. One plot in each pair was fenced to exclude pigs, the other allowed pig access. As of March 1992, 210 seedlings were counted in the plots where pigs were excluded, compared to only 119 in the plots where pigs had free access. By March 1993, this trend was even more pronounced, with the plots excluded from pigs having 222 seedlings, whereas the plots where pigs had access there were only 38 seedlings (Peart 1993).

Removal of pigs from Santa Cruz Island began in 1989. As of October 1990, a total of 1,421 pigs had been removed from a 5,557-acre enclosure. The methods used included trapping and shooting, and ground hunting. Population estimates using a helicopter survey were 907 before the eradication program began, and 158 after trapping (October 1990). These estimates were compared to numbers derived from population reconstruction using the age estimation of removed pigs, which predicted actual pig numbers at the time of each helicopter census to be 1,379 and 174, respectively (Sterner 1993).

Pinnacles National Monument, San Benito and Monterey Counties

Pinnacles National Monument was formed in 1907. The majority of the park is situated in San Benito County, with a small corner on the southwest side extending into Monterey County.

One of the policies of the park is to maintain the native biota. Wild pigs are considered an exotic species, and their impacts on other native species are undesirable. One of the goals stated in the resource management plan for the park is to install fencing around the park to exclude pigs and cattle. As of August 1994, 14 miles of fencing have been installed. There are some areas that are too steep to effectively fence, including the eastern side and Cherry Canyon on the south end of the park. There is also an unfenced portion of the park along the southern border where it abuts a Bureau of Land Management wilderness study area.

The short-term objective of pig management in the park is keeping them out of the riparian areas along Bear Gulch and Chalone Creek. In particular, the park is concerned about negative effects the pigs in these riparian areas may have on the California red-legged frog, a species proposed for federal listing as endangered. The existing fence has essentially trapped pigs in these areas and they are causing extensive damage to the riparian zones. In 1994, the park obtained a Standard Operating Permit allowing them to shoot the pigs. This is done on an informal basis, as the opportunity arises when pig sightings are reported and hikers are not present in the area. The carcasses are put in areas remote from public use and left for scavengers.

Eventually, when enough perimeter fencing has been installed, the park will pursue a formal pig management plan. It is anticipated that this will include hiring a contractor to eradicate pigs from the park.

East Bay Regional Park District (EBRPD) Lands, Alameda and Contra Costa Counties

The EBRPD manages over 75,000 acres of open space in Alameda and Contra Costa counties. These areas are used for recreational parks and wilderness preserves. Wild pig populations in some of these parklands have been increasing since 1986, and pig rooting has caused damage to the habitat and native plants and animals.

EBRPD has surveyed its parklands to document pig populations and damaged areas since 1987. An estimate of the number of pigs in each parkland as of January 1993 (EBRPD 1993) found the largest number of pigs occurred in Sunol Regional Park (40 pigs), Ohlone Regional Wilder-

ness (60-80 pigs), and Mission Peak Regional Park (20 pigs). Populations of between 10 and 15 pigs also were found in Morgan Territory Preserve/Round Valley Regional Park, Diablo Foothills/Castle Rock, Black Diamond Mines Preserve, Las Trampas Regional Wilderness, and Bionas Regional Park.

Potential damage attributed to pig rooting which has been identified in EBRPD parklands includes exaggerated erosion, direct loss of native plant and animal life, invasion of disturbed areas by weedy or noxious plants, and direct competition with native herbivores for food resources. Pigs may be a particular threat to several listed and rare amphibians, ground nesting birds and rodents that occur in the parklands, such as the California red-legged frog, burrowing owl, and Berkeley kangaroo rat. Pigs may also threaten several rare and listed plants that occur in the parklands, such as Mt. Diablo fairy-lantern (*Calochortus pulchellus*), Santa Clara thorn-mint (*Acanthomintha lanceolata*), and Santa Clara Valley dudleya (*Dudleya setchellii*) (EBRPD 1993).

In June 1993, EBRPD completed their Wild Pig Management Plan. The goal of this plan is to minimize pig populations and their associated damage in all parklands managed by the District. Specifically, the EBRPD plans to reduce pig populations by 70-80%, and where feasible, 100% eradication is the goal. EBRPD entered into an MOU with CDFG in September 1993 to remove pigs from parklands. A professional pig hunter was contracted to carry out the pig removal. Methods currently being used to remove pigs are trapping and shooting, shooting under spotlight at night, hunting using dogs, and ground hunting. During the period October 1993 to March 1, 1994, 77 wild pigs were removed from Sunol Regional Park (Escovar 1994).

To achieve 100% eradication will involve installing pig-proof fencing. This is a long-term goal, and placement of fencing will be decided based upon the success of the trapping and removal program.

Marin Municipal Water District Watershed Lands, Marin County

A study of the feral pig population and their impacts was conducted in southern Marin County by Leonard Charles & Associates (LCA 1987). The areas studied included lands owned by the Marin Municipal Water District (MMWD), the Marin County Open Space District (MCOSD), and Audubon Canyon Ranch (ACR). Other undeveloped lands in southern Marin that were studied to determine range and population of pigs included Muir Woods National Monument, Golden Gate National Recreation Area (GGNRA), Mt. Tamalpais State Park, and some private properties. These areas total approximately 100 square miles of undeveloped lands.

Based on observations by hunters and other trained professionals, the pigs inhabiting the southern Marin County area are not wild pigs, but rather feral pigs. They were introduced to the area sometime between 1975 and 1978. This population rapidly expanded, and was estimated to consist of 50-250 individuals by 1984. The public agencies which own and manage the lands felt that pig rooting was causing significant environmental problems, including impacts to native vegetation, sedimentation of waterways, destruction of certain amphibians and reptiles, and spread of exotic plants. To control damage from pigs, several agencies began a trapping

and hunting program. Between 1983 and 1987, 65 pigs were eliminated from MMWD lands. Between 1985 and 1987, 40 pigs were eliminated from GGNRA properties, and ten from ACR. The long-term goal was to build 28 miles of pig-proof fencing. After consideration of the large cost this would entail, in 1986 the agencies contracted to have the pig population and extent of rooted areas studied in more detail.

The results of the 1986-87 study (LCA 1987) showed that the pigs primarily inhabit a central core area which extends in a crescent shape from Bolinas Ridge to Lake Lagunitas. The population peaked between 1983-85, and has since declined. Recent rooting in the area south of Mt. Tamalpais indicated that pigs may be moving out of the central core area, perhaps to escape hunting pressure. As of 1987, pig populations to the north of the study area were minimal, indicating that pigs were not yet moving in that direction. It was estimated that the peak population in the study area in 1984-85 was between 40 and 87 pigs, and the 1986-87 population was 25-35 pigs. The study concluded that the current trapping and hunting program was maintaining a stable population.

As another part of the 1986-87 research, a study was implemented to determine if rooting increased sedimentation. Preliminary results showed that two to three times more sediment was eroded from rooted vs. unrooted plots and that sediment yield was greater from rooted plots for coarse sediments. This study also showed that rooted plots had greater soil infiltration, probably due to the opening of soil structure by rooting and consequent increased porosity. Although the overall erosion of rooted plots was increased, it was estimated that the amount of rooting which occurred in 1986-87 was not enough to cause substantial sedimentation of reservoirs or major tributaries.

The 1986-87 study also included research on effects of rooting on vegetation cover and abundance of certain species. Preliminary results showed that the percent of groundcover present after rooting depended on type of cover present. Short-term impacts were most significant on plots dominated by forbs and grasses, where after one year the control plots had 91-100% cover and the rooted plots had only 7-22% cover. There were little effects on vegetative cover in the plots located in redwood bog and in those where litter was the predominant cover. There was an increase of 6-20% in exotic species on rooted plots. Also, the rooted plots showed at least a short-term increase in the number of species.

From analysis of the habitat in the study area it was determined that between 1,000-3,000 pigs could be supported; however, as noted earlier, current numbers are well below this. GGNRA began fencing over 2,000 acres in 1986. The fenced area will include all of ACR, effectively removing it from future susceptibility to damage by pigs. As of 1987, there were no reports of feral pigs on any of the MCOSD preserves. It was recommended that the preserves with the best pig habitat be monitored in the future to determine pig presence, and that a plan be prepared to manage pigs in the event that they do invade the preserves. For MMWD lands it was recommended that the cost of the trapping/hunting program be compared to the cost of fencing the property, and for the short-term that trapping and hunting continue in order to maintain the pig population at current levels.

The MMWD lands were again surveyed in 1988 for signs of pig rooting (LCA 1988). Rooting was found in only one area, and after a pig was shot in that area in March 1988, no new activity was seen. At GGNRA, in winter and spring of 1987-88, four pigs were shot and possibly three more killed by hunting dogs. The construction of fencing was continuing at GGNRA. The 1988 study also reported an increase in pig activity to the north of the study area, indicating that pigs may be moving in that direction to avoid hunting pressures. The vegetation plots established in 1986 and 1987 were again surveyed in 1988. There was no significant amount of revegetation shown on these plots since 1987 and this was partially attributed to low rainfall during the winter of 1987-88. Also, the number of species was less in the plots in 1988 than in 1987.

East Bay Municipal Utility District (EBMUD) Lands, Alameda, Amador, Calaveras, and Contra Costa Counties

EBMUD manages the Briones, San Pablo, Upper San Leandro and Pardee Reservoir watersheds. Sightings of wild pigs at Briones and Upper San Leandro reservoirs have been reported since 1986, and with increasing frequency in recent years. In the summer of 1990, surveys at Pardee Lake found that the number of pigs was insufficient to warrant the expense of an eradication program. In December 1992, Multiple Use Managers (MUM) surveyed Briones and Upper San Leandro watersheds. They found a large area (one acre) on the north shoreline near the Bear Creek Staging Area that had extensive pig rooting. It was estimated that the population could be from 10-25 pigs. At Upper San Leandro watershed there were several areas of pig rooting seen, including one area encompassing over five acres surrounding Rifle Range Road (MUM 1993). It was estimated that the total number of pigs on the two watersheds was 50-60 and a removal program was recommended.

In January 1993, EBMUD obtained a depredation permit and entered a contract to remove the pigs at Briones and Upper San Leandro watersheds. A total of 29 pigs were trapped and shot over a six-month period (MUM 1994a). In December 1993, the Briones, Upper San Leandro, and Lake Pardee watersheds were again surveyed to assess pig damage. At Briones Reservoir, there was extensive damage from pig rooting, including large sections of cattail and bulrush. It was estimated that the pig population at Briones had increased over the past year despite trapping efforts. At Upper San Leandro Reservoir, it was estimated that the number of pigs was similar to the previous year. At Pardee Reservoir there is a pig herd of approximately 30 individuals using the area (MUM 1994b).

EBMUD currently has an MOU with CDFG (dated 7/15/94) for conducting removal of pigs from their property surrounding Briones, San Pablo, Upper San Leandro and Pardee Reservoirs.

State Parks of Santa Cruz County including Forest of Nisene Marks, Wilder Ranch, and Big Basin Redwoods

CDPR has a policy that encourages removal and prevention of exotic species in state parks. The wild pig is an exotic species and potentially causes damage to native species. In order to assess the impacts from wild pigs, CDPR hired biologists from the UC Berkeley in 1988 to survey state

parks. In Santa Cruz County, these researchers established monitoring sites in The Forest of Nisene Marks, Wilder Ranch and Big Basin Redwoods State Parks (UC Berkeley, unpubl. data). It was determined by C DPR that no pigs occurred in or threatened Henry Cowell Redwoods or Castle Rock State Parks, so these were not included in the survey. In 1990, these sites were surveyed again and results were compared to those of 1988 (Agricultural Commissioner of Santa Cruz County 1990). It should be noted that the 1990 survey occurred during the fourth year of a drought, which may have substantially impacted pig populations. Recommendations on pig management strategies were made. These data are summarized here by park. Information contained in these summaries are from the 1988 draft report by UC Berkeley and the 1990 Agricultural Commissioner report.

The Forest of Nisene Marks. Pigs were first confirmed as occurring in The Forest of Nisene Marks State Park between 1975-78. The first estimate of number of pigs was 17-75 in 1986. By 1988 the pig population had expanded to an estimated 8-15 groups with a total number of up to 130 individuals. The 1990 survey did not estimate the number of pigs, but suggested that the pigs which are concentrated in the core of the park are year-round residents, with other pigs moving into and out of the park. In 1988, 74% of the monitoring sites in Nisene Marks showed pig damage, compared to 50% of the sites surveyed in 1990.

The recommendations for managing the wild pig population in Nisene Marks included devising a coordinated plan with neighboring properties, fencing approximately 2.5 miles of sensitive natural habitat to exclude pigs, and removal of pigs by trapping and shooting. Night-time shooting using spotlights was also recommended as an efficient method of removing pigs from areas difficult to access with traps.

Wilder Ranch. Wild pigs arrived at the southern end of Wilder Ranch in 1980-81, and possibly earlier in the northern end. No estimates of the historical pig numbers are available, but the 1988 survey estimated 10-30 pigs use the park. Sightings are very rare. The 1990 survey did not estimate pig numbers, but concluded that pigs do not live permanently in the park. The 62% of monitoring sites which showed pig damage in 1988 had dropped to only 21% of sites in 1990.

Pig management methods recommended for Wilder Ranch included fencing 4.2 miles of the northern park boundary to exclude pigs, future consideration of pig use before acquiring more land for the park (i.e., Cave Gulch), and restoring the severely rooted site at the top of the Sandy Flat Gulch watershed (site "T") with native perennial grasses. Since pigs do not live year-round in the park, trapping and shooting was not recommended in the 1990 study. However, if pigs do begin living permanently or spending more time in the park, this method may become an effective way to control pig populations.

Big Basin Redwoods. The first confirmed occurrence of pigs within Big Basin Redwoods State Park was in 1987 in the valley of lower Waddell Creek near the park office. However, pigs have occurred on surrounding properties since as early as 1983. The 1987 sighting consisted of three pigs. The 1988 survey found only one area of the park damaged by pigs (4% of the monitoring sites), located along the ridge between Blooms Creek in Big Basin and Scott Creek

in Little Basin State Park. It was thought that the pigs using this area were transients from the resident winter population of up to 40 individuals from Little Basin. No recent sign of pig damage was seen during the 1990 surveys.

Recommendations for pig management at Big Basin Redwoods State Park included developing a coordinated plan with surrounding properties, fencing six miles of the park boundary with the Scott Creek and upper Blooms Creek watersheds, and considering the effect pigs may have before acquiring any new land for the park. In addition, it was suggested that trapping and shooting be considered for Little Basin to prevent pigs from moving into Big Basin.

To date, none of these recommended actions have been implemented in the State Parks in Santa Cruz County.

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Appendix P
WILDFIRE FACTORS AND CONTROL

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1. Wildfire History

In the course of the preparation of this wildfire section, the wildfire specialist contacted the California Department of Forestry and Fire Protection (CDF) station in Smith Creek adjacent to Grant County Park as well as CDF stations in Sunol and Morgan Hill. The Smith Creek station does not collect fire data nor map fire occurrences. As a result, official histories of wildfire on either Grant or Levin County parks is anecdotal, and park personnel are the single best source of fire history on the two parks.

The Grant County Park staff cannot recollect the incidence of a wildfire in the park for at least the last 10 years (Ed Tanaka, personal communication, March 15, 1994). Staff at the Smith Creek Station recall one fire of one to two acres at the intersection of Mt. Hamilton and Quimby roads in about 1989, which is the largest fire in their recollection in ten years (Captain Rodgers, personal communication, July 21, 1994). However, in the past it had been relatively common to burn habitat around Grant Lake and Halls Valley in an attempt to improve wildfowl habitat, and two or three burns of this type were conducted around Grant Lake and Halls Valley as recently as the early 1980s.

According to the staff at the Milpitas Fire Department, there are usually one to two grass fires a year at Levin County Park (Weisgerber, personal communications, June 28, 1994). According to their recollection, some fires start west of and outside of the park and burn into it. Staff at the Sunol CDF also recall a few fires to which they responded (Martin, personal communication, July 21, 1994). Staff at both Milpitas Fire Department and the Sunol CDF recalled one fire that started on private property near the golf course west of the park and burned into the park.

2. Access and Circulation

a. Grant County Park. The Grant County Park fire suppression plan notes that, should a wildfire occur, park users are to stay in the park. If they must evacuate the park, they are to travel west on Mt. Hamilton or Quimby roads. They are not to travel east.

The trail system within the park provides adequate though not ideal access for fire suppression, and limited egress in the event of the need for evacuation. All trails are steep or have steep segments, and many are winding. The width and maintenance of the trail system is generally adequate, with few cuts caused by erosion. The dirt surface is generally adequate, although the roads may become impassable during periods of heavy rain. Access for fire during times of rain is not likely to be an issue in terms of access to fight fire, but may be an issue in terms of access to other emergencies such as hiking injuries or landslides.

Assuming that Mt. Hamilton or Quimby roads are not passable, a number of the park's trails lead out of the park and can provide some level of egress if evacuation is necessary. Two trails lead north out of the park and two trails lead south. Of the two that lead south, the westernmost trail that passes Panochita Hill would be the preferred emergency access in most cases. It eventually connects with Yerba Buena Road, which gives access west to the Santa Clara Valley. Aside from Mt. Hamilton Road, there are no trails that cross Smith Creek and provide access to the east, and the steepness of the Smith Creek drainage makes such a route infeasible in any event. There are no trails that provide clear and direct access down the western ridge to the floor of Santa Clara Valley, and steepness there is an issue as well.

b. Levin County Park. There are few trails that provide access from Levin County Park in case of the need for evacuation. One upper trail connects with the East Bay Regional Park District's Mission Peak and Monument Peak Regional Preserves adjoining the northern border of the park. A lower trail, the Agua Caliente Trail, connects the lower portion of the park to Mission Peak Regional Preserve. Another trail leads from the Summit Point Golf Course to the Sandy Wool Lake field and to Downing Road. A private paved road, formerly Weller Road, provides access to the back of Monument Peak from Calaveras Road just outside of the park. This private road is gated about one-quarter mile north of Calaveras Road, but it is keyed to allow emergency access.

3. Resources at Risk

a. Grant County Park. Natural resources inside Grant County Park that may be at risk from wildfire include oaks that might succumb to an intense fire or ponds that might be inundated with erosion sediment that would likely follow a wildfire. Generally, the park's natural resources are well adapted to fire, but there is some concern that oak stands such as black oak and valley oak might not regenerate adequately following a fire.

Park improvements at risk from wildfire include the park facilities, the historic structures, and fences. With the exception of fences, these resources are mostly on the Halls Valley floor. The stable, however, is at the toe of the western slope of Halls Valley, in an area with heavy fuel loads.

There is some concern that a fire might cross the park boundaries and damage resources outside of the park. Houses are generally the most valued resource at risk from wildfire. There are few houses east of the park, but there are a number of houses west of the park along Quimby and Mt. Hamilton roads that might be at some risk from wildfire. The private inholding northwest of Grant Lake might also be at some minor risk from fire.

b. Levin County Park. The natural resource most at risk from wildfire in Levin County Park is the riparian vegetation along the two creeks, although major damage is unlikely because of the lack of an understory that might otherwise fuel a fire intense enough to damage the trees. Trees weakened from other environmental stresses such as trampling, soil undercutting or drought might be more prone to damage from fire.

The park facilities at risk from wildfire within Levin County Park are the improvements surrounding the Minnis Ranch, the foreman and lessee residences, and the barns and other outbuildings. Fences are at risk as well. Monument Peak Trail would not be damaged from a wildfire, but could suffer from erosion following a fire if adequate erosion mitigation measures were not installed.

Residences west of Levin County Park could be threatened from a wildfire in the park. The golf course that lies between the park and these houses minimizes the threat from a surface fire, but it might not stop a fire spread by embers. Grass, however, is not particularly conducive to production of embers that travel any great distances. South of the park, homes on Vista Ridge are vulnerable to grass fires, especially if grasses in the park carry the fire to the heavier fuels southwest of Calaveras and Downing roads.

4. Climate

General climate information is included earlier in this report. Nearby weather sources do not keep the kind of information needed to analyze the potential for wildfire. For the type of historical weather information needed for wildfire analysis, the Morgan Hill CDF station has the best data relative to Grant and Levin County parks. It is very removed from the two parks, however. Temperature, humidity and wind speed were recorded at the station at 2:00 in the afternoon during fire season for the years 1980 to 1991. The highest temperature recorded at the station was 108 degrees, on July 17, 1988. The minimum relative humidity was 8 percent, which is extremely dry (kiln-dried wood normally has a moisture content of 12 percent). The highest wind speed was 29 miles per hour. It is likely that winds could attain much higher speeds on Levin County Park and on the exposed ridges of Grant County Park, but there are no records to verify this assumption.

While the wind in the area of the parks generally blows from the west, the most severe fire weather occurs when there are strong north or northeast winds. Under these conditions, which are common in the fall, humidities may drop and temperatures may soar. Winds are quite consistent at a regional scale: winds in the Bay Area generally blow from the west in the summer and the south-west in the winter. Local wind patterns, however, are determined by local geographic features. Diurnal shifts in local wind direction occur along the coast where day-time off-shore breezes shift to off-land breezes at night. A similar pattern occurs in mountainous regions where rising, sun-heated air generates an upslope breeze during the day, and night-cooled air slides downslope at night. Such terrain-controlled winds are more prominent under clear skies and low humidity, and they can profoundly affect the rate and direction in which a fire burns.

Local wind is perhaps the most variable and therefore the most difficult wildfire factor to predict, and wind direction and velocity profoundly affect a fire's behavior. Surface winds (within 20 feet of the ground) affect fire intensity by acting to supply oxygen to flames. Surface wind increases the flammability of fuels by removing moisture through evaporation and by angling the flames so that they heat the fuels in the fire's path. The direction and velocity of surface winds can also control the direction and rate at which a fire spreads. Upper winds (20 feet or more above the ground) can carry embers and firebrands, causing spot fires to precede the primary front. In closed canyons and narrow valleys, these upper winds can facilitate the development of convection columns, which dry the surrounding fuels and carry firebrands to unburned areas. Gusty winds cause a fire to burn erratically, making it more difficult to contain.

5. Topography

Like weather, topography strongly influences fire behavior. Steep terrain generally limits response time because roads and trails, if they exist, tend to be steep, winding and narrow. Steep terrain also constrains response time because it is difficult to traverse and to move equipment or water over.

The rate of a fire's spread is most sensitive to steepness of slope; fire on a 30 percent slope spreads six times faster than fire on a level area. Slope also greatly affects the type and extent of erosion potential following a fire. In addition, slope is generally related to soil depth, and thus productivity and generation of fuels.

Slope aspect influences microclimate, since orientation in relation to the sun produces varying lengths of exposure to the sun, and thus differences in the moisture content of vegetation.

a. Grant County Park. The ridgelines in Grant County Park generally run northwest to southeast. This is perpendicular to the strong northeast winds typical of severe fire weather, and acts to produce optimum burning conditions. This northwest to southeast ridge alignment also helps block moist winds that generally come from the west or southwest.

Much of the park has a western exposure, which is a hotter, drier microclimate more conducive to ignitions and rapid spread of fire. The east-facing slopes west of Halls Valley receive afternoon shade and more temperate conditions late in the day, and thus generally have less extreme burning conditions.

b. Levin County Park. From a wildfire perspective, the topography of Levin County Park is generally uniform. Few areas are protected from wind or are deep enough to funnel or bend winds.

6. Vegetation as Fuel for Wildland Fires

Fuel types can be reasonably delineated by grouping plant communities by common fuel models. Fuel models characterize vegetation as tall and short grass, tall and short chaparral, or trees with and without an understory. They also characterize the spatial distribution of vegetation, and spatial distribution is as important in influencing fire behavior as the species of plants. In determining the appropriate fuel model to apply to an area, it is critical to consider the fuel that will actually carry the fire. For example, an oak savanna that has a grass understory may be characterized as a grassland fuel model, as

the oaks within the savannas may not contribute much to fire behavior because they are too large to ignite easily, and the height at which branches start is generally too high to be involved in the fire.

The USDA Forest Service defines a standard set of fuel models that it uses as the basis of its fire behavior prediction system. They are useful in describing fuel models in the parks. The vegetation on the two parks can be typified by five fuel models: (1) grassland, (2) oak woodland, (3) mixed oak/foothill pine woodland, (4) California bay laurel/coast live oak woodland, and (5) shrubland. While Grant County Park has all five of these fuel types, Levin County Park has grassland and California bay laurel/coast live oak woodland fuel types.

The distribution of fuel types over the landscape can greatly affect the pattern of burning and potentially the size of the fire. For example, Halls Valley can help slow or even stop the surface spread of a fire. It would not, however, be expected to stop a fire that is spread by lofting embers. In addition, fire that burns from one fuel type to another will change behavior as it moves into the new fuel type, so the alignment, width, size and shape of fuel types is important. A narrow strip of a different fuel would not influence fire behavior as much as a wider, larger patch of fuel.

There are heavier fuels in the southwest portion of Grant Park south of Mt. Hamilton Road and west of Halls Valley, where an understory of poison oak and coyote brush has developed under the oaks. In contrast, the ridgelines that ring the park are grass-covered, which would act to facilitate fire suppression. The grasslands along the western border, especially, show strong indications that they would act to suppress a wildfire. The eastern edge of the park is a mix of mixed oak/foothill pine woodland. This fuel type has sparse patches of vegetation and pockets of more plentiful fuels that could burn fiercely.

Grass has the greatest ignition potential, and this ignition potential is exacerbated by human access and activity. Large portions of the public roads in the two parks are bordered by grass. Roadside ignitions are the cause of 80 percent of fire ignitions in California. The existing and potential campground sites in Grant County Park and the areas immediately adjacent to the recreation facilities in both parks have a low ignition potential because of the surrounding vegetation. Otherwise, areas of high recreational use corresponds with areas with the highest potential for ignitions. Grasses comprise the vegetation under about one-quarter of the powerline rights-of-way in Grant County Park, with woodland vegetation under the remainder. Woodland generally has a lower ignition potential than does grassland, but a

greater potential heat output. Powerlines can cause fires, especially during dry windy conditions. In fact, powerlines caused three of the 13 major fires that burned in Southern California during November of 1993.

a. Grassland Fuel Type. Grassland fuel types include non-native grasslands and oak savannas. This fuel type also includes stubble, grass tundra, and grass-shrub combinations. Very little shrub or timber is present, generally less than one-third in this fuel model.

In grassland fuel types (Forest Service NFFL fuel model #1), fire spread is governed by fine herbaceous fuels that have cured or are nearly cured. Fires move rapidly through cured grass and associated material. Grass has the lowest resistance to control of the fuels, because of its low total heat output per area, but containment is more challenging because of the fast rate of spread. The grassland fuel type normally has under three-quarters of a ton per acre of fine fuel and a fuel bed height of one foot. Fires will go out if moisture is over 12 percent.

(1) Grant County Park. Grassland as a fuel type occupies approximately one-half of the area of Grant County Park, and is found in large, un-fragmented blocks.

(2) Levin County Park. Grassland occupies more than 80 percent of the area of Levin County Park. The park's riparian corridors include the California bay laurel/coast live oak fuel type. With the strong westerly winds so common in the park, fires can be expected to advance quickly up the slope, but with little heat output. The riparian corridors are not expected to play a significant role in fire behavior as they would not stop a fire, nor add to its intensity, although the absence of an understory could slow a fire's spread.

While grass is the most ignitable fuel, potential ignition sources on Levin County Park are few because of the lack of public roads, powerlines, or public vehicular access. The use of the park and trails by hanggliders is a potential ignition source from vehicles or other motorized equipment.

(3) Oak Woodland Fuel Type. This fuel type includes mixed oak, black oak, coast live oak, and valley oak woodlands.

Oak woodlands occur on the canyon slopes, most commonly on the north or east facing slopes. The canopy is usually not closed but allows for the growth of an understory. The branch wood of the oaks provides larger diameter fuels that would promote hotter fires. The canopies of the trees are not expected

to be involved in a fire in most burning conditions. Woodland fuels are found in narrow "fingers", not wide patches.

In oak woodland fuel types (Forest Service NFFL fuel model #9), fires burn in the surface and ground fuels. Ground fuels include quantities of three-inch or greater limbwood. Crowning out, spotting, and torching of individual trees is somewhat frequent in this fuel type, leading to potential fire control difficulties.

(4) Grant County Park. The oak woodland fuel type occupies nearly 2,200 acres or about one-quarter of Grant County Park.

(5) Levin County Park. There is no oak woodland fuel on Levin County Park.

(6) California Bay Laurel/Coast Live Oak Fuel Type. This fuel type includes the California bay laurel/coast live oak woodlands and the riparian and wetland plant communities. This is the most benign fuel type under all but the most severe burning conditions. Little litter or branch material exists on the forest floor and no grass grows under the closed, evergreen canopy. The canopy cover is complete and precludes development of a flammable understory. This fuel type occurs along drainageways, on eastern-facing slopes, and in moister canyon. This fuel type generally occurs in narrow strips in small parcels.

In this fuel type (Forest Service NFFL fuel model #8), slow-burning ground fires with low flame heights are the rule, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. The needle and leaf understory supports fire, but little undergrowth is present in this compact litter layer.

(7) Grant County Park. The California bay laurel/coast live oak fuel type occupies about 860 acres or approximately 10 percent of Grant County Park.

(8) Levin County Park. The California bay laurel/coast live oak fuel type occupies about 191 acres or approximately 15 percent of Levin County Park.

b. Mixed Oak/Foothill Pine Woodland Fuel Type. The mixed oak/foothill pine woodland fuel type has a flammable understory of shrubs comprised mostly of manzanita, with grass and occasional small pines and oaks.

In this fuel type (Forest Service NFFL model #2), fire is spread primarily through the fine herbaceous fuels, either curing or dead. Fires in this fuel type are surface fires where the herbaceous materials contribute to fire intensity. This fuel type may include clumps of litter and dead-down stemwood from the open shrub or timber understory fuels that generate higher intensity fires and may produce firebrands. The fuel bed depth is one foot, and the moisture of extinction is 15 percent. The total fuel loading is four tons per acre, with one-half of it in fine fuels under one-fourth inch in diameter. Foliage is a minor component of the fuels in this fuel type.

(1) Grant County Park. This fuel type occupies about 1,400 acres or approximately 15 percent of Grant County Park.

(2) Levin County Park. This fuel type is not found on Levin County Park.

c. Shrubland Fuel Type. The shrubland fuel type includes both the diablan scrub and the coyote brush/poison oak scrub vegetation types. In this fuel type (Forest Service NFFL model #5), fire is generally carried in the surface fuels that are made up of litter cast by scrub and grasses or forbs in the understory. Fires in this fuel type generally are not very intense because surface fuel loads are light, the shrubs are young with very little dead material and the foliage contains little volatile material. Shrubs are generally not tall, but often have near total coverage of an area. The fuel bed depth is two feet, and the moisture of extinction is 20 percent. The total fuel loading is light, at three and one-half tons per acre. Over one-half of the fuel loading is comprised of live foliage.

(1) Grant County Park. Very little scrub or scrubland occurs in Grant Park, and what is there is usually found in small patches far from access. This fuel type is almost always found between grassland and woodland fuel types.

(2) Levin County Park. There is little of this fuel type on Levin County Park.

7. Fire Suppression Plans

Both Grant and Levin County parks have fire suppression plans that instruct park staff in the event of fire.

a. Grant County Park. Fire protection of the wildlands of Grant County Park is provided by the California Department of Forestry. Structural fire protection is also provided by the California Department of Forestry. CDF will also respond to other emergencies (vehicular accidents, medical emergencies, for example).

The nearest station, Smith Creek CDF Station, is on the southeastern border of the park on Mt. Hamilton Road at Smith Creek. Even so, response times from this station are delayed by the narrowness and crookedness of Mt. Hamilton Road within the park. Firefighting resources generally arrive within 10 minutes. The station is equipped with wildland fire protection engines, and are otherwise equipped to render structural fire protection.

The next nearest fire suppression facility east of the park is the CDF's Sweetwater Station in San Antonio Valley. To the west, the nearest CDF facility is via helicopter. Helicopter 106 is based near the Lexington Reservoir off Highway 17, and will provide initial attack. Back-up firefighting resources will also be provided by the Milpitas Fire Department from the station on Barber Lane, or by the San Jose Fire Department from stations on Alum Rock or McKee roads.

b. Levin County Park. Fire protection for Levin County Park is divided between the Milpitas City Fire Department, the Spring Valley Volunteer Fire Protection District, and the California Department of Forestry. The Milpitas Fire Department protects all lands, structures and facilities on the site within the Milpitas City boundary, which includes the lower portions of the park. The structures in the upper areas of the park are considered in the "threat zone" of the Milpitas Fire Department, which means that the department will make an initial attack (they will be the first responders) to fires that could threaten structures. The Milpitas Fire Department will send two engines (Type 3 engines), a patrol tanker, and a support unit. This firefighting equipment will come from the nearest station on 1263 Yosemite Avenue, and from the next nearest station at 45 Midwick Avenue. The first engine generally arrives within 10 minutes, and the next will arrive shortly thereafter.

The Spring Valley Volunteer Fire Department will respond year-round to wildland fires and structural fires with patrol tankers and a water tender. The equipment is located at 4350 Felter Road, and volunteers respond from a variety of locations.

After initial size-up of a fire, the California Department of Forestry may be called. They would respond either from Smith Creek Ranger Station east of

Grant County Park, or from the Sunol Ranger Station at 11345 Pleasanton Road, Sunol (Bill Weisgerber, personal communication, June 21, 1994).

8. Fire Protection Recommendations

a. Protect Facilities and Structures. Facilities and structures should be protected from wildfire.

(1) Tools. Mow or weed-whip a 30-foot-wide strip around the campground in Grant County Park and around all other recreation areas once each year immediately after the grass cures (mid-April to mid-June). Mow or weed-whip a 30-foot-wide strip around all park structures once each year immediately after the grass cures.

In addition to mowing or weed-whipping around the perimeter of the campground at Grant County Park, remove understory shrubs and prune trees (vista-prune) to a height of 8 to 10 feet for a distance of 100 feet around the perimeter of the campground. This can be done at any time of the year, except power equipment should not be used during dry weather. Remove shrubs at an interval of once every 10 years. Prune trees at least once every 15 years.

Mow or weed-whip a 30-foot-wide strip around the private inholding in Grant County park and the stable areas once each year immediately after the grass cures. Vista-prune as well.

b. Strengthen Public Roads as Fire Breaks. Public roads should be strengthened in their capacity to act as fire breaks.

(1) Tools. In Grant County Park, mow or weed-whip a 10-foot-wide strip along both sides of Mt. Hamilton and Quimby roads at least once every year shortly after the grass cures (mid-April to mid-June). Work with Caltrans, which already has a program to mow its facilities, to extend their normal mowing width and to ensure proper timing. Vista-prune trees and remove understory shrubs along the public roads to enhance emergency access.

c. Strengthen Internal Roads and Trails as Fire Breaks and Emergency Access. Internal roads and trails should be strengthened in their capacity to act as fire breaks and to provide emergency access.

(1) Tools. As staffing and budgets permit, mow or weed-whip a 15-foot-wide strip along both sides of all internal roads or trails that provide access to structures or facilities, especially in woodland areas. Vista-prune trees and remove understory shrubs along internal roads and trails to enhance emergency access.

Along Downing Road and Calera Creek Trail in Levin County Park, in addition to mowing as recommended above, keep shrubs within 100 feet of each side of these facilities free of dead material and break shrub masses. Masses no larger than eight feet in any direction, with about eight feet between masses.

d. Protect External Boundaries of Levin County Park. The external boundaries of Levin County Park should be protected from fire spread onto and off of the park.

(1) Tools. End current practice of disking park boundaries. In its place, mow a 15-foot-wide strip with a flail mower along the western and southern boundaries of Levin County Park once every year shortly after the grass cures.

e. Fire Management Plan. Amend each park's fire management plan to designate areas where heavy equipment and fire-fighting activities should be off-limits during emergencies. These include:

1. The rock outcroppings at the northern boundary of Grant County Park.
2. Wet meadows, springs, seeps and ponds.
3. Steep slopes.
4. Sensitive vegetation areas.
5. Sensitive biological areas.
6. Cultural resource areas.

Appendix Q
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