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SANTA ROSA PLAINS ENDANGERED PLANT PROTECTION PROGRAM REPORT

Prepared for
Sonoma County Planning Department
and
California Department of Fish and Game
Endangered Plant Project

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April, 1989
Revised April, 1990

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INTRODUCTION

Because extinction can be avoided only by preventing habitat fragmentation, a regional approach is needed to protect vernal pool wetlands systems. That it was needed yesterday must not deter us from taking steps today that will safeguard species diversity for tomorrow. At issue is the survival of a unique and irreplaceable natural resource. As the rapid decline of rare plant populations in the Santa Rosa Plains continues, three of these species of concern will be on a collision course with extinction. We have already lost one species, showy Indian clover. The threat of extinction brings with it the likelihood of listing not only by the State but also by the U.S. Fish and Wildlife Service (USFWS). Should federal listing occur, the control over that species and its habitat falls under the stringent regulatory authority of this federal agency, potentially removing local jurisdiction over land use decisions in those areas considered to be critical habitat.

This report consists of two sections. Section A, Rare Plant Ecology, with accompanying data from Appendices 1-4, is presented in a scientific study format. Field work performed in the first half of 1988 provided the biological data upon which the body of this section rests. Section B, Mechanisms of Protection, picks up where the scientific section leaves off. A two phase program for vernal pool protection is presented that addresses both the immediate need for protection (Phase I Interim Plan) as well as a long term protection plan (Phase II, Sensitive-Area Management Plan).

EXECUTIVE SUMMARY - Vernal Pool Report

SECTION A - RARE PLANT ECOLOGY

The rare plant component of this study undertook confirmation of all 43 known occurrences of rare and endangered plants reported by the California Natural Diversity Data Base to occur in the Santa Rosa Plains and Laguna de Santa Rosa study area. Of the original 43 occurrences, nine have been extirpated (i.e. the plants have been destroyed or have died off). Twenty-nine additional new locations were added in the course of the study. Forty-four (60%) of the existing rare plant locations were considered high quality or better. Twenty-seven locations (37%) face imminent endangerment; of these locations 14 are high biological quality or better. Fourteen locations were rated as the highest priority for preservation based on high biological quality and imminent endangerment. The twenty-eight locations rated as secondary priority for preservation could qualify as first priority sites if threats become imminent.

The five species under study have proven to deserve their status as rare plants. Sonoma sunshine (Blennosperma bakeri) has been reduced to only 30 known locations representing approximately 6 biological populations. Burke's goldfields (Lasthenia burkei) is restricted to 33 locations, representing approximately 5 biological populations. Sebastopol meadowfoam (Limnanthes vinculans) is restricted to 19 locations, representing approximately six populations. Vernal pool mint (Pogogyne douglasii spp. parviflora) is limited to only six locations, representing approximately five populations. Many-flowered navarretia (Navarretia plieantha) occurs at only one site in the study area, earning it the distinction as the rarest of the five species in this study.

Rare plant sites generally fall into three categories: (1) those that are in good condition and not threatened, (2) those that are in good to moderate condition and are threatened by development, and (3) those that are in a deteriorated state and may or may not be threatened. The greatest number of sites in this study are in the second category and deserve immediate attention to ensure their continuation as viable vernal pool ecosystems. The most widespread threats to vernal pool rare plants are residential development, vineyard expansion and effluent irrigation. Vernal pool habitat preservation is essential for long term survival of all five species in the study area. Conservation efforts should initially be focused on preserving the fouteen high quality sites that are most threatened by development. The best long-term approach to conservation of rare plants would involve the establishment of a system of preserves where concentrations of rare plants occur in the study area.

Impacts to vernal pools with rare plants should be avoided in all stages of development until detailed scientific research has been conducted to assess the biological requirements of endangered species. Basic research is necessary to better understand vernal pool hydrology, pollination biology, seed dispersal mechanisms, grazing influences and plant competition before transplanting can be accepted as mitigation.

It is possible to achieve successful rare plant conservation and preservation while accomplishing many other desirable goals (such as providing open space, enhancing wildlife habitat, preventing floodplain encroachment, preserving wetlands, and providing recreational and educational opportunities). Methods of achieving these goals are discussed in Section B - Mechanisms of Protection.

EXECUTIVE SUMMARY - Section A (cont'd)

The scope of this study includes only those rare plant locations that were known previously or found in the course of the study where access to sites was available. This study did not make a systematic effort to survey all potential habitat for rare plants. Therefore the study can not be viewed as a conclusive assessment of all rare plant locations because there will always be the potential for discovery of new sites, until all potential habitat is surveyed. The rate at which potential habitat is surveyed for rare and endangered vernal pool species is dependent on landowner willingness to grant access and availability of funding.

EXECUTIVE SUMMARY - Vernal Pool Report

SECTION B - MECHANISMS OF PROTECTION

Mechanisms of Protection features a two phase program. Phase 1 (Interim Plan) presents a program for administering projects which either are in or are entering the pipeline. The program emphasizes avoidance of adverse impacts to sensitive habitat as the preferred track to project approval. It is not the only track, however. The report also recommends specific mitigation procedures for development proposals that meet all of the following criteria:

(1) The project is in the public interest.
(2) No alternative site exists.
(3) Project design reduces habitat damage to the maximum extent possible.

Phase 2 (Sensitive Area Management Plan) addresses the need for a long term plan. This plan would be the result of a collaborative process in which all parties -- government agencies (federal, state, and local), developers, property owners and citizen advocates -- would participate. Policies and procedures in effect under Phase 1 would provide feedback for the collaborative process underway in phase 2.

Phase 1 implementation includes both regulatory and voluntary programs. The report describes the roles of existing public and private nonprofit agencies. It also identifies the need for a local public resource agency, such as County Open Space District, to administer the acquisition program and manage vernal pool preserve sites.

SECTION A. RARE PLANT ECOLOGY

I. BACKGROUND

A. Ecology of Vernal Pools in the Santa Rosa Plains

The Laguna de Santa Rosa and adjacent Santa Rosa Plains are noted for their seasonal wetland and vernal pool habitats. A significant concentration of rare plant species persists in this locale (De Mars et al, 1977). Most of the rare plants in the study area are found in vernal pools, although some also occur in other seasonal wetlands and the fringes of freshwater marshes.

Many of the species found in vernal pools are known as "endemics", i.e., their distribution is limited to the temporary aquatic environment provided by the vernal pool habitat. In fact, several of the species studied in this report are endemic not just to vernal pools in general, but to the vernal pools of the Santa Rosa plains; that is, they are found no where else in the world. Geographically, vernal pool habitats are inherently uncommon because the unusual combination of soils, climate and hydrology necessary to form the required habitat is limited to portions of California, South Africa, Chile and Australia (Thorne, 1981).

For this habitat to exist, the soil profile must have an impermeable layer that causes ponding by preventing the downward percolation of rainwater and overland flow. These soil conditions are represented in the Laguna area by the Huichica, Wright and Clear Lake series, which have clay restrictions in their profiles (Miller, 1972). Hydrologically, this restricting layer acts to provide a shallow, perched water table that appears as surface water in the depressions of the hummocky topography. The prevailing Mediterranean climate provides seasonal input to the hydrologic regime with precipitation during the cool, wet winter months. Evaporation during the following late spring and summer drought results in a successively diminishing pool of water with different plant species sprouting, growing and blooming in "rings" around the retreating zone of moisture. Each ring provides a zone where a species' specific microhabitat requirements are met.

B. Endangerment of Plants Associated With Vernal Pools In the Santa Rosa Plains.

The Laguna ecosystem, which incorporates much of the Santa Rosa Plains, is still a significant wetland resource as a result of recent regional and statewide decline in wetlands (De Mars et al., 1977, Airola and Messick, 1987; Laguna Advisory Committee, 1988). The greatest concentration of known rare and endangered plant occurrences in Sonoma County are located in the Laguna ecosystem (California Natural Diversity Data Base [CNDDB], 1988). Most of these rare species are found in vernal pools, although some also occur in seasonal wetlands and the fringes of freshwater marshes.

Vernal pools have been diminished by 90% in the Central Valley (Holland, 1978) and are rapidly disappearing in San Diego County (Bauder, 1986) due to a combination of agricultural practices and urbanization. The Santa Rosa

B. Endangerment of Plants Associated With Vernal Pools In the Santa Rosa Plains. (cont'd)

Plains have undergone a similar land use history and the rare plants associated with vernal pools are subject to these same impacts. The accelerated loss of these plants is one reason for this study.

Loss of habitat to urbanization, intensive agriculture (orchards and vineyards) and summer irrigation has reduced much original vernal pool habitat in the Santa Rosa Plains. Urban development has physically covered 40% of the Laguna drainage basin. In the process, much historic vernal pool habitat has been lost as Santa Rosa grew to the northwest and southwest (Harris, 1978). For instance, an historic location of showy Indian clover (Trifolium amoenum), a species associated with seasonal wetlands, was recorded by L. McDonald as occurring one mile north of Santa Rosa High School (CNDDB, 1988). The site has since been urbanized and with the loss of all other historic occurrences, this species is now considered extinct. Rohnert Park's expansion to the north and west also destroyed considerable historic vernal pool habitat. The rapid growth around Windsor is continuing this trend of vernal pool conversion to urban use.

Vineyards and orchards are managed by removing all competing plants, including vernal pool species. Drainages are altered, disrupting the hydrologic regime necessary for vernal pool formation. Where summer irrigation occurs, lands containing native vernal pool flora undergo a conversion from natural plant communities to a more uniform assemblage of introduced pasture grasses. In the process native plants, including rare and endangered species, are crowded out by the competition from introduced species (Tillman, 1982). In the 8,000 acres which roughly comprise the Laguna and Santa Rosa Plains, 4,444 acres are irrigated with highly treated sewage effluent. An increase in acreage is proposed (Carlson, personal communication). Simple arithmetic shows that in those 8,000 acres there has been at least a 50% loss of vernal pool habitat due to irrigation alone.

C. Species of Concern

Consultation among staff of the Endangered Plant Project (Department of Fish & Game [DFG]), The Sonoma County Planning Department (SCPD), the Milo Baker Chapter of the California Native Plant Society (CNPS) and the authors of this report produced a list of species that would be the subject of this study (see Table 1, pgs. 3-4). One species, Trifolium amoenum, is already considered extinct, but was included in the survey nonetheless. The remaining five plants on the list, hereafter referred to as "species of concern," are all associated with vernal pools and are considered rare and are endangered to varying degrees because of continuing loss of individuals resulting from habitat destruction. Three of the species--Burke's goldfields, Sebastopol meadowfoam and many-flowered navarretia--are listed by the state as endangered. Baker's blennosperma is on CNPS List 1B: "Plants Rare and Endangered in California and Elsewhere." The last species, Douglas' pogogyne, is on CNPS List 3: "Plants of limited distribution (a watch list)."

Table 1. SPECIES OF CONCERN THAT ARE KNOWN TO OCCUR IN THE STUDY AREA.

Species were chosen in consultation with the Endangered Plant Program of the Department of Fish and Game, the Milo Baker Chapter of the California Native Plant Society, the Sonoma County Planning Department and the report authors.

Scientific Name (1)	Common Name	CNPS List(2)	CNPS R-E-D Code(3)	CDFG(4)	FWS(5)	Flowering period(6)
Blennosperma Bakeri	Baker's blennosperma	1B	2-3-3	NL	C2	March - April
Lasthenia Burkei	Burke's goldfields	1B	3-3-3	E	C2	April - May
Limnanthes vinculans	Sebastopol meadowfoam	1B	2-3-3	E	C2	April - May
Navarretia plieantha	many-flowered navarretia	1B	3-2-3	E	C2	May - June
Pogogyne Douglasii ssp. parviflora	Douglas' pogogyne	3	?-2-3	NL	C2	May - July
Trifolium amoenum	showy Indian clover	1A	NL	NL	C2	April - June

1. Species are listed as given by the California Native Plant Society (CNPS) (Smith and Berg, 1988).

2. The CNPS List number as defined in Smith and Berg (1988):
   1A = Plants presumed extinct in California.
   1B = Plants rare and endangered in California and elsewhere.
   3 = Plants about which we need more information (a review list).

3. The CNPS R-E-D code from Smith and Berg (1988):

   R (Rarity)
   1 = Rare but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time.
   2 = Occurrence confined to several populations or one extended population.
   3 = Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported.

   E (Endangerment)
   1 = Not endangered.
   2 = Endangered in a portion of its range.
   3 = Endangered throughout its range.

   D (Distribution)
   1 = More or less widespread outside California.
   2 = Rare outside California.
   3 = Endemic to California.

Table 1. (Continued)

4. As designated by the California Department of Fish and Game (CDFG, 1984):
R = Rare, E = Endangered, NL = Not Listed.

5. As listed by the U.S. Fish and Wildlife Service (USFWS, 1980 and 1983):
C1 = Enough data are on file to support the federal listing.
C2 = Threat and/or distribution data are insufficient to support federal listing.
C3c= Too widespread, or not threatened.

6. Munz and Keck (1968); Ornduff (1969).

C. **Species of Concern (cont.)**

Each of the species of concern are afforded varying degrees of protection based upon their formal regulatory agency listing, or their rarity according to expert advice. Species of primary concern are those that are listed by DFG as endangered. Burke's goldfields, Sebastopol meadowfoam and many-flowered navarretia are protected by state law (Native Plant Protection Act [NPPA], California Endangered Species Act [CESA] and California Environmental Quality Act [CEQA]) making their unauthorized disturbance subject to prosecution by DFG. Although not formally a state listed plant, Baker's blennosperma is considered rare and endangered under CEQA guidelines because it is included on the CNPS List 1. In the County's environmental review process, the expert advice of CNPS makes any adverse impacts to rare plants subject to mitigation, or a statement of overriding concern for CEQA compliance. Douglas' pogogyne appears on CNPS List 3 because its tenuous taxonomic status and uncertain statewide rarity leaves its degree of endangerment in question. It may not be technically rare, but its patchy distribution, restriction to special habitat (i.e., vernal pools) and threat from various land uses provide reason to cautiously avoid impact to this plant while the data needed to ascertain the degree of rarity are gathered.

Blennosperma bakeri is a member of the Compositae, or sunflower family and is commonly referred to as Sonoma sunshine, Baker's stick-seed or Baker's blennosperma. It is an annual, spring flowering herb to 30 cm tall with succulent, linear lobes. It produces small yellow flowers and has characteristic red stigmas. The species is found in vernal pools distributed entirely within Sonoma county. Four locations are near the town of Sonoma, the rest are restricted to the area of the Santa Rosa Plains and Laguna de Santa Rosa (Guggolz, personal communication). This species is threatened by development and conversion of pastures. It was recommended for listing as endangered in 1977 (Ornduff, 1977), but the State has not taken action. It is presently being considered for emergency listing as endangered by the U. S. Fish and Wildlife Service (Kramer, personal communication).

Lasthenia burkei, otherwise known as Burke's goldfields is another member of the sunflower family. It is a gold flowered annual herb to 30 cm in height with linear, pinnatified, succulent leaves. The species is distributed in vernal pools of Lake and Sonoma counties. It once occurred in Mendocino County but has since disappeared. Only two occurrences are known from Lake County. In Sonoma county the species is restricted to the Santa Rosa Plains. (Guggolz, personal communication). This species is subject to threats from urban development and agricultural land conversions. It is a state listed endangered species and has been recommended for continued listing by DFG. It is presently being considered for emergency listing as endangered by the U. S. Fish and Wildlife Service (Kramer, personal communication).

Limnanthes vinculans, a member of the Limnanthaceae, or false mermaid family,goes by the common names of Sebastopol meadowfoam and Cunningham

C. Species of Concern (cont.)

Marsh meadowfoam. It is a white flowered glabrous annual to 30 cm tall with succulent, dissected leaves. Its distribution is restricted entirely to Sonoma County in vernal pools of the southern Santa Rosa Plains and the Laguna de Santa Rosa (Guggolz, personal communication). There are also two other historic occurrences of this species at Atascadero Marsh and Cunningham Marsh. This species is subject to threats from urban development and agricultural land conversions. It is a state listed endangered species and has been recommended for continued listing by DFG. It is presently being considered for emergency listing as endangered by the U. S. Fish and Wildlife Service (Kramer, personal communication).

Navarretia plieantha, a member of the Polomoniaceae, or Phlox family commonly referred to as many flowered navarretia. It is a prostrate, spiny annual, branched from the base, forming a mat 2-6 cm wide in the bottom of vernal pools. This species is restricted to four occurrences in Lake County and two occurrences in Sonoma County (Guggolz, personal communication). Trampling and ORV use are threats to this species. It is a state listed endangered species and has been recommended for continued listing by DFG.

Pogogyne douglasii spp. parviflora is a member of the Labiatae, or mint family. Its common name is Douglas's small flowered pogogyne. The plant is strongly aromatic to 30 cm in height with purple flowers forming dense oblong spikes. It grows in vernal pools from locations in Contra Costa, Lake, Mendocino and Sonoma Counties, but is seldom seen. It is known from only a few locations in the Santa Rosa Plains of Sonoma county.

II. SCOPE OF PROJECT

The study area is shown in Figure 1 (pg. 7). It must be emphasized that this report DOES NOT contain records of all the possibly occurring rare plant locations within the study area. The survey and inventory of sites reported in this study are primarily re-confirmations of sites previously known to the California Natural Diversity Data Base (CNDDB) and Betty and Jack Guggolz of the Milo Baker Chapter of the California Native Plants Society (CNPS). Additional new sites reported in this study were located by means of more detailed assessment of areas adjacent to known locations, and visiting areas that looked like suitable habitat based on aerial photo interpretation. Only those areas where permission to enter was granted or obviously open to the public were visited. Therefore, it is possible that many more rare plant locations exist besides those reported in this study. Much more time and effort would be needed to reach the conclusion that most of the rare plant sites in the study area had been assessed.

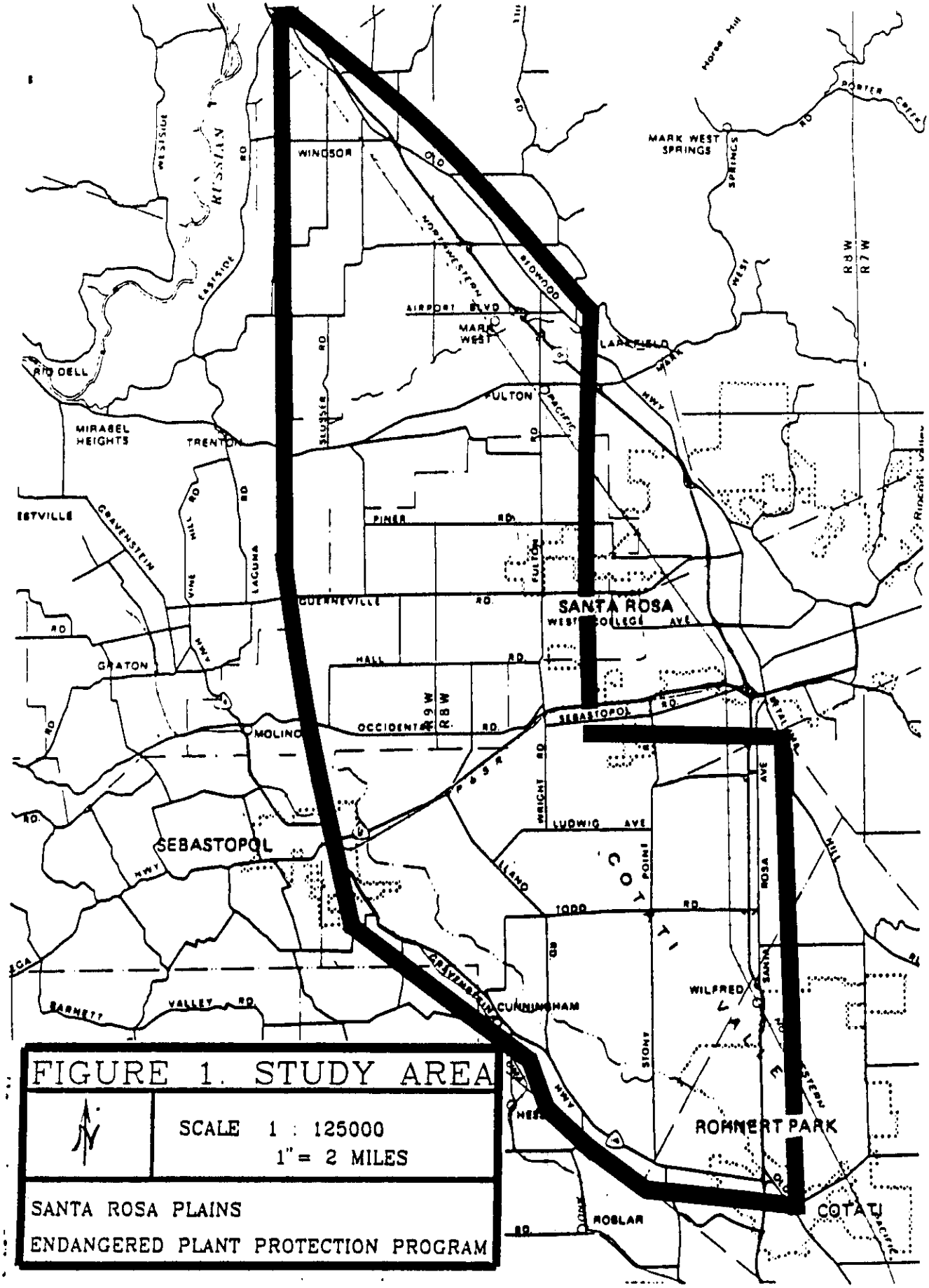

FIGURE 1. STUDY AREA

SCALE 1 : 125000
1" = 2 MILES

SANTA ROSA PLAINS
ENDANGERED PLANT PROTECTION PROGRAM

III. NEED FOR THE PROJECT

This study was instituted to address the rapid decline in rare vernal pool flora and their ecosystems to provide some means of long-term protection using a variety of planning and preservation mechanisms. Several rare plant species (see Table 1) are currently threatened by changes in land use. The habitat for these species--vernal pools and other seasonal wetlands--have become increasingly sensitive because of conversion to summer irrigated pasture, vineyards and urbanization. As a result of these impacts, reductions in the populations of some characteristic vernal pool species in the Santa Rosa Plains have brought about official protection for the rarest plants.

A. The State Role.

The California Endangered Species Act (CESA), the Native Plant Protection Act (NPPA) and provisions of the California Environmental Quality Act (CEQA) provide the legal basis for this study. In addition, the County of Sonoma is proposing specific policies protecting rare plants (Sonoma County, 1987). A discussion of the pertinent laws is included in Appendix One. The need for a means whereby compliance with the laws is promoted provides the impetus for this study. Without a more comprehensive approach to management of rare and endangered plants of the Santa Rosa Plains, the continual decline in populations of several species of concern would inevitably lead to their being federally listed as Threatened or Endangered.

B. The Federal Role.

Clean Water Act (CWA). The rare plants in this study generally grow in wetlands subject to federal regulation. The Federal Water Pollution Control Act of 1972 (P.L. 92-500), referred to as the Clean Water Act, offers official regulation of wetlands such as vernal pools. The Environmental Protection Agency (EPA) legally defines wetlands subject to CWA to include any area that is "inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Specifically, Section 404 of the CWA (33 U.S.C. 1344) applies to vernal pools. This section gives the U. S. Army Corps of Engineers (COE) authority to regulate the deposit of fill material into "waters of the United States" through a program of individual or nationwide permits.

A complicated set of criteria determines the degree of protection a vernal pool receives. First of all, a vernal pool determined to be a wetland adjacent to a "navigable" water or its tributary qualifies as "waters of the United States." Where vernal pools are not adjacent (with no direct hydrologic connection), or exist above headwaters of a stream (where annual flows average less than 10 cubic feet per second), they are considered "other waters," specifically "isolated waters." Isolated waters can receive a disclaimer of jurisdiction from COE unless it can be demonstrated that the waters influence interstate commerce. Isolated vernal pools in the Santa Rosa

B. The Federal Role (cont'd)

area fall within COE jurisdiction under the interstate commerce clause because it has been demonstrated that migratory waterfowl such as ducks, and migratory shorebirds, such as yellowlegs or herons, utilize the vernal pools extensively.

A project with less than an acre of vernal pool wetlands receive a blanket nationwide permit which by definition allows certain fill projects throughout the nation, providing the project meets certain conditions. A project proposing fill of between one and 10 acres of vernal pool wetlands undergoes a pre-discharge notification process which involves distribution of the project plans to EPA, DFG, and the U.S. Fish and Wildlife Service (FWS). These agencies comment on whether the COE should exercise its discretionary authority because of sensitive or critical habitats which should be avoided or mitigated. Under this action, DFG could request an individual permit for projects with rare plants. An individual permit undergoes extensive public review and a stringent alternatives analysis of the need for the project to occur in wetlands. An individual permit is always required for projects which propose to fill over 10 acres of wetlands. The FWS also comments on impacts to federal candidate species. All plants in the study are federal candidates subject to FWS comment.

The EPA, under a new Memorandum of Understanding (MOA) of January 19, 1989, has clarified its relationship to COE and its jurisdictional responsibility in administration of CWA. This new MOA can affect jurisdictional disclaimers granted by COE in cases of "isolated waters." The MOA requires the District Engineer of COE to (1) provide the Regional Administrator of the EPA with all final calls of no jurisdiction, and (2) make any other jurisdictional determinations available to EPA upon request. By requiring copies of all "no jurisdiction" calls, EPA can review the calls for compliance with the EPA's special case categories and technical agreement with the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands," to be published in spring of 1989. Vernal pools may qualify as special cases, or any particular project can be considered a special case, if controversy surrounds a jurisdictional call by COE. Furthermore, disagreements over interpretation of the federal manual of jurisdictional determinations will ultimately be settled by EPA. The controversy surrounding development projects in Northwest Santa Rosa may require involvement by EPA under the new MOA, which will indirectly affect state listed endangered plants there.

Federal Endangered Species Act (FESA). Blennosperma bakeri, Lasthenia burkei and Limnanthes vinculans are all undergoing an emergency listing process by the FWS (Kramer, personal communication). These species could be listed as "threatened" or "endangered" under FESA in the near future if loss of critical vernal pool habitat is shown to be at a stage which could threaten the species with extinction. Should official federal protection be established, any land use decisions affecting federally listed species or their habitat would be subject to the jurisdiction of the U.S. Fish and Wildlife Service under Section 7 of the FESA. In addition, one of the

B. The Federal Role (cont'd)

stipulations of the CWA is the provision that a proposed project "will not destroy a threatened or endangered species as identified under FESA, or endanger critical habitat of such species" [33 CFR 323.42 (4)(b)(1)]. Listing under FESA would require an individual permit for any vernal pool subject to CWA, regardless of acreage of impacted area. Local control would be greatly diminished or eliminated over the lands subject to FWS purview. Implementation of the recommendations of this study are necessary to ensure the survival of rare vernal pool plants. A lack of vernal pool protection could result in federal jurisdiction in our local land use decisions. It then becomes an issue of "local control" versus "federal control", a situation many local jurisdictions would rather avoid.

C. Loss of Diversity

At a more basic level, the need for this project stems from the growing recognition that biological diversity is essential for the maintenance of a healthy ecosystem in which to live. Biological diversity benefits human welfare directly, as various organisms are used to satisfy basic human needs, and indirectly, as diversity supports many ecological processes essential to human progress and survival (U.S. Congress, 1987). In the contest of this study, the component of biological diversity to be preserved is at the species and habitat levels (i.e. vernal pools and associated rare and endangered plants).

Species diversity plays a role in regulation and connection of complex food web relationships in the ecosystem and provides models for research on human diseases and drug synthesis. Species diversity can provide objects of civic pride (eg. "redwood empire") or provide a means of recreation and tourism: 95 million people feed, observe or photograph wildlife each year (U.S. Congress, 1987). Species diversity also plays a role in agriculture and harvested resources. Wild strains of plants are in demand to strengthen domesticated strains from new diseases or to replace diminishing resources.

A species of concern from this study, Sebastopol meadowfoam, provides a clear example of why it is important to maintain biological diversity. Oil can be processed from the seeds of this plant which is similar to that of the sperm whale. (Jain, personal communication), another endangered species. This whale was hunted to the brink of extinction for the production of oils to lubricate delicate machinery. The irony of this situation is that we may be on the brink of losing the only plant that can stop the elimination of a majestic whale species. The results of this study may play a role of preventing this tragedy from happening.

IV. METHODS

This study involved three main tasks: 1) literature review (2) field data collection, (3) data analysis and report production. Sites were surveyed for rare plants and potential habitat from March through July, 1988.

The literature review included sensitive plant data from: (1) the California Native Plant Society (Smith and Berg, 1988; plus mapped information and status reports from CNPS files), (2) the California Natural Diversity Data Base (CNDDB, 1986, 1988; reports and mapping of sensitive plant locations, list of sensitive plants), (3) agencies involved with sensitive plants, including the California Department of Fish and Game (DFG, 1984; lists of designated species, department policies), and the U.S. Fish and Wildlife Service (USFWS, 1985, 1986: lists of designated and candidate species). The Endangered Plant Protection Program of DFG provided the final list of species that are of primary concern (see Table 1, pgs. 4-5). Local experts (Guggolz, Harrison, personal communication) and available local studies (Harrison, 1978) were used to gather historic rare plant information.

Data on vegetation, environment and colonies of species of concern were recorded on field survey forms (see Appendix 2). Boundaries of rare plant colonies and potential habitat were delineated and mapped on aerial photographs (1:4800, 1:6000) made available through the Sonoma County Planning Department. Parcels from which rare plant occurrences are known were plotted on the Planning Department's 1:1000 scale topo-lot line maps (referred to as parcel specific occurrence maps, see Appendix 4).

Data on the presence of rare and endangered plants, the size of rare plant colonies, vernal pool distribution and other site factors were gathered from on-site inspection where permission to enter was granted or open to public use. Where permission was not granted, data were evaluated from public vantage points such as roads. Estimates on plant colony size for these areas was derived from roadside visual estimates and extrapolated to other suitable habitat based on aerial photographs and observations made from a low altitude airplane flight organized by Alan Buckman, biologist for the Department of Fish and Game.

It must be emphasized that all reported numbers of rare plants are estimates based on cursory field review. All sites must undergo a thorough field survey and mapping effort to conclusively establish plant colony size and distribution. Further study is also necessary to understand the ecology of vernal pools in general.

V. RESULTS

A. Field Survey Forms

A total of 84 completed field survey forms are included in Appendix 3. They provide detailed descriptions of plant populations, habitat, land use and management recommendations. These forms are sequentially organized by their "Site Location Number." Locations were identified for all five species of

A. Field Survey Forms (cont'd)

concern (see Table 2). A total of 92 rare plant occurrences were found at 84 different locations, although many were adjacent to each other. Twenty-nine new occurrences were identified (i.e., they were found at locations for which no CNDDB records exist). Locations of these rare plant occurrences are included on parcel specific occurrence maps (see Appendix 4). The greatest number of occurrences were recorded for Lasthenia burkei (33), the least for Navarretia plieantha (1). The greatest number of new occurrences were recorded for Blennosperma bakeri (21). Ten of the locations were sites where more than one species of concern occurred--ensemble sites. One of these was a new site. At three locations three species occurred.

TABLE 2. LOCATIONS AND ATTRIBUTES OF RARE PLANT SITES

Site locations are coded by report identification numbers plotted on Sonoma County Planning Department lot-line maps; the first two numbers refer to USGS quadrangle (20=Healdsburg, 26=Sebastopol, 27=Santa Rosa, 32=Two Rock). The letters A-F, refer to sections of quadrangles on the 1 inch=500 feet lot-line maps. The last two numbers refer to actual occurrences identified in the field. Abundances are defined in terms of estimated numbers of individuals: 6=>10,000; 5=5,000-10,000; 4=1,000-5,000; 3=500-1,000; 2=100-500; 1=<100. LABU=Lasthenia burkei, LIVI=Limnanthes vinculans, BLBA=Blennosperma bakeri, NAPL=Navarretia plieantha, PODOP=Pogogyne douglasii spp. parviflora.

Biological Quality: 4 = very high, 3 = high, 2 = moderate, 1 = low, 0 = extirpated or not found. **Endangerment:** 4 = not found or extirpated, 3 = immanent endangerment, 2 = potentially endangered, 1 = slight potential for endangerment, 0 = preserved. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation.

Location Number	Site Name	Species Abundances					Biologic Quality	Endanger-ment	Preservation Priority
		LABU	LIVI	BLBA	NAPL	PODOP			
C2001	Grill, Old Redwood Hwy,Windsor	4	0	0	0	4	4	3	1
C2002	Arata Ln. overpass, Windsor	0	0	0	0	0	0	4	0
C2003	Starr Rd.#1, Windsor	3	0	0	0	0	2	3	2
C2004	Starr Rd. #2, Windsor	2	0	0	0	0	1	3	3
C2005	Wilcox Rd. wreck. yrd, Windsor	3	0	0	0	0	2	3	2
C2006	Wilcox Rd., Windsor	4	0	0	0	0	3	3	2
C2007	Promenade Ln woodland, Windsor	4	0	0	0	0	3	3	2
C2008	Grange area, Windsor	3	0	0	0	0	2	3	2
E2001	County Airport Preserve	4	0	0	0	0	3	0	0
F2001	County Airport medians	5	0	0	0	0	4	1	3
F2002	Standard Structures, Shilo Rd.	4	0	0	0	0	3	2	2
F2003	Airport treatment plant	0	0	0	0	0	0	4	2
F2004	Coombs easement, Airport B. P.	1	0	0	0	0	1	3	0
F2005	Shilo Rd. horse ranch	6	0	0	0	4	5	2	1
F2006	Heller Labs, Shilo Rd.	0	0	0	0	0	0	4	0
F2007	Gossage, Sanders Rd., Airport	3	0	0	2	0	3	2	1
F2008	Sanders Rd. (end), Airport	4	0	0	0	0	3	2	2
F2009	Skyline Blvd. extension	4	0	0	0	0	3	2	2
B2601	San Miguel x Fulton, NW S.R.	0	0	3	0	0	2	3	2
B2602	San Miguel Rancho, NW S.R.	4	0	5	0	0	4	3	1
B2603	Alton Rd., NW S. R.	0	0	4	0	0	3	1	3
B2604	Hartman Rd near Piner Rd west	1	0	4	0	0	3	2	2
B2605	Maccario's oaks, Piner Rd west	0	0	4	0	0	3	2	2
B2606	Comalli's, Piner Rd west	1	0	4	0	0	3	3	2
B2607	Abramson Rd # 1, Piner HS area	0	0	2	0	0	1	1	3
B2608	Oak Farm Ln, Piner Rd west	0	0	2	0	0	1	2	3
B2609	S.R.224 easement,Piner Rd west	0	0	6	0	0	5	2	1
B2610	Abramson Rd # 2, Piner HS area	0	0	6	0	0	5	2	1
B2611	Abramson Rd # 3, Piner HS area	0	0	5	0	0	4	2	2
B2612	Paradise Ln # 1, Piner HS area	0	0	3	0	0	2	2	3

Table 2 (cont'd)

Location Number	Site Name	Species Abundances LABU	LIVI	ELBA	NAPL	PODOP	Biologic Quality	Endanger-ment	Preservation Priority
B2613	Paradise Rd # 2, Piner HS area	0	0	2	0	0	1	2	3
B2614	Brown Subdivision, NW S. R.	4	0	3	0	2	4	3	1
B2615	San Miguel Est. # 1, NW S. R.	3	0	5	0	0	4	3	1
B2616	San Miguel Est. # 2, NW S. R.	4	0	0	0	0	3	3	2
B2617	Westwood Vlg Subd., Piner HS	0	0	0	0	0	0	4	0
B2618	Francisco elbows, NW S. R.	2	0	3	0	0	3	2	2
B2619	Raplee Terrace, NW S. R.	0	0	3	0	0	2	2	3
B2620	Hemmerle, Piner HS area	0	0	5	0	0	4	3	1
B2621	Rancho San Miguel #2, NW S. R.	0	0	2	0	0	1	3	3
B2622	Manes, San Miguel Rd, NW S. R.	5	0	0	0	0	4	3	1
B2623	Marovich, Waltzer Rd, NW S. R.	2	0	0	0	0	1	3	3
B2624	Pioneer 2000 Apts., NW S. R.	4	0	0	0	0	3	1	0
B2625	Wood Rd.elbows, W. Piner area	4	0	0	0	0	3	2	2
B2626	SW corner of Piner x Fulton	0	0	4	0	0	3	3	2
B2627	Field SW of Piner Elem. Sch.	0	0	4	0	0	3	2	2
B2628	Abramson Rd. # 4	5	0	0	0	0	4	2	2
C2601	Laguna @ Hall Rd., Nunes	0	0	0	0	0	0	4	0
C2602	Sanford Rd. @ the Laguna	0	1	0	0	0	1	1	3
C2603	Occi. Rd near Sanford, Laguna	2	0	0	0	0	1	1	3
C2604	Aggio dairy, Laguna @ Occi. Rd	0	1	0	0	0	1	2	3
C2605	Ambrosini @ Occ.Rd.Br., Laguna	0	0	0	0	4	3	1	3
D2601	Hall x Willowside	0	0	0	0	0	0	4	0
D2602	Hall x Piezza (Crinella)	4	0	0	0	0	3	2	3
D2603	Dairy, Hall&Occi near Fulton	2	6	0	0	0	5	2	1
D2604	Lions Memorial, Occi @ Merced	0	3	0	0	0	3	2	2
D2605	Corrie, off Guern., Piner HS	0	0	6	0	0	5	3	1
D2606	Naval Air Sta., WrightxFinely	0	3	0	0	0	2	3	2
D2607	CALTRANS ROW, Hwy 12xOcci.	0	1	0	0	0	1	2	3
D2608	CALTRANS ROW, Hwy 12 @ Llano	0	1	0	0	0	1	2	3
D2609	Nav. Air Sta., NE quadrant	0	0	0	0	3	2	3	2
E2613	Palm Terrace, Sebastopol	2	0	0	0	0	1	1	3
F2601	Landeros, Todd Rd near Llano	0	5	0	0	0	4	1	3
F2602	Naval Air Sta., SW quad #1	0	6	0	0	0	5	3	1
F2603	Naval Air Sta., Hanger site	0	0	0	0	3	2	3	2
F2604	Naval Air Sta., SW quad #2	0	6	0	0	0	5	3	1
F2605	Naval Air Sta., Concord Rd end	0	0	0	0	0	0	4	0
F2606	Todd Rd Elbow, preserve area	0	3	5	0	0	4	1	3
F2607	ToddxLlano, SW corner,	0	2	0	0	0	1	2	3
F2608	Laguna @ RR br., Sebastopol	1	1	0	0	0	2	3	2
F2609	Todd Rd. Preserve	0	5	3	0	0	4	0	0
F2610	Dom. Carinalli easement,Laguna	5	6	5	0	0	5	0	0
F2611	Hofbauer easement, Laguna	0	2	0	0	0	1	0	0
F2612	S Wright @ Madera, Nav.Air.Sta	0	0	0	0	0	0	4	0
F2613	Walker Ln, near Colgon Cr.	0	3	0	0	0	2	2	3

Table 2 (cont'd)

Location Number	Site Name	Species Abundances LABU	LIVI	ELBA	NAPL	PODOP	Biologic Quality	Endanger-ment	Preservation Priority
F2614	Ash Drive, Old Navel Air Sta	0	4	0	0	0	4	2	2
F2615	Scenic Ave. x Arlington Way	0	1	0	0	0	1	3	3
F2616	Colgon Cr. pasture, nr. Todd	0	2	0	0	0	1	2	3
E2701	Primrose Ave., SW Santa Rosa	0	0	5	0	0	4	2	2
E2702	Todd @ Primrose, SW Santa Rosa	0	0	3	0	0	2	2	3
E2703	ScenicxWhistler, SW Santa Rosa	0	3	1	0	0	2	3	2
E2704	Horn Ave. north, SE Santa Rosa	0	0	0	0	0	0	4	0
E2705	Horn Ave. south, SE Santa Rosa	0	0	0	0	0	0	4	0
E2706	ScenicxHargrave, SW Santa Rosa	0	0	5	0	0	4	1	3
B3201	Gundelfinger, Llano @ Hwy 116	0	6	0	0	0	5	1	2

V. RESULTS (cont'd)

B. Biological Quality Rating

Sites were ranked for biological quality using the following criteria:

# Species On-site	minimum abundance values needed to qualify for Biological Quality Category					
	Excellent	Very High	High	Moderate	Low	Extirpated
1	6	5	4	3	1	0
2	4	3	2	1	-	-
3	3	2	1	-	-	-

Biological quality was defined in an extremely limited sense because the only characteristic considered was the abundance of rare plants. The higher the abundance value, the higher the quality. For instance, location D2605 (Corrie, near Piner H. S.) had Blennosperma bakeri with an abundance value of 6 (greater than 10,000 plants) so it got an excellent quality rating. A site such as the Coomb's easement (F2004) had less than 100 Lasthenia burkei (abundance value = 1) so its quality rating is low. The criteria was weighted to give higher ratings to ensemble sites. For instance, a location may have had less than 100 individuals for any three rare species, but still got a high quality rating (the lowest rating possible for three species). On the other hand, a location with three species could be rated as excellent if all three species had abundance values of 3 (500-1000 individuals). An example of a site with three species that got an excellent quality rating is the Dominic Carinalli easement (F2610).

The ranking of sites based on biological quality ratings is listed on the following page in Table 3.

TABLE 3. BIOLOGICAL QUALITY RANKINGS FOR RARE PLANT SITES IN THE SANTA ROSA PLAINS

Biological rankings based on criteria in Section V.B. Biological Quality Ranking. Site locations are coded by report identification numbers plotted on Sonoma County Planning Department lot-line maps; the first two numbers refer to USGS quadrangle (20=Healdsburg, 26=Sebastopol, 27=Santa Rosa, 32=Two Rock). The letters A-F, refer to sections of quadrangles on the 1 inch=500 feet lot-line maps. The last two numbers refer to actual occurrences identified in the field.

Location Number	Location Name	Species Present
EXCELLENT QUALITY		
F2005	Shilo Rd. horse ranch	LABU, PODOP
B2609	S.R.224 easement,Piner Rd west	BLBA
B2610	Abramson Rd # 2, Piner HS area	BLBA
D2603	Dairy, Hall&Occi near Fulton	LABU, LIVI
D2605	Corrie, off Guern., Piner HS	BLBA
F2602	Naval Air Sta., SW quad #1	LIVI
F2604	Naval Air Sta., SW quad #2	LIVI
F2610	Dom. Carinalli easement,Laguna	BLBA, LABU, LIVI
B3201	Gundelfinger, Llano @ Hwy 116	LIVI
VERY HIGH QUALITY		
C2001	Grill, Old Redwood Hwy,Windsor	LABU, PODOP
F2001	County Airport medians	LABU
B2602	San Miguel Rancho, NW S.R.	LABU, BLBA
B2611	Abramson Rd # 3, Piner HS area	BLBA
B2614	Brown Subdivision, NW S. R.	BLBA, LABU, PODOP
32615	San Miguel Est. # 1, NW S. R.	BLBA, LABU
B2620	Hemmerle, Piner HS area	BLBA
B2622	Manes, San Miguel Rd, NW S. R.	LABU
B2628	Abramson Rd. # 4	LABU
F2601	Landeros, Todd Rd near Llano	LIVI
F2606	Todd Rd Elbow, easement area	BLBA, LIVI
F2609	Todd Rd. Preserve	BLBA, LIVI
F2614	Ash Drive, Old Navel Air Sta	LIVI
E2701	Primrose Ave., SW Santa Rosa	BLBA
E2706	ScenicxHargrave, SW Santa Rosa	BLBA

Table 3 (cont'd)

Location Number	Location Name	Species Present
HIGH QUALITY		
C2006	Wilcox Rd., Windsor	LABU
C2007	Promenade Ln woodland, Windsor	LABU
E2001	County Airport Preserve	LABU
F2002	Standard Structures, Shilo Rd.	LABU
F2007	Gossage, Sanders Rd., Airport	LABU, NAPL
F2008	Sanders Rd. (end), Airport	LABU
F2009	Skyine Blvd. extension	LABU
B2603	Alton Rd., NW S. R.	BLBA
B2604	Hartman Rd near Piner Rd west	BLBA, LABU
B2605	Maccario's oaks, Piner Rd west	BLBA
B2606	Comalli's, Piner Rd west	BLBA, LABU
B2616	San Miguel Est. # 2, NW S. R.	LABU
B2618	Francisco elbows, NW S. R.	BLBA, LABU
B2624	Pioneer 2000 Apts., NW S. R.	LABU
B2625	Wood Rd.elbows, W. Piner area	LABU
B2626	SW corner of Piner x Fulton	BLBA
B2627	Field SW of Piner Elem. Sch.	BLBA
C2605	Ambrosini @ Occ.Rd.Br., Laguna	PODOP
D2602	Hall x Piezza (Crinella)	LABU
D2604	Lions Memorial, Occi @ Merced	LIVI
MODERATE QUALITY		
C2003	Starr Rd.#1, Windsor	LABU
C2005	Wilcox Rd. wreck. yrd, Windsor	LABU
C2008	Grange area, Windsor	LABU
B2601	San Miguel x Fulton, NW S.R.	BLBA
B2612	Paradise Ln # 1, Piner HS area	BLBA
B2619	Raplee Terrace, NW S. R.	BLBA
D2606	Naval Air Sta., WrightxFinely	LIVI
D2609	Nav. Air Sta., NE quadrant	PODOP
F2603	Naval Air Sta., Hanger site	PODOP
F2608	Laguna @ RR br., Sebastopol	LABU, LIVI
F2613	Walker Ln, near Colgon Cr.	LIVI
E2702	Todd @ Primrose, SW Santa Rosa	BLBA
E2703	ScenicxWhistler, SW Santa Rosa	BLBA, LIVI

Table 3 (cont'd)

Location Number	Location Name	Species Present
LOW QUALITY		
C2004	Starr Rd. #2, Windsor	LABU
F2004	Coombs easement, Airport B. P.	LABU
B2607	Abramson Rd # 1, Piner HS area	BLBA
B2608	Oak Farm Ln, Piner Rd west	BLBA
B2613	Paradise Rd # 2, Piner HS area	BLBA
B2621	Rancho San Miguel #2, NW S. R.	BLBA
B2623	Marovich, Waltzer Rd, NW S. R.	LABU
C2602	Sanford Rd. @ the Laguna	LIVI
C2603	Occi. Rd near Sanford, Laguna	LABU
C2604	Aggio dairy, Laguna @ Occi. Rd	LIVI
D2607	CALTRANS ROW, Hwy 12xOcci.	LIVI
D2608	CALTRANS ROW, Hwy 12 @ Llano	LIVI
E2613	Palm Terrace, Sebastopol	LABU
F2607	ToddxLlano, SW corner,	LIVI
F2611	Hofbauer easement, Laguna	LIVI
F2615	Scenic Ave. x Arlington Way	LIVI
F2616	Colgon Cr. pasture, nr. Todd	LIVI
EXTIRPATED, OR NOT FOUND		
C2002	Arata Ln. overpass, Windsor	LABU
F2003	Airport treatment plant	LABU
F2006	Heller Labs, Shilo Rd.	LABU
B2617	Westwood Vlg Subd., Piner HS	BLBA
C2601	Laguna @ Hall Rd., Nunes	LABU
D2601	Hall x Willowside	LABU
F2605	Naval Air Sta., Concord Rd end	LIVI
F2612	S Wright @ Madera, Nav.Air.Sta	LIVI, PODOP
E2704	Horn Ave. north, SE Santa Rosa	BLBA
E2705	Horn Ave. south, SE Santa Rosa	BLBA

Forty four of the locations in the study were "high quality" or better. This represents 60% of the existing 74 locations, or 52% of all 84 known locations when those sites which have been extirpated are included. This means that less than half of the existing 74 locations (40%, or 30 locations) were moderate or low quality.

Nine of the locations were rated as "excellent" (12% of the existing 74 locations). These locations were either sites with over 10,000 individuals of one rare species, high numbers of two species or moderate numbers of three species. Fifteen locations were rated as "high quality" (20% of the existing 74 locations). These sites had very high numbers of one rare species, or moderate numbers of two species. Twenty locations were of "high" quality (27% of the existing 74 locations). These sites had high numbers of one rare species, or lower

numbers of two species. Thirteen sites were classified as "moderate" (18% of the existing 74 locations). These were sites with moderate numbers of one rare species or very low numbers of two rare species. Seventeen locations were "low" quality (23% of the existing 74 locations). These were sites with low numbers of one rare species.

The lowest quality possible would be those locations where rare plants have been lost to changes in land use or have disappeared for several years. Ten of these old locations are known representing a 13% loss in the 84 known past and present locations.

C. Endangerment

Locations were rated for endangerment using the following criteria:

Rating Assigned	Criteria
4 - Extirpated, or not found	Rare plants not found, or confirmed extirpation from site
3 - Imminent Endangerment	Rare plant locations in urban expansion areas, likely vineyard sites, likely wastewater irrigation sites
2 - Potentially Endangered	Rare plant locations in areas with potential for some urban development, vineyards or future wastewater irrigation
1 - Minimal Endangerment	Rare plant locations in areas not likely to undergo land use changes in near future
0 - No Endangerment	Rare plants preserved on managed preserves or binding easements

Assignment of ratings to particular locations was based on a judgement made by the authors using background knowledge of the region and projected land use changes. It is possible for any location to rapidly change to a greater or lesser degree of endangerment because of unforseen land use changes and purchase or easement to protect rare plants.

A listing of locations ranked by endangerment rating is provided in Table 4.

TABLE 4. ENDANGERMENT RANKINGS FOR RARE PLANT LOCATIONS IN THE SANTA ROSA PLAINS.

Site locations are coded by report identification numbers plotted on Sonoma County Planning Department lot-line maps; the first two numbers refer to USGS quadrangle (20=Healdsburg, 26=Sebastopol, 27=Santa Rosa, 32=Two Rock). The letters A-F, refer to sections of quadrangles on the 1 inch=500 feet lot-line maps. The last two numbers refer to actual occurrences identified in the field. Abundances are defined in terms of estimated numbers of individuals: 6=>10,000; 5=5,000-10,000; 4=1,000-5,000; 3=500-1,000; 2=100-500; 1=<100. LABU=Lasthenia burkei, LIVI=Limnanthes vinculans, BLBA=Blennosperma bakeri, NAPL=Navarretia plieantha, PODOP=Pogogyne douglasii spp. parviflora.

Biological Quality: 4 = very high, 3 = high, 2 = moderate, 1 = low, 0 = extirpated or not found. **Endangerment:** 4 = not found or extirpated, 3 = immanent endangerment, 2 = potentially endangered, 1 = slight potential for endangerment, 0 = preserved.

Location Number	Location Name	Biologic Quality	Endangerment Rating	Species Present
Extirpated or Not Found				
F2605	Naval Air Sta., Concord Rd end	0	4	LIVI extirpated
F2612	S Wright @ Madera, Nav.Air.Sta	0	4	LIVI extirpated
C2002	Arata Ln. overpass, Windsor	0	4	LABU extirpated
E2705	Horn Ave. south, SE Santa Rosa	0	4	BLBA, LIVI ext.
D2601	Hall x Willowside	0	4	LABU extirpated
E2704	Horn Ave. north, SE Santa Rosa	0	4	BLBA, LIVI ext.
F2003	Airport treatment plant	0	4	LABU extirpated
B2617	Westwood Vlg Subd., Piner HS	0	4	BLBA extirpated
C2601	Laguna @ Hall Rd., Nunes	0	4	LABU extirpated
F2006	Heller Labs, Shilo Rd.	0	4	LABU extirpated
Imminent Endangerment				
F2604	Naval Air Sta., SW quad #2	5	3	LIVI
F2602	Naval Air Sta., SW quad #1	5	3	LIVI
D2605	Corrie, off Guern., Piner HS	5	3	BLBA
B2614	Brown Subdivision, NW S. R.	4	3	BLBA,LABU,PODOP
B2602	San Miguel Rancho, NW S.R.	4	3	BLBA, LABU
B2622	Manes, San Miguel Rd, NW S. R.	4	3	LABU
B2615	San Miguel Est. # 1, NW S. R.	4	3	BLBA, LABU
C2001	Grill, Old Redwood Hwy,Windsor	4	3	LABU, PODOP
B2620	Hemmerle, Piner HS area	4	3	BLBA
C2006	Wilcox Rd., Windsor	3	3	LABU
B2616	San Miguel Est. # 2, NW S. R.	3	3	LABU
C2007	Promenade Ln woodland, Windsor	3	3	LABU
B2626	SW corner of Piner x Fulton	3	3	BLBA
B2606	Comalli's, Piner Rd west	3	3	BLBA, LABU
D2609	Nav. Air Sta., NE quadrant	2	3	PODOP
E2703	ScenicxWhistler, SW Santa Rosa	2	3	BLBA, LIVI
F2603	Naval Air Sta., Hanger site	2	3	PODOP

Table 4 (cont'd)

Location Number	Location Name	Biologic Quality	Endangerment Rating	Species Present
Imminent Endangerment				
C2005	Wilcox Rd. wreck. yrd, Windsor	2	3	LABU
F2608	Laguna @ RR br., Sebastopol	2	3	LABU, LIVI
D2606	Naval Air Sta., WrightxFinely	2	3	LIVI
C2003	Starr Rd.#1, Windsor	2	3	LABU
B2601	San Miguel x Fulton, NW S.R.	2	3	BLBA
B2623	Marovich, Waltzer Rd, NW S. R.	1	3	LABU
F2004	Coombs easement, Airport B. P.	1	3	LABU
F2615	Scenic Ave. x Arlington Way	1	3	LIVI
B2621	Rancho San Miguel #2, NW S. R.	1	3	BLBA
C2004	Starr Rd. #2, Windsor	1	3	LABU
Potentially Endangered				
B2610	Abramson Rd # 2, Piner HS area	5	2	BLBA
F2005	Shilo Rd. horse ranch	5	2	LABU, PODOP
B2609	S.R.224 easement,Piner Rd west	5	1	BLBA
D2603	Dairy, Hall&Occi near Fulton	5	2	LABU, LIVI
B2611	Abramson Rd # 3, Piner HS area	4	2	BLBA
E2701	Primrose Ave., SW Santa Rosa	4	2	BLBA
B2628	Abramson Rd. # 4	4	2	LABU
F2614	Ash Drive, Old Navel Air Sta	4	2	LIVI
B2625	Wood Rd.elbows, W. Piner area	3	2	LABU
B2605	Maccario's oaks, Piner Rd west	3	2	BLBA
B2604	Hartman Rd near Piner Rd west	3	2	LABU, BLBA
F2002	Standard Structures, Shilo Rd.	3	2	LABU
D2602	Hall x Piezza (Crinella)	3	2	LABU
F2009	Skyine Blvd. extension	3	2	LABU
B2618	Francisco elbows, NW S. R.	3	2	BLBA, LABU
F2007	Gossage, Sanders Rd., Airport	3	2	LABU, NAPL
F2008	Sanders Rd. (end), Airport	3	2	LABU
B2627	Field SW of Piner Elem. Sch.	3	2	BLBA
D2604	Lions Memorial, Occi @ Merced	3	2	LIVI
C2008	Grange area, Windsor	2	2	LABU
E2702	Todd @ Primrose, SW Santa Rosa	2	2	BLBA
B2612	Paradise Ln # 1, Piner HS area	2	2	BLBA
F2613	Walker Ln, near Colgon Cr.	2	2	LIVI
B2619	Raplee Terrace, NW S. R.	2	2	BLBA
B2613	Paradise Rd # 2, Piner HS area	1	2	BLBA
D2607	CALTRANS ROW, Hwy 12xOcci.	1	2	LIVI
D2608	CALTRANS ROW, Hwy 12 @ Llano	1	2	LIVI
B2608	Oak Farm Ln, Piner Rd west	1	2	BLBA
F2607	ToddxLlano, SW corner,	1	2	LIVI
F2616	Colgon Cr. pasture, nr. Todd	1	2	LIVI
C2604	Aggio dairy, Laguna @ Occi. Rd	1	2	LIVI

Table 4 (cont'd)

Location Number	Location Name	Biologic Quality	Endangerment Rating	Species Present
Minimal Endangerment				
B3201	Gundelfinger, Llano @ Hwy I16	5	1	LIVI
F2606	T. Carinalli easement	4	1	BLBA, LIVI
E2706	ScenicxHargrave, SW Santa Rosa	4	1	BLBA
F2001	County Airport medians	4	1	LABU
F2601	Landeros, Todd Rd near Llano	4	1	LIVI
B2624	Pioneer 2000 Apts., NW S. R.	3	1	LABU
B2603	Alton Rd., NW S. R.	3	1	BLBA
C2605	Ambrosini @ Occ.Rd.Br., Laguna	3	1	BLBA
B2607	Abramson Rd # 1, Piner HS area	1	1	BLBA
C2603	Occi. Rd near Sanford, Laguna	1	1	LABU
C2602	Sanford Rd. @ the Laguna	1	1	LIVI
E2613	Palm Terrace, Sebastopol	1	1	LABU
No Endangerment				
F2610	Dom. Carinalli easement,Laguna	5	0	BLBA, LABU, LIVI
F2609	Todd Rd. Preserve	4	0	BLBA, LIVI
E2001	County Airport Preserve	3	0	LABU
F2611	Hofbauer easement, Laguna	1	0	LIVI

The table indicates that 10 sites have reached ultimate endangerment; extirpation, or disappearance from a site. Twenty-seven locations, more than a third (37%) of the 74 existing rare plant sites, face imminent endangerment. Of the 27 sites facing imminent endangerment, 14 of them are of high quality or better. This figure represents 32 % of all the high to excellent quality sites in the study. Three sites of excellent quality are imminently endangered. This figure represents a third of all excellent quality sites in the study. Only 11 sites of high - excellent quality face minimal endangerment, or are preserved. This figure represents approximately one quarter (27%) of all the high - excellent quality sites in the study. Thirty-one locations are potentially endangered. When added to those locations facing imminent endangerment, 57 locations, or 77% of all existing sites in the study are under some degree of threat.

V. RESULTS (cont'd)

D. Species of Concern

1. Lasthenia burkei (LABU)

This species was mostly present in the northern half of the study area, from roughly Sebastopol to Windsor (see Figure 2). The greatest concentration occurred in the vicinity of Windsor, although significant colonies occurred in the Laguna near Sebastopol. In total, 33 occurrences were recorded (see Table 3). The greatest concentration of individuals, greater than 10,000, occurred at the Shilo horse ranch parcel (F2005). Up to 10,000 individuals occurred at the Carinelli Ranch (F2610), also the location of over 10,000 Limnanthes vinculans. Similar numbers of Lasthenia burkei were located at the Sonoma County Airport (F2001, F2002).

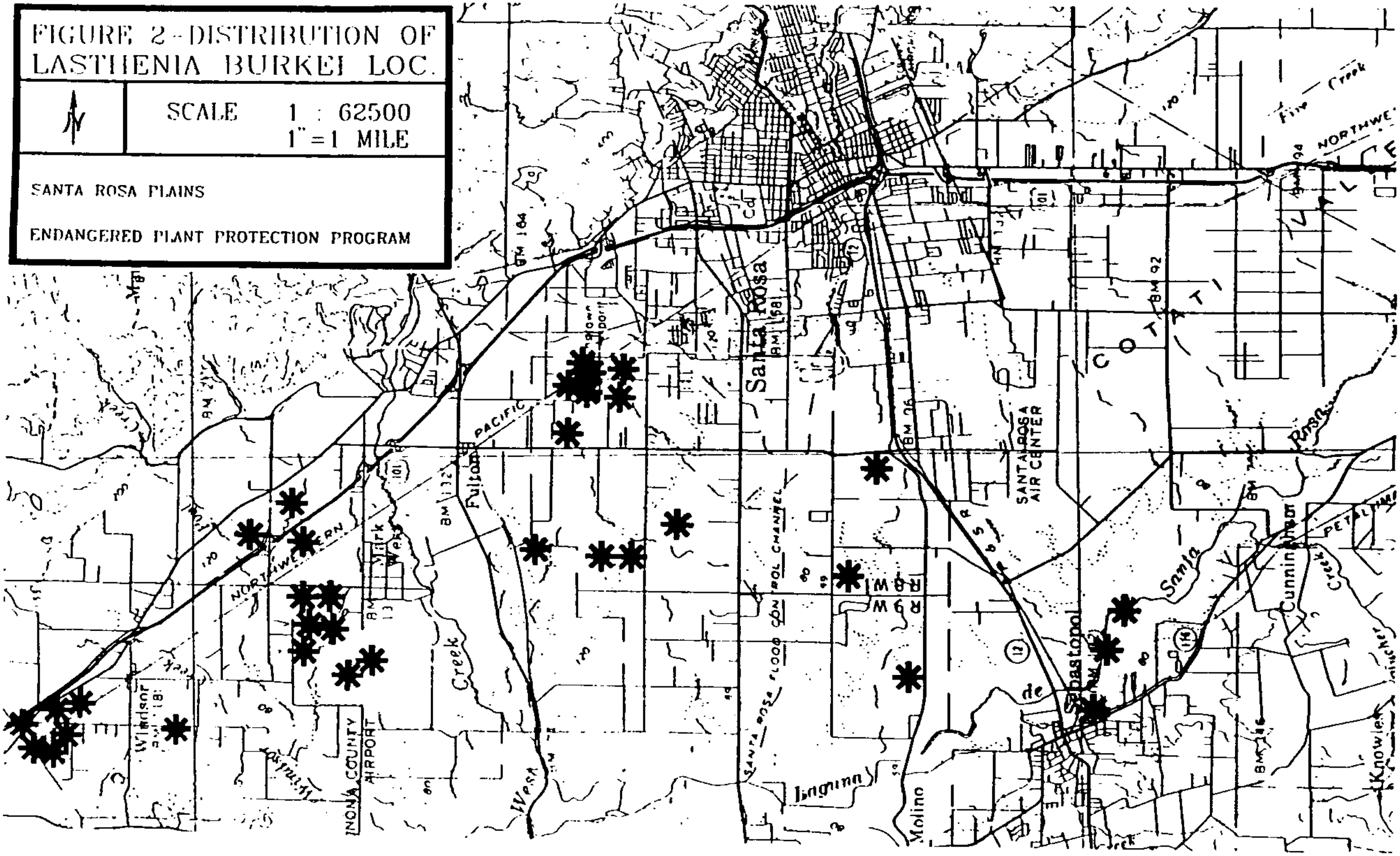

FIGURE 2 - DISTRIBUTION OF LASTHENIA BURKEI LOC.

SCALE 1 : 62500
1" = 1 MILE

SANTA ROSA PLAINS

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TABLE 5. *LASTHENIA BURKEI* LOCATIONS, ABUNDANCES AND PRESERVATION PRIORITY IN THE SANTA ROSA PLAINS

Abundances defined in terms of estimated numbers of individuals: 6 = >10,000; 5 = 5,000-10,000; 4 = 1,000-5,000; 3 = 500-1,000; 2 = 100-500; 1 = <100. LABU=*Lasthenia burkei*. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation.

Report Number	Location Name	LABU Abundance	Preservation Priority
F2005	Shilo Rd. horse ranch	6	1
F2001	County Airport medians	5	3
B2622	Manes, San Miguel Rd, NW S. R.	5	1
B2628	Abramson Rd. # 4	5	2
F2610	Dom. Carinalli easement,Laguna	5	0
C2001	Grill, Old Redwood Hwy,Windsor	4	1
C2006	Wilcox Rd., Windsor	4	2
C2007	Promenade Ln woodland, Windsor	4	2
E2001	County Airport Preserve	4	0
F2002	Standard Structures, Shilo Rd.	4	2
F2008	Sanders Rd. (end), Airport	4	2
F2009	Skyine Blvd. extension	4	2
B2602	San Miguel Rancho, NW S.R.	4	1
B2614	Brown Subdivision, NW S. R.	4	1
B2616	San Miguel Est. # 2, NW S. R.	4	2
B2624	Pioneer 2000 Apts., NW S. R.	4	0
B2625	Wood Rd.elbows, W. Piner area	4	2
D2602	Hall x Piezza (Crinella)	4	3
C2003	Starr Rd.#1, Windsor	3	2
C2005	Wilcox Rd. wreck. yrd, Windsor	3	2
C2008	Grange area, Windsor	3	3
F2007	Gossage, Sanders Rd., Airport	3	1
B2615	San Miguel Est. # 1, NW S. R.	3	1
C2004	Starr Rd. #2, Windsor	2	3
B2618	Francisco elbows, NW S. R.	2	2
B2623	Marovich, Waltzer Rd, NW S. R.	2	3
C2603	Ccci. Rd near Sanford, Laguna	2	3
D2603	Dairy, Hall&Occi near Fulton	2	1
E2613	Palm Terrace, Sebastopol	2	3
F2004	Coombs easement, Airport B. P.	1	0
B2604	Hartman Rd near Piner Rd west	1	2
B2606	Comalli's, Piner Rd west	1	2
F2608	Laguna @ RR br., Sebastopol	1	2

D. **Species of Concern (cont.)**

2. **Limnanthes vinculans (LIVI)**

This species was present mostly in the southern half of the study area (see Figure 3). The greatest concentrations seem to occur in the moistest and best developed pools. A total of 19 locations were recorded (see Table 4). Greater than 10,000 individuals were found at three locations: Gundelfinger's near the Llano Road-Highway 116 intersection (B3201), two at the old naval airport (F2602, F2604) and the Carinalli Ranch easement (F2610). Up to 10,000 also occurred at the Todd Road Preserve (F2609) and adjacent to Todd Road east of Llano Road (F2601; Landeros easement).

FIGURE 3 DISTRIBUTION OF LIMNANTHES VINCULANS LOC.

SCALE 1 : 62500
1" = 1 MILE

SANTA ROSA PLAINS

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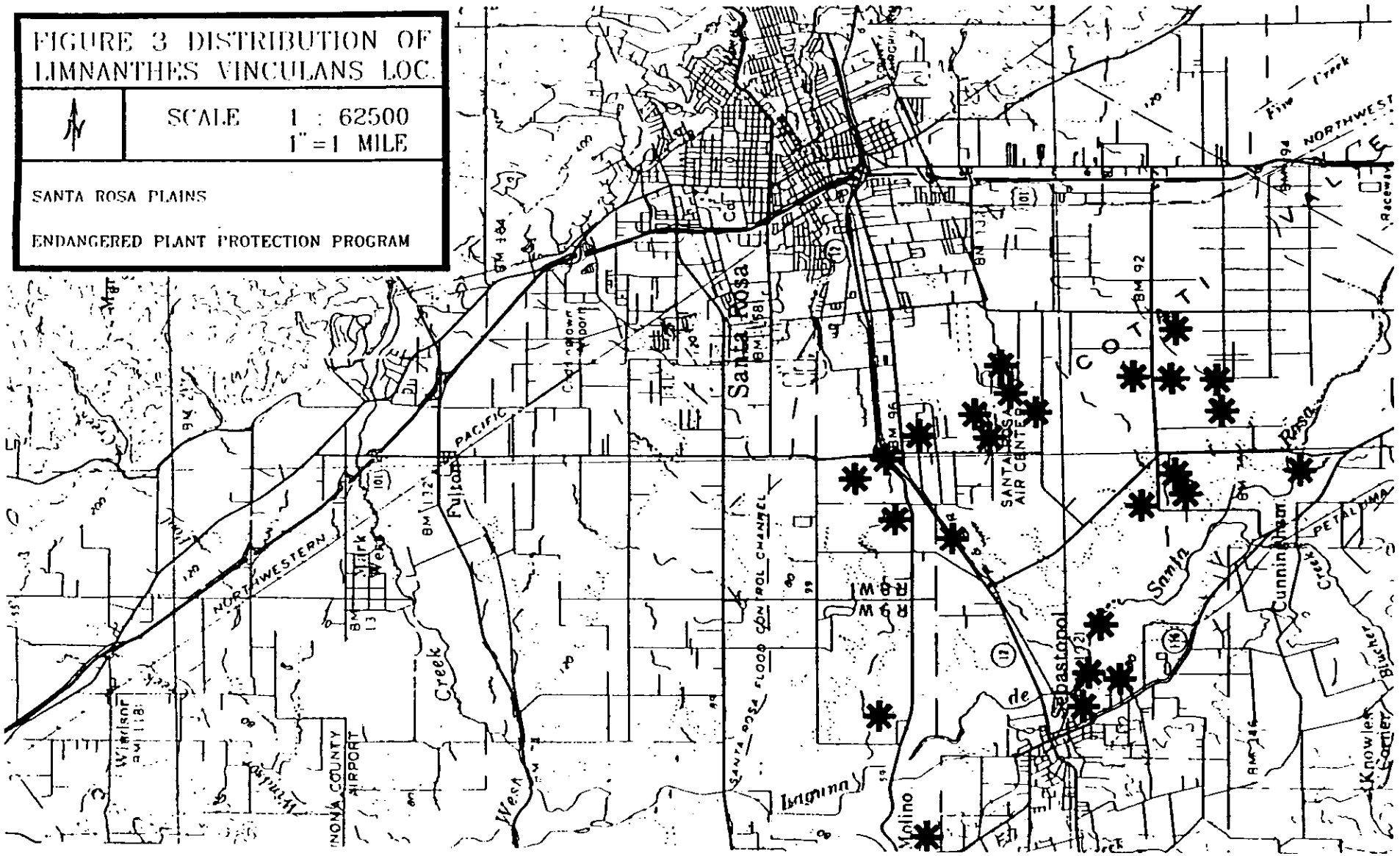

TABLE 6. LIMNANTHES VINCULANS LOCATIONS, ABUNDANCES AND PRESERVATION PRIORITY IN THE SANTA ROSA PLAINS

Abundances defined in terms of estimated numbers of individuals: 6 = >10,000; 5 = 5,000-10,000; 4 = 1,000-5,000; 3 = 500-1,000; 2 = 100-500; 1 = <100. LIVI=Limnanthes vinculans. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation.

Report Number	Location Name	LIVI Abundance	Preservation Priority
D2603	Dairy, Hall&Occi near Fulton	6	1
F2602	Naval Air Sta., SW quad #1	6	1
F2604	Naval Air Sta., SW quad #2	6	1
F2610	Dom. Carinalli easement,Laguna	6	0
B3201	Gundelfinger, Llano @ Hwy 116	6	2
F2601	Landeros, Todd Rd near Llano	5	3
F2609	Todd Rd. Preserve	5	0
D2604	Lions Memorial, Occi @ Merced	3	2
D2606	Naval Air Sta., WrightxFinley	3	2
F2606	Todd Rd Elbow, preserve area	3	3
F2613	Walker Ln, near Colgon Cr.	3	3
F2614	Ash Drive, Old Navel Air Sta	4	2
E2703	ScenicxWhistler, SW Santa Rosa	3	2
F2607	ToddxLlano, SW corner,	2	3
F2611	Hofbauer easement, Laguna	2	3
F2616	Colgon Cr. pasture, nr. Todd	2	3
C2602	Sanford Rd. @ the Laguna	1	3
C2604	Aggio dairy, Laguna @ Occi. Rd	1	3
C2607	CALTRANS ROW, Hwy 12xOcci.	1	3
D2608	CALTRANS ROW, Hwy 12 @ Llano	1	3
F2608	Laguna @ RR br., Sebastopol	1	2
F2615	Scenic Ave. x Arlington Way	1	3

D. Species of Concern (cont.)

3. Blennosperma bakeri (BLBA)

This species was mostly concentrated in the middle section of the study area (see Figure 4). A total of 30 occurrences were recorded for this species (see Table 5, pg. 20). Fifteen of these are new, or not reported in CNDDB printouts. The greatest colonies, over 10,000 individuals, occurred at the Corrie parcel (D2605), south of Piner Road east of Fulton Road (B2609) and adjacent to Abramson Road (B2610, B2611). Up to 10,000 individuals occurred at Primrose Avenue (E2701) and the T. Carinelli easement (F2606). Other significant colonies occurred adjacent to Alton Road (B2603, B2605), adjacent to Hartman Road (B2604) and adjacent to Piner Road east of Fulton Road (B2606).

FIGURE 4 DISTRIBUTION OF BLENNOSPERMA BAKERI LOC.

SCALE 1 : 62500
1" = 1 MILE

SANTA ROSA PLAINS

ENDANGERED PLANT PROTECTION PROGRAM

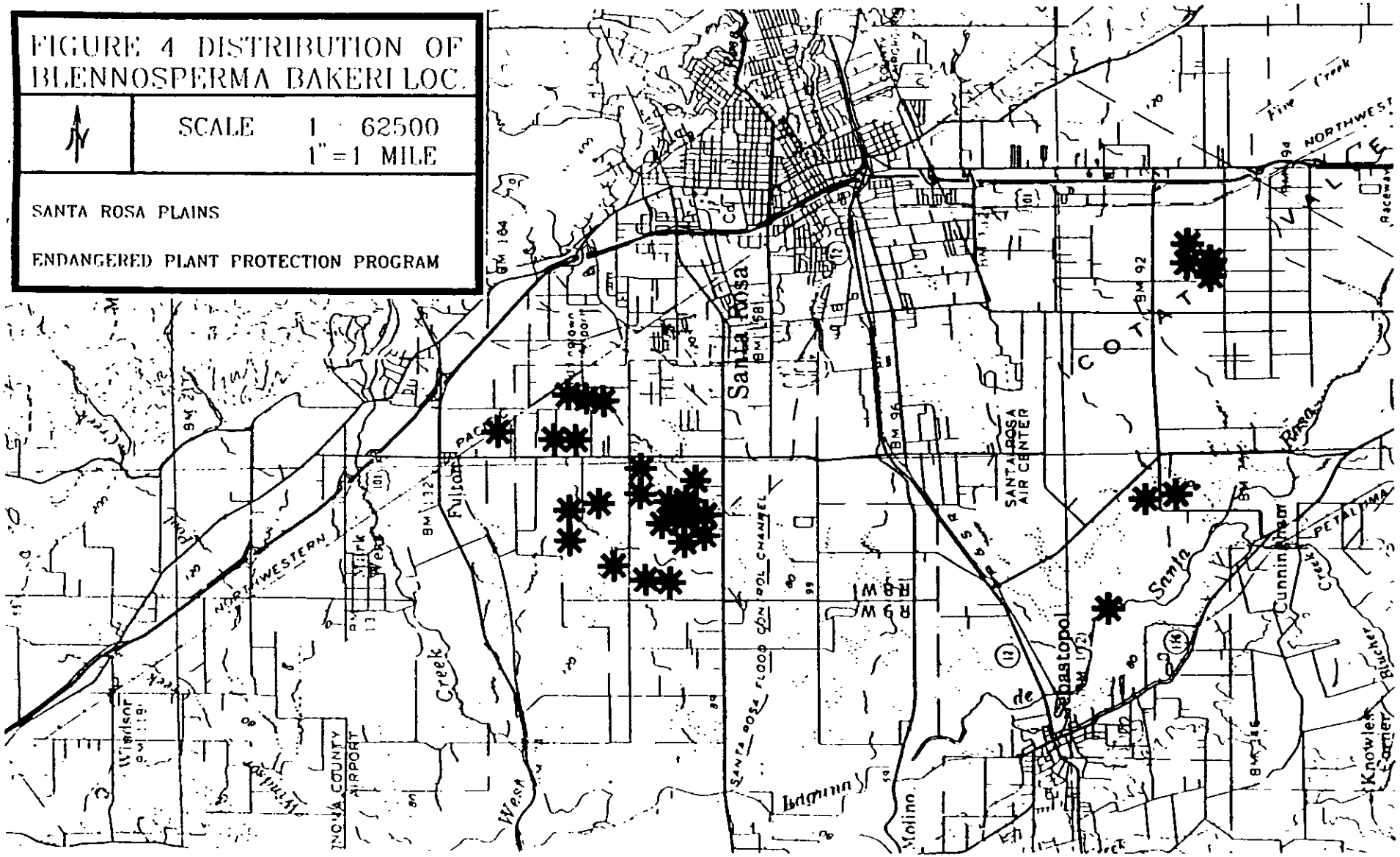

TABLE 7. *BLENNOSPERMA BAKERI* LOCATIONS, ABUNDANCES AND PRESERVATION PRIORITY IN THE SANTA ROSA PLAINS

Abundances defined in terms of estimated numbers of individuals: 6 = >10,000; 5 = 5,000-10,000; 4 = 1,000-5,000; 3 = 500-1,000; 2 = 100-500; 1 = <100. BLBA=*Blennosperma bakeri*. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation.

Report Number	Location Name	BLBA Abundance	Preservation Priority
B2609	S.R.224 easement,Piner Rd west	6	1
B2610	Abramson Rd # 2, Piner HS area	6	1
D2605	Corrie, off Guern., Piner HS	6	1
B2602	San Miguel Rancho, NW S.R.	5	1
B2611	Abramson Rd # 3, Piner HS area	5	2
B2615	San Miguel Est. # 1, NW S. R.	5	1
B2620	Hemmerle, Piner HS area	5	1
F2606	Todd Rd Elbow, preserve area	5	3
F2610	Dom. Carinalli easement,Laguna	5	0
E2701	Primrose Ave., SW Santa Rosa	5	2
E2706	ScenicxHargrave, SW Santa Rosa	5	3
B2603	Alton Rd., NW S. R.	4	3
B2604	Hartman Rd near Piner Rd west	4	2
B2605	Maccario's oaks, Piner Rd west	4	2
B2606	Comalli's, Piner Rd west	4	2
B2626	SW corner of Piner x Fulton	4	2
B2627	Field SW of Piner Elem. Sch.	4	2
B2601	San Miguel x Fulton, NW S.R.	3	2
B2612	Paradise Ln # 1, Piner HS area	3	3
B2614	Brown Subdivision, NW S. R.	3	1
B2618	Francisco elbows, NW S. R.	3	2
B2619	Raplee Terrace, NW S. R.	3	3
F2609	Todd Rd. Preserve	3	0
E2702	Todd @ Primrose, SW Santa Rosa	3	3
B2607	Abramson Rd # 1, Piner HS area	2	3
B2608	Oak Farm Ln, Piner Rd west	2	3
B2613	Paradise Rd # 2, Piner HS area	2	3
B2621	Rancho San Miguel #2, NW S. R.	2	3
E2703	ScenicxWhistler, SW Santa Rosa	1	2

D. Species of Concern (cont.)

4. **Navarretia plieantha (NAPL)**

There was only one re-confirmed occurrence recorded for this species in the study area, adjacent to Sanders Road (F2007) (see Figure 5 and Table 6). This location contained up to 1,000 individuals. The species appears to be thriving despite intensive grazing by sheep.

FIGURE 5 DISTRIBUTION OF NAVARRETIA PLIENTHA LOC.

SCALE 1 : 62500
1" = 1 MILE

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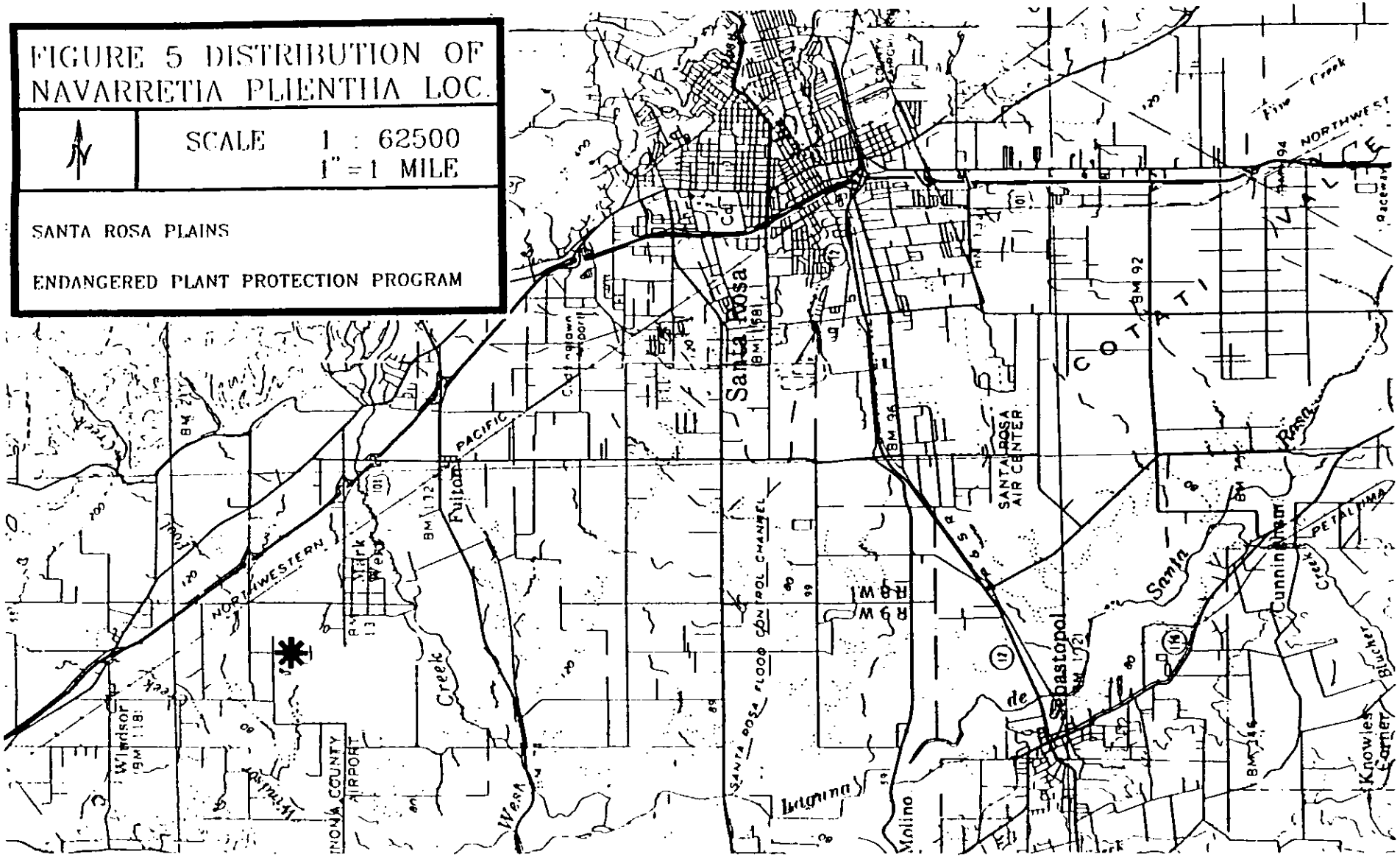

TABLE 8. *NAVARRETIA PLIEANTHA* LOCATIONS, ABUNDANCES AND PRESERVATION PRIORITY IN THE SANTA ROSA PLAINS

Abundances defined in terms of estimated numbers of individuals: 6 = >10,000; 5 = 5,000-10,000; 4 = 1,000-5,000; 3 = 500-1,000; 2 = 100-500; 1 = <100. NAPL = *Navarretia plieantha*. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation.

Site Location	Location Name	NAPL Abundance	Preservation Priority
F2007	Gossage, Sanders Rd.; Airport	2	1

D. Species of Concern (cont.)

5. Pogogyne douglasii spp. parviflora (PODOP)

Six occurrences of this species were recorded in the study area, all reconfirmed from prior surveys (see Figure 6, pg. 25 and Table 7, pg. 26). The greatest colony was located north of Occidental Road bridge where greater than 1,000 individuals occurred in a very large vernal pool. Up to 1,000 individuals occurred at the Shilo Road horse ranch (F2005) and adjacent to Old Redwood Highway near Starr Road (C2001). Colonies occurred at the old naval air station (D2609, F2603). The colony at Brown Subdivision (B2614) was part of an ensemble with Lasthenia burkei and Blennosperma bakeri.

FIGURE 6 DISTRIBUTION OF POGOGYNE DOUGLASII SPP.PARVIFLORA

SCALE 1 : 62500
1" = 1 MILE

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ENDANGERED PLANT PROTECTION PROGRAM

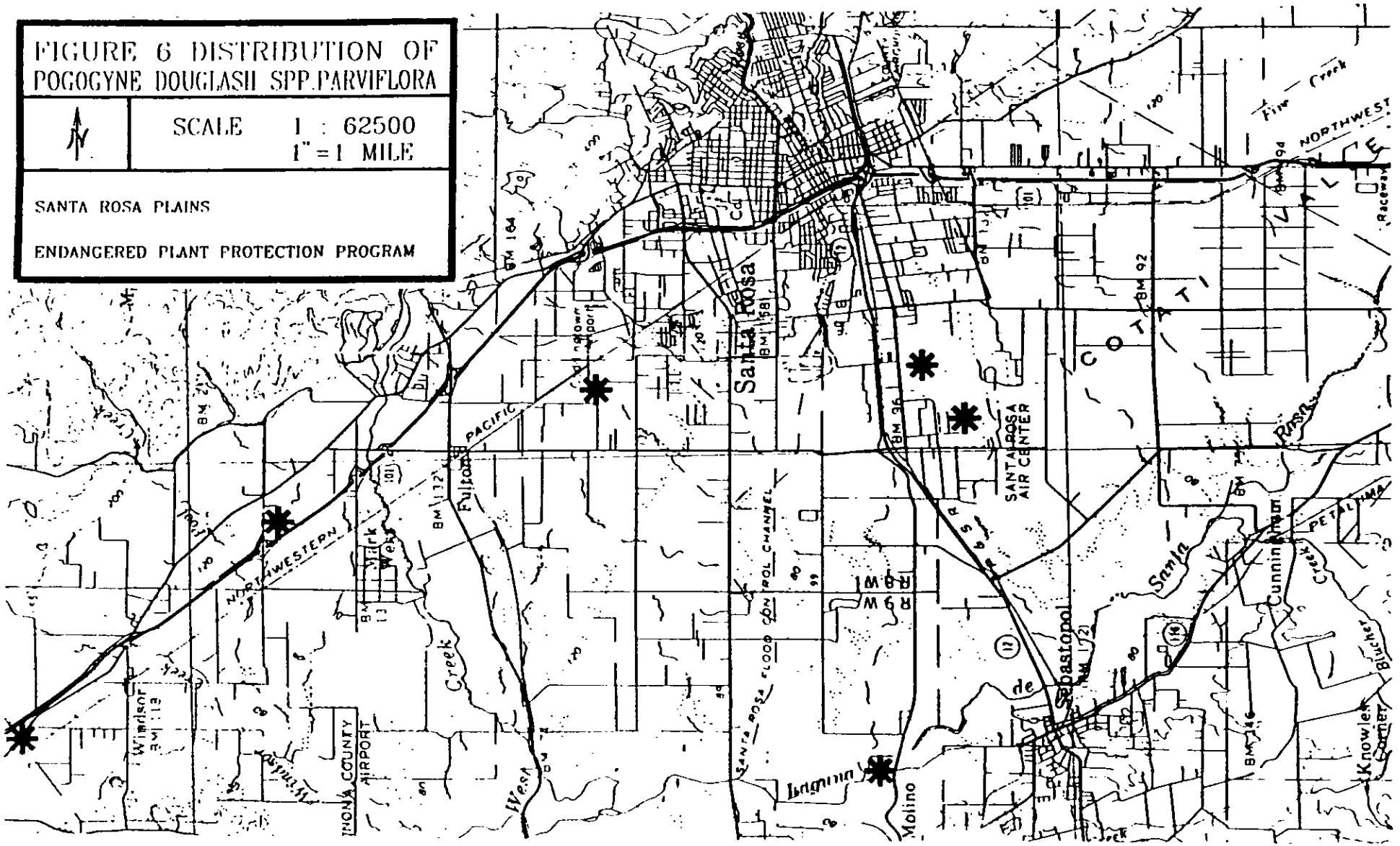


TABLE 9. POGOGYNE DOUGLASII SPP. PARVIFLORA LOCATIONS, ABUNDANCES AND PRESERVATION PRIORITY IN THE SANTA ROSA PLAINS

Abundances defined in terms of estimated numbers of individuals: 6 = >10,000; 5 = 5,000-10,000; 4 = 1,000-5,000; 3 = 500-1,000; 2 = 100-500; 1 = <100. LABU = Lasthenia burkei. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation.

Report Number	Location Name	PODOP Abundance	Preservation Priority
C2001	Grill, Old Redwood Hwy,Windsor	4	1
F2005	Shilo Rd. horse ranch	4	1
C2605	Ambrosini @ Occ.Rd.Br., Laguna	4	3
D2609	Nav. Air Sta., NE quadrant	3	2
F2603	Naval Air Sta., Hanger site	3	2
B2614	Brown Subdivision, NW S. R.	2	1

E. Ensemble Sites

There were a total of 16 ensemble sites, 19% of the total number of sites in the study. These sites are listed in Table 10 below. Two of these sites, the Brown Subdivision (B2614) and the Dominic Carinalli (F2610) easement, had three species present. Most of the sites involved Lasthenia burkei, including the only Navarretia plieantha (Gossage, F2007) site in the study. Seven ensemble sites were a first priority for preservation. Three sites are already protected and the remainder were classified as a secondary preservation priority because of moderate numbers of plants or minimal endangerment.

TABLE 10. RARE PLANT ENSEMBLE SITES IN THE SANTA ROSA PLAINS

Ensemble sites are locations where two or more rare species occur together. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation. Abundances defined in terms of estimated numbers of individuals: 6 = >10,000; 5 = 5,000-10,000; 4 = 1,000-5,000; 3 = 500-1,000; 2 = 100-500; 1 = <100.

Report Number	Location Name	Species Abundance					Preservation Priority
		LABU	LIVI	BLBA	NAPL	PODOP	
Sites where three species were present:							
LABU - BLBA - PODOP							
B2614	Brown Subdivision, NW S. R.	4	0	3	0	2	1
LABU - LIVI - BLBA							
F2610	Dom. Carinalli easement,Laguna	5	6	5	0	0	0
Sites where two species were present:							
LABU - PODOP							
C2001	Grill, Old Redwood Hwy,Windsor	4	0	0	0	4	1
F2005	Shilo Rd. horse ranch	6	0	0	0	4	2
LABU - BLBA							
B2602	San Miguel Rancho, NW S.R.	4	0	5	0	0	1
B2604	Hartman Rd near Piner Rd west	1	0	4	0	0	2
B2606	Comalli's, Piner Rd west	1	0	4	0	0	2
B2615	San Miguel Est. # 1, NW S. R.	3	0	5	0	0	1
B2618	Francisco elbows, NW S. R.	2	0	3	0	0	2
LABU - LIVI							
D2603	Dairy, Hall&Occi near Fulton	2	6	0	0	0	1
F2608	Laguna @ RR br., Sebastopol	1	1	0	0	0	2
LABU - NAPL							
F2007	Gossage, Sanders Rd., Airport	3	0	0	2	0	1
LIVI - BLBA							
F2606	T. Carinalli easement	0	3	5	0	0	0
F2609	Todd Rd. Preserve	0	5	3	0	0	0
F2614	Ludwig Ave., Old Navel Air Sta.	0	3	3	0	0	1
E2703	ScenicxWhistler, SW Santa Rosa	0	3	1	0	0	2

V. RESULTS (cont'd)

F. Preservation Priority

The ranking of rare and endangered plant locations by priority for preservation is shown in Table 11. The criteria used in ranking the locations consisted of evaluating the biologic quality (Table 3) and endangerment assessments (Table 4) for each site. The biologic quality rating and the endangerment rating were multiplied and the product was used as the priority ranking score. For instance, a location with a biologic quality rating of 5 and an endangerment rating of 3 produced a priority rating of 15 (5*3=15), which is the highest score achievable. This site would have the highest priority for preservation. This approach is weighted toward giving the highest quality sites with the greatest degree of endangerment the highest priority for preservation.

Not all locations with high biologic quality received a high priority rating for preservation: the Gundlefinger property (B3201) has a biologic quality of 5, the highest possible, but because of favorable land use and low potential for conversion, its endangerment rating is only 1. The product of these ratings is 5 (5*1=5), so the site is of secondary priority for preservation. This secondary priority rating should not be construed to give the impression that an opportunity to preserve the Gundlefinger site should be avoided. In fact, the premise of any conservation effort strives to preserve all endangered species habitat. However, in recognition of rapidly changing land use in an urbanizing area of the Santa Rosa Plains, assigning a priority for preservation is a rather desperate attempt to stave off extinction by saving the best rare plant habitat currently facing development or conversion to other uses. Once this task has been accomplished, attention can then be directed at other less endangered locations on a basis that highest priority be preserved first.

Priority ratings were broken into four classes: highest priority, secondary priority, low priority and no priority. Locations were assigned a priority category based on the following criteria:

Priority	Rating Score
Highest	10-15
Secondary	5-9
Low	1-4
No Priority	0

Locations are ranked by priority for preservation below in Table 11.

Table 11. PRESERVATION PRIORITY FOR RARE PLANT LOCATIONS IN THE SANTA ROSA PLAINS

Site locations are coded by report identification numbers plotted on Sonoma County Planning Department lot-line maps; the first two numbers refer to USGS quadrangle (20=Healdsburg, 26=Sebastopol, 27=Santa Rosa, 32=Two Rock). The letters A-F, refer to sections of quadrangles on the 1 inch=500 feet lot-line maps. The last two numbers refer to actual occurrences identified in the field. LABU=Lasthenia burkei, LIVI=Limnanthes vinculans, BLBA=Blennosperma bakeri, NAPL=Navarretia plieantha, PODOP=Pogogyne douglasii spp. parviflora. **Biological Quality:** 4 = very high, 3 = high, 2 = moderate, 1 = low, 0 = extirpated or not found. **Endangerment:** 4 = not found or extirpated, 3 = immanent endangerment, 2 = potentially endangered, 1 = slight potential for endangerment, 0 = preserved. **Preservation Priority:** 1 = highest priority, 2 = secondary priority, 3 = low priority, 0 = preserved or confirmed extirpation.

Location Number	Location Name	Biotic Quality	Ranking Endangerment	Priority Score	Species Present
Highest Priority: 14 Locations					
D2605	Corrie, off Guern., Piner HS	5	3	15	BLBA
F2602	Naval Air Sta., SW quad #1	5	3	15	LIVI
F2604	Naval Air Sta., SW quad #2	5	3	15	LIVI
C2001	Grill, Old Redwood Hwy,Windsor	4	3	12	LABU, PODOP
B2602	San Miguel Rancho, NW S.R.	4	3	12	BLBA, LABU
B2614	Brown Subdivision, NW S. R.	4	3	12	BLBA, LABU, PODOP
B2615	San Miguel Est. # 1, NW S. R.	4	3	12	BLBA, LABU
B2620	Hemmerle, Piner HS area	4	3	12	BLBA
B2622	Manes, San Miguel Rd, NW S. R.	4	3	12	LABU
F2005	Shilo Rd. horse ranch	5	2	10	LABU, PODOP
F2007	Gossage, Sanders Rd., Airport	5	2	10	LABU, NAPL
B2609	S.R.224 easement,Piner Rd west	5	2	10	BLBA
B2610	Abramson Rd # 2, Piner HS area	5	2	10	BLBA
D2603	Dairy, Hall&Occi near Fulton	5	2	10	LABU, LIVI
Secondary Priority: 28 Locations					
C2006	Wilcox Rd., Windsor	3	3	09	LABU
C2007	Promenade Ln woodland, Windsor	3	3	09	LABU
B2606	Comalli's, Piner Rd west	3	3	09	BLBA, LABU
B2616	San Miguel Est. # 2, NW S. R.	3	3	09	LABU
B2626	SW corner of Piner x Fulton	3	3	09	BLBA
B2611	Abramson Rd # 3, Piner HS area	4	2	08	BLBA
B2628	Abramson Rd. # 4	4	2	08	LABU
F2614	Ludwig Ave., Old Navel Air Sta	4	2	08	BLBA, LIVI
E2701	Primrose Ave., SW Santa Rosa	4	2	08	BLBA
C2003	Starr Rd.#1, Windsor	2	3	06	LABU

Table 11 (cont'd)

Location Number	Location Name	Biotic Quality	Ranking Endangerment	Priority Score	Species Present
Secondary Priority: 28 Locations (cont'd)					
C2005	Wilcox Rd. wreck. yrd, Windsor	2	3	06	LABU
F2002	Standard Structures, Shilo Rd.	3	2	06	LABU
F2008	Sanders Rd. (end), Airport	3	2	06	LABU
F2009	Skyine Blvd. extension	3	2	06	LABU
B2601	San Miguel x Fulton, NW S.R.	2	3	06	BLBA
B2604	Hartman Rd near Piner Rd west	3	2	06	BLBA, LABU
B2605	Maccario's oaks, Piner Rd west	3	2	06	BLBA
B2618	Francisco elbows, NW S. R.	3	2	06	BLBA, LABU
B2625	Wood Rd.elbows, W. Piner area	3	2	06	LABU
B2627	Field SW of Piner Elem. Sch.	3	2	06	BLBA
D2602	Hall x Piezza (Crinella)	3	2	06	LABU
D2604	Lions Memorial, Occi @ Merced	3	2	06	LIVI
D2606	Naval Air Sta., WrightxFinely	2	3	06	LIVI
D2609	Nav. Air Sta., NE quadrant	2	3	06	PODOP
F2603	Naval Air Sta., Hanger site	2	3	06	PODOP
F2608	Laguna @ RR br., Sebastopol	2	3	06	LABU, LIVI
E2703	ScenicxWhistler, SW Santa Rosa	2	3	06	BLBA, LIVI
B3201	Gundelfinger, Llano @ Hwy 116	5	1	05	LIVI
Low Priority: 28 Locations					
C2008	Grange area, Windsor	2	2	04	LABU
F2001	County Airport medians	4	1	04	LABU
B2612	Paradise Ln # 1, Piner HS area	2	2	04	BLBA
B2619	Raplee Terrace, NW S. R.	2	2	04	BLBA
F2601	Landeros, Todd Rd near Llano	4	1	04	LIVI
F2606	T. Carinalli easement	4	1	04	BLBA, LIVI
F2613	Walker Ln, near Colgon Cr.	2	2	04	LIVI
E2702	Todd @ Primrose, SW Santa Rosa	2	2	04	BLBA
E2706	ScenicxHargrave, SW Santa Rosa	4	1	04	BLBA
C2004	Starr Rd. #2, Windsor	1	3	03	LABU
F2004	Coombs easement, Airport B. P.	1	3	03	LABU
B2603	Alton Rd., NW S. R.	3	1	03	BLBA
B2621	Rancho San Miguel #2, NW S. R.	1	3	03	BLBA
B2623	Marovich, Waltzer Rd, NW S. R.	1	3	03	LABU
B2624	Pioneer 2000 Apts., NW S. R.	3	1	03	LABU
C2605	Ambrosini @ Occ.Rd.Br., Laguna	3	1	03	PODOP
F2615	Scenic Ave. x Arlington Way	1	3	03	LIVI
B2608	Oak Farm Ln, Piner Rd west	1	2	02	BLBA
B2613	Paradise Rd # 2, Piner HS area	1	2	02	BLBA
C2604	Aggio dairy, Laguna @ Occi. Rd	1	2	02	LIVI
D2607	CALTRANS ROW, Hwy 12xOcci.	1	2	02	LIVI
D2608	CALTRANS ROW, Hwy 12 @ Llano	1	2	02	LIVI

Table 11 (cont'd)

Location Number	Location Name	Biotic Quality	Ranking Endan-germent	Priority Score	Species Present
F2607	ToddxLlano, SW corner,	1	2	02	LIVI
F2616	Colgon Cr. pasture, nr. Todd	1	2	02	LIVI
B2607	Abramson Rd # 1, Piner HS area	1	1	01	BLBA
C2602	Sanford Rd. @ the Laguna	1	1	01	LIVI
C2603	Occi. Rd near Sanford, Laguna	1	1	01	LABU
E2613	Palm Terrace, Sebastopol	1	1	01	LABU
No Priority: Preserved: 4 Locations					
E2001	County Airport Preserve	3	0	00	LABU
F2609	Todd Rd. Preserve	4	0	00	BLBA, (LABU), LIVI
F2610	Dom. Carinalli easement,Laguna	5	0	00	BLBA, LABU, LIVI
F2611	Hofbauer easement, Laguna	1	0	00	LIVI
No Priority: Extirpated, or not Found: 10 Locations					
C2002	Arata Ln. overpass, Windsor	0	4	00	LABU
F2003	Airport treatment plant	0	4	00	LABU
F2006	Heller Labs, Shilo Rd.	0	4	00	LABU
B2617	Westwood Vlg Subd., Piner HS	0	4	00	BLBA
C2601	Laguna @ Hall Rd., Nunes	0	4	00	LABU
D2601	Hall x Willowside	0	4	00	LABU
F2605	Naval Air Sta., Concord Rd end	0	4	00	LIVI
F2612	S Wright @ Madera, Nav.Air.Sta	0	4	00	LIVI
E2704	Horn Ave. north, SE Santa Rosa	0	4	00	BLBA, LIVI
E2705	Horn Ave. south, SE Santa Rosa	0	4	00	BLBA, LIVI

F. Preservation Priority (cont'd)

Fourteen of the 74 study sites were ranked as the highest priority for preservation. This figure represents 19% of currently existing sites (excluding the four which have been preserved). All of these locations were excellent or very high in biologic quality because they contained high numbers of one or more rare or endangered plants. Nine of these locations were imminently endangered and four were facing potential endangerment.

Of the 56 un-preserved remaining locations, 28 are of secondary priority for preservation. These sites range from excellent biologic quality and low endangerment to moderate biologic quality and imminent endangerment. It must be stressed that locations ranked as secondary priority are worthy of preservation if and when they become available, but because time and resources are limited, seeking immediate preservation of these secondary sites at the expense of spending resources on a first priority location is unjustifiable. None of the secondary locations are expendable; at a

F. Preservation Priority (cont'd)

minimum all deserve mitigation requiring preservation of existing habitat. In fact, the Gundlefinger location (B3201) is worthy of preserve status, but if the landowners continue benign land use practices, it is in essence preserved making any available funds much better spent at one of the first priority locations. However, changes in land use that could negatively impact the Limnanthes vinculans on the site would cause the location to become a first priority for preservation.

The remaining 28 unpreserved locations were of low priority for preservation. Although most of these sites are of low to moderate biologic quality, several possess high biologic quality but are minimally endangered. One, the T. Carinalli easement (F2606) is protected (but not included as a preserved location because irrigation and discing alter the vernal pool habitat).

G. Protected Locations

Proposals to alter rare plant habitat at low priority sites must include further study for identification of appropriate mitigation. Only low priority sites with moderate or low biologic quality should be considered for transplantation as mitigation for habitat loss. All low priority sites which possess high biologic quality or better would become first priority locations if endangered. For example, the Landeros location (F2601), which has a biologic quality rating of 4, would rate as the highest priority for preservation if expansion of the commercial operation threatened the Limnanthes vinculans on the property because the present endangerment value of 1 would be increased to 3, thereby resulting in a product of 12 (a score qualifying as the highest priority for preservation).

A number of sites in the study area are under a variety of protective management regimes ranging from easements to preserves. Detailed descriptions of these sites are given in the Rare Plant Survey Forms (see Appendix 3).

Location	Location ID Number	Species Present	Owner/ Manager
Todd Road Preserve	F2609	BLBA, LIVI	DFG
Sonoma County Airport Preserve	E2001	LABU	County
D. Carinelli Easement	F2610	LABU, BLBA, LIVI	DFG
T. Carinelli Easement	F2606	BLBA, LIVI	County
Coombs Easement	F2004	LABU	Private
Hofbauer Scenic Easement	F2611	LIVI	Private

H. Confirmed Locations of Listed CNDDB Occurrences

A total of 43 occurrences for species of concern are listed as present in the study area by CNDDB. Of these 43 CNDDB occurrences, 34 were reconfirmed in the field survey. These original 43 CNDDB occurrences were present on 38 of the rare plant locations identified in this study. The reason for there being more CNDDB occurrences than study locations was that several locations have more than one CNDDB occurrence listed for the same parcel or owner. These CNDDB occurrences were lumped for the purposes of the study to consolidate information and make data analysis more efficient. See Appendix 5 for cross reference to study locations.

I. Extirpation of Listed CNDDB Occurrences

A total of nine listed occurrences present in the most recent CNDDB printout are now extirpated.

Location	Location Number	CNDDB Code
Horn Avenue	E2704, E2705	BLBA 1801, LIVI 1201, LIVI 1302
Concord Road	F2605	LIVI 0714
Hall Rd x Willowside Rd	D2601	LABU 1660
End of Hall Road	C2601	LABU 0307
Westwood Village	B2617	BLBA 1350
Highway 101 x Arata	C2202	LABU 1412
Todd Road Preserve	F2609	LABU 0111

J. New Rare Plant Locations Not Listed by CNDDB

A total of 46 new rare plant locations were identified in the field survey. There were a total of 84 locations in the study. Five new locations were ensemble sites; three of these had LABU and BLBA on them (B2618, B2604, B2603); one had BLBA, LABU, and PODOP on it (B2614) and the last had LABU and LIVI on it (D2603). Most were new occurrences of Blennosperma bakeri which added 15 new locations in the study area. Eight new locations were added by occurrences of Lasthenia burkei. Two new locations were added by Limnanthes vinculans.

VI. DISCUSSION

A. Implications for Rare and Endangered Plants in the Vernal Pools of the Santa Rosa Plains

One conclusion drawn from the results of this study indicates that known locations of the species of concern within the study area are very limited in number, making the possibility of extinction very real. Another inescapable conclusion of this study is that there is a large gap in our understanding of the population biology for all species of concern. Much additional research would be required to clarify competitive relations with surrounding species, herbivory response, seed dispersal mechanisms, genetics and pollination biology for each species before a clear understanding of their population biology can be developed. Without a clear understanding of these factors, the most prudent approach to preventing extinction would be to avoid any impacts while immediately seeking to preserve as much of the remaining vernal pool habitat as possible.

Lasthenia burkei exemplifies the problems facing endangered plants in the vernal pools of the Santa Rosa Plains. It is found at only 33 locations. Thirty-three locations represents a much smaller number of populations because many locations are adjacent to each other in clusters where habitat is appropriate. A population may be defined as "a cluster of individuals with a high probability of mating with each other compared with their probability of mating with a member of other populations" (Pianka, 1978). A cluster of adjacent locations would only comprise a single population because plants on one parcel of land would be ecologically related to plants on an adjacent parcel. The functions provided by pollinators and seed dispersal vectors would make all adjacent colonies of Lasthenia burkei part of the same local gene pool. A cluster of locations would qualify as a distinct population, separate from similar, but more distant clusters not sharing pollinators, and therefore genes, with the population.

Changes in the ecology of one location within a population would have implications for an adjacent location also. For instance, if insecticides or some other agent caused the elimination of the solitary bee from one location, pollination in adjacent locations may be insufficient for effective seed production, causing the local extinction of Lasthenia burkei from a cluster. These effects would likely be limited to the impacted population. while the more distant populations remained unaffected. However, the distribution of clusters in Figure 2 show only six to eight clusters, or populations, of Lasthenia burkei present in the study area. If each cluster is indeed a true population, there may be only six to eight populations of Lasthenia burkei in the study area. Loss of one population would be a significant reduction in the total number of Lasthenia burkei known to be present on the planet. The potential for extinction would be greatly increased.

The seriousness of the threats to endangered species in the Santa Rosa Plains is exemplified by the recent loss of five known Lasthenia burkei locations. One of these losses occurred at the Heller Labs (F2006) location during this

A. Implications for Rare and Endangered Plants in the Vernal Pools of the Santa Rosa Plains (cont'd)

study. The transplant mitigation at the Coomb's easement (F2004) may not be functionally similar to the habitat it was supposed to replace, so this may also become extinct. Attempts were made to disk under the Lasthenia burkei at San Miguel Estates #1 last year, and attempts were made this year to transplant from the site without any formal agreement with DFG. Another location at Rancho San Miguel (B2602) has been approved by DFG for transplantation to the Alton Road (B2603) site. The fate of this population is unknown. Five more known locations are threatened by development and annexations in northwest Santa Rosa. An additional six sites are threatened by development in Windsor. In short, most of the Lasthenia burkei locations north of Piner Road (with the exception of the County Airport) have been lost, or face elimination from urban development, vineyard expansion and wastewater irrigation by the Windsor Water District. In total, at least 20 of the 38 known Lasthenia burkei locations have been extirpated or face imminent endangerment; a potential loss of over 50% of all known locations.

There are no data available at present from which a reasonable judgement can be made regarding the feasibility of vernal pool creation and reseeding. Yet several of these experimental attempts have been authorized by the City of Santa Rosa, the County of Sonoma and DFG. The net result could be destruction of known rare plant colonies--a situation that will accelerate and intensify as development pressures increase in the future. Add to this the willingness to trade healthy colonies of Lasthenia burkei for the untested, quasi-mitigation of vernal pool creation and the loss is compounded. If strong, decisive action is taken immediately, there may be a chance to successfully retain sustainable, natural populations of Lasthenia burkei in the Santa Rosa Plains. It is possible that the next twenty years will move Lasthenia burkei from the brink of extinction to complete extinction as has been the fate of Showy Indian Clover (Trifolium amoenum).

Lasthenia burkei is presently a candidate for federal listing. Based on the rarity and threats identified in this study, it is recommended that Lasthenia burkei receive full federal listing as endangered under the Federal Endangered Species Act as a means of providing further protection for this species.

The scenario described above is for the species with the greatest number of known locations. The problem is just the same, but greatly amplified for other species of concern known from fewer locations. Blennosperma bakeri is perhaps the most threatened of all the species in this study because there may be only two populations of this species in the study area based on the clustering shown in Figure 4, page 19. Having only 25 known locations, its distribution is mostly concentrated in areas undergoing rapid changes in land use. Two locations have knowingly been heavily disturbed in the San Miguel Avenue area of Santa Rosa. Vineyards threaten another location at Piner and Hartman Roads. The net result is that half a dozen known locations have been extirpated or seriously damaged in the study area. A host of other sites are being considered for development. Extinction is a very real possibility for this species.

A. Implications for Rare and Endangered Plants in the Vernal Pools of the Santa Rosa Plains (cont'd)

Information from this study on the distribution and abundance of Blennosperma bakeri suggests that this species is similar to Lasthenia burkei and Limnanthes vinculans in rarity and endangerment. Yet, it has not received listing by the state as endangered. It is recommended that the state act immediately to list this species as endangered to provide protection under the Native Plant Protection Act and the Endangered Species Act. Blennosperma bakeri is also a federal candidate for listing as threatened or endangered. It is further recommended that the U. S. Fish and Wildlife Service act to list this species as endangered under the federal Endangered Species Act as soon as possible.

Limnanthes vinculans is known from only 22 locations in the study area, and although urban development threatens several of these, the greatest threat to this species is due to habitat loss from effluent irrigation and associated filling. The distribution of locations shown in Figure 3 indicates this species may actually be one population, or perhaps two. It is likely that more than one thousand acres of potential habitat for this species have been altered or lost due to effluent irrigation and land levelling. Large colonies of this plant from areas around the Naval Air Center and near the Fulton Road - Highway 12 intersection are seriously threatened by development proposals. The adverse effects of development and effluent irrigation pressures may combine to push this species to extinction within the next twenty years.

Limnanthes vinculans is presently a candidate for federal listing. Based on the rarity and threats identified in this study, it is recommended that Limnanthes vinculans receive full federal listing as endangered under the Federal Endangered Species Act as a means of providing further protection for this species.

Pogogyne douglasii spp. parviflora is known from only five locations in the study area and may exist as two or three separate populations based on clustering shown in Figure 6, page 25. Several colonies of this species have been extirpated in the southwestern Santa Rosa area. The colonies at the Naval Air Station are under serious threat of development. The colony at the Grill property in Windsor is also seriously threatened by disturbance and development proposals. The net result will be a remainder of two colonies, an extremely tentative situation which can lead to rapid extinction in the study area, given the likely occurrence of disease, predation or random disturbance.

Although this species is apparently more widespread in the state than the others in this study, it is very rare within the Santa Rosa Plains and Sonoma County. It should be treated with the same protection and concern as the other rare and endangered species in the study.

A. Implications for Rare and Endangered Plants in the Vernal Pools of the Santa Rosa Plains (cont'd)

The status of Navarretia plieantha which occurs as only one colony at a single parcel near the County Airport, has the most tenuous hold on existence in the County. A single debilitating adverse impact from disease, predation or other random or planned disturbance would cause extinction of this species in the planning area.

Navarretia plieantha is presently a candidate for federal listing. Based on the rarity and threats identified in this study, it is recommended that Navarretia plieantha receive full federal listing as endangered under the Federal Endangered Species Act as a means of providing further protection for this species.

Lastly, Trifolium amoenum meets the definitions of Section 1901, Chapter 10 (Native Plant Protection) of the CDFG Code and is therefore eligible for state listing as endangered. Several other presumed extinct species are currently state listed as "endangered". We feel that there is a possibility that this species could be rediscovered in the Santa Rosa Plains (last seen in 1969) or elsewhere in its historic range. Once rediscovered, T. amoenum would no doubt need immediate recognition and protection due to the strong development pressures and land use practices in its habitat.

B. Site Quality

The biological quality of sites in the study is based solely on the number of species and individuals present at a given location. A more accurate and complete assessment of site quality would be more exhaustive, including criteria that reflect the degree to which the biological integrity of the ecosystem is still present and functioning.

For instance, data regarding the distribution and size of vernal pools on a site would be an important factor. Information on the number of pools with rare plants present would provide more information on available habitat. The presence or absence of indicator plant and animal species would provide a better understanding of the ecological structure of a site and indicate the degree of its integrity. The effects of herbivory by insects and vertebrates would provide essential information regarding the autecololgy for each rare species, as would data on competitive relations with other species. Information regarding symbiotic relationships, pollinators and seed dispersal vectors would also be essential to determine if a given location truly had the biological quality to ensure continuation of the species at the site. Such an assessment was beyond the scope of this study, but additional data present in the database could undergo further analysis to refine site quality for locations, given the possibility of further research.

For the purposes of this study, the abundance of a rare plant was considered adequate to estimate site quality because a large colony of plants would indicate site conditions were good. However, the opposite is not true. A

B. Site Quality (cont'd)

small colony of plants at a location could be present in pristine vernal pools. For instance, several areas had very large vernal pools that had been undisturbed for a long time in which most characteristic vernal pool species were present, except for the species of concern. In contrast, areas ranked as high quality because of the number of individuals present could be located in the midst of highly disturbed terrain. For example, the Pioneer 2000 apartments (B2624) harbors a larger colony of Lasthenia burkei residing in an isolated vernal pool surrounded by sidewalks and high density housing. In short, the quality rankings for a site have a very limited breadth. Further study at each location in the study is necessary before conclusions about the ecological integrity of a site can be drawn.

Because assessment of site quality was restricted to the vernal pool habitat, the surrounding upland areas were not characterized in much detail. In general, most were grazed pastures that were completely dominated by weedy annual grasses. In the midst of this altered environment, it was common for vernal pools to contain many vernal pool indicator species. This fact indicates that the specialized adaptions of vernal pool plants give them a competitive edge over weedy generalist species in the overgrazed, fertilized (with manure) and hayed world of the oak savanna. This is also true of areas adjacent to urban development subjected to vandalism and off road vehicle use. These land use and abuse features cannot be used to color or influence the perception of site quality if rare plant colonies are thriving and reappearing annually. Any vernal pool, regardless of size, isolation, previous land use history or current land use practice in surrounding areas should be regarded as a high quality site if the rare plants are found there and are not declining.

This view of site quality is supported by data gathered in the field surveys. The only location of Navarretia plieantha in the study area is at the Gossage parcel (F2007) an ensemble site (Lasthenia burkei also present) that is perhaps the most heavily overgrazed in the entire study. Yet the persistence of these two species of concern in what would be subjectively considered a degraded environment points to a positive interaction with grazing disturbance. On the other hand, several locations ion the study where grazing had been excluded for several years correlate with the decline or disappearance of Lasthenia burkei. The number of individuals of this species at the Coomb's easement (F2204) have probably declined as a result of grazing removal, as well as hydrologic changes. This is not proof that the lack of grazing has caused the disappearance of Lasthenia burkei, but it fits a model of range management principals that recognize a competitive balance is maintained in properly managed grazing systems (Stoddard et al, 1955). A greater diversity of species can persist where some form of disturbance, such as grazing, keeps aggressive plant species from increasing their cover and crowding out those with more restrictive habitat requirements (O'Connel, 1978).

B. Site Quality (cont'd)

It is interesting to note that Limnanthes vinculans has the distinction of having the greatest number of excellent quality sites as well as low quality sites. However, from a population biology perspective it has only 10 locations having high quality or better, while Blennosperma bakeri has 20 locations and Lasthenia burkei has 23. Loss of a site with biological quality ranked high or better for Limnanthes vinculans would be a drastic reduction in the number of individuals in the total population. Considering that a high quality site can be contained within one vernal pool like the one at the Pioneer 2000 apartments (82624), it would not take much of an impact to eliminate the whole colony. This aspect of rare plant occurrences points to the fact that high biologic quality does not equate with resiliency to impact.

C. Endangerment

Thirty-seven of the 84 rare plant locations in this study have either been extirpated or face imminent endangerment (Table 4). Of these, 10 have been extirpated. More importantly, nine of the 14 sites with the highest priority for preservation are imminently endangered. Of the 28 locations of secondary priority, 13 face imminent endangerment. Opportunities for preservation of high quality rare plant sites have the potential to disappear fast unless prudent action is taken by land use regulators and resource agencies.

Four principal sources of endangerment to species of concern in this study have been identified: 1) indirect conversion of vernal pool habitat as a result of effluent irrigation, 2) direct loss of vernal pool habitat through conversion to urban development, 3) direct loss of vernal pool habitat through conversion to intensive agriculture (i.e., vineyards, etc.) and 4) mosquito abatement activities which drain vernal pools and prompt farmers to engage in unregulated filling of vernal pools.

Historically, the distribution of vernal pools and their flora and fauna occupied much of present day western Santa Rosa, Windsor and the Rohnert Park/Cotati area, covering more than 10,000 acres. Development and intensive agriculture in these areas has eliminated significant amounts of this pre-historic vernal pool ecosystem. All wastewater treatment systems in the study area combine to irrigate as much as 6,000 acres with large increases of irrigated acreage expected in Windsor. Many oak trees have died without replacement from a variety of causes, of which summer irrigation may have an indirect or direct role. Vineyard expansion has converted much of the vernal pool ecosystem to an intensively managed monoculture. Huge expanses of freshwater marsh and riparian forest have been devastated because of channelization and land grading projects. The net result of all this land conversion is an endangered Santa Rosa Plains and Laguna de Santa Rosa ecosystem.

Remnants of the native ecosystem are so fragmented in the study area it is doubtful that they function in an integrated way. Small islands of vernal pool habitat are more likely to undergo random extinction of species

C. Endangerment (cont'd)

(MacArthur and Wilson,1963, 1967). The natural biotic linkages between the oak savanna, grassland, vernal pools and freshwater marshes have been severed. The ecosystem within the study area may soon pass a threshold where fragmentation and loss of vital biotic linkages cause the total disintegration of any resemblance to the original natural character of the Laguna and the Santa Rosa Plains.

There is considerable evidence that the ecological character of the study area has been greatly altered already. Declines in migratory waterfowl numbers using the Laguna have been reported by most long-time residents. The endangered California yellow billed cuckoo (Coccyzus americanus occidentalis) and Pacific freshwater shrimp (Synacaris pacifica) have not been reported from the Laguna for decades. Ten historic locations for rare plants in this study have recently been lost. Showy Indian clover is presumed extinct. Elk and pronghorn antelope, not to mention the grizzly bear, have been gone from the study area for almost a century. Anadromous fish numbers are on the decline and their use of the Laguna watershed has probably been diminished as a result of habitat loss and water quality problems. The number of trees in the oak savanna of the plains is rapidly declining and the acreage of riparian forest of the Laguna has been diminished by an estimated 75% (Waaland, 1989). These kinds of changes in the ecology of the study area suggest the integrated function between flora, fauna and their habitat has been severely diminished. Unless a more comprehensive, ecosystem approach of habitat conservation is undertaken, piecemeal preservation of isolated vernal pools may not do more than provide a fishbowl type opportunity to view a remnant of Sonoma County's natural heritage.

Characteristics of endangerment threats are described below.

1. Effluent Irrigation

Within this region of floodplain and low, marshy and poorly drained terrain 4,600 acres are irrigated with reclaimed wastewater. The greatest remaining intact vernal pool areas are in the greater Laguna de Santa Rosa area and subject to potential impacts from expansion of the current and long term reclamation system (CH2M Hill, 1989). Growth in Windsor will add pressure to the Windsor Water District to expand wastewater irrigation to at least 1,000 acres. The County Airport Sewage treatment plant continues to seek expansion of its irrigated acreage. So far, the hydrologic and biotic impacts of this activity have not been evaluated by the North Coast Regional Water Quality Control Board in a comprehensive manner to assess cumulative impacts. Expansion of irrigation has spawned a number of correlated problem such as major increases in mosquito abatement actions, unregulated filling of wetlands and changes in streamflow for a number of Laguna tributaries.

Included with irrigation land use is the practice of land leveling, which inhibits the summer ponding of effluent and the creation of mosquito disease vector problems. Widespread irrigation has increased

1. Effluent Irrigation (cont'd)

the amount of draining and filling of vernal pools at the behest of the Marin-Sonoma Mosquito Abatement District. As a result, many acres of vernal pools have been filled without the benefit of a County grading permit, or a Section 404 (Clean Water Act) fill permit from the Army Corps of Engineers. The City of Santa Rosa has recently begun conducting pre-irrigation assessment of potential irrigation sites to prevent or mitigate impacts to vernal pools and rare plant habitat (Ferris, personal communication). This problem will be addressed in their long-term studies. Recent litigation with the Windsor Water District and a citizens group has established a protocol for assessing rare plant impacts (Woods, personal communication). Similar assessment has been adopted by the County and should be required by all special districts irrigating with effluent. To prevent unmitigatable biotic impacts, the North Coast Regional Water Quality Control Board should ensure compliance with CEQA, Section 404 of the Clean Water Act, and state and federal endangered species acts when reviewing applications for land disposal of treated effluent.

2. Urbanization

Urbanization is also a serious threat to rare and endangered species habitat because numerous high quality Blennosperma bakeri, Lasthenia burkei, Limnanthes vinculans and Pogogyne douglasii spp. parviflora sites occur along the western fringe of Santa Rosa. Most of these sites are zoned for high density residential or commercial uses. It is likely that vernal pool habitat was present throughout the current City limits of Santa Rosa and most of this has been lost to urbanization.

High quality vernal pools remain in the northwest section of the City, but several of these have been altered since this study was initiated. Many more rare plant sites are present in the City's sphere of influence, especially in the southwestern section of town. Beyond City limits, many rare plant sites occur where lands have been zoned for ranchettes at relatively low densities, but landscaping and penning of livestock or horses will have equally destructive effects on vernal pools. Most of the future growth of the unincorporated Windsor area is planned to expand into the remaining Lasthenia burkei sites in the north half of the study area.

Problems mitigating impacts to Blennosperma bakeri and Lasthenia burkei have arisen in northwest Santa Rosa. For example, Blennosperma bakeri was completely removed from a site before the requirements of a mitigation agreement with DFG had been addressed by the project proponent. In the process, existing Blennosperma bakeri colonies at the mitigation receptor site were impacted. The CEQA process had not even been initiated at either location and the proponent did not respond to a request from DFG to stop.

2. **Urbanization (cont'd)**

These events point to the fact that the existing endangered plant laws and the CEQA process are ineffective because enforcement becomes an issue of responsibility. Therefore, only strong local ordinances adopted by the County of Sonoma and the City of Santa Rosa can ensure protection of rare plants.

The urbanization threat will have a greater impact on the higher, upper watershed vernal pools. This is due in large part because urban centers avoided the lower elevations of the Laguna area to avoid the flood threat. Therefore, upland vernal pools have historically been the first to be lost to development. Much of the City of Santa Rosa was built on this habitat. Since these upper, dryer areas have been urbanized before the lower, flood-prone sites, the upland form of vernal pool has diminished to a greater extent than those in the floodplain.

3. **Intensive Agriculture**

The recent widespread planting of wine grapes in the northern half of the study area has also led to substantial reductions in vernal pool habitat. Furthermore, the Press Democrat (March 28, 1989) reported an estimated 10,000-13,000 acres of marginal land is going to be required for vineyard expansion in the future. It is likely that much of the targeted land will be vernal pool habitat. Not all of the new vineyards are responsible for the initial loss of habitat; much of the area put into grape production was previously orchard. Nonetheless, much rare plant habitat has been lost to intensive agricultural uses and parcels containing endangered plants are targeted to become new vineyards. As with urbanization, the endangered plant habitat type impacted the most by this land use is the upland vernal pools north of Piner Road.

Other forms of habitat loss due to intensive agriculture stem from channelization and land leveling along the Laguna channel. This land treatment was initiated to drain the large vernal pools and seasonal marshes so that corn and other crops could be grown more productively. For example, Lasthenia burkei at the Nunes Farm (C2601) has been recently extirpated by agricultural conversion. Other rare plant occurrences in south Santa Rosa (E2704, E2705) have been extirpated by persistent discing and seeding to non-native pasture grasses for hay production.

It must be noted that non-irrigated, grazed pastures maintain healthy colonies of rare plants in vernal pools. Grazing may have the effect of reducing competition for water, nutrients and sunlight from aggressive introduced plant species. Therefore, it appears that the dairy and livestock industry can coexist with vernal pool flora. This relationship becomes incompatible when the entire pasture is irrigated because of the complete change in growth conditions. A mechanism should be developed whereby dairymen can receive monetary compensation for leaving a certain

3. Intensive Agriculture (cont'd)

amount of acreage out of irrigation if rare plants are present. This approach would provide an incentive for the operator to continue existing operations without the need to convert all of his summer-dry vernal pool habitat to year-round moisture.

D. Preservation of Endangered Species and Their Habitat

The results of this study indicate that all species of concern are endangered in the study area because of continued and accelerated loss of rare plant colonies and habitat. The study also establishes that the potential for extinction of all species of concern in the study area is very real. Unless a comprehensive protection program which establishes a system of rare plant preserves and a mechanism for providing easements is instituted, the prospects for the continued existence of the rare plants in the Santa Rosa Plains is bleak, at best.

A species preservation approach that includes the vernal pool/oak savanna habitat mosaic will provide the necessary ecosystem support functions needed to adequately meet all the requirements of an individual endangered species. Although, saving a single vernal pool in the midst of development may be viewed as a minimal form of mitigation, an approach based on the perpetuation of a single species as though it were an isolated phenomenon will require long-term costs for intensive management. Each endangered plant is part of complex inter-relationships with other plant species: pollinators, seed dispersal vectors and wildlife which utilize it as a food resource. A preservation approach that focuses on habitat is most likely to succeed, as whole natural systems with their complex, co-evolved interactions maintain populations of rare plants more efficiently than intensively managed single species preserves. This reduces need for human intervention and drastic emergency measures, resulting in a more cost effective approach (Norton, 1988). Corollary benefits of habitat preservation include:

(1) maintenance of urban fringe open space for aesthetic and community buffer purposes,
(2) protection of seasonal wetland wildlife habitat that fosters animal species that are declining due to the statewide and national disappearance of wetlands, and
(3) the opportunity for educational uses that illustrates biological diversity as well as the co-dependence of natural communities and humans as they interact within the shared ecosystem of the Laguna de Santa Rosa and the Santa Rosa Plains.

1. Prioritization of Study Sites for Preservation

Unfortunately, evaluation of the rare plant situation in the Santa Rosa Plains resembles a medical triage system where casualties are grouped into three categories: (1) those with superficial wounds that do not require immediate attention; (2) those in the middle range, having

1. Prioritization of Study Sites for Preservation (cont'd)

serious but treatable wounds; and (3) those with wounds too serious to make treatment efficacious. Once rare plant occurrences are formulated in this manner, it seems obvious that efforts toward species preservation are best concentrated in the second category (Norton, 1988). In other words, those sites with viable colonies of rare plants subjected to the greatest development pressure have the highest priority for preservation. Sites in this category have been identified as "high priority" locations for preservation in this study (Table 2). Despite the proximity of development, the presence of viable colonies of rare plants is proof enough that the area is biologically significant and contains critical habitat with the highest degree of threat.

Based on the triage analogy, the first category of sites are those with wounds not serious enough to require immediate attention. The only sites in the study which qualify for this category are those that are presently under some degree of protected status or preservation. These sites are : Todd Road Ecological Reserve (F2609), Sonoma County Airport Preserve (E2001, F2001) D. Carinelli Easement (F2610), T. Carinelli Easement (F2606), Landeros Supply Easement (F2601), Coombs Easement (F2004), Santa Rosa 224 "scenic open space" (B2609), and Hofbauer Scenic Easement (F2611). All other sites in the study area are subject to the threat of effluent irrigation, urbanization or agricultural practices.

The sites in the second category--those with serious but treatable wounds--are the bulk of locations in the study area. They have viable colonies of rare plants present, but no protective status. Most of these locations are designated as "secondary priority" for preservation in this study. Of these locations, some are high quality sites. Outstanding examples of large acreage are worthy of State Park or Nature Conservancy Preserve status. Others would be adequately protected with easements for sensitive habitats. The actual selection of preserve sites is beyond the scope of the present study but should be conducted in the next phase. (see Section B, Phase II).

The last category of sites are those that are either already preserved, face minimal threat or are so degraded that long term survival of the rare plants is in question. Those locations that are small, isolated colonies not adjacent to a larger complex may be possible sacrifice sites if research shows that transplanting is a viable option. However, this level of research would have to be adequately funded and initiated soon to collect the minimum five years of data necessary on which to base a judgement. These sites are the only ones in the study that should be considered to have any potential for experimental transplantation, testing the effects of seeding rare plants into protected available habitat. Before any transplantation experiments take place, specifications should be developed that include saving of topsoil, securing appropriate available habitat, and a monitoring program designed to develop data consistent with scientific methods.

2. Biological considerations in developing the Santa Rosa Plains Endangered Plant Protection Program

All of the rare plants in this study are annual herbs, a life form that is small in stature, and possesses a rapid growth rate to exploit ephemeral growth conditions and blooms at the end of this temporarily favorable growth period. The proportion of annual biomass production that is devoted to seeds is very large. Production of many seeds is a survival mechanism promoting dispersal to distant available habitats where new colonies of plants can arise. Frequent, local extinction is most common among small, short-lived organisms that occur in patchy habitat associations, such as vernal pools (Harrison, 1988). All these attributes are parts of a reproductive strategy that exploits a very short growing season while producing many seeds for dispersal to other available habitats (Grime, 1977).

Dispersal of seed is most likely accomplished by transport via the hooves, feet and digestive system of grazing animals and waterfowl (rabbits, ducks, cattle and historically, tule elk). The vernal pool habitat of the pre-historic Santa Rosa Plains was visited by an abundance of wildlife. This wildlife utilized the prolonged water and green forage that persisted in the vernal pools well after the surrounding grassland had dried. Large ungulates, such as tule elk, would likely visit these pools for food, water and wallowing. The seeds of the vernal pool flora were then distributed to other pools where these activities occurred. Perhaps more importantly, this kind of perennially repeated disturbance would select for species tolerant of some degree of grazing and hoof impact.

Evidence for this exists in all the cattle grazed pastures where rare plants presently occur. Grazing gives a competitive advantage to the diminutive rare plants by functioning to keep fast growing, aggressive plant species in check by constantly clipping them. Without this selective clipping by animals, the more dominant species would crowd out rare plants in competition for space, nutrients, water and sunlight. Changes in plant community structure and diversity have occurred since grazing has been removed from the Todd Road Ecological Reserve (F2609) and the Coombs easement (F2004). The implications of these ecological changes for the continued existence of rare plants are unknown, but it is possible that more aggressively growing introduced plant species could crowd out species of concern. Research through an appropriate university would be necessary to define the needs of a particular species and its coexistence with other species.

The implication of the co-evolution of grazers and seed dispersers with the rare plants of this study is that present day management strategies need to integrate and mimic historic conditions as much as possible. A well designed preserve would be actively managed to integrate some form of grazing management. It would maintain access to vernal pools for

2. Biological considerations in developing the Santa Rosa Plains Endangered Plant Protection Program (cont'd)

agents of seed dispersal during the appropriate time of year. It would also provide vernal pool habitat that is unoccupied by rare plants so that the continuation of natural patterns of dispersal and regeneration of the species is continued.

Criteria for optimal design of endangered species preserves are derived from the principles of island biogeography (Soule and Wilcox, 1980; Frankel and Soule, 1981). An island is defined as a discrete patch of unique habitat, such as a vernal pool, that is isolated from similar habitat because the surrounding matrix (e.g., water, grassland) is completely different. Studies of species on islands indicate a species requires a certain geographic area in which an adequate population can persist so that a threshold number of individual plants can reproduce and replace natural mortality while maintaining genetic viability (MacArthur and Wilson, 1963, 1967). The probability of extinction increases as island size decreases, increasing the importance of other nearby islands that provide propagules to replenish those individuals lost to natural mortality. Application of these principles to preserve design incorporates features based on the following relationships:

(a) large reserves better than small
(b) a single, large reserve better than four smaller ones of equal area
(c) a circular reserve is better than any other shape
(d) mutually adjacent reserves are better than linearly arranged
(e) close replicate reserves are better than distant ones
(f) smaller but connected reserves are better than separate, unconnected reserves of equal area (MacMahon, 1979).

3. Practical Considerations in Establishing Rare Plant Preserves

Although island biogeography would predict many large reserves scattered over the entire range of a rare plant, realistic assessment of the situation in the Santa Rosa Plains reveals that most of the remaining colonies are highly impacted fragments that are small in size and low in numbers of individuals. Sites that are small in area should not be "written off" as potential reserves merely because island biogeography suggests that these sites are too small for the long term retention of species. It is important to note that in a highly altered natural system such as the Santa Rosa Plains, the opportunity to optimize preserve design has passed (Reznicek, 1988). This may not be a problem for rare plants associated with vernal pools because many of the species of concern can occur in very small pools--as small as one yard in diameter (Site 2603). A natural ecological attribute of vernal pools is that they vary greatly in size. This attribute favors the long-term survival of rare plants in the study area because many of the remaining sites are small.

3. Practical Considerations in Establishing Rare Plant Preserves (cont'd)

It should be noted that management problems will occur at small reserve sites whether or not they are ecologically stable. If a site is too tiny, small scale events such as incidental filling, rubbish dumping or collecting can destroy it, as well as natural disturbances such as fire. Administratively, coordinating management of many widespread small sites can be problematic. Some management practices, such as grazing or maintenance of the native fauna, may be intrinsically difficult. Small sites may also be more sensitive to environmental changes such as drainage alterations or weed infestations, requiring a larger buffer zone. Lastly, a small reserve is a smaller target for the agents of seed dispersal. For instance, seeds stuck to the feet of ducks are more likely to end up at a large vernal pool where waterfowl are more likely to land.

4. Problems with Establishing Rare Plants Using Artificial Pool Creation

Vernal pool creation has been suggested as a possible means of mitigation for loss of habitat from development impacts. To mitigate requires compensation of a lost resource value with the same resource value elsewhere. Typically, a project developer will hire a botanist to make a case before the local government officials that transplanting rare plants elsewhere is adequate compensation for impacts. The decision making body, not being expert in these issues thinks that the problem is solved by moving the problem elsewhere. Ecological ethics aside, transplantation has a host of inherent risks including destruction of intact natural areas, high costs, unreliability, a false sense of security and the undermining of ongoing preservation efforts (Fahselt, 1988).

To date, there are no published data or anecdotal evidence to suggest that artificial pool creation is a viable, repeatable method of conserving rare vernal pool flora. The only scientific studies for which transplantation of rare plants from vernal pools has been addressed have been conducted in San Diego under the direction Dr. Paul Zedler of San Diego State University. In his research on the transplantation of Pogogyne Abramsii, a federally listed endangered species threatened by urbanization, Dr. Zedler can make no conclusions regarding the effectiveness of the technique because only a few years of data are available and the density of the species has not approached that of the original habitat (Zedler, personal communication). Results from two years of study at the CALTRANS restoration site show native plants became established, but created pools had large areas of bare ground (86%) and plant populations had decreased in the second year (Zedler, in press). Studies of rare plant transplantation efforts in a variety of Southern California habitats report serious problems in the majority of cases and concludes that further work needs to be done before it can truly be considered a reliable form of mitigation (Hall, 1987).

4. Problems with Establishing Rare Plants Using Artificial Pool Creation (cont'd)

All other published information available regarding vernal pool creation reports on experimental efforts to gather preliminary data about the general vernal pool ecosystem. In one instance, the first year of data from three experimentally created and seeded vernal pools at the Del Sol Reserve in Santa Barbara indicates that several native plants became established, but long term monitoring was needed to demonstrate the degree to which created vernal pools resemble local natural vernal pools (Pritchett, in press).

To date, there are two unpublished attempts at artificial pool creation in the vicinity of the Sonoma County Airport (Sites F2003 and F2001). In one case, seeds were dispersed into a runway median in 1987. No data have been reported for this attempt. The other site was created as part of the mitigation for the loss of several Lasthenia burkei colonies destroyed during development of the industrial park on Skyline Boulevard. Observation of this site showed several small tufts of Lasthenia burkei in patches, but the rest of the associated vernal pool flora is largely absent and most of the graded ponds are predominantly bare ground. It is very unlikely this artificial pool creation effort constitutes successful revegetation as would be required with a certified Memorandum of Understanding with DFG (Cochrane, personal communication). The marginal condition of the plants at this site, especially in comparison to the biological value of the sacrificed habitat, could compel CDFG to require that the site be revegetated once again under much stricter guidance. It is not the policy of CDFG to promote this experimental approach for mitigation, their emphasis being habitat preservation (Cochrane, personal communication).

A recent transplantation effort in North Santa Rosa went ahead of schedule before the detailed mitigation plan required by DFG was produced. In fact, the construction of dams and dikes at this receptor site impacted existing Blennosperma bakeri colonies. It was obvious that this transplant effort was conducted in an urgent fashion before any preliminary baseline requirements were met. This kind of approach to rare plant conservation only undermines the efforts of DFG and the provisions of CEQA, while further threatening the rare plant mitigation it is supposed to protect. It also highlighted the problem of overlapping jurisdictions under different environmental laws.

Because of the lack of information upon which to develop a rational basis for successful establishment of rare plants in artificial pools, any attempts using this methodology in the Santa Rosa Plains should be viewed as experimental and not as mitigation. Vernal pool restoration should be viewed as a complement to, not a substitute for, preservation. It should be attempted only if doing so does not use resources that could otherwise be used for preservation (Howell, 1988). The only

4. Problems with Establishing Rare Plants Using Artificial Pool Creation (cont'd)

defensible use of experimental efforts as part of mitigation may be where an impacted rare plant site is extremely degraded with less than 100 individuals of a species of concern present. If this habitat is considered unlikely to support the plants in the near future, their seeds could be collected and used in experiments to expand into nearby available habitat--if a similar amount of habitat containing the species is also preserved.

These experimental efforts should proceed independent of environmental impact studies, but should be financed by project proponents through a public entity such as DFG. These experiments must use up-to- date scientific methods to generate quantitative data subject to peer review so that specifications and guidelines can be established should this approach appear feasible. These studies should consider the acknowledged lack of information regarding wetland restoration in general. The overall objectives of this research should determine aspects of population biology for all species of concern as well as specific research challenges such as cumulative impact studies, water quality studies, habitat value determinations, food chain studies, wetland dynamics analysis and plant and animal succession studies (Weller et al, 1988).

5. Management Considerations in Conserving Endangered Species

The conservation and management of rare and endangered plants has been attempted using a variety of methods including zoning restrictions, federal regulation of habitat under the Endangered Species Act and Section 404 of the Clean Water Act, and preservation of habitat by private institutions, such as the Nature Conservancy or agencies of county, state and federal governments (Elias, 1987). The basis of any conservation program must be founded on measures which:

(a) protect plants from direct loss
(b) maintain habitat (including management of natural disturbance and grazing)
(c) protect habitat quality and viability (i.e. drainage patterns)
(d) allow for the continuation of plant relationships with pollinators and agents of seed dispersal
(e) maintain relationships with other plants
(f) minimize competition
(g) establish long-term active management measures for the private or government landowners (Huenneke, 1988).

Implementation of a preservation program is discussed in more detail in Section B.

5. Management Considerations in Conserving Endangered Species (cont'd)

The essential conservation management information can be distilled to a single concept: "protect rare plant habitat." For the species of concern in this report, this means protecting vernal pools. Since vernal pools are isolated within "seas" of grassland/oak savanna, it is essential that rare plant habitat be defined to include the vernal pool/oak savanna mosaic and associated micro-watersheds. In most instances, vernal pools with rare plants in them must not be subject to direct disturbances such as grading, filling, deep discing or herbicidal treatments. The vernal pool habitat should be maintained by ensuring that all aspects of the ecosystem affecting rare plants persist when mitigating impacts through habitat avoidance. This includes management of native grazers including jackrabbits, gophers, or livestock. Proper range management techniques should be utilized for larger herbivores such as sheep, deer, horses and cattle, where they occur. Wildlife also provides beneficial disturbance features such as seed imprinting by hoof impact and micro-scale seedling nurseries on gopher mounds.

6. Management Recommendations

The quality of the vernal pool habitat should be maintained by leaving the physical and biological components functionally intact. Swales, which provide a hydraulic connection between pools, should be left intact to convey replenishing surface water during storm events. The clay hardpan in the pools should be left intact to prevent perched water table from seeping into the subsoil layers. Gophers, which have been identified as an important component in maintaining pools by means of their excavation activity (Cox, 1981), should be allowed to exist. The vernal pool flora has evolved with the influence of many native grazers, including pocket gophers, mice, black-tailed jackrabbit, ground squirrel, elk and deer, which if eliminated from the vernal pool ecosystem will alter the relationships between rare plants and other species (Zedler, 1987). At most of the occurrences in this study, black-tailed jackrabbits were observed and evidence of pocket gophers was abundant.

By protecting and maintaining vernal pool habitat, some adjoining and adjacent habitats will also be preserved. These habitats are essential for pollinators, such as bees, so that there will be some pollen resource available from plants blossoming in the uplands while the vernal pool species are still in the vegetative state. Bees require successive flowering stages provided by different plant species so that when the upland flowers have gone to seed, the blossoming vernal pool flowers provide a pollen resource. Disruption of this phenologic timing may cause the loss of the rare plant pollinator, thus indirectly endangering a colony of rare plants.

Habitat protection and maintenance will preserve existing plant relationships and minimize competition for the species of concern. Little is known about the autecology (interaction with the environment

6. Management Recommendations (cont'd)

and other species) of the species of concern, so it must be assumed that a competitive equilibrium allows coexistence between rare plants and other species in the micro-ecosystem of Santa Rosa Plains vernal pools. Each species in the pool has a unique function and affects the habitat of the rare plants to some degree.

Included in the plant/environment relationship is the interaction of native grazers such as gophers, mice and rabbits. When an imbalance is instituted (i.e., overgrazing, drainage alteration, or native wildlife elimination), a vernal pool may turn into a weed infested marsh. Less desirable plant species, that are more tolerant of perennial soil moisture and heavy clipping and fertilization from animal waste, will out-compete the native rare plants. Maintaining and enhancing the physical and biological integrity of vernal pools where rare plants occur is the key to preventing extinction of these species in the wild.

7. A Conceptual Plan for a Rare Plant Preserve System in the Santa Rosa Plains

A formal preserve system in the Santa Rosa Plains would be comprised of a cluster of closely spaced reserves of as large an acreage as possible where the centroids of a species distribution occur naturally. Figure 7 shows in concept a distribution of larger preserves scattered across the study area. The process of making this preserve system a reality would involve the initial step of seeking purchase, easement or monetary compensation for maintaining existing uses where irrigation is available for landowners with rare plants on their property. This process can only go forward where a landowner is willing to enter into a formal agreement or volunteers use restrictions. The most logical approach would be to focus on the high priority sites first. Once this avenue has been fully explored, the secondary priority sites should be investigated. Low priority sites should be considered as they become available, or mitigated in such a way that the rare plant resource make a net gain. Extirpated sites should be replaced in situ or at another location such as available vernal pool habitat where rare plants can be introduced.

These preserve clusters would be replicated throughout a species distributional range. For instance, based on the clustering shown in Figure 2, a preservation plan for Lasthenia burkei would include six preserves distributed in the following areas: northwest Windsor, southwest Windsor, the County Airport, northwest Santa Rosa, the northern Laguna de Santa Rosa, and the central Laguna-Todd Road Preserve area. The clustering shown in Figure 3, for Limnanthes vinculans suggests preserves at the following locations: the Fulton Road near Highway 12, the old Naval Air Station, the vicinity of the Todd and Llano Road intersection, the southern Laguna de Santa Rosa, Sebastopol and the Occidental Road bridge. Clustering of Blennosperma bakeri locations shown in Figure 4, indicates a more tightly packed system of

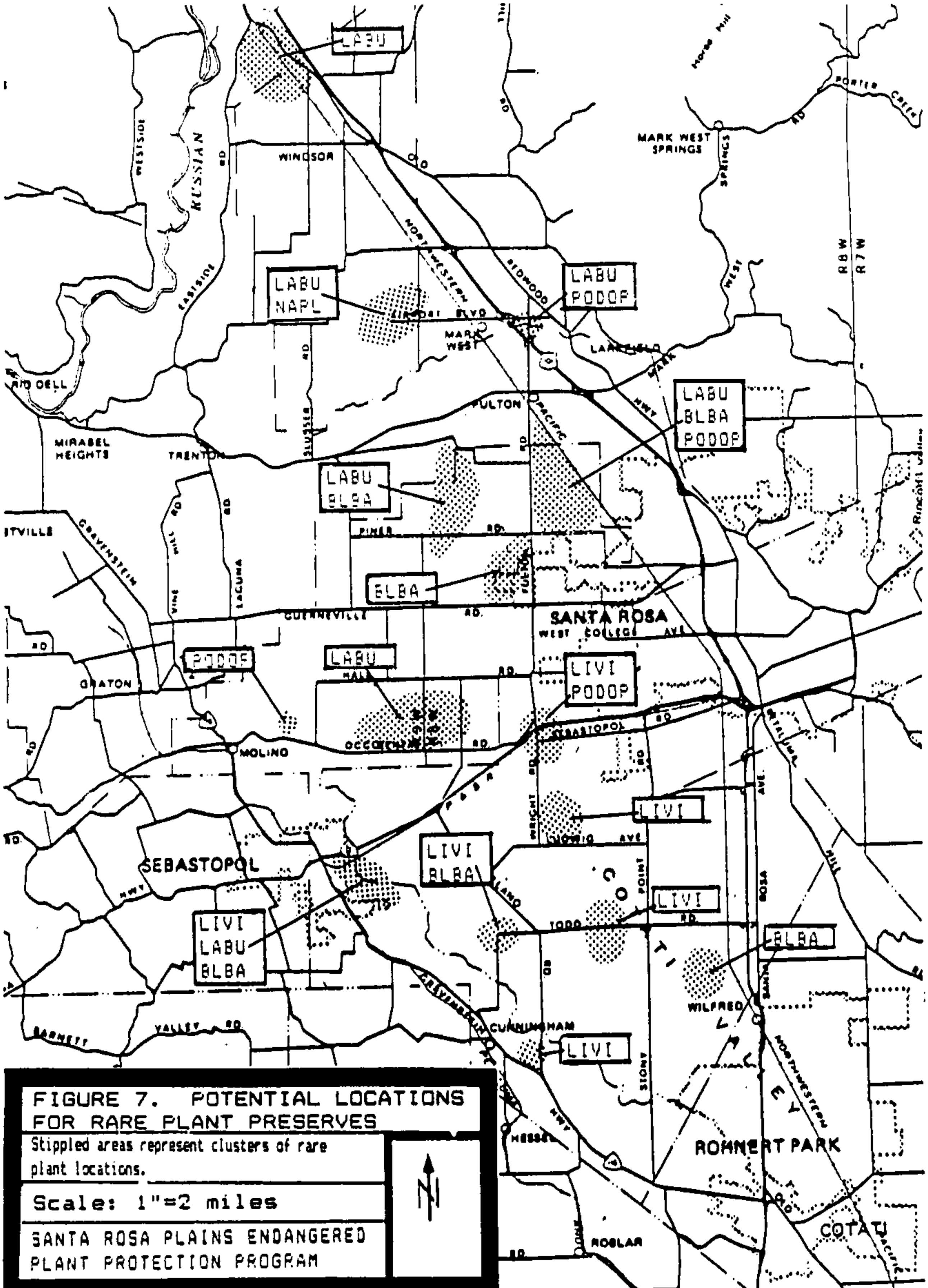


FIGURE 7. POTENTIAL LOCATIONS FOR RARE PLANT PRESERVES

Stippled areas represent clusters of rare plant locations.

Scale: 1"=2 miles

SANTA ROSA PLAINS ENDANGERED PLANT PROTECTION PROGRAM

7. **A Conceptual Plan for a Rare Plant Preserve System in the Santa Rosa Plains (cont'd)**

preserves in the following areas: the San Miguel Avenue area of Santa Rosa, the Wood Road/Alton Road area west of Fulton Road, the area between Piner and Guerneville Roads west of Fulton Road, the Primrose Avenue/Scenic Avenue area, the Todd Road elbows area and Sebastopol.

It is obvious from Figure 5, that there is only one location for a Navarretia plieantha preserve. Lastly, Figure 6, indicates preserves for Pogogyne douglasii spp. parviflora be established in north Windsor, Shilo Road, the old Naval Air Station and the Occidental Road bridge. The 14 ensemble sites, where more than one rare plant species occurs, would be a high priority for preserves because a given unit of land can be managed more efficiently as the number of species on-site increases.

VI. CONCLUSIONS

A. All of the species of concern have proven to deserve their status as rare plants. Each species is threatened by either development, irrigation or intensive agriculture. Rare plant sites generally fall into three categories: (1) those that are in good condition and not threatened, (2) those that are in good to moderate condition and are threatened by development, and (3) those that are in a deteriorated state and may or may not be threatened. The greatest number of sites in this study are in the second category and deserve immediate attention to ensure their continuation as rare plant colonies.

B. Blennosperma bakeri has been reduced to only 30 known locations representing approximately 6 biological populations. Most locations are in the central section of the study area. It is probably the most endangered of the species of concern being threatened by urbanization and effluent irrigation. Preservation of most of the remaining habitat for this species is crucial for its survival. This species should be listed as Endangered by the State as soon as possible.

C. Lasthenia burkei is restricted to 33 locations, representing approximately 5 biological populations. Most locations are in the northern half in the study area. Urban encroachment threatens the existence of this species. Habitat preservation is essential to the continuation of this species.

D. Limnanthes vinculans is restricted to 19 locations, representing approximately six populations. Most locations were in the southern half of the study area. Effluent irrigation is the greatest threat to this species. Preservation of the remaining habitat is essential for the continuation of this species.

E. Pogogyne douglasii spp. parviflora is limited to only six locations, representing approximately five populations. The locations are scattered across the study area. Several of these sites are under immediate threat. Habitat preservation is essential for the continuation of this species in the study area.

F. Navarretia plieantha occurs at only one site in the study area, earning it the distinction as the rarest of the five species in our study. Immediate action is necessary to ensure the preservation of this species' habitat.

G. The practice of allowing artificial pool creation as adequate mitigation for destruction of existing rare plant occurrences must be stopped immediately! It is an unproven experimental approach that to date has not been successful in Sonoma County or elsewhere. Continuation of this practice as the sole form of mitigation will further endanger the existence of rare plants in the study area.

H. Because only a minor amount of quality rare plant habitat is left in the study area, resources and mitigation should focus on the preservation of the remaining habitat. This necessity may require avoiding vernal pool rare plant habitat at any stage in the development process. The best approach would be the establishment of preserve clusters where rare plants are concentrated in the study area.

I. Unless the habitat management recommendations and mechanisms of protection described in this report are adopted and rapidly instituted, it is likely most of the species of concern will eventually become federally listed and subject to the authority of the U.S. Fish and Wildlife Service under the federal Endangered Species Act. The authority and increased review necessary under the federal act will require more complete and lengthy documentation and mitigation analysis. Opportunities for local solutions to the rare plant problem will become increasingly difficult as plants become rarer.

J. It is possible to achieve successful species preservation while accomplishing many other desirable goals (such as providing open space, enhancing wildlife habitat, preventing floodplain encroachment, preserving wetlands, and providing recreational and educational opportunities). The rare plant resource in the study area is at a turning point where immediate action can make a successful, and perhaps a model preservation program achievable. This is a short lived opportunity that the State and County should be proud to participate in. To do so shows recognition of this truly unique resource and will provide the opportunity for future generations to enjoy also.

Further study is required in the following subjects before an adequate preserve program can be established:

(a) ecological studies including population biology of each species of concern (i.e. pollination biology and seed dispersal, germination requirements), grazing interactions, competitive interactions with other plant species, the effects of habitat fragmentation and water relations.

VI. CONCLUSIONS - J (cont'd)

(b) hydrologic studies of the surface and sub-surface hydrologic dynamics of vernal pools.

(c) further inventory of all remaining potential habitat to be surveyed

SECTION B: MECHANISMS OF PROTECTION

I. INTRODUCTION

This section presents a two-phase program for vernal pool protection. Phase 1 is a detailed Interim Plan which can be implemented right away. Phase 1 implementation demonstrates a good-faith effort toward compliance with applicable state and federal regulations, giving the county time to proceed on the collaborative course of conflict resolution and long-range planning outlined in Phase 2.

Phase 2 can also begin immediately. Once started, it will take time to develop and implement, since the participation of all parties -- government agencies (federal, state, and local), developers, property owners and citizen advocates -- is required. Policies and procedures established in Phase 1 would provide feedback for the process underway in Phase 2.

Compatible with this implementation process is the creation of an Open Space District to fill the need for a local resource agency to own and manage preserve sites.

II. VERNAL POOLS - A DESCRIPTION

In areas underlain by hardpan, rainwater runoff moves through swales (channels) to collect in depressions called vernal pools. Both pools and swales are upland elements of the larger Laguna de Santa Rosa/Russian River wetlands system.

The occurrence of vernal pools in Sonoma County is related to our Mediterranean climate. These pools occur only in areas with perched water tables where seasonal rains are retained long enough to allow some purely aquatic organisms to grow and reproduce, but not long enough to permit the development of a typical pond or marsh ecosystem.

"The alternation between standing water and very dry substrate creates an unusual ecological situation that supports a unique and diverse biota. In order to survive in a vernal pool environment, a species must be able to either tolerate a wide range of conditions or to mature and reproduce in the short life space of the pool environment. Plants and animals associated with vernal pools are specialized and often restricted to small geographical areas." (Source: "Vernal Pools," California Wetlands, An Element of the California Outdoor Recreation Plan, Public Review Draft - July 1988, State Department of Parks and Recreation.)

III. THE IMPORTANCE OF SONOMA COUNTY'S VERNAL POOLS

The California Wetlands report cited above concludes its Vernal Pools section with this strong recommendation: "VERNAL POOLS CONTINUE TO BE AMONG THE MOST THREATENED OF CALIFORNIA'S WETLAND TYPES. THEREFORE, ALL VERNAL POOLS IN CALIFORNIA SHOULD BE INCLUDED AS POTENTIAL AREAS OF ACQUISITION AND ENHANCEMENT."

This study confirms the existence in Sonoma County of a vernal pool wetlands system which supports significant concentrations of state listed rare, threatened, and endangered (RTE) plant species. Listed species face the very real threat of

extinction. If their populations fall too low, their fate is irreversible. Their presence today is no guarantee of their survival unless their existing habitat is protected. The only way to ensure survival is to protect existing habitat. The protection of existing habitat establishes a safe minimum standard, a threshold, below which the ecosystem dare not fall.

IV. POLICY FOR ENDANGERED SPECIES PROTECTION

The following resolution is recommended for adoption by Sonoma County Board of Supervisors. It addresses habitat protection for all state and federally protected rare, threatened and endangered species, not just those singled out in this study.

WHEREAS, maintaining natural diversity, healthy ecosystems, and environmental quality contributes to the health, safety, and welfare of the people of Sonoma County;

WHEREAS, it is in the public interest to maintain a wide diversity of native plant and animal communities in Sonoma County and to protect those species which are listed by the State of California or the federal government as "rare, threatened, or endangered";

NOW THEREFORE BE IT RESOLVED that it shall be the policy of Sonoma County to promote the protection and enhancement of endangered species and their habitats.

BE IT FURTHER RESOLVED that no county agency may take any action, either directly through their own projects or indirectly through the permit process, which jeopardizes the continued existence of listed species or causes a reduction of habitat acreage or values.

VI. PHASE 1: INTERIM PLAN

A. Program Goals

A-1. To preserve and enhance existing vernal pool rare plant habitat and to avoid reduction in habitat acreage or values.

A-2. To preserve and enhance existing endangered plant species and to avoid reduction in plant populations.

B. Program Objectives

B-1. Avoid loss in vernal pool habitat with rare plant populations due to development.

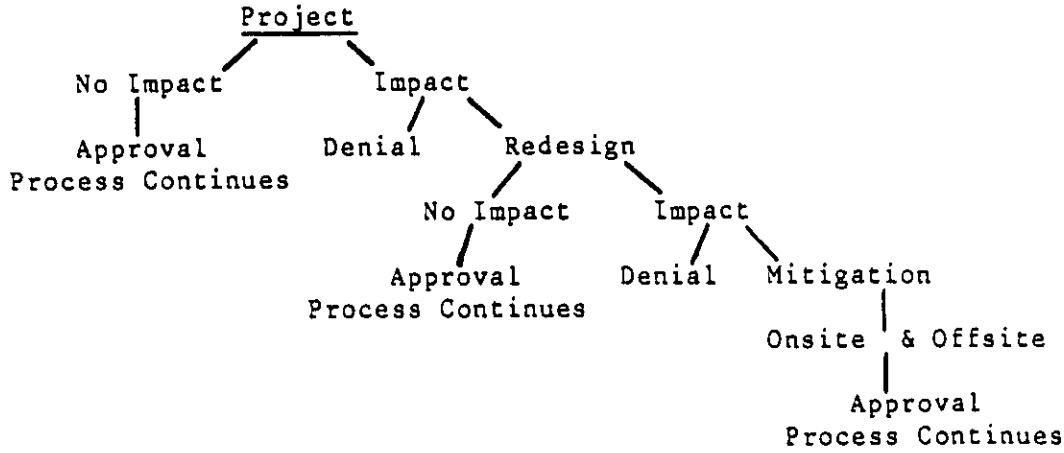
B-2. Public acquisition of vernal pool preserves, including clusters of vernal pool sites which provide biological diversity and which connect hydrologically with larger preserves.

C. Recommended Implementation Policies

C-1. Regulatory Process

C-1-a. Any action that could cause a reduction in acreage or values of vernal pool habitat and/or of endangered plant populations shall be avoided or fully mitigated.

Schematic of Regulatory Process



C-1-b. As recommended in the Draft Open Space Element of the General Plan Update (OS-4b), mapped vernal pool systems should be rezoned to the Biotic Resource combining district.

C-2. Voluntary Public & Private Protection Programs

Three methods of protection shall be available to landowners who wish to participate voluntarily in the Vernal Pool Protection Program:

a. Grants of Conservation Easements
b. Grants of Land in Fee
c. Registration of Rare Plant Sites

D. Implementation Procedures

D-1. Regulatory

Endangered vernal pool plants and their habitats are highly sensitive to any change in their environment and are especially vulnerable to development impacts. Any projects proposed in vernal pool areas must include the professional services of specialists in vernal pool biota. The names of specialists approved by the California Native Plant Society (CNPS) and the State Department of Fish & Game (CDFG) shall be provided by the Sonoma County Department of Planning upon request.

D. Implementation Procedures (cont'd)

D-1-a. Project Design

To gain approval a proposed development must not be destructive to vernal pool habitat. The development must be designed with nature in order to preserve the physical requirements of vernal pool systems. Required design elements may include setbacks, buffer areas, sedimentation control, and retention of natural hydrology (inflow and drainage) within the preserved natural systems. The construction of artificial "vernal pools" is not an acceptable substitute for the protection of existing habitat. A statement confirming the avoidance of impacts must be provided by the State Department of Fish & Game (CDFG) or their designated representative. The developer/applicant shall post bonds and provide monitoring and contingency plans to safeguard against after-the-fact damage to plants and/or habitat. Voluntary dedications of conservation easements will be encouraged.

Projects determined to have an adverse impact on vernal pool habitat must be denied or redesigned to avoid adverse impacts.

D-1-b. Mitigation Policy

Mitigation may be considered only after project redesign has failed to avoid adverse impacts and if development proposals meet all of the following criteria:

1. The project is in the public interest.
2. No alternative site exists.
3. Project design reduces habitat damage to the maximum extent possible.

Where unavoidable on-site damage is likely to occur, the mitigation plan must include both on-site and off-site remedies. On-site measures include the preservation and enhancement of remaining habitat, including buffer areas. Off-site measures shall include the acquisition and enhancement of permanent vernal pool preserves as compensation sites. Developers have the option of (1) acquiring, dedicating, and endowing approved sites or (2) paying mitigation fees sufficient to cover public acquisition, enhancement, and management costs of preserve sites.

IN LIEU FEES. Payment of mitigation fees will be an available option. Fees will be based on the fair market value (FMV) of the land at the time of development approval. The total land value of the parcel will be divided by the total acreage. That per-acre value multiplied by the amount of off-site habitat required yields the mitigation fee (Example: $40,000 per acre X .6 acres = $24,000 mitigation fee). Relating mitigation fees to site specific land values avoids the usual pitfall of in lieu fees: payments too low to cover acquisition and management costs of replacement habitat. For comparison, the "mitigation credit" charged at the Bracut Marsh Mitigation Bank near Humboldt Bay for filling pocket marshes in Eureka is $.75 per square foot or $32,670 per acre (source: Elizabeth Riddle, State Coastal Conservancy). The administration of in lieu fees and the timely acquisition of preserve sites will be the responsibility of the State Department of Fish & Game, acting as the "lead agency."

COMPENSATION SITES. Acquisition and dedication of approved off-site preserves (by grant deed or conservation easement) is another mitigation option. In this case, the developer is responsible for coordinating site selection and acquisition with the State Department of Fish & Game, who must approve the site and accept the dedication. Completion of the acquisition must precede development start-up. In recognition of the perpetual nature of the responsibility being taken on by the State as a consequence of private development, an endowment must accompany each dedication. The recommended endowment is $10,000-$25,000 to offset the relatively high managing and monitoring costs associated with small, scattered sites. Reductions may be possible for sites contiguous to other preserves. Increases will be required as needed to keep up with inflation.

ACREAGE CALCULATIONS. In most situations, preservation of off-site habitat will be required on an acre-for-acre basis, with all of the vernal pool habitat on the development parcel counting in the acreage calculation, including buffer areas and areas protected by on-site measures. This approach minimizes shortfalls in achieving the goal of no reduction in habitat acreage or values. If, however, all on-site habitat is likely to be damaged or destroyed, the preservation of off-site habitat shall be required at a minimum ratio of 2 to 1 (two acres preserved off-site for every acre of habitat, including buffer areas, damaged or destroyed on-site). Higher ratios will be required if the replacement habitat is inferior in ecological value to the habitat on-site.

APPLICANT'S RESPONSIBILITY. Applicants shall be responsible for preparing, submitting and carrying out mitigation plans. Mitigation plans shall contain these basic elements:

- baseline conditions
- mitigation objectives
- on-site protection and monitoring plan
- plan for off-site preservation, including payment of fees
- timetable for completion
- performance standards with contingency plan (to redress shortfall)
- posting of negotiable securities

ADMINISTRATION OF MITIGATION PLANS, SITES & FEES. The State Department of Fish & Game (CDFG) will be the "lead agency" for coordinating mitigation implementation and approving mitigation plans. CDFG will also own and manage off-site preserves. The County of Sonoma (or its designated representative) will be responsible for collecting mitigation and endowment fees and depositing them in the Vernal Pool Trust Fund. This fund will be established exclusively for implementation of mitigation plans. It will be set up as a revolving fund to reimburse CDFG, or other participating agencies, for expenditures made to acquire and manage off-site preserves and to monitor on-site protected areas. On-site preserves would be protected by conservation easements and not owned in fee by a resource agency.

RATIONALE. This mitigation policy is based on the principle that permanent protection diminishes the ecological effects of permanent damage. It mitigates habitat destruction in the following ways:

1. It insures that off-site land acquired and/or fees paid will be sufficient to acquire and manage permanent preserves.
2. It relates the remedy directly to the impact of the development.

Mitigation planning is part art, part science. Some experts may argue that protection of existing habitat does not constitute mitigation, that only the creation and enhancement of new habitat can achieve the goal of no net loss. The flaw in that logic is that it allows natural habitat to be destroyed and replaced with artificial habitat. Constructed vernal pools are grossly inferior to natural ones. Vernal pool wetlands are complex systems that take millenniums to form. The goal of this mitigation program is to avoid losses of natural habitat, but in the event of unavoidable loss, to compensate for it with permanent protection and enhancement of remaining natural habitat, both on- and off-site.

D-2. Voluntary Implementation Procedures

D-2-a. Grants of Conservation Easements

Protection of vernal pools by landowners shall be encouraged through voluntary grants of conservation easements to qualified public and private nonprofit agencies. Recipient agencies are encouraged to coordinate with the State Department of Fish & Game (CDFG) and the California Native Plant Society (CNPS) to develop standard provisions for vernal pool conservation easements.

QUALIFIED PUBLIC AGENCIES	QUALIFIED NONPROFIT AGENCIES
The State Department of Fish & Game	The Sonoma Land Trust
The County of Sonoma	The California Native Plant Society
A County Open Space District (proposed)	The Nature Conservancy

DEFINITION. A conservation easement is the legal instrument by which a landowner limits the development potential of property, without relinquishing ownership.

A conservation easement runs with the land -- that is, the original owner and all subsequent owners are bound by the restrictions of the easement. The executed easement document is recorded at the County Recorder's Office. This enables all future owners and lenders to learn about the restrictions when they obtain title reports.

The term "conservation easement" is used generically in this report to connote all similarly deeded restrictions on land use -- conservation easements, open space easements, scenic easements, forever-wild easements, agricultural preservation easements, conservation restrictions, restrictive covenants, etc. It includes all easements granted for habitat preservation purposes, however else they may be designated in legislation or popular parlance.

RESERVED RIGHTS & PROHIBITED USES. The easement document spells out the specific rights a property owner reserves and forgoes when granting a vernal pool conservation easement. The owner and the prospective easement holder identify use rights and restrictions that are necessary to protect the vernal pool habitat -- what the owner can and cannot do on the property. The easement is only as restrictive as necessary to protect the vernal pool habitat and buffer area. Since the goal is to protect a relatively undisturbed natural area, the easement would prohibit all construction, as well as activities that would alter the land's present natural condition. Even the most restrictive easements typically permit landowners to continue traditional uses of the land.

Reserved Rights & Prohibited Uses (cont'd)

By granting an easement in perpetuity, the owner may be assured that the habitat values of the property will be protected, no matter who the future owners are.

EASEMENT TERM. Whether the development limitations placed on the progerty by the conservation easement last in perpetuity or for a term of years depends on the nature and purpose of the easement . For protection of vernal pool habitat, most recipients would accept only perpetual easements. By state statute, a Conservation Easement (Civil Code Sections 815-816) must be granted voluntarily and must run with the land in perpetuity. An Open Space Easement (Government Code Sections 51070-51097) may be granted for a term of years or in perpetuity and it may be granted voluntarily or required as a condition of government approval.

EASEMENT VALUE. The value of a conservation easement is determined by a "before and after" appraisal, which estimates the fair market value of the total property, not just the portion being restricted, both before and after the conservation restrictions are applied. The reduction in property value resulting from the easement restrictions equals the market value of the conservation easement.

FUNDING SOURCES. Funds for acquisitions of vernal pool conservation easements by public agencies are extremely limited.

COMPETITIVE STATEWIDE	COUNTY
Various State Bond Funds	Mitigation Fees
Environmental License Plate Fund	Special Bonds (50% vote required)
State Income Tax Check-off	Special Assessment (66.6% vote required)

Most qualified nonprofit agencies have no funds for purchase of vernal pool easements, but will consider accepting them as gifts from conservation-minded owners. The gift or bargain sale (part gift, part sale) of a conservation easement, if it meets certain IRS requirements, qualifies as a tax deductible charitable contribution for the donor/seller.

RESPONSIBILITY OF EASEMENT HOLDER. Holding an easement entails significant responsibility. By law conservation easements can be accepted only by government agencies and qualified nonprofit organizations, who assume the legal responsibility for monitoring and enforcing the easement restrictions. A property owner must be certain that the recipient agency has the time and resources to carry out that responsibility. If no other source of funds exists for perpetual monitoring and enforcement, it is customary for a nonprofit organization that accepts an easement to ask the owner to make a contribution to the organization's easement protection fund.

HOW TO CREATE A VERNAL POOL EASEMENT PROGRAM:

-- Define the goals for the program.
-- Compile regional and site specific baseline data.
-- Establish criteria for qualified sites.
-- Develop a program budget, including long term funding support.
-- Market the program to build landowner and community support.
-- Master the acquisition process, including easement drafting.
-- Develop and implement monitoring plan.
-- Be prepared to use legal remedies to defend an easement.

REFERENCES

-- The Conservation Easement Handbook, by Janet Diehl & Thomas Barrett, published by the Trust for Public Land & the Land Trust Exchange, 1988.

-- The Conservation Easement in California, by Thomas Barrett & Putnam Livermore, published by Island Press, 1983.

D-2-b. Grants of Land in Fee

Full ownership is variously called "fee", "fee title", and "fee simple". It comprises all the property rights that the law allows -- the full bundle of sticks. The legal instrument used to transfer land title is a grant deed. If the grant is to a public or private agency exclusively for conservation purposes, deed restrictions may be included which run with the land and which specify the conservation purpose intended.

D-2. Voluntary Implemenation Procedures (cont'd)

Fee grants of land containing vernal pool habitat may be offered to the same agencies identified under Section C-2-a:

QUALIFIED PUBLIC AGENCIES	QUALIFIED NONPROFIT AGENCIES
The State Department of Fish & Game	The Sonoma Land Trust
The County of Sonoma	The California Native Plant Society
County Open Space District (proposed)	The Nature Conservancy

Funding sources are also the same as those described in Section C-2-a:

COMPETITIVE STATEWIDE	COUNTY
Various State Bond Funds	Mitigation Fees
Environmental License Plate Fund	Special Bonds (w/50% vote)
State Income Tax Check-off	Special Assessment (w/66.6% vote)

Owners may offer vernal pool habitat to a qualified agency as a market sale, bargain sale or gift. These techniques are discussed in Section E, Acquisition Techniques.

D-2-c. Rare Plant Registry

A registry program provides landowners with a voluntary, nonbinding way to protect their land. The program is designed to honor and recognize owners of outstanding natural areas for their commitment to the protection of these unique sites. Registration does not occur without an owner's cooperation and consent. The program relies exclusively on the willingness of individual landowners to safeguard prime habitat areas on their property.

A Sonoma County Rare Plant Registry could be developed to enroll high quality vernal pools and other rare plant sites. It could be administered much like the County Landmarks Program, which provides a registry for historic buildings and landmark trees. An alternative might be a Registry administered by a qualified nonprofit organization, such as the Milo Baker Chapter of the California Native Plant Society. Another alternative might be participation in an existing program run by The Nature Conservancy (TNC).

D-2. Voluntary Implemenation Procedures (cont'd)

Prime vernal pool sites in Sonoma County could be included in The California Nature Conservancy's "Registry of Natural Areas." To qualify candidate sites must contain at least one of the following natural elements:

- -- Habitat for a rare, threatened or endangered plant.
- -- Habitat for a rare, threatened or endangered animal.
- -- A rare, threatened or endangered native plant community or ecosystem.

When asked about including Sonoma County vernal pool sites, TNC's Director of Landowner Contact for the Register, Lynn Lozier, said, "The Nature Conservancy would be happy to add the most highly ranked sites to the list and would provide educational and scientific support to interested owners." She cautioned that time and staff are limited and that they "cannot cover all the bases as it is."

TNC's program provides an excellent model for Sonoma County. Essentially, participants agree to manage their property for the benefit of its natural values and to inform TNC before selling or developing the land. In return, TNC offers the following services free of charge:

- -- An annual ecological "check-up" on the health of the threatened element.
- -- Preparation of a management plan, if needed, to assure the continued health of the element.
- -- Consultation on how to protect the element should a transfer of ownership or other change become necessary.
- -- In honor of the commitment to protect the land, the owner receives a hardwood plaque bearing his or her name and the name of the Registered Area. Alternatively, a framed certificate is available.

A Rare Plant Registry provides neither regulatory authority nor legally-binding, permanent protection. It is an agreement that may be cancelled by either party at any time. Registration involves no payment or receipt of funds. Its effectiveness is based on voluntary cooperation. By informing owners of the importance of these sites, the program reduces the chance that significant natural areas might inadvertently be destroyed.

"Registry participants have the satisfaction of joining other select California landowners in a voluntary program to protect natural diversity, a benefit to present and future generations." (Source: TNC Brochure.)

E. Acquisition Techniques

A brief introduction to land acquisition techniques follows. It provides basic information about the mechanics of market sales, bargain sales, and gifts, and reviews the types of real estate interests which can be acquired: fee title, conservation easements, and remainders.

E-1. Mechanics

E-1-a. Market Sale

For any interest in real estate solicited from a landowner, government agencies are required by law to offer fair market value (FMV), based on agency-approved appraisals. The steps involved in a fair market purchase are as follows:

1. Identify the qualified property.
2. Establish its availability for purchase.
3. Obtain title information.
4. Obtain a qualified appraisal.
5. Buyer and seller negotiate purchase price.
6. Upon acceptance of the offer, buyer and seller open escrow.
7. Acquisition is complete upon close of escrow and recordation of the deed.

E-1-b. Bargain Sale

Occasionally, a landowner willingly sells land to a public agency or qualified nonprofit organization for less than fair market value. This is a "bargain sale". It is part sale, part gift. The gift portion qualifies as a tax deductible charitable contribution. Bargain sales are entirely voluntary, with both buyer and seller having full knowledge of the land's appraised FMV. Such discount purchases depend entirely on the cooperation and philanthropic motivation of the seller. Bargain sales have great public benefit because they can stretch limited acquisition funds to obtain more land for dollars spent. The steps in the transaction are essentially the same as a market sale.

E-1-c. Gift

Government agencies are prohibited by statute from soliciting land without offering fair market value. Qualified nonprofit organizations face no such statutory restriction and frequently solicit voluntary gifts of land. If, rather than being solicited by a government agency, the land is offered as a gift or bargain sale, the statute requiring FMV does not apply.

E-1. Mechanics (cont'd)

Gifts, by definition, are dependent upon the willingness of landowners to protect their property without direct financial compensation. Indirect compensation exists in the form of federal and state tax benefits, which help offset the cost of the gift. The donor is entitled to a charitable income tax write-off equal to the fair market value of the gift as determined by a qualified appraisal. Also, for some owners, a gift of property frees them from costs and responsibilities they can do without. Following are steps involved in a gift transaction:

1. Landowner offers gift.
2. Recipient agency assesses merit of gift and obtains preliminary title information.
3. If offer is accepted, escrow is opened and deed is recorded upon close.
4. If donor wishes to claim a charitable tax deduction, he or she obtains a qualified appraisal of the land's FMV within 90 days of close of escrow, either before or after.

E-2. Types of Real Estate Interests Acquired

Ownership rights can be sold or donated all or in part. This section summarizes types of land interests commonly acquired for conservation purposes.

E-2-a. Fee Title - Full Ownership

This is variously called "fee", "fee title", and "fee simple." It comprises all the property rights that the law allows -- the largest bundle of sticks. The legal instrument used to transfer title to land is a grant deed.

E-2-b. Conservation Easement - Partial Interest

A conservation easement is a partial interest in real estate. It is restrictive in nature and conveys to the easement holder the legal responsibility for enforcing compliance with the terms of the easement. The landowner retains the underlying fee, which constitutes less than the full bundle of sticks which existed prior to the easement grant. A conservation easement is also the legal instrument which transfers or extinguishes development rights, depending on the purpose of the easement and the language in the easement document. (See also D-2-a.)

SUMMARY OF CALIFORNIA ENABLING LEGISLATION

Cons. Easements Act of 1979	Civil Code Sections 815-816
Open Space Easement Act of 1974	Gov. Code Sections 51070-51097
Scenic Easement Deed Act of 1959	Gov. Code Sections 6950-6954

E-2-c. Remainder - Future Interest, with a Reserved Life Estate

A remainder is a conveyance of fee title by a grant deed with a life estate reserved. A life estate entitles a landowner -- and anyone else the landowner may designate -- to remain in possession of the property during his or her lifetime. A remainder interest entitles the recipient organization to receive full ownership of the property upon the death of the last holder of the life estate. Customarily, the owner of a life estate remains liable for real estate taxes and maintenance costs for the duration of the life estate. The valuation of a remainder interest follows actuarial rules that discount the fair market value of the property according to the amount of time the life estate is expected to last.

B. Immediate Problems (cont'd)

4. **Fragmented Jurisdiction.** Both EPA and the COE are responsible for deciding whether an area qualifies as wetland under Section 404 of the Clean Water Act. COE evaluates and issues most permits. The US Fish & Wildlife Service (USFWS) has authority for federally listed rare, threatened and endangered (RTE) species. CDFG has legislative authority for state listed RTE species. Local agencies have control over land use and building permits. This fragmented authority makes it extremely difficult to deal with habitat protection and with development pressures in an effective way.

C. Collaborative Process

Conflict can play a useful role in decision-making. It helps people weigh the consequences of inaction, to identify issues and to assert influence. Conflict loses its productive function when frustration and distrust begin to characterize the relationships among participants. To remain useful, conflict must be channeled into goal-oriented activity.

A collaborative approach to conflict resolution helps disputing or distrustful parties to shift the context of their interaction from antagonism and fear of loss to cooperation and mutual gain.

D. Participants

The collaborative process requires the participation of all parties:

1. **Federal Regulators & Resource Agencies:**
   - The Army Corps of Engineers
   - The Environmental Protection Agency
   - The US Fish & Wildlife Service

2. **State Regulators & Resource Agencies:**
   - Department of Fish & Game
   - Regional Water Quality Control Board

3. **County Regulators:**
   - Board of Supervisors
   - Planning Commission
   - Planning Department
   - Building Department
   - Sonoma County Water Agency

4. **City Regulators:**
   - City Council
   - Planning Commission
   - Community Development Department

VII. PHASE 2: SENSITIVE AREA MANAGEMENT PLAN

A. Introduction

Given the complex, multi-party issues involved, it will take time to develop and implement a comprehensive program for the preservation, mitigation, management and monitoring of vernal pool habitat.

Phase 1, the Interim Plan, identifies specific policies and procedures that could be implemented immediately. It is intended to function on a short-term basis until the long-range management plan is developed in Phase 2.

Phase 2, presented here in general terms, is a process, not a packaged product. The outcome of the process would be a sensitive area management plan (SAMP) developed through the coordinated efforts of the Corps of Engineers (COE), the Environmental Protection Agency (EPA), the State Department of Fish and Game (CDFG), City and County Planning Departments, and the yet-to-be-created Open Space District (OSD). Ideally, this multi-jurisdictional approach to environmental problem-solving and land use decision-making would be collaborative rather than adversarial.

B. Immediate Problems

Several immediate problems must be addressed at the outset.

1. **Lead Agency.** Under Phase 1, the State Department of Fish & Game is the interim lead agency which analyzes development impacts, approves mitigation plans, monitors mitigation sites, and acquires and manages preserves. The role of the lead agency in Phase 2 is quite different. Since EPA has experience administering SAMPs, they might be an alternative choice. However, a local lead agency, such as an Open Space District, would seem better able to provide local control and responsiveness to local needs. In any case, a resource agency that is motivated to complete the process and has experience with SAMPs, should be selected as the lead agency.

2. **Project Leader.** The task of achieving consensus will demand the utmost sensitivity and persistence. A project leader must be selected with great care. The success or failure of the process depends on it.

3. **Comprehensive Inventory, Evaluation and Mapping Needed.** The participants in Phase 2 will need complete baseline data on locations of vernal pools and associated rare plant communities. The inventory contained in this report is a good start, but more information on site characteristics and habitat requirements is needed.

D. Participants (cont'd)

5. **Private Sector Representatives:**
   - Landowners
   - Development Industry
   - Conservation Organizations
   - Citizen Advocates

E. Producing Results

The inventory of vernal pools, the determination of habitat value, and the assessment of development impact are fairly objective and technical tasks. The establishment and implementation of management goals, however, go far beyond science and technology. They involve social decisions about how the future should look, acceptable trade-offs between conservation and development, and the cost of different options.

Phase 2 participants will be asked to produce a plan of action which addresses the needs and concerns of all parties. Ideally, the results would include the following features:

1. Official wetlands inventory and maps.

2. Goals that balance protection of the resource with pressure for land development.

3. An area management plan that:

   a. determines boundaries for protected areas.
   b. identifies candidate sites for preserve acquisition.
   c. sets minimum safe standards for development encroachment.
   d. addresses the cumulative impacts of development.
   e. includes mitigation requirements.

4. Coordination of federal, state and local agencies in exercising regulatory authority over vernal pools and associated rare plant species.

5. Consistency of treatment for permit applications, resulting in increased certainty of outcome for applicants.

6. Preservation on a regional basis of clusters of vernal pool sites which connect hydrologically with several larger preserves.

F. Updating of Information

Any significant changes to the vernal pool system , especially those resulting from regulatory decisions, should be fed back into the vernal pool and RTE plant inventory to keep it current, in order for future decisions to be based on up-to-date information.

SECTION C. FINAL REPORT RECOMMENDATIONS

1. Seek California Department of Fish and Game (CDF&G) listing of Blennosperma bakeri (Baker's blennosperma) as "Endangered".

2. Seek California Department of Fish and Game (CDF&G) listing of Trifolium amoenum (showy Indian clover) as "Endangered".

3. Create a mechanism within the Sonoma County Planning Department for updating rare plant locations.

4. Require rare plant surveys (to be conducted by a qualified biologist during the appropriate flowering season) on major and minor subdivision and use permits for all parcels that contain vernal pool habitat in Sonoma County.

5. Seek additional funding from California Department of Fish & Game (CDF&G) (and other appropriate sources) for: (1) continuing rare plant inventory, (2) monitoring and (3) ecological study.

6. Adoption of Phase I: Interim Plan (see pg. 50).

7. Initiation of Phase 2: Sensitive Area Management Plan (see pg. 61).

8. Establishment of County Open Space District to provide local control of open space resources (including vernal pools).

9. Cease allowing the creation of artificial vernal pools (and seeding, transplanting plants or topsoil, etc., into such pools) as mitigation for impacting existing rare plant occurrences.

10. Cease allowing salvaging (seed collecting, transplanting or topsoil removal) of rare plants as the sole form of mitigation for impacting rare plant occurrences.

11. Promote the expansion of rare plant colonies into available (currently unoccupied) vernal pool habitat.

12. Promote a greater public level of awareness of vernal pool resources through educational activities.

PERSONS AND AGENCIES CONTACTED

Allan Buckman, California Department of Fish and Game, Region III Wildlife Biologist, Yountville.

Dan Carlson, Sanitary Engineer, Department of Public Utilities, City of Santa Rosa.

Susan Cochrane, Coordinator, Endangered Plant Project, California Department of Fish and Game, Sacramento.

Bill Cox, California Department of Fish and Game, Region III Fisheries Biologist, Yountville.

Calvin Fong, Corps of Engineers, San Francisco.

Cay Goude, Ecological Services, U.S. Fish and Wildlife Services, Sacramento.

Betty Guggolz, Rare Plant Chairperson, Milo Baker Chapter, California Native Plant Society.

Subodh Jain, Department of Agronomy and Range Sciences, University of California, Davis.

Karla Kramer, Endangered Species Office, U. S. Fish and Wildlife Service, Sacramento.

Richard Lehtinen, Sonoma County Planning Department.

Lynn Lozier, The Nature Conservancy, San Francisco.

Robert Mayes, Sonoma County Water Agency.

Ted Morrison, Sonoma County Building Department.

Phil Oshida, Environmental Protection Agency, San Francisco.

Vicki Reynolds, Corps of Engineers, San Francisco.

James Swanson, California Department of Fish and Game, Regional Headquarters, Yountville.

Hal Woods, Director, Windsor Water District, California.

Carl Wilcox, California Department of Fish and Game, Region III Wildlife Biologist, Yountville.

Appendix 1. LAWS PERTAINING TO RARE AND ENDANGERED PLANTS

A number of federal, state and local laws regulate rare plants that occur in the project vicinity. Table 1 (see pgs. 4-5) lists the species of concern for this study.

Federal . Although most of the species of concern are federal candidates, they are afforded no protection under the mandate of the federal Endangered Species Act (ESA). However, federal involvement in a project usually involves interagency agreements specifying conservation measures for candidate species (Bartel, 1986). Such species may also be formally listed as rare, threatened or endangered should an "emergency" situation arise.

State. State laws are the most important regarding this project because there is no federal listing for potentially occurring species. The three relevant laws follow:

1. The Native Plant Protection Act (NPPA). Passed in 1977 by Senator Nejedly, this law directed the California Department of Fish and Game (CDFG) to "preserve, protect and enhance endangered plants of this State." Under Section 1900, Chapter 10 of the Fish and Game Code, a native plant is defined as "rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens." A native plant is defined as "endangered when its prospects of survival and reproduction are in immediate jeopardy from one or more causes." NPPA involves provisions that prohibit the taking of plants from the wild and a salvage requirement for landowners.

2. The California Endangered Species Act (CESA). This act is the result of the combination of two Assembly bills, 3270 (Campbell) and 3309 (Costa), passed in 1984. The law expands upon, but does not replace, the original NPPA. However, it created a new "Threatened" category of species, subspecies or variety "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by this Act." This act also adds State agency consultation procedures that discourage approval of projects under CEQA that would "jeopardize" endangered or threatened species. Memorandums-of-understanding are required for unavoidable impacts which will "take" listed species and attempt restoration as mitigation. However, "rare" species are limited to the protections in NPPA.

3. The California Environmental Quality Act (CEQA). Where rare or endangered species are concerned, CEQA mandates consultation with CDFG as a "responsible agency" (Sections 21080.3, 21080.4 and 21153) which has jurisdiction over "taking" of rare, threatened or endangered species under NPPA and CESA. Under the "mandatory findings of significance" in the Initial Study, any project which may "reduce the number or restrict the range of a rare or endangered plant" is to be considered significant, thereby requiring the preparation of an Environmental Impact Report (EIR) (Section 15065), or a mitigated Negative Declaration. Through consultation with CDFG, alteration of project design or mitigation measures are developed which compensate for losses to rare and endangered species (Section 15091). Alternatively, the lead agency may adopt a "statement of overriding concern" which states the benefits of the proposed project outweigh the adverse environmental impacts (Section 15093). However, such a statement does not exempt the lead agency from the "taking" provisions of NPPA and CESA.

CEQA also provides for considering impacts to species which are not officially listed but deserving of such status. Section 15380 states that species not on th e Rare, Threatened or Endangered list shall nevertheless be considered if the species can be shown to meet the criteria for State listing.

3.0 NATURAL RESOURCES

Sonoma County is rich in plant and animal habitats which warrant protection. Primary components mapped on the open space plan maps are biotic resource areas and riparian corridors. Figure OS-3 on page 113 shows designated natural resource protection areas.

3.1 POLICY FOR BIOTIC RESOURCE AREAS

Certain biotic communities provide wildlife habitat and contribute to the quality of life in Sonoma County. They need special protection because they are highly sensitive to change and could be adversely affected by development.

Important biotic resource areas include:

1. Wetlands and Marshes -- These are identified as critical habitats and may include, but are not limited to, tidal salt marshes and estuaries, fresh water marshes, and vernal pools. Wetlands provide a habitat for many animal and plant species and serve as the base of a food chain which supports many types of fish, waterfowl and other birds and mammals. Loss of wetlands affects these species and decreases hunting, fishing, and recreational opportunities.

2. Unique Natural Areas -- Remnants of native bunchgrasses and oak savannas represent the original vegetation of Sonoma County. Sargent Cypress Forests, Pygmy Forests, and Coastal Dunes contain rare and endangered species, are easily damaged and are difficult to re-establish. These areas may include but are not limited to preserves of the Sonoma County Land Trust, Audubon Society, the Academy of Science.

Goal OS-4 Identify areas with important biotic resources and assure that the quality of these natural resources is maintained and not adversely affected by development activities.

Objective OS-4.1 Designate important wetlands, marshes and unique natural areas and maintain low intensity land uses in these areas.

Objective OS-4.2 Establish development guidelines to protect designated biotic resource areas.

The County shall use the following policies to achieve these objectives:

OS-4a: Add a Biotic Resources combining district to the zoning ordinance which implements the Open Space Element.

OS-4b: Rezone to the Biotic Resource combining district any lands designated as a biotic resource area.

OS-4c: Require the preparation of a biotic resource assessment to develop mitigation measures where the Planning Director determines that a discretionary project could adversely impact a designated biotic resource area.

OS-4d: Establish building envelopes which avoid biotic resource areas on tentative maps for parcels with designated sites.

OS-4e: Require on building permits a minimum setback of 50 feet from the edge of designated wetlands. Exempt existing farm buildings and allow them to be expanded or modified. Consider waiver of the setback if, after preparation of a biotic resource assessment, it is determined that applying the setback makes the parcel unbuildable or the structure is a noncommercial agricultural building and must be located adjacent to an existing farm complex for efficient farm operation.

5.2 PROTECTION OF RARE AND ENDANGERED SPECIES

Small populations of plants and animals which are in danger of extinction due to the loss or alteration of habitat are protected by state and federal law. These species are highly sensitive to any change in their habitat and could be adversely impacted by development. Rare and endangered plant and animals species frequently provide essential links in the natural ecosystem.

Goal RC-6 Identify and protect rare and endangered species and their environment.

Objective RC-6.1 Identify the locations of rare and endangered plants and animals (Figures RC-2a through 2i pages 173 through 189.) Review projects using locations mapped in the Natural Diversity Date Base and Native Plant Society Surveyor.

Objective RC-6.2 Require that any development on lands containing rare and endangered species be done in a manner which protects the resource.

5.2 PROTECTION OF RARE AND ENDANGERED SPECIES (cont'd)

The County shall use the following policies to achieve the above objectives:

RC-6a: Maintain and update "Biotic Resource" data maps which show the locations of known rare and endangered species, critical habitats, and unique natural areas and use them in the environmental review process for development permits.

RC-6b: Require that a biotic resource assessment be prepared for a discretionary project on a parcel containing a rare or endangered species. Prepare it at the appropriate time of year to allow the best assessment of project impacts before any construction activities. Develop mitigation measures to be included in the project which comply with the Endangered Species Act of 1973. Require sufficient bonding to guarantee performance.

APPENDIX 5. List of California Natural Diversity Data Base Occurrences and Corresponding Report Locations

Appendix 5. LIST OF CALIFORNIA NATURAL DIVERSITY DATA BASE OCCURENCES AND CORRESPONDING REPORT LOCATIONS

Site locations are coded by report identification numbers plotted on Sonoma County Planning Department lot-line maps; the first two numbers refer to USGS quadrangle (20=Healdsburg, 26=Sebastopol, 27=Santa Rosa, 32=Two Rock). The letters A-F, refer to sections of quadrangles on the 1 inch=500 feet lot-line maps. The last two numbers refer to actual occurrences identified in the field. LABU=Lasthenia Burkei, LIVI=Limnanthes vinculans, BLBA=Blennosperma Bakeri, NAPL=Navarretia plieantha, PODOP=Pogogyne Douglasii spp. parviflora. CNDDB (California Natural Diversity Data Base) code numbers are defined as follows: first two digits are occurrence number; last two digits are map symbol number.

Location Number	Location Name	CNDDB Occurrence Number	
C2001	Grill, Old Redwood Hwy,Windsor	LABU 1318	
C2002	Arata Ln. overpass, Windsor	LABU 1412	
C2003	Starr Rd.#1, Windsor	LABU 1211	
C2004	Starr Rd. #2, Windsor		
C2005	Wilcox Rd. wreck. yrd, Windsor	LABU 1211	
C2006	Wilcox Rd., Windsor	LABU 1211	
C2007	Promenade Ln woodland, Windsor		
C2008	Grange area, Windsor		
E2001	County Airport Preserve	LABU 0706	
F2001	County Airport medians	LABU 0908	
F2002	Standard Structures, Shilo Rd.		
F2003	Airport treatment plant	LABU 0807	
F2004	Coombs easement, Airport B. P.	LABU 0807	
F2005	Shilo Rd. horse ranch	LABU 1009	
F2006	Heller Labs, Shilo Rd.	LABU 1009	
F2007	Gossage, Sanders Rd., Airport	LABU 0807	NAPL 0912
F2008	Sanders Rd. (end), Airport	LABU 0807	
F2009	Skyine Blvd. extension	LABU 0809	
B2601	San Miguel x Fulton, NW S.R.		
B2602	San Miguel Rancho, NW S.R.		
B2603	Alton Rd., NW S. R.		
B2604	Hartman Rd near Piner Rd west		
B2605	Maccario's oaks, Piner Rd west		
B2606	Comalli's, Piner Rd west	BLBA 1556	
B2607	Abramson Rd # 1, Piner HS area	BLBA 1148	LABU 1348
B2608	Oak Farm Ln, Piner Rd west		
B2609	S.R.224 easement,Piner Rd west		
B2610	Abramson Rd # 2, Piner HS area		
B2611	Abramson Rd # 3, Piner HS area		
B2612	Paradise Ln # 1, Piner HS area		
B2613	Paradise Rd # 2, Piner HS area		
B2614	Brown Subdivision, NW S. R.		
B2615	San Miguel Est. # 1, NW S. R.	BLBA 1008	
B2616	San Miguel Est. # 2, NW S. R.		

Location Number	Location Name	CNDDB Occurrence Number			
B2617	Westwood Vlg Subd., Piner HS	BLBA 1350	B2618	Francisco elbows, NW S. R.	
B2619	Raplee Terrace, NW S. R.				
B2620	Hemmerle, Piner HS area				
B2621	Rancho San Miguel #2, NW S. R.				
B2622	Manes, San Miguel Rd, NW S. R.				
B2623	Marovich, Waltzer Rd, NW S. R.				
B2624	Pioneer 2000 Apts., NW S. R.				
B2625	Wood Rd.elbows, W. Piner area				
B2626	SW corner of Piner x Fulton	BLBA 0946			
B2627	Field SW of Piner Elem. Sch.	BLBA 1962			
B2628	Abramson Rd. # 4				
C2601	Laguna @ Hall Rd., Nunes	LABU 0307			
C2602	Sanford Rd. @ the Laguna				
C2603	Ccci. Rd near Sanford, Laguna	LABU 1457			
C2604	Aggio dairy, Laguna @ Occi. Rd				
C2605	Ambrosini @ Occ.Rd.Br., Laguna				
D2601	Hall x Willowside	LABU 1660			
D2602	Hall x Piezza (Crinella)	LABU 1761			
D2603	Dairy, Hall&Occi near Fulton				
D2604	Lions Memorial, Occi @ Merced	LIVI 0310			
D2605	Corrie, off Guern., Piner HS				
D2606	Naval Air Sta., WrightxFinely	LIVI 0209			
D2607	CALTRANS ROW, Hwy 12xOcci.	LIVI 2222			
D2608	CALTRANS ROW, Hwy 12 @ Llano	LIVI 2452			
D2609	Nav. Air Sta., NE quadrant				
E2613	Palm Terrace, Sebastopol				
F2601	Landeros, Todd Rd near Llano	LIVI 1118			
F2602	Naval Air Sta., SW quad #1	LIVI 0815			
F2603	Naval Air Sta., Hanger site				
F2604	Naval Air Sta., SW quad #2	LIVI 0815			
F2605	Naval Air Sta., Concord Rd end	LIVI 0714			
F2606	Todd Rd Elbow, preserve area	BLBA 0808	LIVI 0108		
F2607	ToddxLlano, SW corner,	LIVI 1920			
F2608	Laguna @ RR br., Sebastopol	LIVI 1017			
F2609	Todd Rd. Preserve	BLBA 1455	LABU 0111	LIVI 0420	LIVI 1920
F2610	Dom. Carinalli easement,Laguna	BLBA 1249	LABU 1457	LIVI 0613	LIVI 2558
F2611	Hofbauer easement, Laguna				
F2612	S Wright @ Madera, Nav.Air.Sta	LIVI 0512			
F2613	Walker Ln, near Colgon Cr.				
F2614	Ludwig Ave., Old Navel Air Sta				
F2615	Scenic Ave. x Arlington Way				
F2616	Colgon Cr. pasture, nr. Todd				
E2701	Primrose Ave., SW Santa Rosa				
E2702	Todd @ Primrose, SW Santa Rosa				

Location Number	Location Name	CNDDB Occurrence Number	
E2703	ScenicxWhistler, SW Santa Rosa	BLBA 1703	LIVI 1403
E2704	Horn Ave. north, SE Santa Rosa	BLBA 1801	LIVI 1201
E2705	Horn Ave. south, SE Santa Rosa	BLBA 1801	LIVI 1302
E2706	ScenicxHargrave, SW Santa Rosa		
B3201	Gundelfinger, Llano @ Hwy 116	ALAES0209	LIVI 1501

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