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OPERATIONS AND MAINTENANCE SCHEDULE BALDWIN LAKE ECOLOGICAL RESERVE (AND ADJACENT LANDS)

FINAL REPORT
AUGUST 1989

Prepared For:

California Department of Fish and Game
Endangered Plant Program
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Sacramento, California 95814

Prepared By:

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In Cooperation With:

California Nature Conservancy
785 Market Street
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OPERATIONS AND MAINTENANCE SCHEDULE BALDWIN LAKE ECOLOGICAL RESERVE (AND ADJACENT LANDS) SAN BERNARDINO COUNTY, CALIFORNIA

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Funded by California Endangered Species Tax Check-off Fund
Contract No. FG-7605

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* BLER = Baldwin Lake Ecological Reserve

INTRODUCTION

The proposed Baldwin Lake Ecological Reserve includes 124 acres located in San Bernardino County on the northwest shore of Baldwin Lake (Figure 1). Baldwin Lake, at an elevation of 6720 feet (2050 m), lies at the east end of Big Bear Valley. From here the northern slope of the San Bernardino Mountains drops abruptly to the Mojave Desert. State Highway 18 runs along the north shore of Baldwin Lake and bisects the ecological reserve.

The focus of this operations and maintenance schedule is the proposed Baldwin Lake Ecological Reserve, state-owned properties managed by the California Department of Fish and Game (CDFG). Formal designation of the area as an Ecological Reserve was initiated in April 1989 and should be completed by the end of the year (Gronholdt 1989).

This management plan also addresses adjacent lands, managed by the U.S. Forest Service (USFS) and The Nature Conservancy (TNC), because of the occurrence of contiguous rare plant populations on these lands. Therefore this schedule also includes a proposal to develop a cooperative management plan for the three agencies and their respective lands (Figure 2). The proposed management actions in this schedule will serve only as recommendations for the U.S. Forest Service and The Nature Conservancy. The relevant USFS parcels (also referred to as the "Lamane" parcels to distinguish them from other surrounding USFS lands) occur within the North Baldwin Lake and Holcomb Valley Special Interest Area; management actions are specified by the USFS for this Area. The entire area addressed in this report will be referred to as "the study area." The acreage, ownership and management status of these lands are given in Table 1.

The study area is within the Big Bear Basin, a locality noted for a high degree of plant endemism. In fact, the San Bernardino Mountains have one of the richest endemic floras in the state, with 23 endemic taxa of plants. The study area hosts an ensemble of 14 rare or sensitive species. Included in this list are two federally-listed and state-listed endangered species, the bird-footed checkerbloom, *Sidalcea pedata* and the slender-petaled mustard, *Thelypodium stenopetalum*. The endemic plant species occur in three principle habitats: 1) pebble plains (seven species); 2) wet meadow habitat (four species); 3) vernal creeks (three species). A list of the rare species and their current status is given in Table 2.

Also present in Baldwin Lake when the water level is sufficiently high is the federally-listed endangered unarmored three-spine stickleback, *Gasterosteus aculeatus* ssp. *williamsoni*. This species was last seen along the north shore of Baldwin Lake, within the Ecological Reserve, in 1985 (Malcolm, pers. comm.). Sticklebacks could possibly re-invade the lake from outlying populations (e.g. Shay Creek) in subsequent years when the lake level is high.

The present study was initiated under supervision of the California Department of Fish and Game, Endangered Plant Program through a cooperative program with the California Nature Conservancy. Prior to initiation of field studies, a scoping meeting involving representives of the California Department of Fish and Game, California Nature Conservancy, U.S. Forest Service, and Friends of the Big Bear Valley Preserve was held on the study site. The scoping session produced a list of the relevant management concerns and discussion of the potential for cooperative management efforts in the study area.

The field studies conducted include: inventories of the vascular plant species, plant communities, vertebrate species; physical and hydrological features; distribution of special habitats, state- and federally-listed Threatened and Endangered species, and USFS Sensitive species; disturbance impacts within the study area; and determination of historical and current land uses on the reserve and surrounding lands.

This operation and maintenance schedule and management plan address the significant management objectives for the Baldwin Lake Ecological Reserve and adjacent lands within the study area. For each of the rare taxa, species management goals have been formulated. As part of a long-term goal of monitoring the rare species, a preliminary monitoring plan for these unique species has been included. The property also has a structure, the "horse house" built in the 1940's, which requires management action.

Table 1. Location, size, ownership, and management status of lands included within the study area.

Land Owner/ Manager	Size (acres)	Location	Management Status
California Department of Fish and Game	124	T2N,R2E NW1/4 Sec. 6	Ecological Reserve
Nature Conservancy	30.7	T3N,R1E portion Sec. 35	Private-Protected
U.S. Forest Service[1]	453	T3N,R2E SW1/4 Sec. 31 T3N,R1E portion Sec. 36	Public-Protected
Private Inholding ("Cemetary" parcel)	14	T2N,R2E portion Sec. 6	Private-Unprotected

[1] Designated as part of North Baldwin Lake Special Interest Area.

In summary, this plan proposes the development of a cooperative management program between the participating agencies with respect to the study area. Species management goals can be accomplished through the shared action of California Department of Fish and Game, The Nature Conservancy and the U.S. Forest Service personnel. The most significant objectives include acquisition of a private inholding, redirecting wild burro activity away from rare plant populations, developing an interpretive program, and implementing a monitoring program.

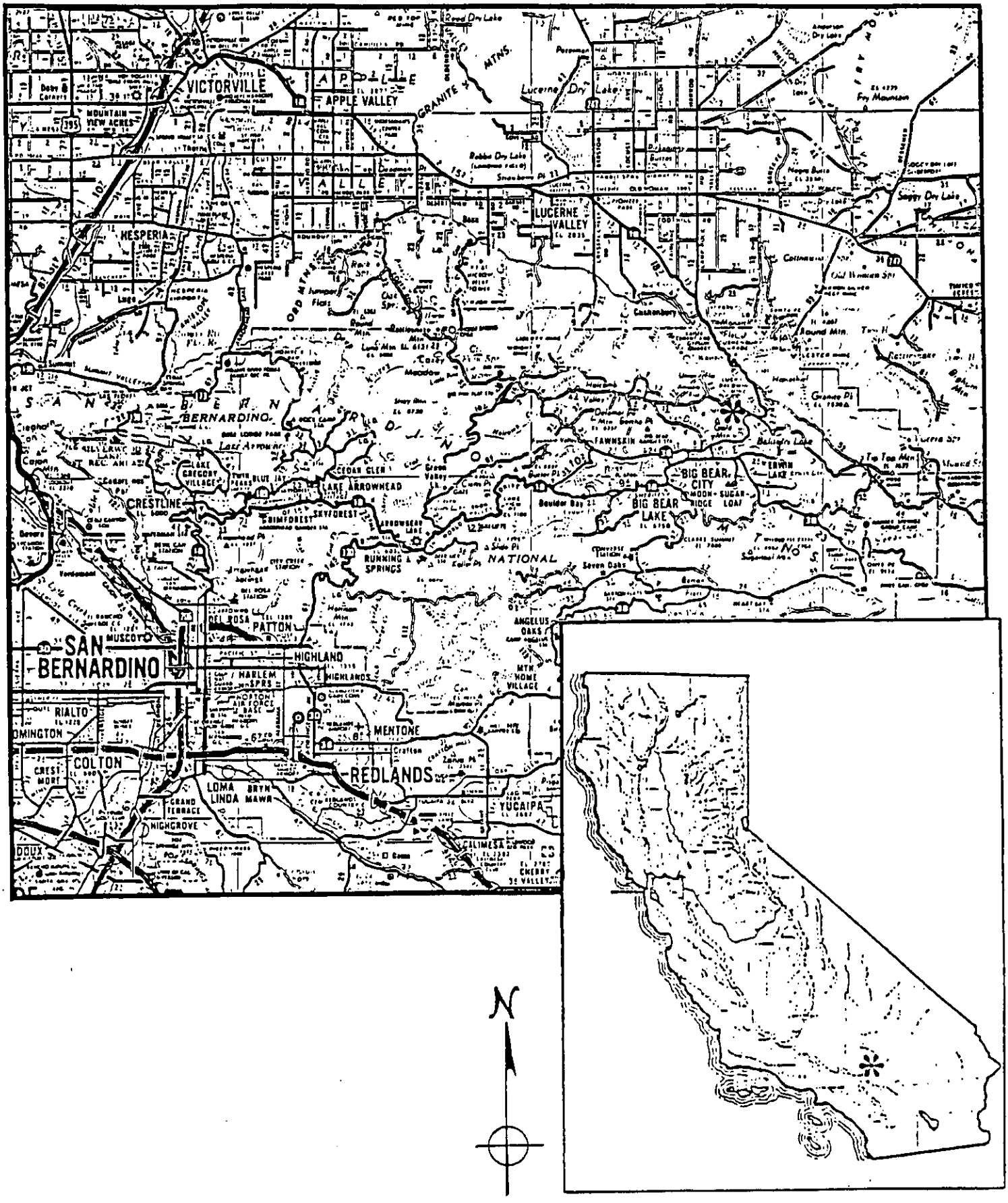

Figure 1. Location of the Baldwin Lake Ecological Reserve in San Bernardino County, California. Map is from Southern California Automobile Association, San Bernardino County map (1986).

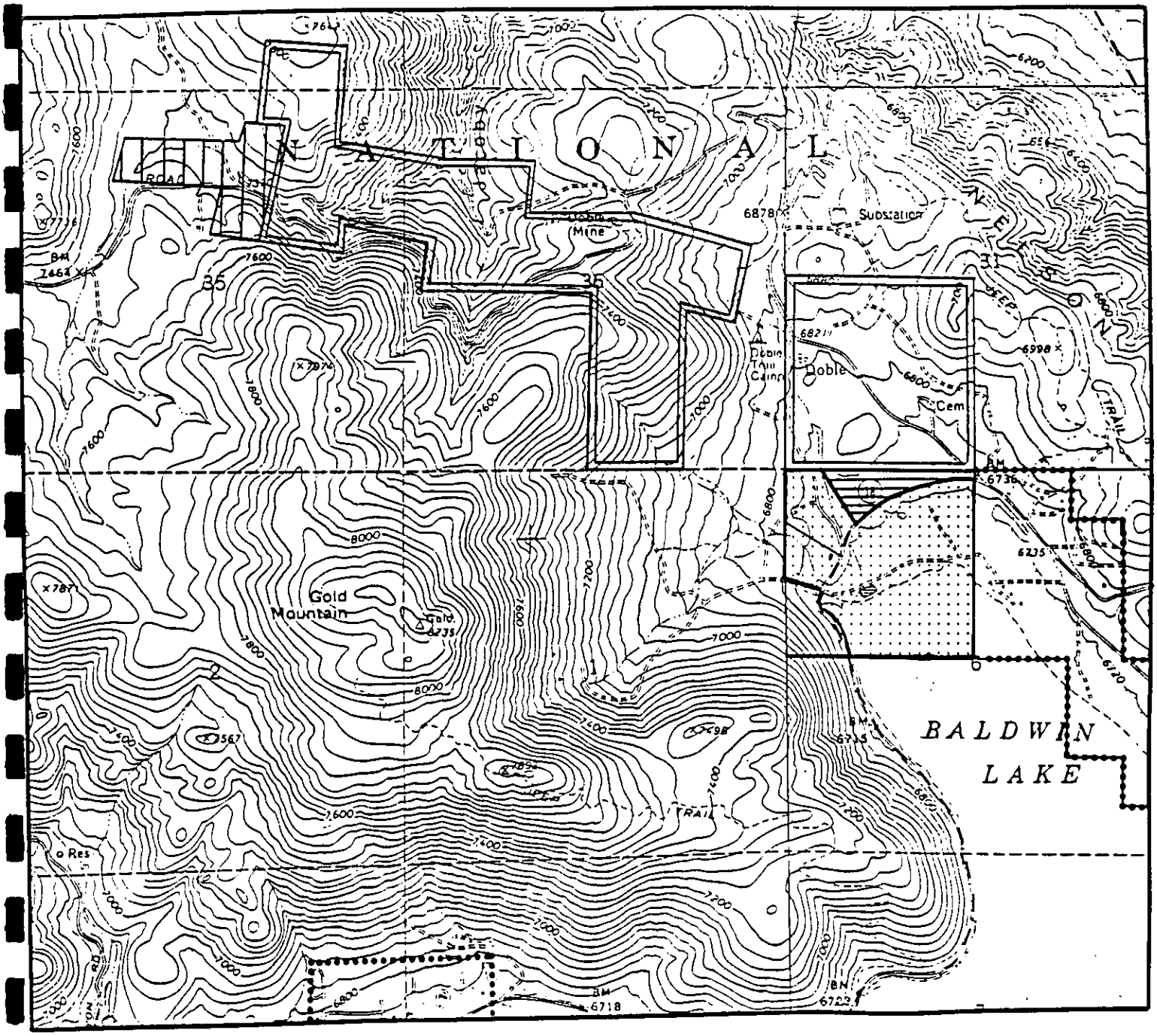

Figure 2. Location and land management responsibilities for the properties within the study area at Baldwin Lake. Private lands not within the study area are shown by a dotted line. The remaining lands surrounding the study area are managed by the U.S. Forest Service.

= California Department of Fish and Game

= U.S. Forest Service, Lamanc parcels

= The Nature Conservancy, Starland parcel

= "Cemetary" parcel, private inholding

= Other private lands not within study area

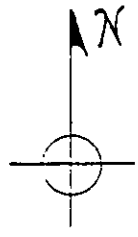

Table 2. Federally-listed, state-listed, and species of special concern which are known or expected to occur in the proposed Baldwin Lake Ecological Reserve study area, including U.S.F.S. (Lamane) and Nature Conservancy (Starland) managed lands. Species are listed according to habitat type. Page 1 of 2.

Scientific Name Common Name	Federal[1]/State[2] Status	U.S.F.S Status	Growth[3] Form	Flowering Time	Geographical[4] Distribution
PAVEMENT PLAIN					
Arabis parishii Parish's rock cress	C2/	Sensitive	PH	Mar-May	San Bernardino Mountains but not limited to pavement plains; also occurs on limestone.
Arenaria ursina Bear Valley sandwort	C2/	Sensitive	PH	May-July	San Bernardino Mountains, restricted to pavement plains. Endemic to Big Bear Basin
Castilleja cinerea Ashy-gray paintbrush	C2/	Sensitive	PH	May-Aug	San Bernardino Mountains but not restricted to pavement plains. Big Bear Ranger District endemic.
Echinocereus engelmannii munzii Munz's hedgehog cactus	C2/	Sensitive	C	May-June	San Bernardino Mountains, San Jacinto Mts., SE of Julian, SE of Tecate, BC.
Eriogonum kennedyi austromontanum Southern mountain buckwheat	C2/	Sensitive	PH	July-Aug	San Bernardino Mountains, restricted to pavement plains. Endemic to Big Bear Basin.
Ivesia argyrocoma Silver-haired ivesia	C3c/	Not-listed	PH	June-Aug	San Bernardino Mountains, but with a few occurrences elsewhere in Southern California, Baja.
Linanthus killipii Baldwin Lake linanthus	C2/	Sensitive	AH	May-July	Endemic to San Bernardino Mountains, Big Bear Ranger District.

Table 1. Federally-listed, state-listed, and species of special concern which are known or expected to occur in the proposed Baldwin Lake Ecological Reserve study area, including U.S.F.S. (Lamane) and Nature Conservancy (Starland) managed lands. Species are listed according to habitat type. Page 2 of 2.

Scientific Name Common Name	Federal[1]/State[2] Status	U.S.F.S. Status	Growth[3] Form	Flowering Time	Geographical[4] Distribution
WET MEADOW					
Poa atropurpurea Bear Valley bluegrass	C1/	Sensitive	PH	May-June	Endemic to Southern California, in San Bernardino Mts., Riverside and San Diego Counties.
Sidalcea pedata Bird-footed checkerbloom	FE/CE	Endangered	PH	May-July	Endemic to the Big Bear Basin, San Bernardino Mts.
Taraxacum californicum California dandelion	C1/	Sensitive	BH	May-July	Endemic to San Bernardino Mts.
Thelypodium stenopetalum Slender-petalled mustard	FE/CE	Endangered	BH	June-July	Endemic to the Big Bear Basin, San Bernardino Mts.
VERNAL CREEK					
Mimulus exiguus Eyestrain monkeyflower	C2/	Sensitive	AH	June-July	San Bernardino Mts. and northern Baja California.
Mimulus purpureus purpureus Purple monkeyflower	C2/	Sensitive	AH	May-July	Endemic to San Bernardino Mts.
Orthocarpus lasiorhynchus San Bernardino Mt. owl's clover	C2/	Sensitive	AH	June-July	San Bernardino Mts., San Jacinto Mts., Cuyamaca Peak, Julian.

[1] C1 = Category 1 (Enough data are on file to support federal listing); C2 = Category 2 (Insufficient data to support federal listing); C3c = Category 3c (Too widespread and/or not threatened); FE = Federally listed, endangered.

[2] CE = State listed, endangered.

[3] AH = annual herb, PH = perennial herb, BH = biennial herb, C = cactus

PART I: INVENTORY

The following section details the results of inventories of the natural and cultural features of the study area. Emphasis in the inventory phase was on distribution of the rare plant species. In depth inventories of vertebrate species were not made; however lists of all vertebrate species observed are included in this section.

METHODS AND MATERIALS

Field studies were initiated on the Baldwin Lake Ecological Reserve on 25 March 1988. The first visit was made to search for early blooming species. Subsequent visits in 1988 were made on a weekly or biweekly basis. Additional field work was carried out from 1 April to 31 July 1989.

The primary focus of field work in April through June of each year was mapping of rare plant populations. All of the lands under California Department of Fish and Game management were thoroughly surveyed to determine rare plant distribution, type and distribution of plant communities, and land use (historical and current). Comprehensive surveys of the rare plant habitats and historical sites within the Lamane (U.S.F.S) and Starland (TNC) parcels were also completed at this time.

In addition to field mapping, the distribution of rare plants was determined from California Natural Diversity Data Base (CNDDB) records (dated 23 August 1985) and from local botanical expert Tim Krantz. The 1988 season was very dry and many species were absent or were present in very reduced numbers. Additional mapping of rare plant populations was completed in Spring 1989; unfortunately the 1989 season was at least as dry as the 1988 season. Information on some locations for some species (e.g. *Linanthus killipii*, *Mimulus exiguus*) are based on records maintained by Mr. Krantz; some of these populations (e.g. *Mimulus exiguus*) have not been observed for at least five years (Krantz, personal communication).

Vegetation mapping is based on ground surveys and aerial photo interpretation. Names given to vegetation types/plant communities are modified from Holland (1986) and Paysen *et al.* (1980). Aerial photographs, available from the USFS, Big Bear Ranger District collection, were consulted for the following dates: 3 August 1938, 20 June 1949, 22 February 1953, 15 June 1965, 19 August 1972, 29 August 1983, and August 1988. These photographs were also used to determine changes in land use patterns, presence of roads and trails, and changes in man-made features within the study area.

A base map of the Baldwin Lake Ecological Reserve was prepared by Tom Lupo, geographer for the CNDDB. This map was used to locate rare plant populations and other features of the reserve; it is the map used for many of the figures herein. Where additional plant populations or land use features occurred outside the reserve, but within the study area a second map was prepared on U.S.G.S. 7.5 minute topographic maps of the area.

To determine the effectiveness of potential monitoring methods and to familiarize the author with the plant species, some preliminary "test" monitoring was conducted on one of the pebble plains in April 1988. This preliminary monitoring transect was used to

determine species composition, and to evaluate the nested frequency plot method in detecting trends in selected species within the pebble plain rare plant community. Additional data to evaluate potential monitoring techniques were obtained from a monitoring program established on other pebble plains within the Big Bear Ranger District (Barrows, 1988).

No quantitative censuses of vertebrate populations were made in the study area. Bird and reptile species encountered during field work were recorded. Small mammals which occur on the Baldwin Lake Ecological Reserve were detected by live-trapping between 29 August and 29 September 1988. Traps were placed in random clusters in three habitats: 1) pebble plains; 2) wet meadow; 3) sagebrush scrub. In each habitat Sherman live-traps were placed in a scattered pattern, clustered within a 50 m^2 area. In each area 50 to 100 traps were placed per night. Traps were checked in the early morning and the small mammals present were identified to species. Sherman live traps were operated on a total of six nights for a total of 450 trap-nights.

The presence of wild burro populations was monitored in several ways. During the spring months, burros were regularly seen in the North Baldwin Lake area during the early morning and late evening hours. When burros were present, their activity and feeding patterns were observed and recorded. During the summer and fall months, little burro activity was observed. However, surveys of the study area indicated their presence by trails, tracks, and scat. The presence of other large mammals was detected from their signs (scats, tracks, diggings).

The information on previously recorded populations of the unarmored three-spined stickleback (*Gasterosteus aculeatus* ssp. *williamsonii*) in Baldwin Lake was obtained from Dr. James Malcolm, University of Redlands, Redlands, California. Dr. Malcolm has been studying the sticklebacks in Baldwin Lake and adjacent Shay Meadow since 1981.

Information on the historical land use and settlement patterns in the study area were largely obtained from Tom Core, president of the Big Bear Valley Historical Society. A site visit with Mr. Core was made on 2 November 1988. During this visit Mr. Core pointed out the location of historical buildings near the town of Doble and discussed the various land use activities during the period from 1870 to the present. A telephone conversation with Mr. Core on 29 September 1988 also provided information on the history of the area. The information he provided was useful in determining some of the potential effects of historical land use on the study area and the rare plant populations.

RESULTS AND DISCUSSION

Plant Communities

The Baldwin Lake Ecological Reserve and adjacent lands which comprise the study area include a diversity of vegetation types typical of the San Bernardino Mountains. Several topographic and climatic features interact to influence the vegetation; the proximity of the Mojave Desert results in a generally dry climate. The Baldwin Lake area receives less than 38 cm (13 inches) of precipitation per year, mostly as snowfall. Another influence on the vegetation is a nighttime temperature inversion which occurs in the Big Bear Basin (Minnich 1971) resulting in a colder climate than is typical for this elevation.

The map of the distribution of plant communities within the study area is presented in Figure 3. The plant communities within the study area include pebble plain, wet meadow, sagebrush scrub, pinyon pine woodland, juniper woodland and scrub, jeffrey pine forest, and alkaline scrub/wetland vegetation around the margins of Baldwin Lake. The acreage and percent cover for each vegetation type within the study area is given in Table 2.

Pebble Plains

The study area is notable for the presence of several vegetation types which support a host of endemic plant species. Among these, the pavement or pebble plains are the most evident as open, tree-less expanses amidst the surrounding forest. Pebble plains are identified by the presence of two indicator species, the southern mountain buckwheat (*Eriogonum kennedyi* ssp. *austromontanum*) and the Bear Valley sandwort (*Arenaria ursina*). The flora includes 33 species (Derby 1979); five are rare species including the two mentioned above and the ashy-gray paintbrush (*Castilleja cinerea*), Parish's rock cress (*Arabis parishii*), and Munz's hedgehog cactus (*Echinocereus engelmannii* var. *munzii*). Other dominant species on the pebble plains include Bear Valley bluegrass (*Poa incurva*), Douglas' draba (*Draba douglasii* var. *crockeri*), and low everlasting (*Antennaria dimorpha*).

Wet Meadows

At several locations within the study area, low-lying areas which collect precipitation in the form of snow or rain develop vernally wet conditions that support wet meadow vegetation. These wet meadow sites typically occur where a heavy clay layer in the soil intercepts a drainage or seep. The wet meadow vegetation is often associated with pebble plains. On the Baldwin Lake study area, wet meadow habitat occurs on either side of Highway 18 (see Figure 3). This vegetation supports two endangered species, the bird-footed checkerbloom (*Sidalcea pedata*), and the slender-petaled thelypodium (*Thelypodium stenopetalum*). At this location, the thelypodium occupies slightly higher ground along the margin of the drainages or wet spots; it is more closely associated with open sagebrush (*Artemisia nova*) stands. The checkerbloom is located within or on the edges of shallow drainages. A third wet meadow-associated species which does not occur with thelypodium and the checkerbloom at this site is the California dandelion (*Taraxacum californicum*); the distribution of this species is discussed in the following section on plants. Another rare species associated with wet meadow areas but not observed in 1988 is Bear Valley bluegrass

(*Poa atropurpurea*). The dominant species in the wet meadow areas include western blue flag (*Iris missouriensis),* Bolander's horkelia (*Horkelia bolanderi*), various rushes (*Juncus effusus, J. balticus, J. bufonius*), Parish's spike-rush (*Eleocharis parishii*, also *E. coloradoensis, E. macrostachya*) and hairy wheatgrass (*Agropyron pubescens*).

Vernal Creeks

A third rare plant habitat has been called vernal creeks (Krantz, personal communication). This habitat supports three rare species, the eye-strain monkeyflower (*Mimulus exiguus*), purple monkeyflower (*M. purpureus purpureus*) and yellow owl's clover (*Orthocarpus lasiorhynchus*). However, this habitat does not constitute a distinct vegetation type and so will be addressed in the following section on rare plants.

Table 3. Plant communities found within the study area including dominant species, acreage covered and percent cover.

Plant Community	Dominant Species	Acreage Covered	Percent Cover
Pebble Plain	*Eriogonum kennedyi, Arenaria ursina*	33	5%
Wet Meadow	*Eleocharis* spp., *Sidalcea pedata*	7	1%
Pinyon Pine Woodland	*Pinus monophylla, Artemisia tridentata Cercocarpus ledifolius*	178	29%
Juniper Woodland/Scrub	*Juniperus occidentalis* ssp. *australis Artemisia tridentata*	5	1%
Jeffrey Pine Forest	*Pinus jeffreyi, Cercocarpus ledifolius*	293	47%
Big Sagebrush Scrub	*Artemisia tridentata, A. nova Eriogonum wrightii* ssp. *subscaposum*	89	14%
Alkali Scrub	*Chenopodium* spp., *Atriplex* spp., *Sitanion* hystrix	11.5	1%

Pinyon Pine Woodland

The Pinyon Pine Woodland community occurs in association with the pebble plains. The dominant species in this type include pinyon pine (*Pinus monophylla*), mountain mahogany (*Cercocarpus ledifolius*), western juniper (*Juniperus occidentalis* ssp. *australis*), and in the

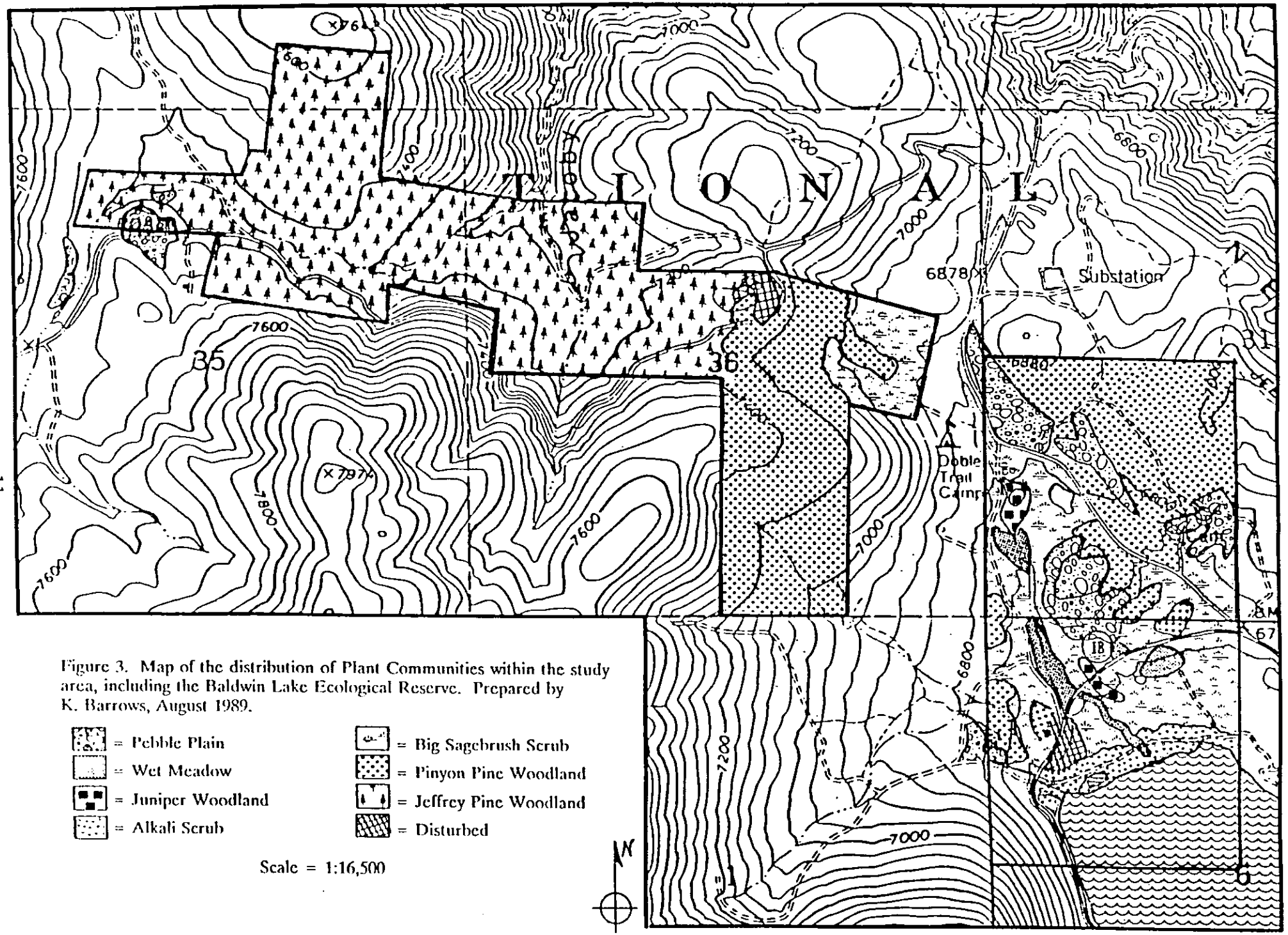

Figure 3. Map of the distribution of Plant Communities within the study area, including the Baldwin Lake Ecological Reserve. Prepared by K. Barrows, August 1989.

- = Pebble Plain
- = Wet Meadow
- = Juniper Woodland
- = Alkali Scrub
- = Big Sagebrush Scrub
- = Pinyon Pine Woodland
- = Jeffrey Pine Woodland
- = Disturbed

Scale = 1:16,500

understory, *Eriogonum umbellatum* ssp. *munzii*. This community is closely associated with big sagebrush scrub dominated by *Artemisia tridentata*.

Juniper Woodland and Scrub

The occurrence of this community is very limited on the study area. Small stands of large stately western junipers occur associated with big sagebrush, rabbitbrush (*Chrysothamnus nauseosus, C. viscidifolia*) and a variety of herbs and grasses.

Jeffrey Pine Forest

The stands of Jeffrey pine forest intergrade with pinyon pine woodland but Jeffrey pine is the clear dominant on the USFS (Lamane) and TNC (Starland) parcels along Holcomb Valley Road. This mixed forest is dominated by Jeffrey pine (*Pinus jeffreyi*) with associated pinyon pine, western juniper, mountain mahogany, and canyon live oak (*Quercus chrysolepis*). Common understory shrubs include big sagebrush and greenleaf manzanita (*Arctostaphylos patula* ssp. *platyphylla*). On the forest floor sulfur-flowered buckwheat and various grasses (*Sitanion hystrix, Elymus glaucus* ssp. *virescens, Bromus tectorum*) are common in openings.

Big Sagebrush Scrub

The presence of big sagebrush scrub on the site, dominated by *Artemisia tridentata*, is an indicator of the Mojave Desert influence. This community varies considerably in both the density of *Artemisia* and in species composition. A common associate in these stands is dwarf sagebrush (*Artemisia nova*). Around the "horse house" and on the east side of Highway 18 on the CDFG parcel, nearly pure stands of dense sagebrush occur. Elsewhere in the vicinity of the horse house and on the Lamane parcels (USFS) more open stands of sagebrush occur. In these open stands associated species include desert mallow (*Sphaeralcea ambigua*), interior bush lupine (*Lupinus excubitus* ssp. *austromontanum*), and Mojave antelope bush (*Purshia glandulosa*). On abandoned roads and other disturbed sites, rabbit brush, snakeweed (*Gutierrezia sarothrae*), prickly poppy (*Argemone munita*), storksbill (*Erodium cicutarium*), and rattlesnake weed (*Euphorbia albomarginata*) are common.

Alkali Scrub/Grassland

Along the margins of the lakebed is a mixed association of alkaline and wetlands species. Because the lake has been dry since 1985, many marsh or wetlands species which may occur there were absent during the survey. The margins of the lake were dominated by a variety of grasses and alkaline indicators including squirrel-tail, salt grass (*Distichlis spicata*), hairgrass (*Deschampsia danthonioides*), and alkali heliotrope (*Heliotropium curassavicum* var. *oculatum*). On the dry lakebed were various chenopods including lamb's quarters (*Chenopodium fremontii*), four-wing saltbush (*Atriplex canescens*), red goosefoot (*Chenopodium rubrum*), and dark green goosefoot (*Chenopodium atrovirens*).

Plants

One significant feature of the proposed Baldwin Lake Ecological Reserve and adjacent lands in the study area is the abundance of rare plants. The inventory of rare plants involved mapping and estimating abundance for the fourteen species which may occur on the study area. These species are reported below by habitat. No effort was made to estimate abundance for all species; however, state/federally-listed species were counted individually.

Both the 1988 and 1989 seasons were so dry that a number of the rare plant species were present in numbers far below average, and others, known previously from the area, were not found. Additional surveys in the spring of 1989 failed to detect some of the plant species not present in 1988 (*Mimulus exiguus*, *Linanthus killipii*).

The list of rare plant species for the study area is given in Table 2. A complete list of all plant species known to occur in the Baldwin Lake area (Krantz 1986) is given in Appendix I.

Wet Meadow Rare Plants

The wet meadow habitat supports two state- and federally-listed endangered species, the bird-footed checkerbloom (*Sidalcea pedata*) and slender-petaled thelypodium (*Thelypodium stenopetalum*) in addition to a third Southern California endemic, Bear Valley bluegrass (*Poa atropurpurea*). Also present in wet areas but not associated with the checkerbloom and thelypodium at this site is the California dandelion (*Taraxacum californicum*).

1. **Bird-footed Checkerbloom (*Sidalcea pedata*)** - This species is known to occur in four different locations within the study area (Figure 4). In the 1988 season checkerblooms were observed only in the small drainage which crosses Highway 18 (labeled "A" in Figure 4). Approximately 130 plants were counted here on 9 May in 1988, on either side of the road. The other mapped locations were mapped by Tim Krantz (personal communication) in previous years. In the 1989 season a more thorough map of this species' distribution and a much more accurate count of individuals was made. In the larger drainage ("A" in Figure 4) 1724 individuals were counted. An additional 188 individuals were counted in a smaller drainage ("B" in Figure 4). In both of these subpopulations approximately 30 to 50% of all flowering plants counted had the flower stalks clipped near the base; it is possible that this clipping was done by burros.

2. **Slender-petaled thelypodium (*Thelypodium stenopetalum*)** -This species is known to occur at two locations within the study area (Figure 4). In 1988 the counted population of this species was extremely small; only 11 individuals were observed at the site labelled "C" in Figure 4. Not all of the potential habitat was surveyed thoroughly (this species can be difficult to locate as it often grows under and up through sagebrush bushes). Plants were observed only on the east side of Hwy 18. In 1989 a more thorough survey of this species was completed. Again plants were only observed at the site labeled "C" but this year a more accurate count located 19 flowering plants and 10

Baldwin Lake Ecological Reserve

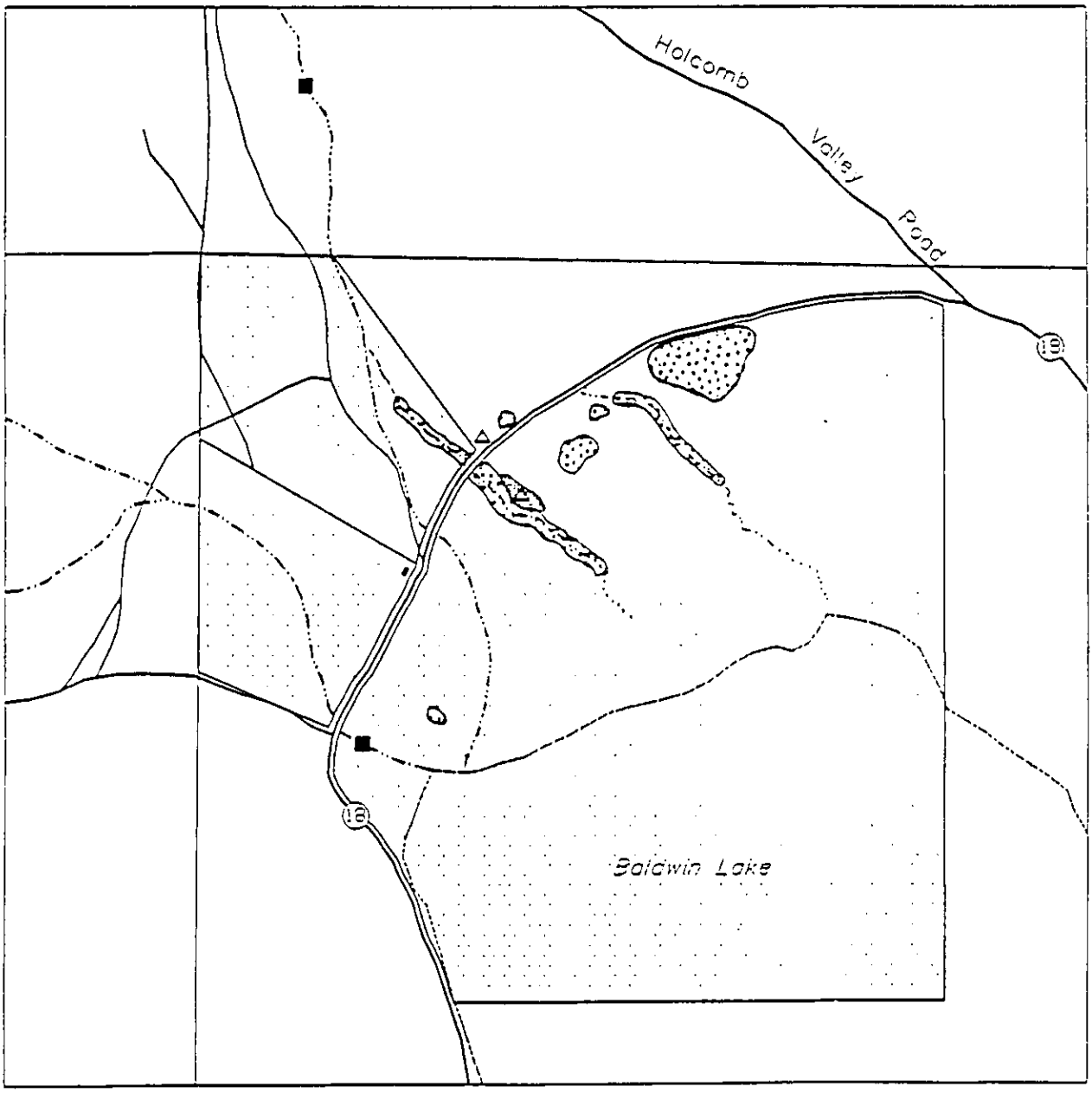

Figure 4. Location of Rare Plants found in Wet Meadow habitat on the Baldwin Lake Ecological Reserve, San Bernardino County, CA.

= *Sidalcea pedata*

= *Thelypodium stenopetalum*

■ = *Taraxacum californicum*

△ = *Poa atropurpurea*

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first year rosettes. A monitoring transect was established in one portion of the population and the location of all individuals was mapped. This species' habitat received fairly heavy trampling by burros since the field surveys in 1988.

3. **Bear Valley bluegrass** (***Poa atropurpurea***) - This species occurs in wet meadows or seeps within the study area. Only one population of this species is known from the study area but no individuals of this species were observed in 1988 or 1989. However, perhaps due to the dry year surveys for the species were not successful. The known occurrence is located on the private "inholding" (Figure 4) where it may be associated with *Sidalcea pedata* and *Mimulus exiguus*.

4. **California dandelion** (***Taraxacum californicum***) - There are two known populations of this species within the study area (Figure 4). One of these is a fairly large population, with approximately 130 individuals observed in 1988, associated with a small spring on the Lamane (U.S.F.S.) property just south of the historical Doble town site. This population is impacted by burro trampling around the spring and invasion of the weedy common dandelion, *Taraxacum officinale*. At least several hybrid individuals resulting from a cross between these two *Taraxacum* species have been observed at this site (Krantz, personal communication). A second location, near an abandoned well, has not supported this species since 1985, probably because the well has been dry (Krantz, pers. comm.); the well was flowing during the spring/summer 1989 season but no California dandelions were observed.

One of the primary concerns for *Taraxacum californicum* is the potential for hybridization with the weedy introduced *T. officinale*. California dandelion is distinguished from the common dandelion by the erect, not reflexed, phyllaries. Also the leaves in *T. californicum* are subentire to sinuate-dentate; those in *T. officinale* are pinnatifid to deeply incised. Hybrid individuals have erect phyllaries but more deeply incised leaves.

Pebble Plain Rare Plants

The pebble plain habitat supports eight species of rare plants. Surveys of these species included qualitative estimates of species abundance and mapping of the distribution of rare taxa. Two maps are included for each rare plant species in this habitat. One of the maps gives the distribution (labeled "a") only on the Baldwin Lake Ecological Reserve; the second map (labeled "b") shows the distribution on the remaining lands within the study area.

1. **Bear Valley sandwort** (***Arenaria ursina***) - This species, one of the indicators for pebble plain habitat, is sparsely distributed on the study area (Figure 5). It occurs on each of the three largest pebble plains (labeled "A", "B", "C" in Figure 5) but is very restricted. For example on plain B, called the knoll pebble plain, the Bear Valley sandwort occurs only on the north-facing slope of the site. On plain C it is very scattered in its occurrence; it is most common in the southeast corner of the site. This species may have the narrowest range of tolerance on the pebble plains; it was not observed away from this habitat.

2. **Kennedy's buckwheat** (***Eriogonum kennedyi* ssp. *austromontanum***) - This species is among the most common of the pebble plains species. It is very common on all the pebble plains. In addition this species was found growing off the pebble plains in several areas where it was associated with *Arabis parishii* and *Castilleja cinerea*. The general distribution of this species is shown in Figure 5.

There are two related *Eriogonum* taxa which occur on the study area which are similar in aspect to *E. kennedyi* ssp. *austromontanum*. These are *Eriogonum kennedyi* ssp. *kennedyi* and *Eriogonum wrightii* ssp. *subscaposum*. The latter species is common as an understory species in yellow pine forest, sagebrush scrub and in the pinyon pine woodland. It is distinguished by characteristics of the flowering stems; in *E. wrightii* the inflorescence stems are branched, in *E. kennedyi* they are unbranched. *E. kennedyi* ssp. *austromontanum* and *E. k. kennedyi* are difficult to distinguish. Characters used by Reveal (1979) are as follows:

E. k. austromontanum	*E. k. kennedyi*
Lvs. 6-12 mm long	Lvs. 2-4 mm long
Lvs. loosely matted	Lvs. forming dense mats
Flowering July - September	Flowering April - June
Achenes 3.5-4 mm long	Achenes ca. 2 mm long

Krantz (1981) indicates that the Knoll pebble plain includes representatives of both subspecies of *E. kennedyi*. *Eriogonum kennedyi* ssp. *kennedyi* also occurs on the pebble plains on the north side of Holcomb Valley Road (USFS, private) and on a small pebble plain southwest of Doble Trail Camp.

3. **Parish's rock cress** (***Arabis parishii***) - This species is a Big Bear Basin endemic but is relatively widespread in appropriate habitat. This species was found to be common on the pebble plains and also in open areas of sagebrush scrub. Its distribution on the study area is shown in Figure 6.

4. **Ashy-gray paintbrush** (***Castilleja cinerea***) - This hemiparasitic species is associated with the roots of *Eriogonum kennedyi* ssp. *austromontanum* and with *Artemisia nova*. It is present on the pebble plains but is also common off the pebble plains in patches, usually associated with *Arabis parishi* and/or *Eriogonum kennedyi* ssp. *austromontanum*, its distribution appears to be closely tied to the presence of clay soils (whether or not saragosa quartzite pebbles are present). The species is variable in flower color, ranging from sulfur yellow to orange-red. Its distribution is shown in Figure 6.

5. **Rat tails** (***Ivesia argyrocoma***) - This species is patchily distributed on the pebble plains within the study area. It is often associated with disturbed areas, such as old roads or vehicle tracks. The known locations on the study area are shown in Figure 7. It is no longer on the U.S. Forest Service sensitive plant list.

6. **Baldwin Lake linanthus** (***Linanthus killipii***) - This endemic species is variable in its occurrence, depending at least partially on the soil moisture in a given season. This species was not observed at the Baldwin Lake study area in either 1988 or 1989. It was

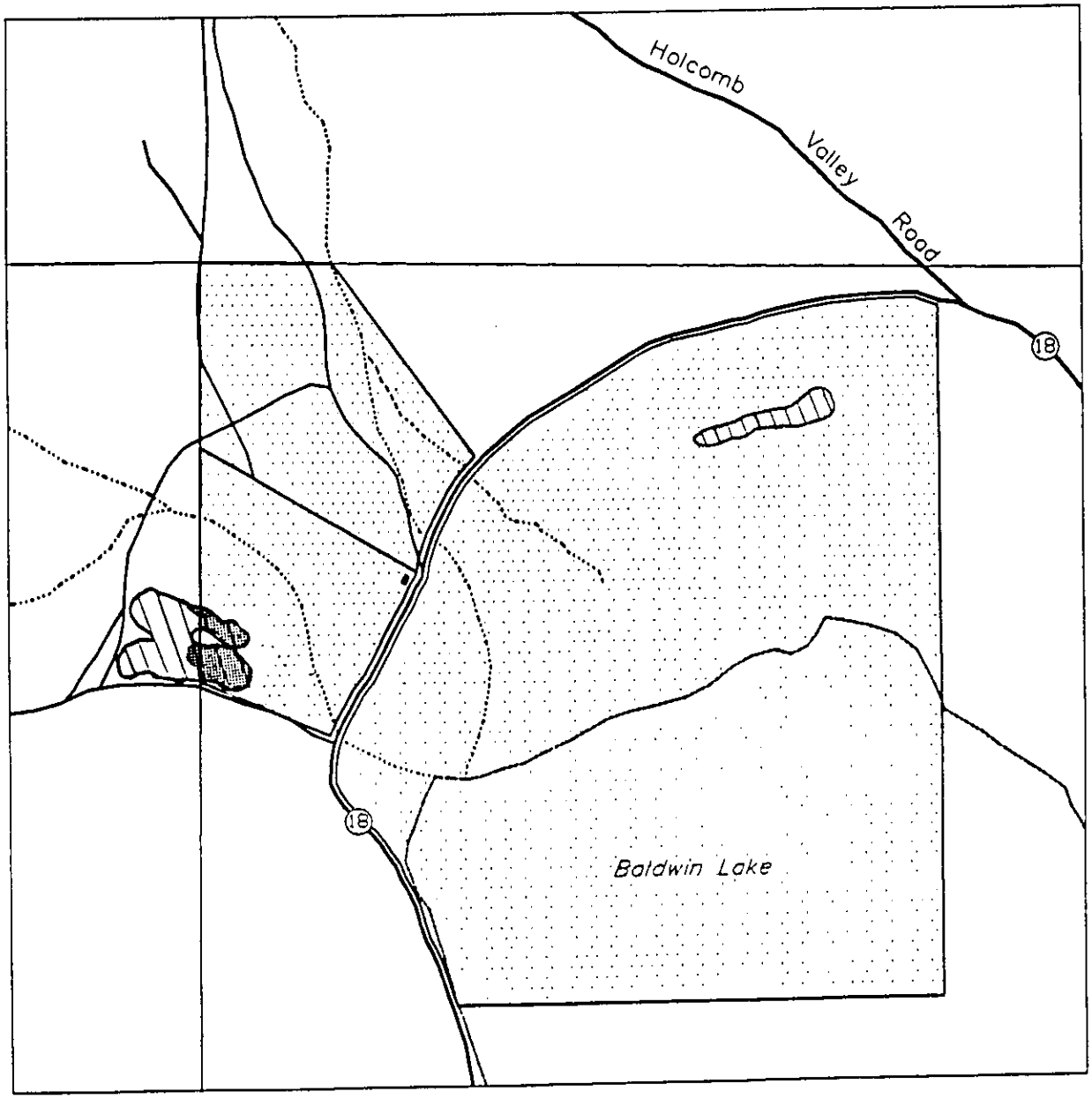

Figure 5a. Location of rare plant populations found on pebble plains on the Baldwin Lake Ecological Reserve, San Bernardino County, CA.

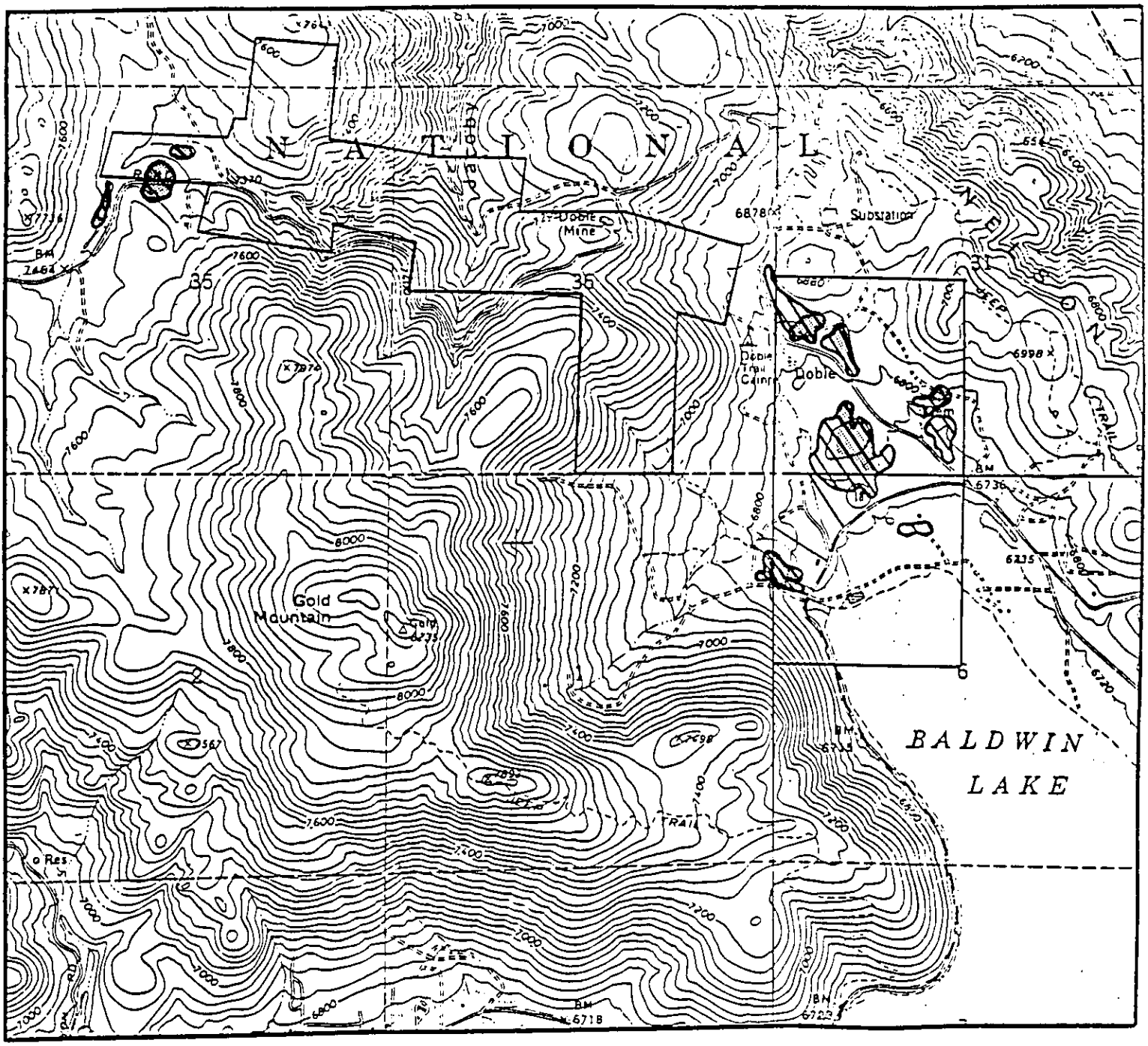

Figure 5b. Location of rare plant populations found on pebble plains on the study area at Baldwin Lake, CA. Map is from USGS 7.5' Big Bear City quad, enlarged to scale = 1:18,000.

= *Arenaria ursina*

= *Eriogonum kennedyi* ssp. *austromontanum*

Baldwin Lake Ecological Reserve

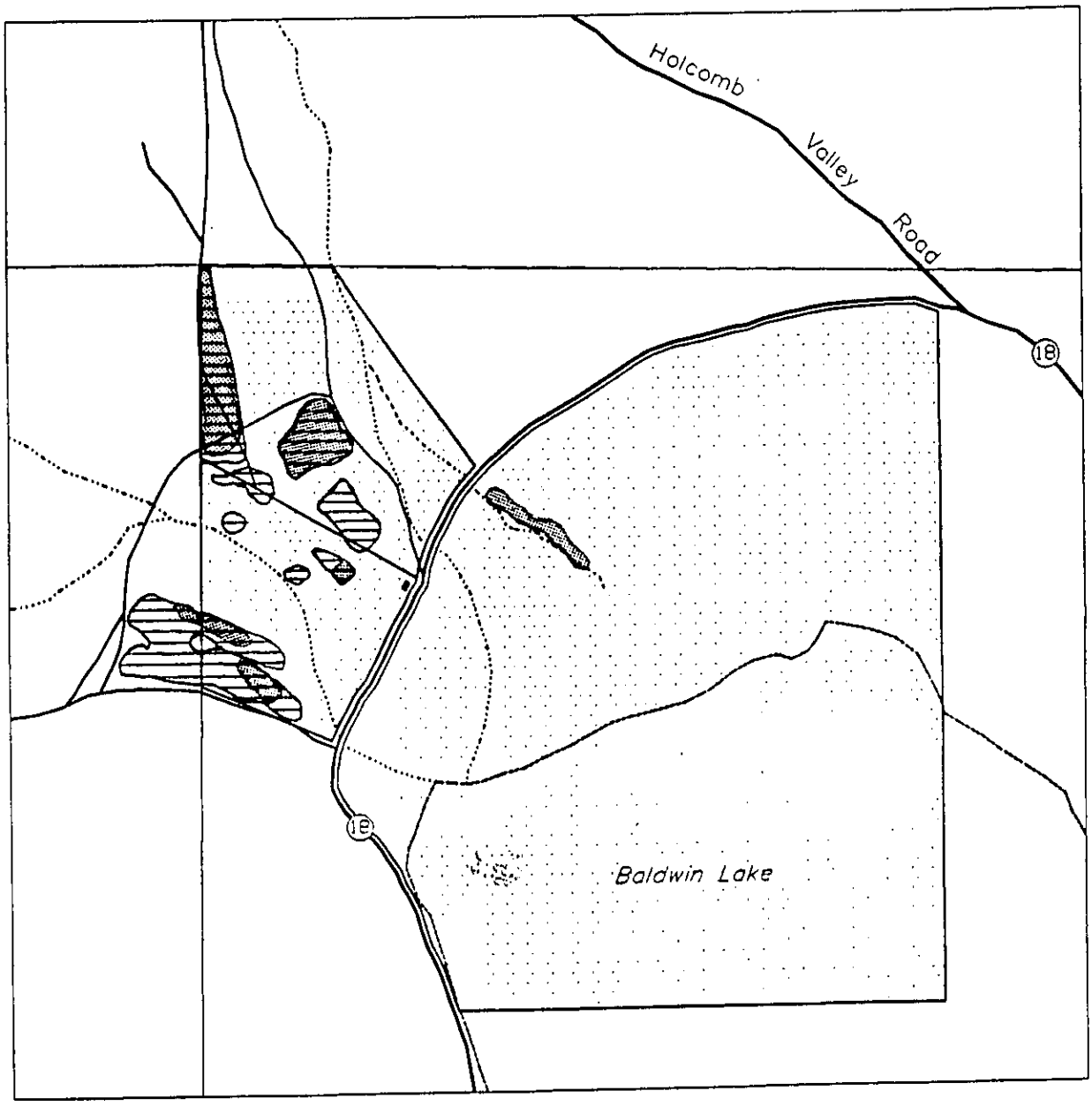

Figure 6a. Location of rare plant populations found on pebble plains on the Baldwin Lake Ecological Reserve.

= *Arabis parishii*

= *Castilleja cinerea*

0 1000

Feet

N

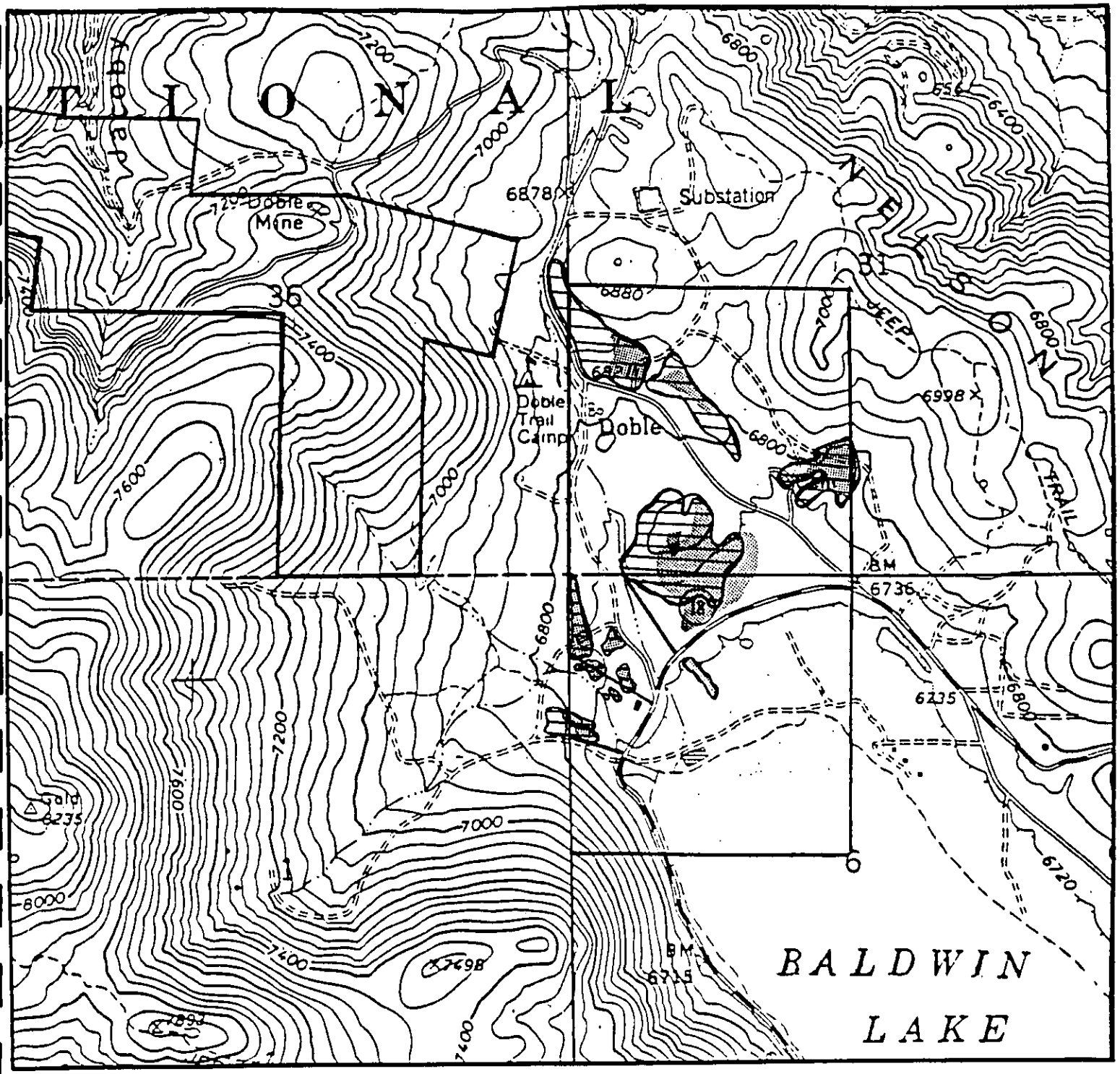

Figure 6b. Location of rare plant populations found on pebble plains on the study area at Baldwin Lake, CA. Map is from USGS 7.5" Big Bear City quad, enlarged to scale = 1:18,000.

= *Arabis parishii*

= *Castilleja cinerea*

Baldwin Lake Ecological Reserve

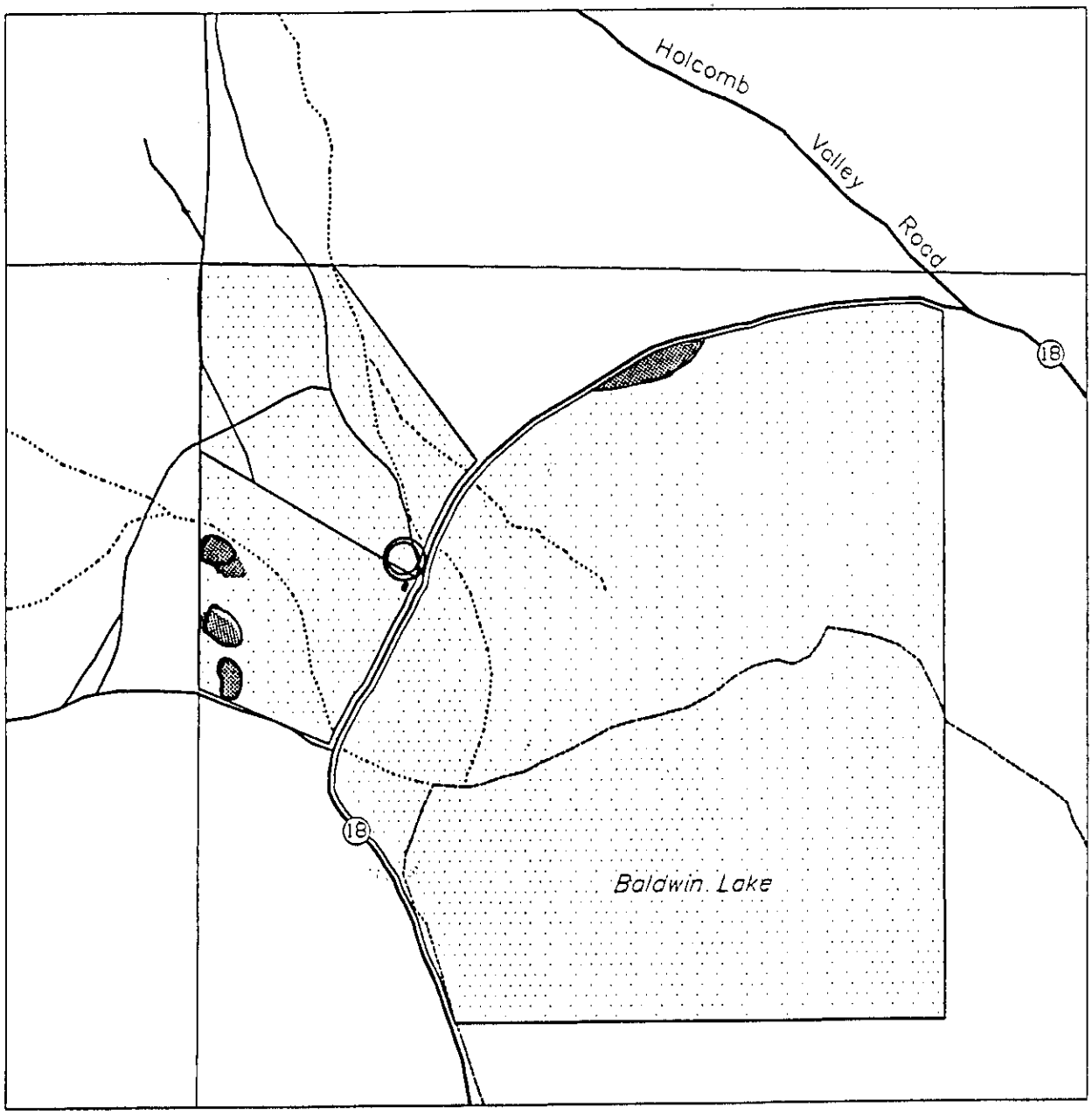

Figure 7a. Location of rare plant species on pebble plains within the Baldwin Lake Ecological Reserve. Populations of *Echinocereus engelmannii* ssp. *munzii* were observed in the mapped locations. Locations for other species are based on data from the CNDDB and from Tim Krantz (1988).

= *Echinocereus engelmannii* ssp. *munzii*

= *Linanthus killipii*

= *Ivesia argyrocoma*

0 1000

Feet

N

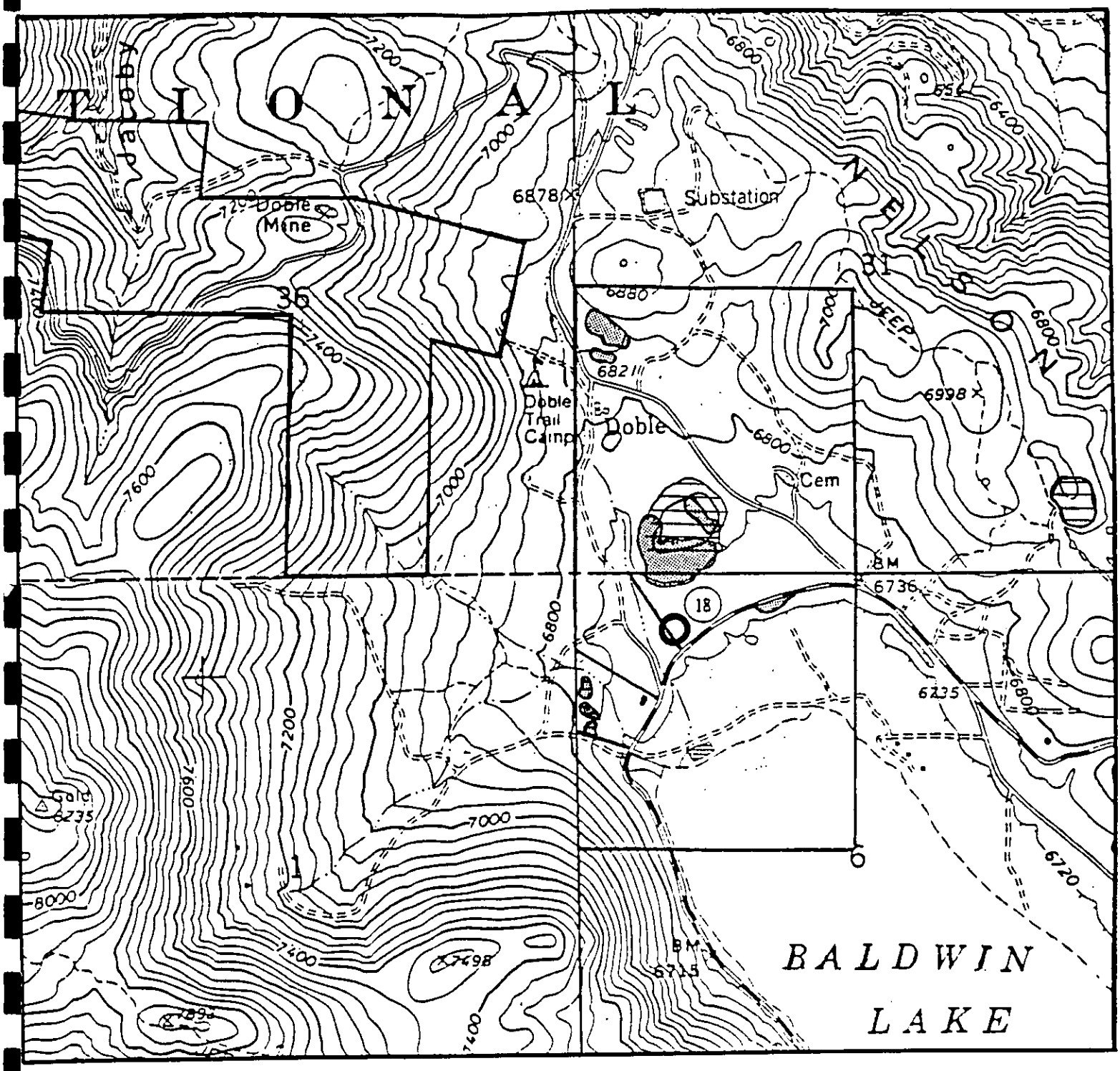

Figure 7b. Location of rare plant species on pebble plains within the study area at N. Baldwin Lake. Map is from USGS 7.5' Big Bear City quad.

= *Echinocereus engelmannii* ssp *munzii*

= *Linanthus killipii*

Scale = 1:24,000

observed in flower on several other pebble plains (e.g. Sawmill). In some years this species carpets the pebble plains for brief periods (Krantz 1983). Occurrences for this species from the CNDDB are included in Figure 7.

7. **Munz's hedgehog cactus** (*Echinocereus engelmannii* **var.** *munzii*) - This species is very patchy in its distribution on the pebble plains. Where it occurs it is in small clumps of 3 to 15 individuals. It was flowering in late June in 1988; on 28 June 1988 approximately 200 individuals were counted on the knoll pebble plain (Figure 7). On the pebble plains behind the "horse house" three clumps of the species were located with 11, 11, and 15 individuals counted. More thorough mapping and monitoring of this species is needed. In 1989 a series of transects was established to monitor this species on the knoll pebble plain (Neel 1989).

Vernal Creek Rare Species

The habitat for three of the rare species is generally characterized by vernally moist creeks or drainages. However, at least one of the species, *Mimulus exiguus* may occur in vernally moist locations associated with pebble plains. The primary habitat of this kind on the study area occurs on the Starland parcel (TNC). There is approximately two miles of habitat in a narrow strip along the drainage (Krantz, pers. comm.) a portion of this drainage occurs within the Starland parcel.

1. **Eye-strain monkeyflower** (*Mimulus exiguus*)- This species is the smallest member of the genus with flowers only 2.5 mm. long. It was not observed on the study area this season; it is possible that it was in flower on the Starland parcel drainage and its appearance was missed. This ephemeral species may be in evidence for only a week or so. The locations where this species has been observed are shown in Figure 8 (from Krantz, pers. comm., and CNDDB).

2. **Purple monkeyflower** (*Mimulus purpureus purpureus*) - This species is associated with *Mimulus exiguus* in wet areas. It was observed in the Starland parcel drainage on 11 May 1988 although in low numbers. Further surveys are needed. Its distribution is shown on Figure 8.

3. **Yellow owl's clover** (*Orthocarpus lasiorhynchus*) - This species was also observed in the Starland parcel drainage on 11 May 1988 (Figure 8). It occurs in a very patchy distribution along the drainage. It was much less dense at this site than at other locations where it was observed in 1988 (e.g.. Castle Glen, Bluff Lake).

Baldwin Lake Ecological Reserve

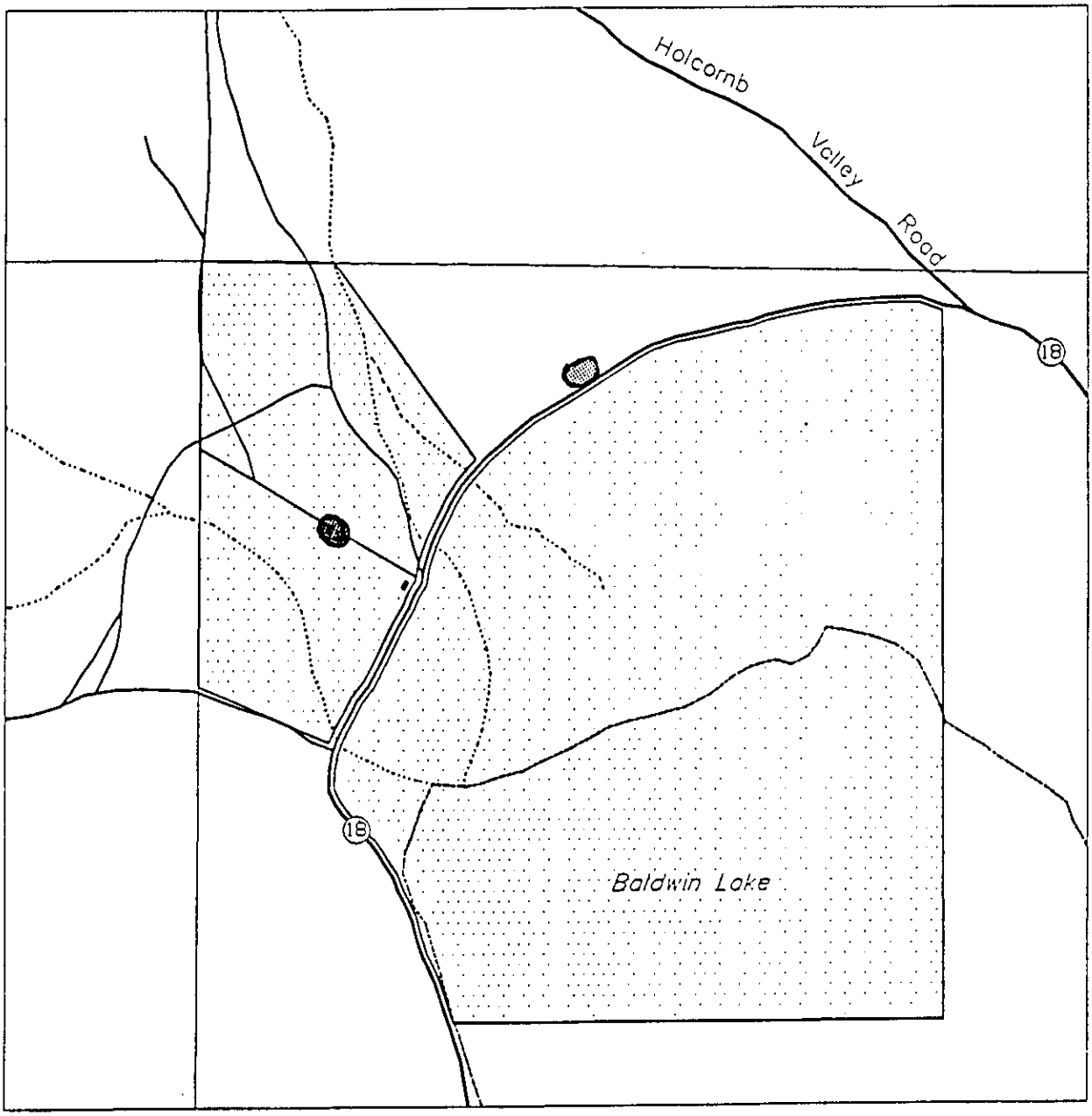

Figure 8a. Location of rare plant populations found in Vernal Creek habitat, on the Baldwin Lake Ecological Reserve, San Bernardino County, CA.

= *Mimulus exiguus*

N

0 1000

Feet

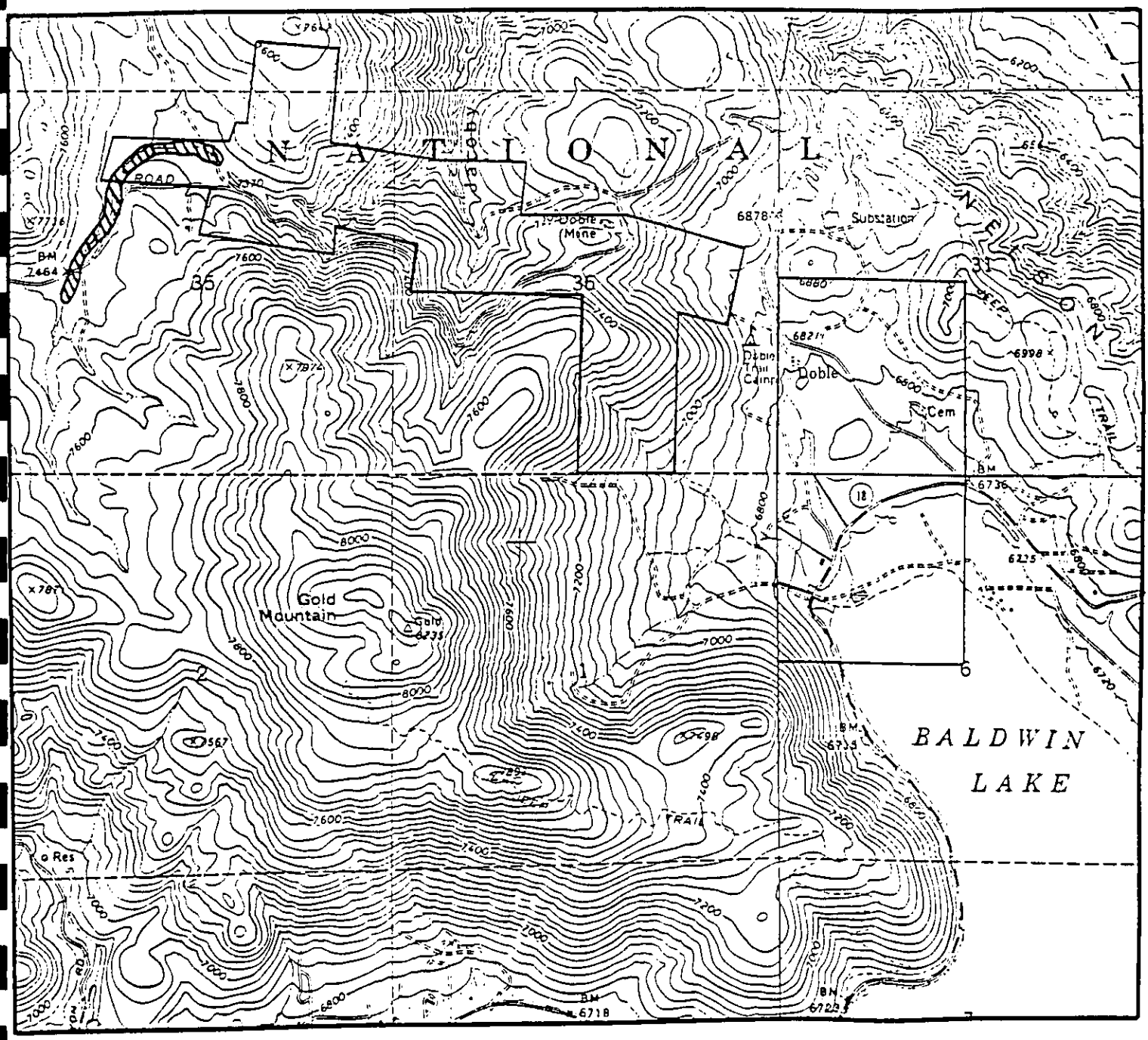

Figure 8b. Location of rare plant populations found in Vernal Creek habitat on the Starland parcel. Map is from USGS 7.5' Big Bear City quad. Scale = 1:24,000.

= Vernal Creek habitat

Animals

Mammals

The mammal live-trapping was carried out in sagebrush scrub, open pinyon pine woodland, and the perimeter of the pebble plain behind the horse house. The mammals known to occur on the study area, determined from live-trapping, observations (including scat, tracks, etc), or other written sources are given in Table 4.

Table 4. Mammalian species observed or detected on or near the Baldwin Lake study area, San Bernardino County, during May through October in 1988.

Species	Method of Detection
Lepus californicus - Black-tailed Hare	observed
Eutamias merriami - Merriam Chipmunk	observed
Sciurus griseus - Western Gray Squirrel	observed
Thomomys bottae - Botta Pocket Gopher	sign
Dipodomys sp. - Kangaroo Rat [1]	live-trap
Peromyscus maniculatus - Deer Mouse	live-trap
Microtus californicus - California Meadow Mouse	live-trap
Neotoma fuscipes - Dusky-footed Woodrat	sign
Urocyon cineroargenteus - Gray Fox	sign
Felis concolor - Mountain Lion [2]	literature
Lynx rufus - Bobcat	literature
Odocoileus hemionus californicus - Mule Deer	literature

[1] Species identification not confirmed. Probably *D. panamintus* or *D. agilis*
[2] Observations from Krantz (1983).

Birds

The list of bird species encountered on the study area during field work is given in Table 5. The list includes the species of water birds that would likely use the north shore of Baldwin Lake during periods when it contains water; these species were not observed during 1988 or 1989.

Table 5. Bird species observed within the study area at Baldwin Lake, San Bernardino County during April through November of 1988 and 1989.

Species	
Pied-billed Grebe	Nuttall's Woodpecker
Eared Grebe	Downy Woodpecker
American White Pelican	Common Flicker (Red-shafted)
Great Blue Heron	Western Wood Pewee
Gadwall	Dusky Flycatcher
Green-winged Teal	Western Flycatcher
Mallard	Tree Swallow
Common Pintail	Stellar's Jay
Cinnamon Teal	Scrub Jay
Northern Shoveler	Pinyon Jay
Redhead	Common Raven
Ring-necked Duck	Mountain Chickadee
Common Merganser	Bushtit
Sharp-shinned Hawk	White-breasted Nuthatch
Cooper's Hawk	Red-breasted Nuthatch
Red-tailed Hawk	Brown Creeper
American Kestrel	Western Bluebird
Mountain Quail	White-crowned Sparrow
Band-tailed Pigeon	Chipping Sparrow
Common Screech Owl	Nevada Sage Sparrow
Great Horned Owl	Green-tailed Towhee
Saw-whet Owl	Brown Towhee
Common Nighthawk	Brown-headed Cowbird
White-throated Swift	Lesser Goldfinch
Anna's Hummingbird	House Finch
Calliope Hummingbird	

Reptiles and Amphibians

Very little reptile activity was observed within the study area. Subsequent observations from individuals familiar with the local herpetofauna should be compiled into a complete list of reptiles and amphibians.

Fish

One significant fish species occurs in Baldwin Lake during the periods when it is full of water. This is the federally-listed Endangered unarmored three-spined stickleback (*Gasterosteus aculeatus* ssp. *williamsonii*). This species was last collected in Baldwin Lake the last time it was full of water, in August 1985 by Dr. James Malcolm of the University of Redlands. Late in 1985 Dr. Malcolm observed a die-off of the sticklebacks as the lake level receded. He also observed eared grebes, mergansers, and great blue herons feeding on the fish during this period. Additional natural history information and management concerns are addressed in the section on Species Management Goals for this species.

Invasive Exotic Plants and Animals

The potential for negative impacts on the native flora, particularly the rare species, was evaluated during the field surveys. Three exotic species, two plants and one mammal, have the potential for seriously impacting the natural values within the study area. The distribution and abundance of these species is described.

1. **Common Dandelion** - The common dandelion (*Taraxacum officinale*) occurs in scattered locations in disturbed areas within the study area. At one location (Figure 9) this species is posing a threat to the continued existence of the native, rare California dandelion (*Taraxacum californicum*). This location on the Lamane (U.S.F.S) parcel occurs in a small spring, known locally as Bluebird Spring. Common dandelion has become an invasive species at this site, crowding out the California dandelion. Another problem in this regard is the apparent hybridization between the two species; several hybrids were observed in 1988 (Krantz, pers. comm.). In May of 1988, 700-800 common dandelions were removed by hand from Bluebird Spring (Krantz, pers. comm.); at least 700 plants remain there.

2. **Oleaster/Russian Olive** - The introduced Russian olive (*Elaeagnus angustifolia*, family Elaeagnaceae) is described as invasive in wet places. This species occurs in two locations on the north shore of Baldwin Lake (Figure 9). Near the margin of the lake there are 15 small trees, each approximately 5 to 6 m tall, on the small levee built to establish a duck pond. This duck pond was built around 1946 and the oleasters were probably planted at that time to provide cover (Core, pers. comm.). During the 1988 and 1989 season's field surveys an extensive search for seedlings was conducted in the vicinity of the planted trees but none were found. Another four trees are located near a small spring to the west of the "duck pond"; one of these trees is nearly dead.

3. **Wild Burros** - Wild burros (*Equus asinus*) on the study area pose a potential threat to the rare plant species. During the 1988 field season an effort was made to assess qualitatively the likely impacts of the burros on rare species or special habitats. In 1989 additional observations were made of burro activity and impacts.

Observations of the burros' activity patterns were made when the animals were present on the study area, during the spring months. Burros were seldom observed on the study area after approximately 30 June in 1988. Presumably, dry conditions resulted in decreased use of the area. However, droppings and hoof prints indicated that the burros

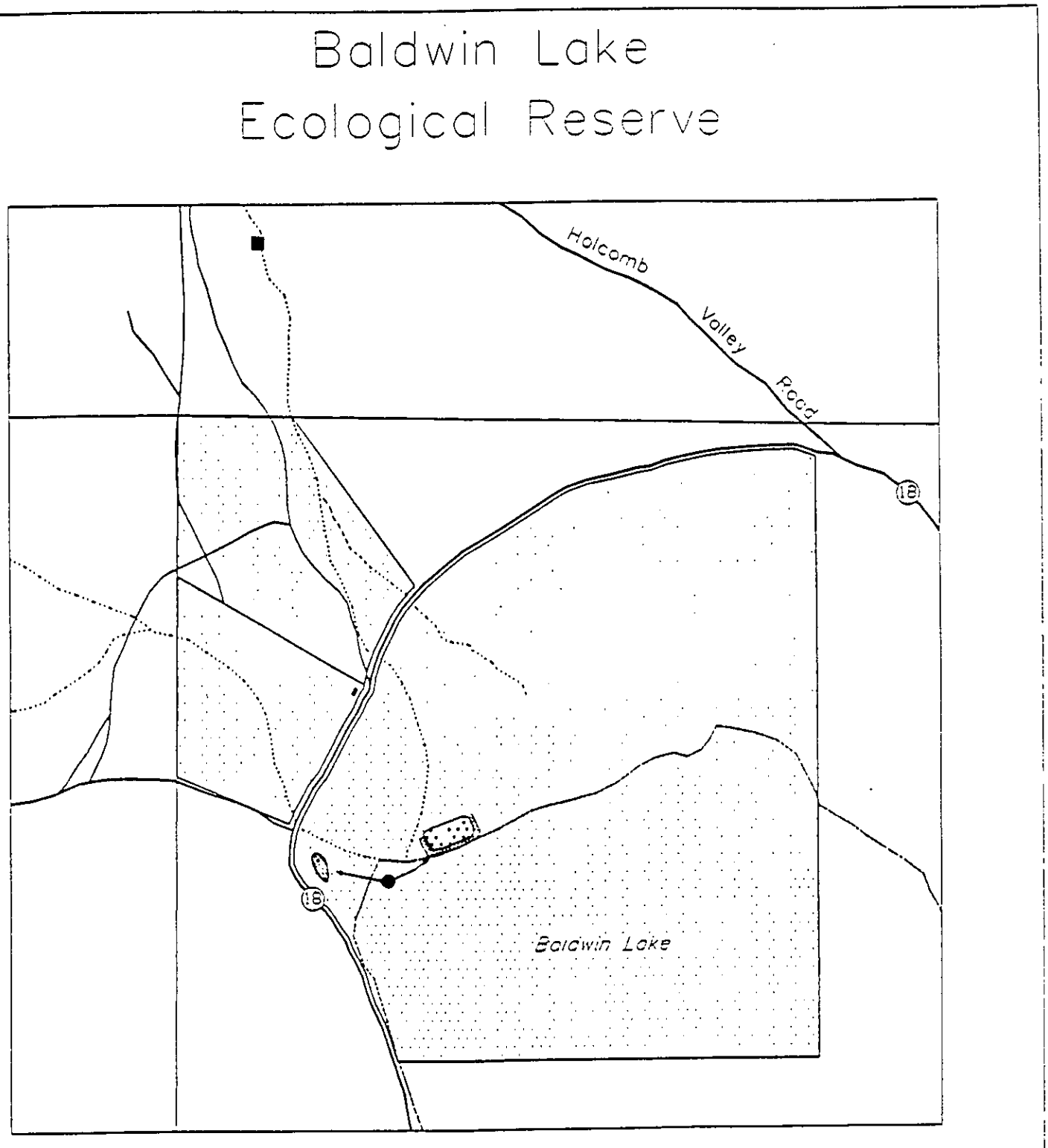

Figure 9. Location of populations of exotic plant species of concern on the Baldwin Lake Ecological Reserve and adjacent USFS land.

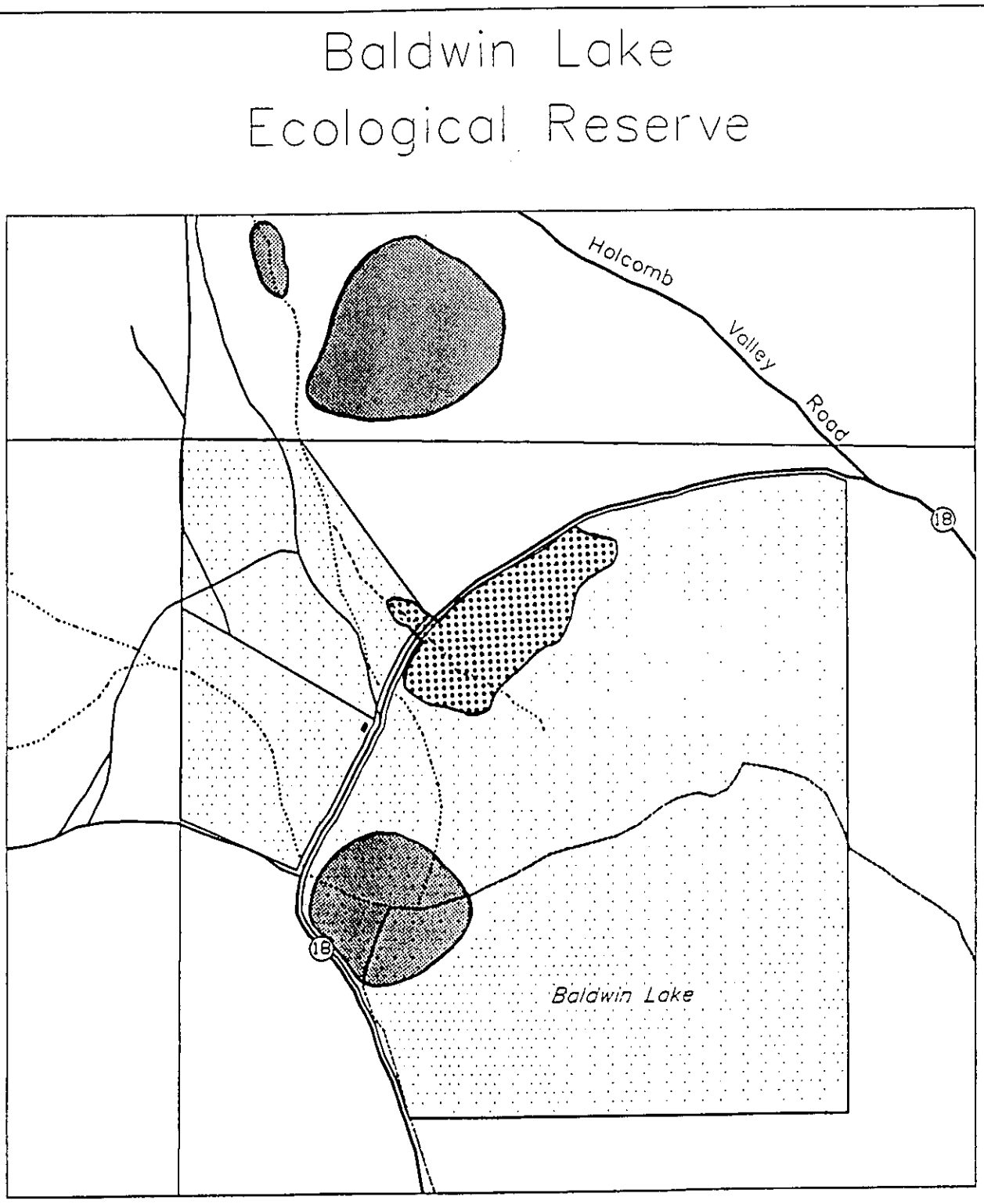

Figure 10. Areas where observations of wild burros were made during the period from 30 April to 1 July 1988; no burros were observed in 1989.

were still present in the area through October 1988. No burros were actually observed by the author in 1989 but there was considerable evidence of their activity within rare plant habitat.

The primary areas where burros were observed was on the Knoll pebble plain (on Lamane/"Cemetary" parcel) and in the grass-covered margins of the dry lake bed (Figure 10). Observations of the burros on the pebble plains were made in the evening hours when as many as 12 animals were observed on the Knoll pebble plain. As many as 24 animals have been observed in the area by others; in December 1989 23 animals were observed (Coelho, pers. comm.). Burro droppings can be found on the pebble plain located behind the "horse house" as well. Burros are predominantly grazing animals (Bleymeyer, pers. comm.) so they are probably foraging on grasses. The extent to which they may forage on or impact rare species on the pebble plains is not known.

A series of trails is evident in the sagebrush scrub and wet meadow habitat on the east side of Hwy 18 in and around the habitat for *Thelypodium stenopetalum* and *Sidalcea pedata*. A burro trail was established over the course of the 1988 season alongside a cement block trail which passes through the *Thelypodium* habitat. No direct observations of trampled plants were made but the burro trail was devegetated. A second burro trail crosses the drainage which supports *Sidalcea pedata*; this trail may impact the checkerbloom population as well.

In 1989, the evidence of burro activity in the wet meadow/sagebrush scrub habitat that supports both *Thelypodium* and *Sidalcea* was increased from 1988. A well-worn trail is now present immediately adjacent to the thelypodium population. Further surveys of the potential rare plant habitat southeast of Highway 18 in 1989 revealed extensive burro trails and droppings. A direct count of the number of individuals of *Sidalcea pedata* in a narrow drainage (shown by an "A" in Figure 10) revealed a large number of plants with the flowering stalk clipped off by an herbivore; of 117 plants which flowered, 70 of these had a clipped stalk. This predation of *Sidalcea* could be due to burros or rabbits/hares; similar predation was not observed in any other population of *Sidalcea pedata*.

Another area where burro activity is evident is the Bluebird Spring site (on USFS land), location of a California dandelion population. Evidence of trampling is conspicuous at this location as the burros presumably gather to graze on succulent vegetation. It also may be that their trampling encourages the growth of common dandelion; this species aggressively occupies disturbed ground in the area.

The U.S. Forest Service, Big Bear Ranger District has developed a burro management plan (1986) which calls for maintaining the burro population at 60 individuals on the district. Estimates of the current population range from 120 to more than 300 animals (Malachek 1988; Coelho 1988). No thorough census of the burro population has been conducted recently. The U.S.F.S. conducted a one-day population count in March 1989 to get an approximate idea of the burro population and to determine the need for control measures. A total of 61 animals was counted within the Big Bear Ranger District; 17 animals were found at North Baldwin Lake. At present the only monitoring of burro activity involves recording "problem calls" when the USFS is contacted about burros which have been hit by a car, are creating a nuisance, or may be injured (Malachek, pers. comm.).

Physical Features

Soil

The soils found within the study area are generally characterized by a high clay component related to the geological history of the area as a Pleistocene lake bed. The pebble plain soils have been described as fine mixed mesic typic haploxeralfs of the Hodgson family (Retelas 1978). An exploratory soil pit excavated by Derby (1979) on the Van Dusen pebble plain indicated greater than 60% clay particles in the B2 horizon. Observations on road cuts in the Big Bear basin reveal the abrupt change in soil texture at the B2 horizon. The pebble plain soils are also transported easily as fine clay particles are removed by wind and water. The surface on the pebble plains is dominated by rock cobbles which average 3 to 10 cm across, although larger rocks (+ 20 cm) are not uncommon.

The high clay component in the soil also contributes to the formation of wet meadow habitat. This habitat occurs where clay lenses in the soil are intercepted by shallow drainages or springs. The clay forms a barrier to infiltration of water and creates appropriate conditions for the rare species. The soil profile at these sites differs primarily in the absence of a surface layer of rock cobbles. Vernal creeks and drainages are the result of similar conditions.

Geology

The San Bernardino Mountains are part of the Transverse Ranges Geomorphic Province of California. The uplift of the San Bernardino Mountain Range is estimated at a minimum age of 6.2 million years (Woodburne 1975). The continuous movement of the Pacific lithospheric plate in a northwestern direction with respect to the North American plate creates active uplift which has occurred since the Pliocene; the San Andreas and San Jacinto faults are the principal zones of this activity (Crowell, 1975).

The basins that form the present day Baldwin Lake and Big Bear Valley are both the result of deposition of lake-bottom and alluvial debris (Stout 1976). During the Ice Age, approximately 18,000 to 20,000 years ago, the entire basin was filled by a huge lake. There is some evidence to suggest that there may have been at least two earlier lakes in the Big Bear Valley. A thick section of blue-gray clay up to 60 meters thick is one indication of a second lake which filled both Big Bear and Baldwin Lake basins (Stout 1976). Today, Baldwin Lake is a closed basin with internal drainage.

The deep clay layers deposited by ancient lakes in the Baldwin Lake basin contribute to the unusual plant association on the pebble plains. These clay deposits persist on the hillsides which surround Baldwin Lake as well. Rocks in the area are predominantly Saragosa Quartzite of Precambrian age (Stewart and Poole 1975). The distinctive surface pebble evident on the pebble plains is composed of Saragosa Quartzite rocks. This Saragosa Quartzite Formation is lithologically correlated with eastern Mojave and Great Basin units (Stewart and Poole 1975).

Hydrology

The hydrologic features in the Baldwin Lake Ecological Reserve lands consist of a series of small drainages which drain into Baldwin Lake. Annual precipitation in the Baldwin Lake area is less than 38 cm (17.3 inches) with most occurring in the form of snowfall. Some of these drainages include the sources of water for rare plant habitats, the wet meadows and the annual creeks. Hydrologic features within the study area are shown in Figure 11. The significant drainages, in terms of rare plant habitat, are designated with a letter; these letters are referred to in the following discussions of the hydrologic features.

The primary populations of both *Sidalcea pedata* and *Thelypodium stenopetalum* occur in or near a small drainage indicated by an "A" in Figure ll. This drainage is fed by run-off from the slopes to the north and west and from the slopes of the Knoll pebble plain immediately north of the drainage. The drainage crosses Hwy. 18 via a culvert under the highway. The so-called "Cemetary parcel", privately owned property immediately adjacent to this drainage, is part of the watershed for run-off waters that contribute to the wet meadow habitat. Potential for development of this parcel constitutes an off-site threat to hydrologic conditions which maintain the rare plant populations.

There is evidence from aerial photographs of considerable variation in the extent of the wet meadow habitat surrounding drainage A. An August 1938 aerial photograph on file at the Big Bear Ranger Station indicates the extent of wet meadow habitat during a wet period, when the Baldwin Lake level was high. Then the wet meadow plants extended to the road west of this drainage. A second drainage which supports *Sidalcea pedata* is labeled with a "B" in Figure 11. This drainage also receives run-off water from the "Cemetary parcel" via a culvert under Hwy. 18.

Another historical influence on hydrologic conditions in the area is a man-made ditch which is evident on aerial photographs as a straight line running from the site of the Baird's mill to a well at the edge of Baldwin Lake (indicated at "C" in Figure ll). This ditch was built during the mining period (probably 1899-1900) to support a pipeline for water pumped from the well to the mill site (Core 1988). The ditch remains very evident today; it is approximately 8 inches deep and may divert water from the wet meadow area during wet periods.

The Bluebird Spring area (indicated by a "D" on Figure 11) supports the *Taraxacum californicum* population and falls within drainage "A" described above. The impacts of wild burros on hydrologic conditions at this site are described in the previous section (page 25).

There are also several wells located on the reserve property which are remnants of the gold-mining and "horse house" eras. These wells (indicated by "E" and "F" in Figure 11) are located in the northwest corner of Baldwin Lake, near the duck pond. One of the wells is an artesian well with a high flouride content; this well has a shut-off valve which was turned on in spring 1989 (Coelho, pers. comm.). It flows at a rate of approximately 10 gallons/minute and has resulted in a luxuriant growth of wetland plants below the well. A second well has water at the surface but presently has just a well-casing. It was apparently installed to maintain the water level in the duck pond.

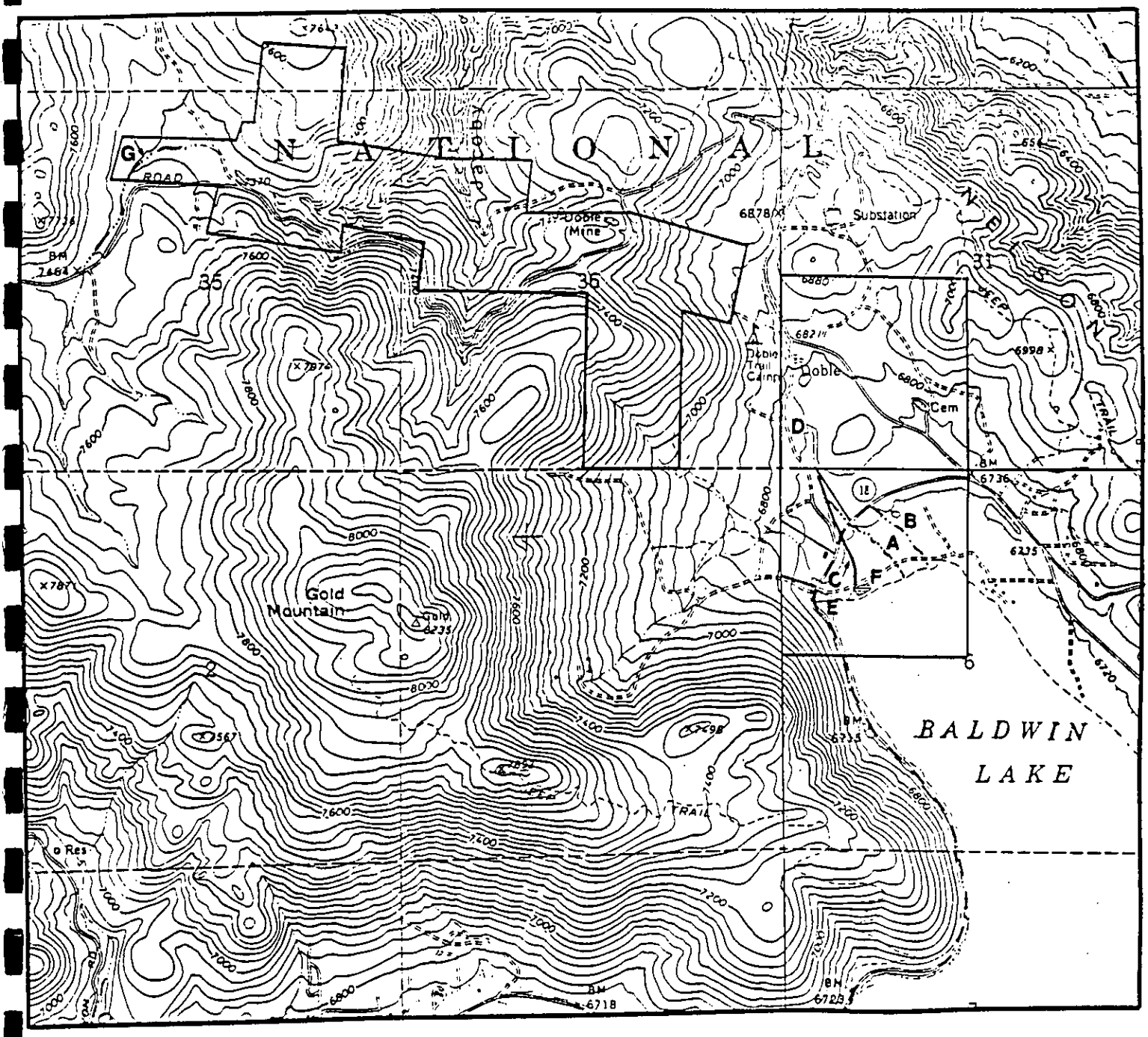

Figure 11. Hydrological features on the study area at Baldwin Lake, San Bernardino County, CA. Map is adapted from USGS 7.5' Big Bear City quad.

A = Rare Plant Habitat in Wet Meadow Drainage

B = *Sidalce pedata* Habitat in Drainage

C = Ditch for Mill Water Supply (historical)

D = Bluebird Spring

E, F = Artesian Well, historical well

G = Drainage on Starland Parcel

The level of water in Baldwin Lake influences the potential for waterfowl habitat around the perimeter, for bald eagle foraging habitat, and for three-spined stickleback habitat within the lake. The water level in the lake normally fluctuates from completely dry to an elevation of 6698 feet when full. Information from a local historian (Core 1988) familiar with the lake level of Baldwin Lake since 1923 indicates the wet/dry cycle typical since that date. During the period from winter 1923-24 to winter 1935-36 the lake was dry. The winter of 1937-38 was very wet and the lake level remained high for 3-4 years, then dwindled until a wet year in 1944-45. Flooding of some of the houses on the south perimeter of the lake occurred in winters of 1973-74 and 1983-1985. The lake has been dry since 1985.

Cultural Features: Historical Land Use

Structures

The predominant historical land use within the study area was mining for gold. The historic site of the town of Doble and the remains of several old mine sites are still in evidence. The mining activity began in 1873 with the construction of the first stamp mill by Lucky Baldwin (at "A" in Figure 12). This mill burned down in 1875 and a second mill was not built until 1899-1900. This second mill was operated by Delamar and was located in the canyon, below Holcomb Valley Road ("B"), on the Lamane property (U.S.F.S.). This mill used the cyanide process beginning in 1916; the waste materials were allowed to drain into Baldwin Lake or into the ground. The mill was shut down in 1923 and was disassembled for scrap in 1933 (Core 1988).

A third, 3-stamp mill was present near the Doble town site. The ground disturbance is still evident from a white powdery soil that covers the small knoll where the mill was located (at "C" in Figure 12). This mill was operated by Sam Baird who gave Doble its first name -- Bairdstown. This mill was powered by a steam plant which used water from Baldwin Lake transported in a ditch (Figure 11) from the lake's edge to the mill site (Core 1988).

The town of Doble was, during its heyday, home to approximately 180 people (Core 1988). A 1900 photograph shows 24 to 28 buildings, including at least one on the north side of the present Holcomb Valley Road, on the pebble plain. A school was built somewhere on the north side of this road although no evidence of it remains; the remains of the cemetary, where about 40 people were buried, are still evident. The last three buildings from Doble were removed by the Forest Service in the 1970's due to vandalism problems.

The effects of cutting trees for wood to feed the mill operations are still evident. At the Baldwin mill site ("B" in Figure 12) the cleared area can still be seen, although many pinyon pines have become established since that time.

Another historical building is more recent in its origin, the so-called "horse house." This house (at D) on the CDFG property was built in about 1945 by a man who hoped to develop a duck hunting club. He also established the "duck pond" (E) at the lake margin and approximately 50 duck blinds were built. The pond area and some scrap wood

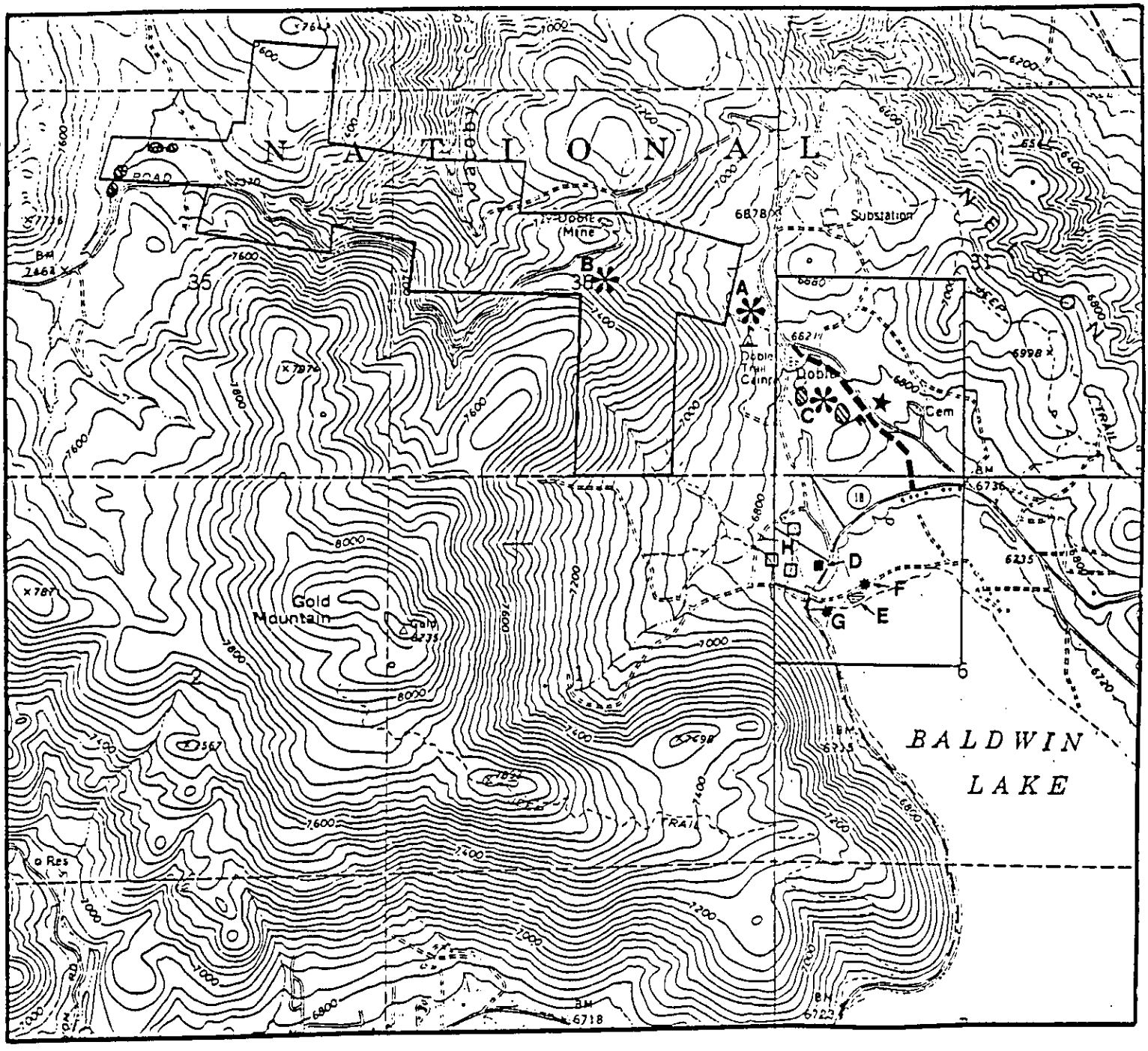

Figure 12. Historical land use features on the study area, including proposed Baldwin Lake Ecological Reserve. Map is adapted from USGS 7.5' Big Bear City quad, enlarged to scale = 1:18,000.

★ = Doble Schoolhouse

✻ = Gold Stamp Mill Site

■ = "Horse" house

▭ = Duck Pond

▨ = Debris Piles (from Gold era)

● = Well Site

□ = Dump Area

▬ ▬ = Original Road

from the blinds are still present. Two different wells were used to pump water into the pond; these are shown at "F" and "G" in Figure 12. The hunting operation was unsuccessful and the site was abandoned after about four years. The "horse house" designation apparently came much later; historian Tom Core (personal communication 1988) had never heard the name, could not explain it's origin or recall another more appropriate name for the building.

The "horse house" was occupied again in 1974 by a man who hoped to have a small grocery store there. The present roof, windows and the electricity were added in 1974. The occupants at that time hoped to eventually exchange fix-up activity on the house for a partial interest in the property but this never came to pass. The house was occupied only for a few years before it was again abandoned (Core 1988). The house has been abandoned since the parcel was purchased by the Nature Conservancy in 1983.

The area behind and to the north of the "horse house" is dotted with many small trash piles. This area had been used by the public as a dump site. Piles of rusty tin cans, old bottles, old beds and other large items are very common, particularly in the area denoted by "H".

Cultural Features: Current Land Use

Structures

The "horse house" in its current condition, as of November 1988, was not suitable for use. The building had no windows or doors, no utilities, and portions of the structure were unsafe. The Friends of the Big Bear Valley Preserve, a non-profit support group for Nature Conservancy and USFS protection activities, is interested in using the facility as a visitor center. They currently offer interpretive walks throughout the year. With some repair work, the building could be used as a gathering place for visitors and a limited interpretive facility.

The Nature Conservancy and the Friends of the Big Bear Valley Preserve have received permission from California Department of Fish and Game regional headquarters to restore the building on a limited scale. Current plans for the "horse house" call for upgrading the structure so that it can be used as a meeting place/visitor center and storage location for supplies and tools. In the long-term, a full-fledged visitor center might be developed here; however this option would require funding and staffing requirements well beyond current capabilities. At the present time, the facility can be used as a meeting place, for the location of an interpretive kiosk, and as the take-off point for interpretive trails.

In spring 1989 the Friends group initiated restoration of the "horse house". They removed the southern "wing" of the building, which was considered unsafe. They are now in the process of replacing exterior siding, installing windows and doors, insulating and enclosing the interior walls, and installing electricity to the building. A proposal for restoration of the building, written by preserve manager John Stephenson, is included in Appendix III.

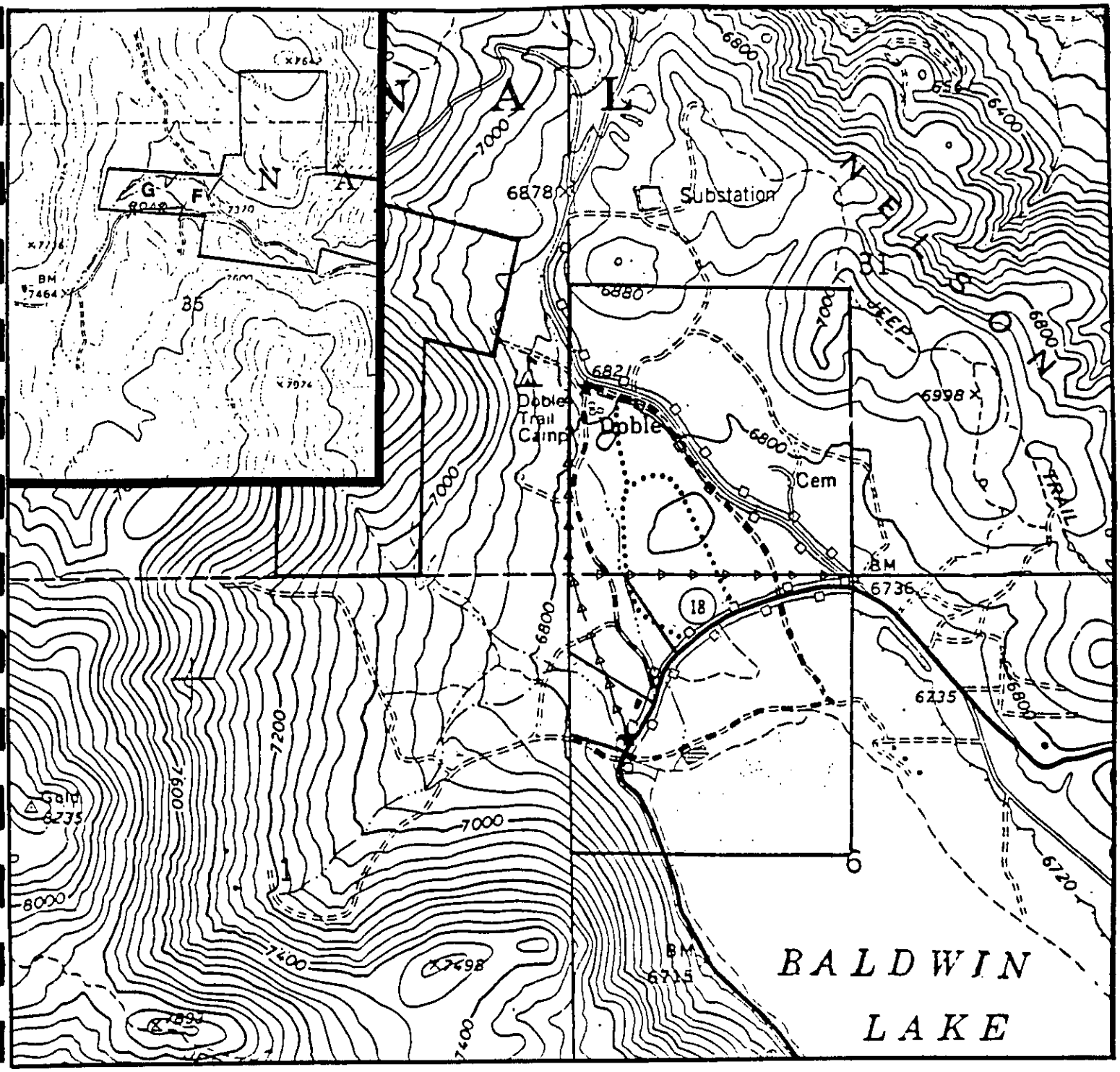

Figure 13. Current land use features, including roads, trails, and fences within the Baldwin Lake Ecological Reserve and the study area. Map is adapted from USGS 7.5' Big Bear City quad, enlarged to scale = 1:18,000.

= Original Roads (from historical Doble)

= Powerline Access Road

= Three-strand Barbed Wire Fence

F, G = Vehicle Trespass/Target Shooting Site

= Foot Trail

= OHV Road

★ = Gate for Road Closure

N

Roads and Trails

The California Department of Fish and Game lands within the study area were owned by the Nature Conservancy until their purchase by the State in 1986. In 1986 and 1987, a barbed wire fence was erected along the Highway 18 boundaries of the property. The property on either side of Holcomb Valley Road was also fenced at this time; this fence protects pebble plains and associated habitat under U.S. Forest Service management. The location of existing fences and other current land use features is shown in Figure 13; these features are referred to in the text by letters of the alphabet as indicated on the map.

At present there is only one established trail within the CDFG lands; in most cases old roads serve as trails. This trail (indicated with an "X" in Figure 13) is located on the east side of Hwy 18, through the area where *Thelypodium stenopetalum* and *Sidalcea pedata* grow. The trail has 10" round cement stepping stones to prevent trampling of the habitat; these stones extend for approximately 50 yards from the road. Burros also use this trail as it is the only place where there is a pass-through in the fence. Impact to the rare plant habitat could be minimized by relocating this trail.

There are a series of roads that cross through the CDFG and Lamane-east parcels. These roads are shown in Figure 13. Some of these roads were established by early miners and residents of Doble; these roads are indicated as "A" and "B", both are evident in 1938 aerial photographs of the site. Road A was used by miners and residents of Doble as the main road to Hwy 18 before the existing Holcomb Valley Road was built (Core 1988). The Holcomb Valley Road is first evident in 1949 photographs.

One of the roads which cuts on a southeast-northwest diagonal across the CDFG lands is an access road to the Southern California Edison power line. This road continues north to Holcomb Valley road along the boundary between sections 31 and 36, and east along the boundary between sections 31 and 6, across the "Knoll" pebble plain. The latter section of the road, indicated by a "C" in Figure 13, is first evident in 1965 photographs of the site. The other sections of this road are not evident until 1983 aerial photographs.

Off-Highway Vehicle Use

The remainder of the roads on the property are apparently the result of vehicle activity since 1965. Prior to the fencing of the perimeter along paved roads, there was a serious problem with OHV-trespass. Access to the CDFG parcels on the west side of Hwy 18 has been limited by the three-strand barbed wire fence and locked gates at all roads. Off-road vehicle trespass has not been a problem in the last several years (Coelho 1988).

There is a problem with OHV access to the CDFG property on the lake side of Hwy 18. During periods when Baldwin Lake is dry it is an attractive site for OHV enthusiasts. Access to this property is from the dry lake to the south. Occasional vehicle trespass might involve using one of the existing little-used roads to travel north to Hwy 18 (indicated by a "D" on Figure 13). This activity could threaten rare plant habitat although to date there has not been this kind of problem; however, during certain times of the year (particularly winter and summer) vehicle trespass on the lake is common (Coelho 1988).

Other access points for OHV use within the study area occur on the Lamane and Starland parcels. On the Lamane-east parcel, access to the pebble plains along Holcomb Valley Road has been possible from the Nelson Ridge Road (at "E" on Figure 13), on the ridge to the north. This road has been temporarily closed by a gate and fence since 1987 (Neel 1988); it will likely be permanently closed by early 1989.

On the Starland and Lamane-west parcels, some vehicle access is evident in the vicinity of the drainage which supports rare plant habitat (at "F"). This area is extensively used for target shooting and occasional camping. No serious impacts to the habitat are apparent at present but it is an area that needs to be monitored. Evidence of limited OHV activity was also found along the drainage (at "G"); this activity is not an apparent threat to the habitat at present but should be monitored.

Potential for Development: Surrounding Lands

There remains one private "inholding" in the study area which is a significant property ("H") with respect to protection of the wet meadow rare plant habitat. This property is currently for sale. The potential for development on the three parcels included here is fairly limited for several reasons: 1) the parcels were previously proposed for a cemetary development (the Audubon Society sued to prevent the development, on the basis of the potential impacts on two endangered species of plants), 2) the area is zoned as open space in the Big Bear Basin Community Plan approved in early 1989, 3) there is a small population (less than 12 plants) of *Sidalcea* on the property.

Other private land occurs along the eastern boundary of the CDFG property. This property has low value in terms of development because it is within the high water zone of Baldwin Lake. There is an existing, though decrepit, fence along this boundary. A series of crumbling shacks ("I") are the remains of an auto wrecking yard from the post World War II period (Core 1988). In April 1989 a real estate office was established to the east of these shacks. Development potential in the North Baldwin Lake area is severely limited by water availability.

The remainder of the lands which border the CDFG property on the west and north are managed by the Forest Service.

Potential Mining Claims: Surrounding Lands

There is some possibility that mining claims on the U.S. Forest Service lands on the east slope of Gold Mountain could be activated and mining could occur. There are claims on much of the U.S. Forest Service lands west of the study area. In early 1989 several claims were activated on USFS land north of the Lamane (Kenline, pers. comm.) property (see Figure 13). There are several mine claims located to the northwest of the State lands, in the vicinity of Doble and the Doble Trail Camp; these claims have not been activated.

The potential for use of the various claims in the vicinity of the study area for gold exploration/extraction is probably very limited for several reasons: 1) When the Lamane parcels were transferred from the Nature Conservancy to the U.S. Forest Service, a 20-year mineral withdrawal was attached to the deed; 2) the only productive way to extract gold here would be with the use of a cyanide heap-leaching process (Kenline 1989). The

approval of a cyanide-leaching operation is very unlikely (Kenline 1989); 3) the economic value of the gold residues in the N. Baldwin Lake area west to Jacoby Creek is probably low (Kenline 1989).

Baldwin Lake Level: Recreational Use

The level of Baldwin Lake varies tremendously as described in the previous section on hydrology. During the periods when the lake is full of water, the area supports populations of waterfowl that are attractive to hunters. Hunting on Baldwin Lake is presently allowed but it is restricted to a special permit basis. The Baldwin Lake permit allows hunting only on two days of the week, Wednesdays and Saturdays (Coelho 1988). This restricted season was established in response to complaints about hunting from surrounding residents. Hunting may occur only from a boat; boats are launched from a turnout off of Hwy 18 on the east side of the lake ("J"). Another issue related to hunting on Baldwin Lake is the use of lead shot. This shot can result in lead poisoning to top carnivores such as the bald eagle. To date, lead shot is legal; steel shot is a reasonable alternative is the use of lead shot for hunting.

Baldwin Lake Level: Bald Eagle Habitat

When adequate water is present in Baldwin Lake to support waterfowl, bald eagles are attracted to the area. Eagles have been observed roosting in the Jeffrey pine trees on the west side of Baldwin Lake, west of Hwy. 18 (Krantz, personal communication) (see Figure 14).

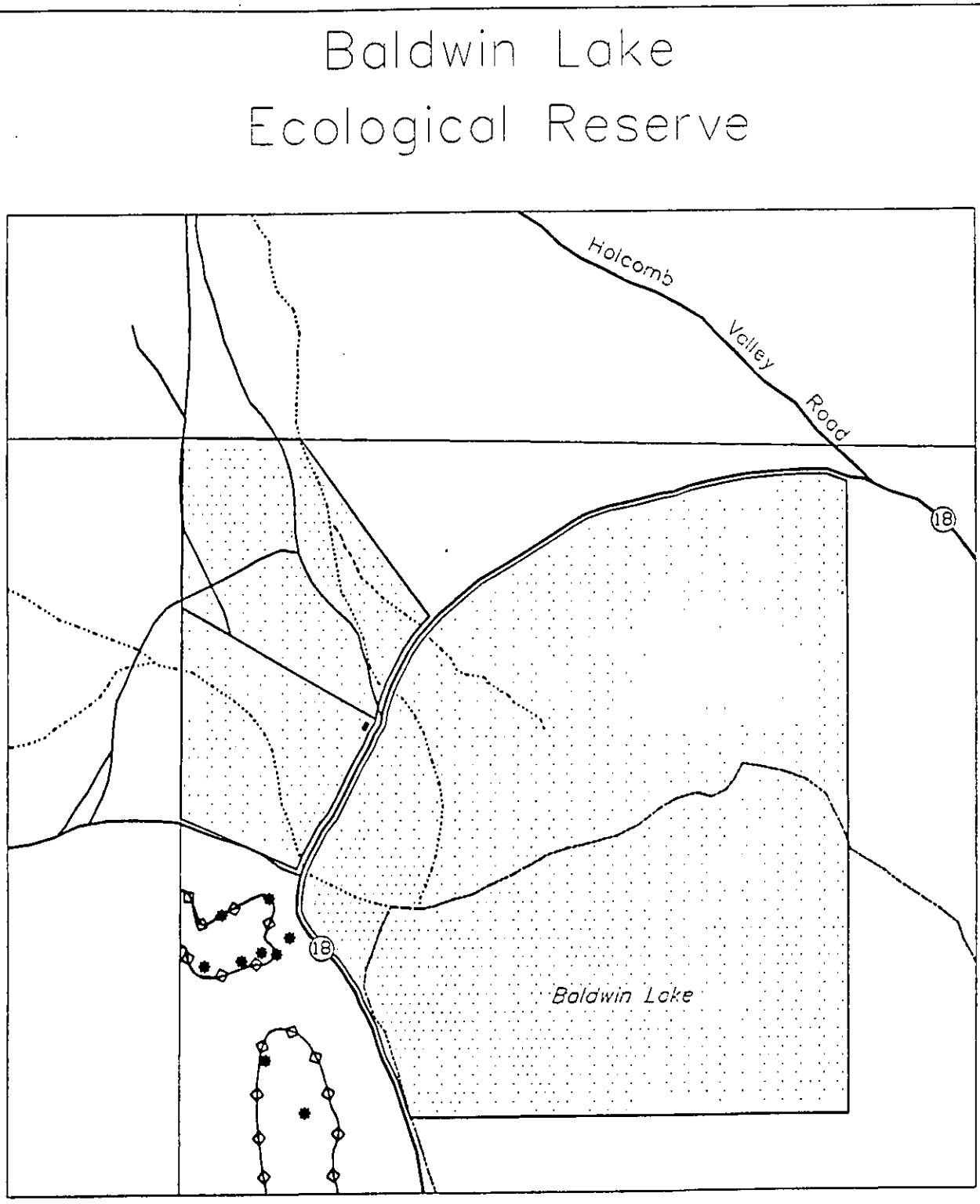

Figure 14. Location of Bald Eagle roost trees and potential roost areas on the Baldwin Lake Ecological Reserve. Location data are from Krantz (1986).

PART II: SPECIES MANAGEMENT GOALS

This section reviews background information on systematics, habitat, distribution, current status, historical distribution, and ecology of rare species of plants and animals or special habitats on the study area. The factors which may limit the populations of these species are discussed. Management actions already taken to protect the species are listed. The threats to each of these species and the potential for recovery of degraded populations are also addressed. These data are used to develop a series of management goals to maintain viable populations of species or areas of habitat. The possibility of increasing the populations/habitats are addressed by enhancement goals.

The individual species considered in this section include only those with federal or state-listed status. Since the two listed plant species occur together at this site the species management goals are essentially the same. These are stated following the background information on these two species. This is followed by a description for the one listed animal species. Other rare plant species are covered in this section under the special habitat in which they occur. Species management goals for these habitats are listed following the background information for each one.

SPECIES ACCOUNTS

Bird-footed Checkerbloom (*Sidalcea pedata*)

Description. The bird-footed checkerbloom is a many-stemmed perennial, 2-4 dm. tall from a fleshy taproot (no rhizomes). The species is distinguished by the mostly basal leaves which are 3(-5)-lobed. The cauline leaves are divided into three primary segments, which are further dissected into linear segments. The five-parted flowers, which occur in terminal racemes, may vary in color from pink to magenta with pale white stripes. The petioles are distinctively bright red. The carpels are smooth, another distinguishing feature.

Habitat. This checkerbloom is restricted to vernally wet meadows and sparsely vegetated dry meadows in the Big Bear Valley, San Bernardino Mountains. The wet meadow habitat occurs where heavy clay soils coincide with wet areas. Within the wet meadow habitat the checkerbloom tends to occupy the upland sites where conditions are slightly drier; individuals generally are not found in the dense rush and/or sedge thickets typical in the low spots of drainages. At Baldwin Lake this species is most common along the upper margins of the small drainages.

Distribution. The historical distribution of the bird-footed checkerbloom is thought to have been much more extensive prior to the development of Big Bear Dam in the 1890's. Early botanists, notably Samuel Parish (1838-1928), reported that the lower parts of Big Bear Valley were a green subalpine meadow; Parish reported the checkerbloom as "frequent in the meadows of Bear Valley" (Parish 1917 (from Krantz 1983a)). Subsequent development or recreational activities in the Big Bear Basin have eliminated much of the wet meadow habitat essential to the bird-footed checkerbloom.

The present distribution of this species is restricted to twelve occurrences (Cox 1986) in Big Bear Valley. This species has not been known to occur naturally in the adjacent Holcomb Valley; approximately 20 checkerblooms were transplanted from a threatened site to Holcomb Valley in 1986; the status of these plants has not been determined. The only populations of *Sidalcea pedata* in a fully protected status are those at Baldwin Lake. Other populations at Metcalf Bay, Bluff Lake, Eagle Point, and Pan Hot Springs are partially protected by landowner agreements in the case of the first three. The Nature Conservancy is currently negotiating with the Big Bear City Community Services District, owners of the Pan Hot Springs property, for a conservation easement of the rare plant habitat. The distribution and population status of this species was documented by Krantz (1983b).

Status of Population on Reserve. The bird-footed checkerbloom occurs in four locations on the north shore of Baldwin Lake; three of these locations are within the CDFG boundaries and the fourth, a very small population of 2 to 6 individuals (Krantz 1988), is on private land. In the 1988 season, approximately 130 individuals were counted in drainage "A" (Figure 11). The species was not surveyed at the other two sites on CDFG land and was not present at the site on private land.

In 1989 a much more thorough count of this species was made. Within drainages "A" and "B" all individuals were counted as either plants with flowers or plants without flowers. The results of these counts are given in Table 6.

Table 6. Population counts for *Sidalcea pedata* in three subpopulations at North Baldwin Lake.

Subpopulation	No. of Plants With Flowers	No. of Plants Without Flowers	Total
Drainage A	689	1322	2011
West of Hwy. 18	(138)	(298)	(434)
East of Hwy. 18	(551)	(1026)	(1577)
Drainage B	117	71	188

Limiting Factors. The primary limiting factor for *Sidalcea pedata* appears to be the availability of sufficient soil moisture. Though no quantitative research has been conducted on habitat requirements for this species, the presence of clay soils is also a consistent habitat characteristic. The maintenance of hydrologic conditions within the wet meadow habitat is of critical importance to this species' survival.

Threats to Populations. The greatest threat to the continued existence of bird-footed checkerblooms at Baldwin Lake is alteration of soil moisture conditions. Another threat to the populations, OHV trespass, has been only partially controlled. The access to the wet meadow habitat from Hwy 18 has been fenced to prevent vehicle trespass; a limited

threat of vehicle trespass from the dry lake bed to the south is present. Vehicle activity could impact the *Sidalcea* population in the northeast corner of the CDFG lands. To date, no significant trespass is evident at this location.

Another potential threat to the checkerbloom is trampling by burros and/or humans. At present there is only one location where a burro trail crosses the checkerbloom habitat. This trail could be closed off to prevent burro access. Burro activity is on the increase within the Big Bear Ranger District (Malachek 1988). Relocation of a pass-through in the fence along Hwy 18 would probably reduce burro trampling in the wet meadow habitat.In addition to trampling, there may be some evidence that burros are eating checkerblooms. In May 1989, approximately 60% of the individuals in one population had the flower stalks clipped off; this damage might also be caused by rabbits.

Management Actions Completed. Actions already taken to protect this species include completion of fencing along both sides of Hwy 18 in 1986. Some interpretive programs to educate the public about the rare plants at Baldwin Lake have been presented by the Friends of the Big Bear Valley Preserve, a local support group for the Nature Conservancy.

Recovery Potential. The only evidence of degradation of the checkerbloom populations within the study area is the clipping of flower stalks. It is not known whether this predation is by burros or rabbits. Several steps can be taken to prevent degradation; these are described under the species management goals.

Slender-petaled Thelypodium (*Thelypodium stenopetalum*)

Description. The slender-petaled mustard is a glabrous, glaucous biennial with simple stems 3 to 8 dm tall; there may be one to several branches per plant. The many-flowered inflorescence has small whitish petals, 10 to 14 mm long. The calyx has a purplish tinge which gives the inflorescence a purple hue. This species can be distinguished by the oblanceolate leaves of the basal rosette, which whither soon after anthesis. The cauline leaves are sagittate or auriculate-clasping at the base. The plant is generally glaucous, often with a purplish cast to the leaves.

Habitat. This species tends to occupy the drier upland portions of wet meadows or sparsely vegetated dry meadows. The locations where it occurs at Baldwin Lake are dominated by open sagebrush scrub vegetation. The plants are often seen growing up through the sagebrush shrubs; these individuals can be nearly 1 m tall. These sagebrush scrub sites are closely associated with wet areas along the margins of drainages or low areas where water collects in the spring. Associated species include *Artemisia tridentata*, *Gutierrezia sarothrae*, *Iris missouriensis*, *Castilleja cinerea*, *Distichlis spicata*, *Oenothera californica*, and *Linum lewisii*.

Distribution. Once more extensive around Big Bear Valley, the populations of this species have been restricted as a result of inundation of Big Bear Lake, and disturbance of its habitat as a result of development. At the present time there are six known occurrences for this species; three of these populations are protected and one population will be protected. The population size was determined for each of these sites in 1989; the largest

population is at Eagle Point. Additional information on the annual variation in size and density of these populations is needed.

Status of Population on Reserve. There are two known populations of the slender-petaled thelypodium on the Baldwin Lake CDFG lands (see Figure 4). The only one in evidence in the dry 1988 season occurred on the east side of Hwy 18, adjacent to the small drainage that supports *Sidalcea pedata*. Only 11 individuals were counted in 1988. In 1989 a more thorough survey was conducted but again plants were found only in the same area. In 1989 there were 29 plants counted.

Limiting Factors. The potential habitat for this species is limited on the site. However, the parameters of the habitat for this mustard have not been studied or defined. The species occurs in association with wet meadow sites so soil moisture is apparently a critical feature. The clay content of the soil is also important, although no quantitative data are available regarding the specific soil characteristics this species prefers.

Threats to Populations. The significant threat to the species is the trampling of individual plants by burros and, to a lesser degree, by humans. Burro and human trails both pass directly through the habitat. The burro trail was apparently established during the 1988 season by burros moving from the west side of Hwy 18 toward the lake. There is also a limited threat of OHV trespass in the second population of this species, in the northeast corner of the CDFG property. This is the same area described as potentially threatened in the section on *Sidalcea pedata*.

Alterations in surface or subsurface hydrology could also impact the slender-petaled thelypodium populations. This might occur if development were to take place on the so-called "Cemetary" parcel, upslope of the mustard populations.

Management Actions Completed. The protection of this species has been promoted by the completion of a fence along Hwy 18 in 1986. However, a break in the fence directs foot travellers on a trail through the middle of the mustard habitat. Cement stepping stones (12" diameter) have been placed along the trail to prevent direct trampling of the plants.

Recovery Potential. The degradation of habitat for the slender-petaled mustard appears to have increased from 1988 to 1989. Trampling by burros or humans should be terminated by removing the trails or old roads which pass through the population. The potential for enhancing the species' populations has not been addressed at this or any other site. Monitoring is needed to determine annual population size and trends.

Unarmored Three-spined Stickleback
(*Gasterosteus aculeatus* ssp. *williamsoni*)

Description. The unarmored three-spined stickleback is a subspecies of the three-spined stickleback which is identified by the absence of armored plates on the back. The species is identified by sampling a portion of the population. From a sample of no less than 15 fish, 50% of the adults will have 2 plates or less or 50% will be plateless (Malcolm 1988). The fish that occur in Baldwin Lake when water is present are genetically related to fish

present in perennial pools above and below Shay Meadow at the south end of Baldwin Lake. The subspecies was first described from a population in the Santa Clara River. Though the taxonomy is not fully confirmed, there is some indication that the Big Bear populations may be genetically distinct from the Santa Clara River populations. Hence, at the present time the Big Bear populations are allied with the ssp. *williamsoni* awaiting further clarification of their taxonomic status (Malcolm 1988).

Habitat. This species occupies shallow waters, 2 to 3 feet deep, in perennial pools or streams in the Big Bear basin. The fish may occur in open or sheltered areas of the pool. They can tolerate high alkalinity/salinity levels in the water; quantitative data on the habitat characteristics of the species are currently being gathered (Malcolm 1988). Sticklebacks make their nests in shallow protected waters along the margins of the pool or lake where they occur. Nests are probably associated with vegetation along the water margins.

Distribution. The known local populations of the unarmored three-spined stickleback are limited to two occurrences near Shay Meadow. At both of these sites, perennial pools are maintained to provide habitat for this species. Sticklebacks have been collected from the north shore of Baldwin Lake by Dr. James Malcolm, most recently in August 1985. Thus, during periods of high water in Baldwin Lake, a population of fishes colonizes the lake portion of the CDFG lands. This population is derived from a "seed" population in the Shay Creek pool.

Status of Population on Reserve. The occurrence of this species on the reserve is limited by the presence of high water in Baldwin Lake. There is no quantitative data on the number of fish that might occur within the study area during these periods. Preliminary sampling of fish populations in the two perennial ponds was initiated in in 1988. At the Shay Meadow pool, 240 fish were captured in a minnow trap during a four-hour period in September (Stephenson 1988).

Limiting Factors. Not enough data is currently available to determine limiting factors for this species.

Threats to Population. The occurrence of sticklebacks at North Baldwin Lake is contingent on the appropriate water level. Threats to the species are primarily from destruction of habitat as a result of alterations in hydrology. The apparently natural wet-dry cycle in Baldwin Lake indicates that a water level sufficient to maintain a permanent population of sticklebacks in north Baldwin Lake will occur only during wet years. As long as the populations in Shay Creek are maintained, fish can reinvade Baldwin Lake during wet periods.

The species apparently is not adversely affected by hunting activity on the lake or by the predation by grebes, mergansers, and herons (Malcolm 1988).

Recovery Potential. The recovery of this species within the reserve area would require permanent stabilization of the level of Baldwin Lake. Representatives of the Big Bear City Community Services District have indicated a long-term goal of stabilizing the lake level to enhance its recreational values. The sources for adequate water supplies to accomplish this goal have not yet been determined. Historic data seem to indicate that cycles of wet and dry years are normal for Baldwin Lake.

HABITAT/SPECIES ACCOUNTS

Management concerns for the remaining rare species on the study area are addressed under the habitat in which they occur. Long-term maintenance of these species is assumed to depend on long-term viability of their habitats. Species Management goals follow each habitat description.

Pebble Plain

Description. Pebble plains are islands of sparse, low-growing vegetation within forests of Jeffrey pine or woodlands of pinyon pine. The plains typically occur on level or gently sloping sites. They occur in areas where clay soils are intercepted by saragosa quartzite rock pavements. The treeless pavements show no evidence of ever having supported trees (Derby and Wilson 1978); they appear to represent a topographic-edaphic climax within the surrounding Jeffrey Pine Forest or Pinyon Pine Woodland.

The flora and physiognomy of the pebble plains share many characteristics with an alpine habitat, dominated by caespitose perennials, cushion plants and dwarfed annuals (Derby and Wilson 1978). For the San Bernardino Mountains, pebble plains are identified based on the presence of two endemic plants, *Eriogonum kennedyi* ssp. *austromontanum* and *Arenaria ursina*. The distribution and abundance of these species varies from site to site and within a pebble plain due to local variation in topography. Some of the pebble plains are almost exclusively populated with caespitose perennials and annuals. At other sites the dwarf sagebrush, *Artemisia nova* may represent 50% or more of the cover. Pebble plains in Holcomb Valley are partially tree-covered.

Distribution. The pebble plains occur in an area of approximately 155 km of the northeastern San Bernardino Mountain Range (Derby and Wilson 1978), centered around Holcomb and Big Bear Valleys. They are found within an elevation range of 1830 to 2288 m. Other similar "pebble plains" occur at Table Mountain (Thorne 1976) and at Garner Valley, San Jacinto Mountains (Hamilton 1988). Species composition at these latter sites is distinctively different.

The pebble plains in the San Bernardino Mountains occur in clusters of "islands" surrounded by forest vegetation. There are 12 sites where they occur; these sites have experienced varying degrees of disturbance although most are now in a protected status (Neel 1988).

Status of Habitat on Reserve. Within the study area, including CDFG, USFS, and TNC lands, there are at least four pebble plains; within the CDFG parcel there is one pebble plain which occurs half on Department land and half on USFS land. Each of the pebble plains has received at least some disturbance, primarily due to access roads or OHV travel. Another disturbance factor which affects CDFG lands in particular is the collecting of saragosa quartzite rocks from the pebble plains; these distinctive rocks are gathered for decorative purposes. Their removal is usually evident on the pebble plains by the large

holes that are left behind. Other potential sources of disturbance include changes in hydrology, burro activity, and human trampling.

Limiting Factors. The occurrence of pebble plains is limited by topographic and edaphic factors. These include level or gentle slopes, high percentage (e.g.. 53% (Derby and Wilson 1978)) of clay in the soil, saragosa quartzite rock pebbles, elevations between 1830 and 2288 m.

Threats to Habitat. At present, the most significant threat to the pebble plains, OHV activity, has been controlled by fencing of the perimeter access from Hwy 18. OHV activity results in roads or tracks which disturb the surface soil structure and destroy plants. Disturbance of the soil profile and surface topography may result in changes in hydrology that might impact rare species. Rock collecting has been controlled by the restricted access; the large holes left by collectors are still very evident on the pebble plain on CDFG lands, behind the "horse house". The impacts of human trampling and burro activity are not conspicuous; increased interpretive use of the area could create a trampling problem. The impact of burros is not clearly evident. The burros use the pebble plains at least some of the time for foraging; their droppings are scattered on all the pebble plains.

Another potential threat to the long-term maintenance of pebble plain habitats is encroachment of tree species. Derby and Wilson (1979) found that densities of pebble plain endemic species was inversely correlated with litter buildup and light intensity under tree canopies. Potential encroachment begins with tree or shrub seedling establishment under existing tree canopies; they found that in no case was a tree seedling found outside an existing tree or shrub canopy. Examination of aerial photographs of the North Baldwin Lake study area from 1938 and 1988 suggests that encroachment occurs very slowly, if at all, along the margins of the pebble plains. The presence of newly established trees in in 1988 photographs was not obvious on pebble plains within the study area. However, in non-pebble plain vegetation "new" trees are conspicuous on these photographs. Monitoring of forest encroachment is needed to assess the impacts of this long-term trend.

Management Actions Completed. The boundaries of both CDFG and USFS lands along Hwy 18 and Holcomb Valley Road were fenced in 1986. On one of the pebble plains on the Lamane-east (U.S.F.S.) parcel a truck track established during wet weather left deep ruts in the surface. Water bars were installed in 1987 to reduce erosion and encourage recontouring of the slope. Unauthorized OHV access from surrounding lands is being limited by U.S.F.S. road closures on Nelson Ridge (in 1988-1989).

Recovery Potential. The effects of changes in hydrology as a result of established roads need to be determined. The desirability of recontouring the surface topography in these areas needs to be assessed. Revegetation of the roads is occurring naturally and is probably adequate to eventually satisfy recovery goals. Species composition of revegetated areas needs to be monitored. At one site on the Lamane-east parcel, a recovering road is heavily populated with matchweed, *Gutierrezia sarothrae*; this species is scarcely present on undisturbed portions of the pebble plain.

Wet Meadow

The listed species associated with wet meadow habitats were addressed individually at the beginning of the section. Other species associated with wet meadow habitats include *Taraxacum californicum* (TACA) and *Poa atropurpurea* (POAT).

Description. Low-lying swales or drainage areas underlain by heavy clay soils. These areas collect precipitation and runoff from surrounding slopes and drainages. They are generally vernally wet but may have persistent soil moisture into the summer in wet years. Dominants include various rushes (Juncus spp.), sedges (*Carex* spp.), spike-rush (*Eleocharis* spp.) and Missouri iris.

Distribution. Wet meadow habitats are present in the Big Bear and Holcomb valleys of the Big Bear area. Three of the four rare species are San Bernardino Mountains endemics (SIPE, THST, TACA) and one is a Southern California endemic (POAT). Wet meadow habitat which supports these species has been impacted by development and recreational use in the area. This habitat occurs at less than 15 sites within the Big Bear Ranger District.

Status of Habitat within Reserve. The wet meadow habitat occurs at five sites within the study area. However not all the associated rare species occur at all sites. *Poa atropurpurea* is known from only two of the sites; *Taraxacum californicum* is known at two sites.

Limiting Factors. Wet meadow habitat and the associated rare species occur where heavy clay soils intercept high soil moisture. California dandelion appears to favor sites where the ground is saturated or inundated; it is not found in the drier portions of these wet meadows.

Threats to Habitat/Species. The most significant current threat to wet meadow habitat, specifically where *Taraxacum californicum* occurs, appears to be invasion of the exotic *T. officinale*. This common weed seems to colonize areas previously disturbed by burros, as well as other disturbed ground. Alteration of surface hydrology is a potential threat.

Management Actions Completed. The reduction of general disturbance in the study area was accomplished with the completion of perimeter fencing in 1986. Manual removal of *Taraxacum officinale* from one wet meadow site was accomplished by Tim and Ariel Krantz in 1987.

Recovery Potential. The immediate need for recovery within this habitat is at the California dandelion population near Bluebird Spring (See Figure 8). The prevention of burro access and removal of common dandelion (and any hybrids which may be present) must be accomplished prior to recovery efforts. Evaluation of the need for enhancement of wet meadow species should follow completion of these efforts.

Vernal Creek

Description. Vernal creeks/drainage areas are drainages that flow only intermittently that are underlain by heavy clay soils. These annual creeks or drainages may be similar to wet

meadows and some rare plant species occur in both habitats. Vernal creeks are distinguished by the rare species they support, including *Mimulus exiguus*, *Mimulus purpureus*, and *Orthocarpus lasiorhynchus*. Within the study area, the vernal creek habitat occurs in a drainage on the Starland (TNC) parcel. This drainage is deeper and more sparsely vegetated than the typical wet meadow drainages. These drainages appear to be subject to a much greater degree of scouring during flooding events than drainages which support wet meadow vegetation.

Distribution. Vernal creeks or drainages which support rare plant habitat are very limited in occurrence within the Big Bear Basin. They tend to be associated with pebble plains, so are subject to similar disturbance factors. Other good examples of this habitat occur at Castle Glen (TNC) on the south side of Big Bear Lake, Eagle Point (TNC), a remnant wet meadow on the south side of Big Bear Lake, and Upper Sugarloaf (U.S.F.S.), a series of pebble plains on the north-facing slope of Sugarloaf Mountain.

Status of Habitat on Reserve. The primary habitat for vernal creek species occurs in a shallow drainage on the Starland tract. Two other local occurrences of *Mimulus exiguus* have been documented: one on CDFG land near Hwy 18 and another on the "Cemetary" parcel (see Figure 8).

Limiting Factors. This habitat is limited by the presence of adequate precipitation/runoff and heavy clay soils. The species are sensitive to annual variations in water availability; most of the species were observed in very low numbers (*Mimulus purpureus*, *Orthocarpus lasiorhynchus*) or not at all (*Mimulus exiguus*) in 1988 and 1989.

Management Actions Completed. No specific management actions have been taken to protect this habitat. Access to the drainage on the Starland parcel is unrestricted from U.S.F.S. road 3N02 and Holcomb Valley Road. One population of eye-strain monkey-flower occurs on private, unprotected land.

SPECIES MANAGEMENT GOALS

Bird-footed Checkerbloom (*Sidalcea pedata*)
Slender-petaled Thelypodium (*Thelypodium stenopetalum*)

The ultimate goal of the management program for the Baldwin Lake CDFG property and adjacent lands is to insure the continued survival of the rare plant and animal species present there.

1. Maintain Viable Populations of Rare Species. This goal is the ultimate purpose behind the management of the study area. Because of the size and configuration of the lands within this unit, the goal must also be applied to management of surrounding lands.

2. Maintain Current Hydrologic Conditions to Support Rare Plant Habitat. Alteration of current hydrologic conditions would seriously impact the survival of rare species.

3. Protect Populations of Rare Species From Negative Impacts. The potential for damage from human activities or exotic species must be considered in protection efforts.

4. Gain More Thorough Understanding of Rare Species Biology/Ecological Requirements. Without baseline information on the population status and ecology (vigor, demography, habitat requirements, survivorship) of these species there is no basis for evaluating the success of management practices.

5. Evaluate the Need for Enhancement of Populations of Rare Species. The potential for increasing the population densities of rare species must be consistent with other management goals. Attainment of the previous three goals is necessary before enhancement efforts can be successful.

6. Establish Protection Strategy for the Reserve and Surrounding Lands. The cooperative nature of the management effort at this site requires the participation of all agencies in formulating a protection strategy for the study area.

Unarmored Three-spined stickleback
(*Gasterosteus aculeatus* ssp. *williamsoni*)

Until the potential for establishing a permanent high water level in Baldwin Lake has been determined, the management goals for the unarmored three-spined stickleback are limited to strategies during periods when this animal occupies the north end of Baldwin Lake, during wet periods resulting from natural precipitation.

1. Maintain Viable Population of Species. This goal will apply to management actions undertaken during high water periods to insure survival of this species.

2. Determine Baseline Data for Population. Estimates of the population of this species during periods of occupation of north Baldwin Lake are needed to monitor population trends for the long-term.

3. Maintain and/or Enhance the Nest Habitat for Species. A significant aspect of protection for this species is the success of nesting. Protection of nest habitat is an important part of this goal.

HABITAT/SPECIES MANAGEMENT GOALS

Pebble Plain

The management goals for the pebble plains are focused on the protection of the rare species associated with this habitat.

1. Maintain Viable Populations of Featured Species. This goal is the ultimate management concern; it must also be applied to surrounding lands where rare species may occur. Other more specific goals listed below are required for attainment of this goal.

2. Insure Protection of Rare Plant Habitats from Disturbance. The most significant impacts, from vehicle access have been controlled. Assessment and prevention of other impacts is needed. For example, the impact of wild burros on pebble plains is not obvious but should be evaluated over the long-term.

3. Develop Baseline Data for Populations of Featured Species. The need for a monitoring plan focusing on endemic species is essential. The data gathered in the initial years will be useful to describe typical species composition, density, and viability for rare species. The necessity of some management actions can be better determined once this baseline data is available.

4. Enhance Public Awareness and Appreciation of Habitat. The development of interpretive programs is essential to long-term protection of habitat. Interpretive uses must be designed to minimize impacts to rare species; potential impact should be monitored.

5. Establish Protection Strategy for Habitat. The cooperative nature of the management effort at this site requires the participation of all agencies in formulating a protection strategy for the study area.

6. Evaluate Need for Enhancement of Populations of Featured Species. Restoration of disturbed areas should be addressed under this goal. Determination of minimum viable population size should also be addressed.

Wet Meadow

The management goals for wet meadow habitat are identical to those stated for *Sidalcea pedata* and *Thelypodium stenopetalum* (page 41). The specific objectives used to accomplish these goals vary depending on the species involved and local disturbance factors. These objectives are delineated in the following section "Area Management Objectives".

Vernal Creek

The management goals for the vernal creek habitat and associated rare species are essentially identical to those for wet meadow habitats.

1. Maintain Viable Populations of Featured Species. This is the ultimate goal for management of this habitat. Other more specific goals listed below are required for attainment of this goal.

2. Maintain Current Hydrologic Conditions to Support Rare Plant Habitat. Alteration of current hydrologic conditions would seriously impact the survival of rare plant species.

3. Protect Populations of Rare Species from Negative Impacts. This goal includes all protection measures from acquisition of relevant properties to fencing to exclude vehicles.

4. Determine Baseline Data for Rare Species. The development of a monitoring program for rare species will allow evaluation of the success of management practices.

5. Evaluate the Need for Enhancement of Populations of Rare Species. Development of a monitoring program to assess potential impacts/population declines is an important aspect of this goal.

6. Establish Protection Strategy for the Reserve and Surrounding Lands. Though this habitat does not occur on the CDFG lands, the cooperative nature of the management effort at this site requires the participation of all agencies in formulating a protection strategy for the study area.

PART III: AREA MANAGEMENT OBJECTIVES

This section presents a discussion of the objectives and actions for accomplishing the species management goals put forth in Part II. The biological, physical, administrative, and financial implications of these objectives are also described. The attainment of goals and objectives through the cooperative effort of the participating agencies is delineated. The need for staff participation and financial support of management programs is included in the context of a cooperative effort. Specific objectives are defined in the following areas: Assessment and Monitoring objectives, including those necessary to evaluate management needs/techniques; Protection objectives, including acquisition, interpretive, and regulatory needs; Manipulation objectives, including restoration and control of exotic species. Table 6 lists the major species management goals for the featured species and habitats of the study area and the principal objectives needed to meet these goals.

ASSESSMENT OBJECTIVES

1. Inventory listed/sensitive plant and animal species to determine population status and map distribution.

The most basic assessment need with respect to management is the inventory and documentation of listed/rare species status and distribution within the study area. Most of the inventory and mapping of featured species and habitats was completed in the preparation of this plan. The results of the inventory were presented in Part I. However, because the seasons in 1988 and 1989 were very dry, a number of species were absent and many species were under-represented. Additional inventory and mapping of plant species is called for in future wet years.

2. Develop long-term monitoring program for listed/sensitive species.

The implementation of a monitoring program for the study area will involve several components which focus on three basic management objectives. The first objective is to establish a baseline of data on annual variation in rare species populations to assess trends. These baseline data can also be used to evaluate the effectiveness of management actions and future impacts on populations of rare species.

A second monitoring objective is to document the effects of disturbance and track the recovery of disturbed areas. Nearly all of the roads which cross pebble plains have been closed or will be closed by the end of 1989. Monitoring of the natural revegetation of these roads is needed to document the species composition and rate of recovery. Qualitative observations of pebble plains during the 1988 season suggest that, at least in areas where the soil profile and surface topography are relatively intact, natural revegetation is sufficient to bring about eventual recovery of the site. Exceptions to this pattern may occur where disturbance has resulted in total devegetation of the pebble plain and subsequent disturbance of surface topography. In some cases, recontouring may be necessary to restore natural hydrologic conditions. This is likely for the largest pebble plain on the Lamane-

east parcel (see Figure 3), where deep ruts have altered the concentration of seasonal runoff. Water bars have been installed at this site.

Another recommendation for monitoring on the study area is to track the recovery of wet meadow habitat impacted by human and burro trails. Following relocation of these trails, monitoring would provide data to evaluate the natural recovery of the vegetation and possible need for enhancement of rare plant populations.

A third objective, and one that is not a high priority at the present time, involves monitoring the invasion of trees and shrubs on the pebble plains. Preliminary evidence from aerial photographs suggests that this may not be a significant concern.

An outline of a monitoring plan, including significant questions and suggested methodologies, is included in Appendix II.

3. Determine impacts of burros on rare plant populations/special habitats.

The potential impacts of wild burros on rare species were evaluated in a qualitative manner during the inventory phase of this plan. Some of the impacts are significant enough that they warrant action in terms of protection objectives; these objectives are delineated in the following section. For these cases, including impacts on habitat for two species, *Thelypodium stenopetalum* and *Taraxacum californicum*, assessment objectives include monitoring the effectiveness of management actions.

In the case of burro activity on pebble plains, the impacts are less clear. For this habitat, determination of the impacts of burros would involve short-term research using exclosures. Barbed wire exclosures, designed to prohibit entry by burros but not by other grazing animals (e.g. deer) can be erected on the pebble plains and sampled over time. With a proper experimental design, including control plots and replicate samples, the impact of burro activity can be determined. However, based on qualitative observations and comparison with other pebble plains, the impacts of burros do not appear significant for this habitat.

Table 7. Summary of primary species management goals for the proposed Baldwin Lake Ecological Reserve and adjacent lands within the study area and the principal objectives needed to achieve each goal.

Management Goal	Objectives and Actions
Maintain Hydrologic Conditions	
Sidalcea pedata *Thelypodium stenopetalum*	* Determine strategy for protection/ acquisition of the "cemetary" parcel * Determine impact of burros on wet meadow habitat
Taraxacum californicum	* Control burro access to Bluebird Spring * Determine impact of burros on spring * Determine future status of artesian well along edge of Baldwin Lake
Wet Meadow Habitat	* Determine strategy for protection/ acquisition of the "cemetary" parcel * Determine impact of burros on wet meadow habitat
Vernal Creek	* Develop "cooperative management agreement" for U.S.F.S. and TNC lands which control drainage
Protect Populations from Negative Impacts	
Sidalcea pedata	* Determine strategy for protection/ acquisition of the "cemetary" parcel * Determine impacts/possible grazing by burros * Post and sign southern boundary of Reserve * Develop an interpretive program
Thelypodium stenopetalum	* Control burro access/trampling in habitat * Relocate visitor trail which is now through habitat * Determine strategy for protection/ acquisition of "cemetary" parcel * Post and sign southern boundary of Reserve * Determine impacts of burros. * Develop an interpretive program

Table 7 (continued)

Management Goal	Objectives and Actions
Pebble Plain	* Determine strategy for protection/ acquisition of "cemetary" parcel * Support closure of Nelson Ridge Rd. by U.S.F.S. * Establish cooperative patrolling program with CDFG, TNC, and USFS personnel * Determine impacts of burros * Develop interpretive program
Wet Meadow	* Determine strategy for protection/ acquisition of "cemetary" parcel * Establish cooperative patrolling program with CDFG, USFS, TNC * Control *Taraxacum officinale* population at Bluebird Spring and elsewhere * Develop an interpretive program
Vernal Creek	* Fence access to Starland Creek at Union Flat road * Establish cooperative patrolling program * Develop an interpretive program.
Determine Baseline Data	
All Rare Species/Habitats	* Inventory listed/sensitive plant & animal species for population status/distribution * Develop long-term monitoring program * Determine impacts of burros/exotic plants
Establish Protection Strategy	
Sidalcea pedata	* Develop strategy for protection of "cemetary" parcel * Develop "cooperative management agreement" between CDFG, TNC, and USFS
Thelypodium stenopetalum	* Determine strategy for protection of "cemetary" parcel * Develop "cooperative management agreement" between CDFG, TNC, and USFS
Taraxacum californicum	* Develop "cooperative management agreement" between CDFG, TNC, and USFS
All Rare Habitats	* Determine strategy for protection of "cemetary" parcel * Develop "cooperative management agreement" between CDFG, TNC, and USFS

4. Determine threats posed by exotic plant species to rare plants/special habitats.

Two exotic plant species were described as potential threats to the rare species. The first of these, *Taraxacum officinale*, is a weedy species which colonizes wet areas which is habitat for the native *Taraxacum californicum*. *T. officinale* is invasive and appears to compete for space with the native dandelion. Because this species is so invasive, control of its population is included as a management objective. Assessment and monitoring of the effectiveness of removal of this species is needed as a follow-up.

Two other issues are relevant to determination of threats to the native dandelion from its introduced relative. The first of these is the evidence of hybridization between the two *Taraxacum* species; several potential hybrids were observed during the 1988 season; hybrids exhibit intermediate characteristics between the two species, although no formal description of the hybrids has been published. The primary objective should be to remove *Taraxacum officinale* (and all hybrids) from the area. However, to assess the hybridization problem, an annual count of the number of hybrid individuals in the population should be made. A possible research question would involve the extent of this hybridization within the range of the species. For the purposes of monitoring, the number of hybrid individuals in the Bluebird Spring population should be counted annually.

A second question with respect to the common dandelion is the extent to which burro activity favors this species. Burros tend to trample and scrape in spring areas. Qualitative observations suggest that *T. officinale* colonizes the open ground created by burro activity. However, more information is required to address this question. A burro exclosure designed to exclude burros but not native grazing animals, such as deer (Blymyer 1988), is proposed. The recommended specifications are for a four-strand barbed wire fence with smooth wires on the top and bottom. The lowermost wire is 20" from the ground, the second wire 35" from the ground, the third wire 39 inches from the ground (it is important to have no more than 4" spacing on the upper wires to prevent strangulation) and the upper wire 43" from the ground (Helvie 1971). An exclosure of 5 to 10 square meters is appropriate; an adjacent area should be designated as a control. Within the exclosure five to six square meter plots can be sampled in a randomized block design (Zar 1984) for density of the two dandelion species; the same sample layout will be used in the control area.

The other weedy species of concern is the Russian olive, *Elaeagnus angustifolia*. This species does not appear to be spreading on the site; however, counts of the number of individuals and a survey for seedlings should be conducted annually.

PROTECTION OBJECTIVES

1. Determine strategy for protection of the "Cemetary" Parcel.

This property includes habitat for several rare species and influences the drainage into wet meadow habitat for two endangered plants on CDFG lands. Protection of this property is important to prevent development or other activity that would alter the hydrologic regime. The current owners of the property have demonstrated some hostility toward the cause of endangered species protection. Possible alternatives for protecting this property include acquisition by the U.S.F.S, acquisition by TNC, a landowner agreement or conservation easement, and acquisition involving Proposition 70 (State Parks and Wildlife Bond Act of 1988) funds. At the present time, the Nature Conservancy and the U.S. Forest Service are making preliminary inquiries regarding acquisition (Stephenson 1988, Neel 1988). The precise boundaries of the CDFG lands should be also determined; there is uncertainty as to the location of the boundary between the "cemetary" parcel and CDFG lands along the primary drainage from Bluebird Spring.

2. Complete "Ecological Reserve" designation for CDFG property.

Official designation of the CDFG Baldwin Lake lands as an Ecological Reserve has yet to be finalized. This designation is important for several reasons. The designation gives the land official protection status, subject to the rules and regulations of the Department. The designation also gives the local game warden law enforcement capabilities with respect to issuing citations for violation of the State Fish and Game Code. The designation also gives the property official recognition within the public sector which enhances the effectiveness of interpretive and enforcement programs.

Official designation of the Baldwin Lake CDFG lands as a reserve was initiated in April 1989. The final designation should be completed by the end of 1989 (Gronholdt 1989).

3. Develop cooperative patrolling plan.

The successful implementation of some of the protection measures described herein will depend on patrolling and management of incidents of trespass, vandalism etc. At present the CDFG game warden is responsible for the Baldwin Lake Reserve lands. U.S.F.S. rangers patrol the federal lands. The TNC preserve manager has maintained fences and informed trespassers of the significance of the area. Ideally, a cooperative patrolling program could be developed. This program would give the TNC manager authority to call the CDFG warden or USFS ranger when an incident occurs. An incident report form could be developed to track the kinds of incidents that occur, potential problem areas, and appropriate responses.

4. Develop "Cooperative Management Agreement" for study area, to include California Department of Fish and Game, U.S. Forest Service, and Nature Conservancy lands.

The contiguous nature of the lands within the study area and the distribution of rare plant species are conducive to a cooperative management program involving all three

agencies. A cooperative spirit has already developed with regard to accomplishing management goals and a de facto cooperative relationship has existed at the site for the last five years.

Still, an official management agreement is called for which would delineate responsibilities of the participating agencies. This agreement could also be used to establish responsibilities for implementation costs of this management plan.

5. Determine appropriate policy for hunting on Baldwin Lake.

Baldwin Lake has been used as a waterfowl hunting area during years when the water level is adequate to support these wildlife. Consumptive uses such as hunting are permitted on ecological reserves; the policy with respect to hunting is dependent on the most appropriate use and protection of primary resources at the individual reserve in question. Several aspects of the hunting issue have been the subject of concern. In the past, local residents complained about hunting on the Lake and asked the Department to disallow it; the Department responded by strictly limiting hunting on Baldwin Lake to two days a week by permit only (Coelho 1988). Another concern with regard to hunting is the use of lead shot which poses a potential negative impact on bald eagles that roost around the lake and might feed on contaminated waterfowl. Positive control measures have been taken to limit the impacts of hunting including the two-day a week limit and a regulation that permits hunting only from boats. Disallowing hunting on the site might result in an increase in poaching violations (Coelho 1988). A ban on the use of lead shot on Baldwin Lake would insure protection of Bald Eagles and other predators and should be instituted.

6. Develop an interpretive program to inform visitors of resource values and minimize impacts on rare species.

Education of the public regarding the natural resource values on the study area is an effective way to reduce negative impacts such as trespassing and vandalism. The installation of a large interpretive sign or kiosk, one or more interpretive trails and the development of a trail brochure are all suitable components of an interpretive program. An existing facility, the so-called "horse house" would function well as a meeting place and take-off point for trails. A plan to improve the house has been prepared by the Nature Conservancy's Preserve Caretaker; a copy of the proposed restoration plan is included in Appendix III (Stephenson 1988). This improvement plan has been approved by regional CDFG personnel. The repair and improvement process was begun in March 1989 and is proceeding well. The cost of the basic restoration has been estimated at between $2,000 and $3,000; the Friends of the Big Bear Valley Preserve is prepared to provide some, if not all, of the necessary financial support.

Development of an interpretive program must be based on the minimization of impacts to rare species. The existing trail on the east side of Hwy 18 (Figure 15) should be rerouted to avoid the *Sidalcea/Thelypodium* habitat. This trail can be moved to the south side of the drainage, allowing access to the rare plant habitat for viewing but reducing the trampling of sensitive habitat. An existing trail is already present which could begin directly across the street from the horse house and pass through sagebrush scrub in a non-sensitive area (Figure 16). Relocation of the pedestrian pass-through in the fence would also be necessary. The present pass-through should be removed to discourage burro use of this

trail. An additional barrier could also be erected at the edge of the small drainage where a burro trail currently exists through the wet meadow habitat (Figure 17).

A suitable interpretive trail could follow existing roads behind the "horse house" to loop around the pebble plain (Figure 15); signs and plant labels could be installed along the route. A self-guiding trail brochure would guide the visitor through the wonders of the pebble plain world. The potential for cooperative development of a trail brochure is excellent; all parties are enthusiastic about the idea. A preliminary trail route and potential interpretive stops were determined in a field meeting with U.S.F.S and TNC personnel in August 1988.

7. Post and sign the southern boundary of the Reserve lands to control trespass.

The southern boundary of the CDFG lands is the only unrestricted access point for vehicles on the east side of Hwy 18. When it is dry, Baldwin Lake is an attractive site for OHV and four-wheel drive enthusiasts. Trespass onto CDFG lands is illegal but not controlled at present. No trespassing signs, with additional language about the sensitive nature of the habitat, need to be installed along the southern boundary; posting would also be a good idea along the eastern boundary. This posting would greatly facilitate enforcement of the restrictions as it would give the warden legal authority to cite trespassers from the State Penal Code (Section 602.m).

8. Contact utilities, military personnel to ask cooperation in reducing vehicle access on pebble plains.

Powerline access roads are used routinely by utilities personnel for maintenance purposes. Military personnel also have used the area as part of training exercises. These individuals need to be informed of the sensitive plant habitat in the area.
A list of contacts is given in Appendix V.

MANIPULATION OBJECTIVES

1. Implement control measures for exotic plant species.

The common dandelion, *Taraxacum officinale* is such an invasive weed that efforts to control its spread should be implemented as soon as possible. An initial effort to reduce the population was carried out in 1988 when 700-800 plants were manually removed from the site (Krantz 1988). The remainder of the plants could be removed manually by a team of agency personnel and volunteers in 1989. Subsequent monitoring of the success of this method is a necessary component of this objective.

2. Implement measures to control wild burro access to rare plant habitat.

Burro trampling of rare plant habitat is a serious concern at two locations: 1) the *Thelypodium stenopetalum* habitat on CDFG land near Baldwin Lake; 2) the *Taraxacum californicum* habitat at Bluebird Spring on the Lamane-east property. At the first location an attempt to control burro access will involve relocation of the trail and fence pass-through as described in Protection Objective #5 above. If this is ineffective, fencing the sensitive habitat can be considered.

At Bluebird Spring, an exclosure experiment to test the impacts of burro activity on the relative dominance of the dandelion species is described in Assessment Objective #3; this experimental exclosure will also effectively protect at least part of the *Taraxacum californicum* population. Complete exclosure of the spring is another protection option.

3. Develop strategy for control of burro population if necessary.

Assessment and protection objectives with respect to burro populations are aimed at describing and controlling burro impacts within the study area. The U.S. Forest Service, Big Bear Ranger District carried out a burro census (Malachek 1988) in early 1989. They are currently reevaluating the burro management program. Populations of this exotic species are not to exceed 60 animals on the district. Estimates of their present numbers range from 120 to 300 animals.

The location of burro exclosures, trail barriers, signs, and other items described in the protection and manipulation objectives are shown in Figure 16.

Baldwin Lake Ecological Reserve

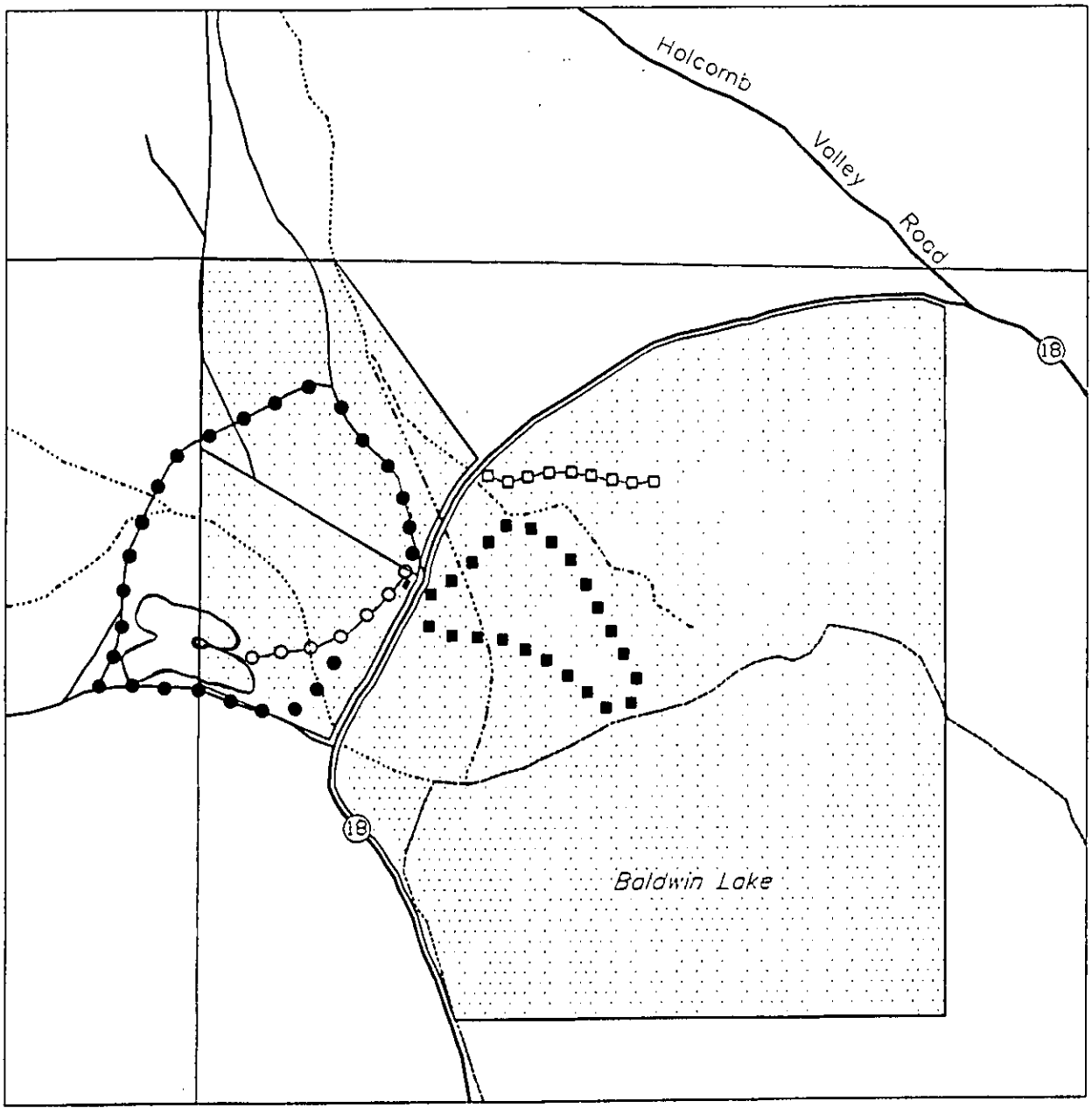

Figure 15. Location of existing trail and proposed location of new interpretive trails for the Baldwin Lake Ecological Reserve and adjacent study area.

□—□—□ = Existing Trail (to be closed)

●—●—●—● = Proposed Interpretive Loop Trail: Pebble Plain

○—○—○—○ = Proposed Short Interpretive Trail: Pebble Plain

■ ■ ■ ■ = Proposed Interpretive Loop Trail: Wet Meadow

Baldwin Lake Ecological Reserve

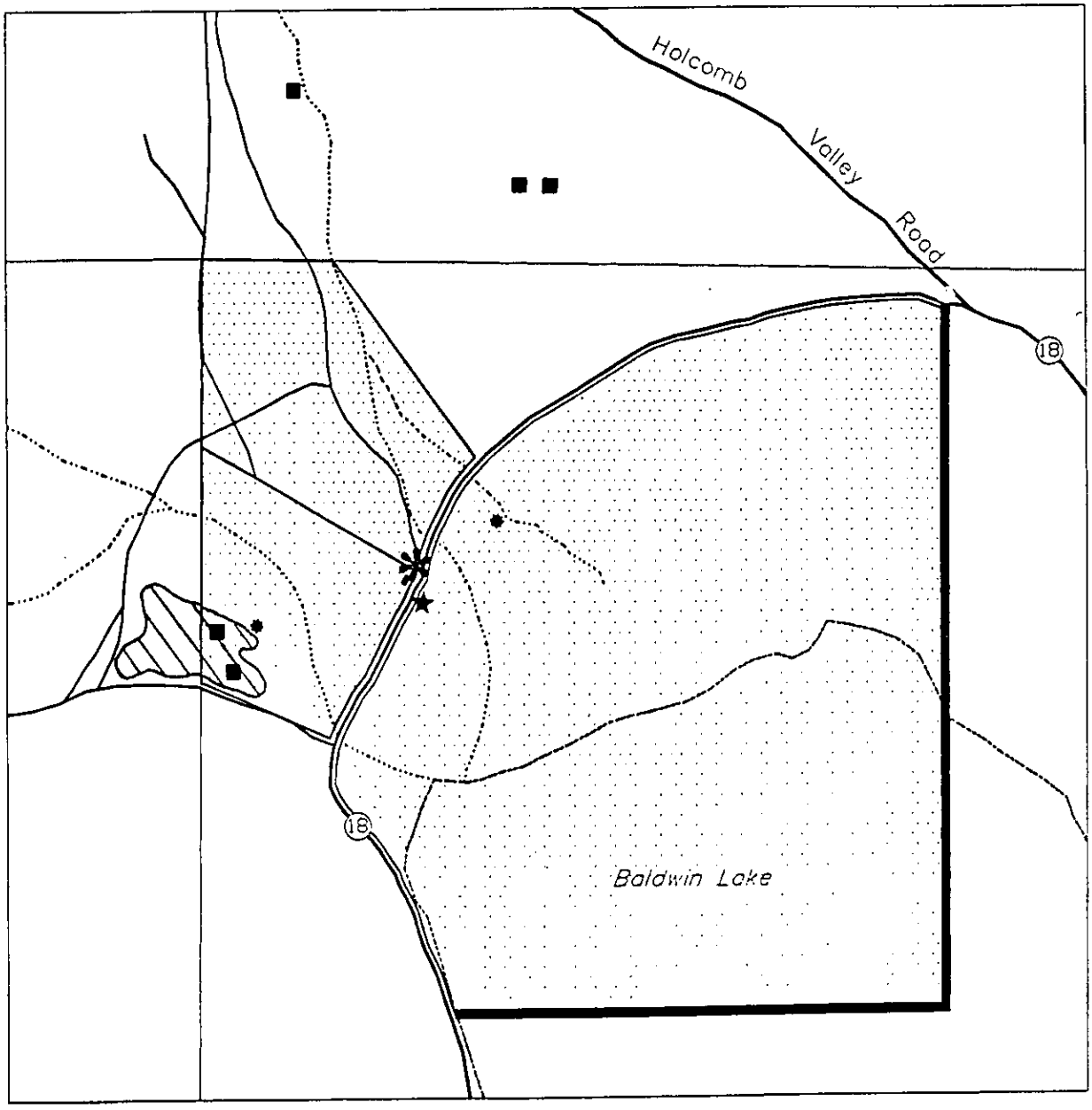

Figure 16. Location of recommended implementation actions for the proposed Baldwin Lake Ecological Reserve and adjacent lands. Map is from USGS 7.5' Big Bear City quad, enlarged to scale = 1:18,000.

- ● = Trail Barrier
- ■ = Burrow Exclosure
- ★ = Pedestrian Pass-through
- ✱ = Interpretive Sign
- ▬ = Post and Sign Boundary

N

0 1000

Feet

PART IV: OPERATIONS AND MAINTENANCE PLAN

This section details, in tabular format, the operations and maintenance jobs required to fulfill the area objectives. This plan includes those jobs required to attain species management goals, as well as recommended jobs for maintenance of the area. Each job is given a priority rank from 1 to 3 with 1 being the highest priority. Tables 8 and 9 includes costs associated with protection actions for the study area.

ACTION	PRIORITY	RESPONSIBLE AGENCY	LABOR SOURCE
I. Legal and Regulatory Requirements.			
A. Department of Fish and Game Policies			
1. Ecological Reserve designation	1	CDFG	CDFG
a. gives Warden enforcement authority			
b. in progress by regional CDFG staff			
2. Hunting policy	2	CDFG	-
a. recommend prohibition of lead shot			
b. does not impact rare plant habitat			
c. precedent for waterfowl hunting			
B. Applicable city/county ordinances			
1. Hunting regulated by local ordinance			
a. permitted on Wednesdays, Saturdays (by CDFG permit) to reduce conflict with residential areas.			
C. Hazardous areas requiring restricted access			
1. Doble Mine Posting	1	USFS	USFS/ TNC
a. requires posting to warn of hazard			
D. Attractive nuisances/potential liabilities			
1. Doble Mine Hazard	1	USFS	-
E. Handicap access requirements			
1. provide access to "horse house" with interpretive sign there.	2	CDFG	TNC/ Vol.
F. Cooperative Management Agreement	1	CDFG	-
1. Determine regulatory requirements for each agency involved		TNC USFS	
a. Cooperative patrolling	2		ALL
b. Cooperative interpretive program	1		TNC/
c. Involve Friends of Big Bear Valley Preserves, volunteers.			USFS/ Vol.
II. Non-biological Considerations.			
A. Stabilization of Baldwin Lake level	3		
1. Lake level fluctuates naturally from wet to dry.			
2. No current source of water to stabilize.			
3. Big Bear City Community Services District is lead agency.			

ACTION	PRIORITY	RESPONSIBLE AGENCY	LABOR SOURCE
B. Removal of debris dumps from CDFG property	3	CDFG	Vol.
1. Area used as dump site by public			
III. O & M Jobs required to fulfill Objectives			
A. Water allocation			
1. Secure control of "Cemetary" parcel	1	TNC/CDFG	
a. Acquisition at estimated $70,000 (owner asking $275,000).		USFS?	
b. Availability of Prop. 70 funds?			
c. Determine correct boundary line	1	CDFG	
2. Determine status of artesian well	2	CDFG	
B. Exotic plant/animal control			
1. Implement control of Wild Burros	1	CDFG/USFS	TNC/
a. Reroute trail in THST habitat			Vol.
b. Barriers in wet meadow habitat		"	"
c. Establish/monitor exclosure at Bluebird Spring		USFS	USFS/
2. Determine impacts on rare plant habitat	1	USFS/TNC	TNC/
a. Establish exclosures on pebble plains	2		Vol.
3. Common Dandelion (*Taraxacum officinale*)			
a. Implement control by hand removal	1	USFS	Vol.
b. Monitor effectiveness on annual basis			
4. Russian Olive (*Elaeagnus angustifolia*)			
a. No need for control at present	3	CDFG	
b. Monitor population status annually	1		Vol.
C. Administration of Public Use			
1. Design and posting of signs to inform public of special habitat	1	CDFG	TNC/ USFS
a. Determine whether signs should reflect cooperative management of area.			
b. Develop incident reporting form	2	ALL	
2. Development of interpretive facility	2	CDFG	Vol.
a. Plan to restore "horse house" submitted to CDFG			
b. Determine maintenance needs			
3. Trail construction/maintenance	2	CDFG/ USFS	Vol.
a. Minimize impacts to rare plants			
4. Develop cooperative plan for staffing/volunteer support	2	ALL	Vol.
D. Monitoring Program			
1. Develop monitoring plan	1	TNC USFS	Vol.
a. long term trends in populations			
b. recovery from disturbance			
c. cooperative plan for implementation			
E. Habitat improvement			
1. Evaluate need for revegetation on roads, trails (may also require recontouring)	2	ALL	Vol.
2. Management of successional states	3	ALL	
a. evidence of invasion of pebble plains by trees?			

Table 8. Summary of actions and costs for implementation of species management goals on the proposed Baldwin Lake Ecological Reserve and adjacent lands. Estimated person days are listed (in parentheses under personnel column) for actions involving CDFG, USFS, and TNC personnel. An asterisk (*) denotes actions that can be completed with the assistance of volunteers. FBBVP = Friends of the Big Bear Valley Preserves. An itemization of materials and costs used to develop these figures is given in Appendix IV.

Action	Priority	Personnel	Comments	Estimated Cost
Post and sign South and east boundaries of CDFG lands.	1	CDFG/TNC(1)	One-time	$ 500
Reroute trail away from THST habitat	1	CDFG/* (1)	One-time	$ 50
Install protective barriers in rare plant habitat	1	CDFG/TNC (1)	One-time	$ 50
Establish burro exclosure at Bluebird Spring	1	USFS/TNC/* (1)	Annual Monitoring	$ [300]
Design & Install interpretive sign/kiosk at "Horse house"	1	CDFG/TNC (7)	One-time	$ 3,700
Prepare interpretive brochure	2	USFS/TNC/ CDFG/*(14)	Design & layout by USFS/TNC	$ 2,500
Develop interpretive trail system	2 2	USFS/TNC/ CDFG/* (7)	Existing trails can be used	$ 350
Establish experimental burro exclosures in pebble plains	3	USFS/TNC/ CDFG/* (2)	Install & monitor annually	$ 300
Implement long-term monitoring plan	1	Contract/*	Annual for 2 yrs. then every 5 yrs	$ 3,000
Complete restoration of "Horse house"	3	FBBVP/TNC	Will take 3 months	$[2,000]
SUMMARY OF ESTIMATED IMPLEMENTATION COSTS[1]				$10,450

[1] = Summary cost estimate includes only those costs incurred by the California Department of Fish and Game; costs to other agencies or organizations are shown in brackets.

Table 9. Summary of actions and costs for protection of the proposed Baldwin Lake Ecological Reserve and adjacent lands. Estimated person days are listed for actions involving CDFG, USFS, and TNC personnel.

Action	Personnel	Comments	Annual Cost	One-time Cost
Secure watershed for SIPE/THST habitat by protection of "Cemetary" parcel	TNC/CDFG USFS	14 acres @ FMV $5,000/acre		$70,000
Develop Cooperative Management Agreement	CDFG/USFS/ TNC	Coordinate plans with each agency		$??
Patrol Baldwin Lake Ecological Reserve area to control illegal trespass	CDFG/USFS/ TNC (12)	One person, 4 hours, bimonthly	$2,400	
Maintain fences	TNC	One person, 4 hours, monthly	$1,200	
Maintain horse house facilities	TNC/CDFG	One person, 4 hours, monthly	$1,200	
Fence vernal annual creek habitat on Starland parcel	TNC/USFS	Proposed as part of Arrastre/Union Flat road closure	(USFS)	
SUMMARY OF ESTIMATED PROTECTION COSTS			$4,800	$70,000

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APPENDIX I. List of plant species for the Baldwin Lake study area. This list was prepared by Tim Krantz (1986) for a volunteer docent training booklet published by Friends of the Big Bear Valley Preserves. It represents the most complete plant list available for the study area.

A Species Checklist for the
Flora of the North Baldwin Lake Botanical Area

CUPRESSACEAE

Juniperus occidentalis ssp. australis - - western juniper

PINACEAE

Pinus jeffreyi - - - - - - - - - - - - - - Jeffrey pine

Pinus monophylla - - - - - - - - - - - - - pinyon pine

EPHEDRACEAE

Ephedra viridis - - - - - - - - - - - - - - green mormon tea

APIACEAE

Lomatium nevadense var. parishii - - - - Parish's lomatium
(tauschia parishii?)

AMARANTHACEAE

Amaranthus albus - - - - - - - - - - - - - white amaranth

Amaranthus californicus - - - - - - - - - California amaranth

ASTERACEAE

Achillea millefolium - - - - - - - - - - - common yarrow

Agoseris heterophylla - - - - - - - - - - annual agoseris

Agoseris retrorsa - - - - - - - - - - - - - spear-leaved agoseris

Antennaria dimorpha - - - - - - - - - - - low everlasting

Artemisia biennis - - - - - - - - - - - - - biennial sagewort

Artemisia dracunculus - - - - - - - - - - taragon sagebrush

Artemisia ludoviciana - - - - - - - - - - western mugwort

Artemisia nova - - - - - - - - - - - - - - dwarf sagebrush

Artemisia tridentata - - - - - - - - - - great basin sage

Aster adscendens - - - - - - - - - - - - - long leaf aster

Aster frondosus - - - - - - - - - - - - - - short-rayed alkali aster

ASTERACEAE (continued)

Aster occidentalis - - - - - - - - - - - - western mountain aster

Chaenactis santolinoides - - - - - - - - - santolina chaenactis

Chrysothamnus parryi - - - - - - - - - - - Parry's rabbit-brush

Chrysothamnus nauseosus - - - - - - - - - - common rabbit-brush

Chrysothamnus viscidiflorus - - - - - - - - sticky-leaved rabbit-brush

Cirsium tioganum - - - - - - - - - - - - - leafy thistle

Cirsium occidentale - - - - - - - - - - - - cobweb thistle

Conyza canadensis - - - - - - - - - - - - - mare's tail

Crepis occidentalis - - - - - - - - - - - - western hawk's beard

Erigeron aphanactis - - - - - - - - - - - - basin rayless daisy

Erigeron breweri ssp. *porphyreticus* - - - Brewer's daisy

Erigeron divergens - - - - - - - - - - - - diffuse daisy

Eriophyllum confertiflorum - - - - - - - - yellow yarrow

Gaillardia pulchella - - - - - - - - - - - blanket flower

Gnaphalium chilense - - - - - - - - - - - - cotton-batting plant

Gnaphalium palustre - - - - - - - - - - - - lowland cudweed

Gutierrezia sarothrae - - - - - - - - - - - common matchweed

Haplopappus linearifolius - - - - - - - - - golden aster shrub

Hemizonia ramosissima - - - - - - - - - - - slender tarweed

Hymenopappus filifolius - - - - - - - - - - columbia cutleaf

Iva axillaris - - - - - - - - - - - - - - - poverty weed

Lactuca serriola - - - - - - - - - - - - - prickly lettuce

Layia glandulosa - - - - - - - - - - - - - white layia

Lessingia glandulifera - - - - - - - - - - valley lessingia

Machaeranthera canescens - - - - - - - - - hoary aster

Lygodesmia spinosa - - - - - - - - - - - - thorny skeleton-plant

Madia elegans - - - - - - - - - - - - - - - common madia

Matricaria matricarioides - - - - - - - - - pineapple weed

ASTERACEAE (continued)

Microseris linearifolia - - - - - - - - - - uropappus

Psilocarphus brevissimus - - - - - - - - - dwarf woolly-heads

Stephanomeria virgata - - - - - - - - - - - tall stephanomeria

*Taraxacum californicum - - - - - - - - - - California dandelion

Taraxacum officinale - - - - - - - - - - - common dandelion

Tragopogon dubious [acc. Thorne] - - - - - yellow salsify

BORAGINACEAE

Cryptantha jamesii var. abortiva - - - - prostrate oreocarya

Cryptantha micrantha - - - - - - - - - - - prickly cryptantha

Heliotropium curassavicum var. oculatum - seaside heliotrope

Plagiobothrys hispidulus - - - - - - - - - bristly popcorn flower

Plagiobothrys torreyi - - - - - - - - - - - Torrey's popcorn flower

BRASSICACEAE

*Arabis dispar - - - - - - - - - - - - - - - unequal rockcress

Arabis holboellii var. pinetorum - - - - Holboell's rockcress

*Arabis parishii - - - - - - - - - - - - - - Parish's rockcress

Arabis pulchra - - - - - - - - - - - - - - beautiful-rockcress

Brassica campestris - - - - - - - - - - - - field mustard

Caulanthus major - - - - - - - - - - - - - slender wild cabbage

Caulanthus crassicaulis (rptd Parish, 1917) wild cabbage

Descurania obtusa ssp. adenophora - - - - desert tansy-mustard

Descurania pinnata - - - - - - - - - - - - western tansy-mustard

BRASSICACEAE (continued)

Descurania sophia - - - - - - - - - - - - - tansy-mustard

Draba douglasii var. crockeri - - - - - - - Douglas' draba

Erysimum capitatum - - - - - - - - - - - - western wallflower

Hutchinsia procumbens - - - - - - - - - - - prostrate hutchinsia

Lepidium perfoliatum - - - - - - - - - - - round-leaf pepper-grass

Lepidium virginicum - - - - - - - - - - - - wild pepper-grass

Rorippa curvisiliqua - - - - - - - - - - - western yellow-cress

Rorippa nasturtium-aquaticum - - - - - - - water-cress

Sisymbrium altissimum - - - - - - - - - - - tumble mustard

*Thelypodium stenopetalum - - - - - - - - - slender-petaled thelypodium

Thysanocarpus curvipes var. eradiatus - - hairy fringe pod

CACTACEAE

*Echinocereus engelmanii var. munzii - - - hedgehog cactus

Echinocereus triglochidiatus var. mohavensis - mound cactus

Opuntia basilaris - - - - - - - - - - - - - beavertail cactus

Opuntia littoralis var. piercei - - - - - - prickly pear

CAPRIFOLIACEAE

Sambucus caerulea - - - - - - - - - - - - - blue elderberry

Symphoricarpos parishii - - - - - - - - - - Parish's snowberry

CARYOPHYLLACEAE

Arenaria ursina - - - - - - - - - - - - - - bear valley sandwort

Sagina occidentalis - - - - - - - - - - - - western pearlwort

Silene verecunda ssp. platyota - - - - - - cuyamaca campion

Spergularia rubra - - - - - - - - - - - - - purple sand spurry

CHENOPODIACEAE

Atriplex argentea exspansa - - - - - - - - silver salt bush

Atriplex canescens - - - - - - - - - - - - hoary saltbush

Atriplex rosea - - - - - - - - - - - - - - red saltbush

Atriplex truncata - - - - - - - - - - - - truncate saltbush

Chenopodium atrovirens - - - - - - - - - - dark green saltbush

Chenopodium fremontii - - - - - - - - - - - Fremont's goosefoot

Chenopodium glaucum ssp. salinum - - - - oak-leaved goosefoot

Chenopodium leptophyllum - - - - - - - - narrow-leaved goosefoot

Chenopodium rubrum - - - - - - - - - - - red goosefoot

Chenopodium degenerianum ? [acc. Thorne]

Nitrophila occidentalis ? [poss. acc. Thorne] - western nitrophila

Monolepis spathulata (rptd Munz) - - - - club-leaved monolepis

Salsola iberica - - - - - - - - - - - - - - Russian thistle

Salsola paulsenii (rptd Munz) - - - - - - Russian thistle

Suaeda depressa var. depressa - - - - - - Pursh's sea-blite

CONVOLVULACEAE

Calystegia fulcrata - - - - - - - - - - - Sonora morning glory

Cuscuta californica - - - - - - - - - - - California dodder

CRASSULACEAE

Dudleya abramsii - - - - - - - - - - - - Abram's dudleya

ELEAGNACEAE

Eleagnus angustifolia - - - - - - - - - - Russian olive

ERICACEAE

Arctostaphylos patula ssp. platyphylla - greenleaf manzanita

EUPHORBIACEAE

Euphorbia albomarginata	rattlesnake weed
Euphorbia palmeri	wood spurge
Euphorbia serpyllifolia	thyme-leaved spurge

FABACEAE

Amorpha californica	California false indigo
Astragalus douglasii ssp. *parishii*	Douglas' rattleweed
**Astragalus leucolobus*	bear valley woolly-pod
Astragalus purshii var. *lectulus*	Pursh's woolly-pod
Astragalus lentiginosus ssp.	mottled rattleweed
Lotus crassifolius	thick-leaved trefoil
Lotus oblongifolius	narrow-leaved trefoil
Lotus purshianus	Spanish clover
Lotus nevadense	Sierra Nevada trefoil
Lupinus andersonii	Anderson's lupine
Lupinus concinnus	elegant annual lupine
Lupinus confertus	prairie lupine
Lupinus breweri	Brewer's lupine
Lupinus excubitus var. *austromontanum*	interior bush lupine
Melilotus officinalis	yellow sweet clover
Trifolium variegatum	white-tipped clover
Trifolium wormskioldii	cow clover

FAGACEAE

Quercus chrysolepis	canyon live oak
Quercus turbinella?	turban oak

GENTIANACEAE

Frasera parryi - - - - - - - - - - - - - - - Parry's green gentian

GERANIACEAE

Erodium cicutarium - - - - - - - - - - - - red-stem filaree

Geranium richardsonii - - - - - - - - - - - Richardson's geranium

HYDROPHYLLACEAE

Eriodictyon trichocalyx - - - - - - - - - - hairy yerba santa

Nama demissum - - - - - - - - - - - - - - - purple mat

Nemophila menziesii - - - - - - - - - - - - baby blue-eyes

Phacelia austromontana - - - - - - - - - - Mojave phacelia

Phacelia bicolor - - - - - - - - - - - - - two-color phacelia

Phacelia curvipes - - - - - - - - - - - - - Washoe phacelia

Phacelia imbricata - - - - - - - - - - - - imbricate phacelia

Phacelia mohavensis - - - - - - - - - - - - Mojave phacelia

LAMIACEAE

Marrubium vulgare
Salvia pachyphylla - - - - - - - - - - - - rose sage

Salvia columbariae - - - - - - - - - - - - chia

Scutellaria austinae - - - - - - - - - - - Austin's skullcap

Stachys albens - - - - - - - - - - - - - - white hedge nettle

Trichostema micranthum - - - - - - - - - - small-flowered blue-curls

LINACEAE

Linum lewisii - - - - - - - - - - - - - - - western blue flax

LOASACEAE

Mentzelia congesta or aff. to
Mentzelia affinis ? acc Sanders - - - - - hydra stick-leaf

LOSACEAE (continued)

Mentzelia laevicaulis - - - - - - - - - - - blazing star

MALVACEAE

Alcea rosea - - - - - - - - - - - - - - - - hollyhock

Malacothamnus fasciculatus - - - - - - - - mesa malacothamnus

Malacothamnus orbicularis - - - - - - - - - round-leaf malacothamnus

Malva nicaeensis - - - - - - - - - - - - - bull mallow

Sida leprosa var. hederacea - - - - - - - - alkali-mallow

*Sidalcea pedata - - - - - - - - - - - - - bird's foot checker

Sphaeralcea ambigua - - - - - - - - - - - desert mallow

NYCTAGINACEAE

Mirabilis bigelovii - - - - - - - - - - - wishbone bush

ONAGRACEAE

Camissonia pusilla - - - - - - - - - - - - dwarf sun cup

Epilobium adenocaulon - - - - - - - - - - northern willow-herb

Epilobium paniculatum - - - - - - - - - - panicled willow-herb

Gayophytum diffusum - - - - - - - - - - - diffuse gayophytum

Oenothera californica - - - - - - - - - - California evening primrose

Oenothera caespitosa - - - - - - - - - - desert evening primrose

OROBANCHACEAE

Orobanche californica ssp. feudgei - - - California broomrape

Orobanche uniflora ssp. occidentalis - - naked broomrape

PAPAVERACEAE

Argemone munita - - - - - - - - - - - - - prickly poppy

Eschscholtzia californica - - - - - - - - California poppy

PLANTAGINACEAE

Plantago purshii var. oblonga - - - - - - - Pursh's plantain

POLEMONIACEAE

Allophyllum violaceum - - - - - - - - - - violet allophyllum

Eriastrum densifolium - - - - - - - - - - many-leaved eriastrum

Gilia cana - - - - - - - - - - - - - - - - broad-flowered gilia

Linanthus breviculus - - - - - - - - - - Mojave linanthus

*Linanthus killipii - - - - - - - - - - - Killip's linanthus

Microsteris gracilis - - - - - - - - - - slender microsteris

Navarretia breweri - - - - - - - - - - - Brewer's navarretia

Navarretia peninsularis - - - - - - - - - Baja navarretia

Phlox austromontana - - - - - - - - - - - western mountain phlox

Phlox covillei - - - - - - - - - - - - - Coville's phlox

POLYGONACEAE

Chorizanthe watsonii - - - - - - - - - - Watson's spiny herb

Eriogonum davidsonii - - - - - - - - - - Davidson's buckwheat

Eriogonum fasciculatum - - - - - - - - - California buckwheat

*Eriogonum kennedyi ssp. austromontanum -Kennedy's buckwheat

Eriogonum kennedyi ssp. kennedyi - - - - Kennedy's buckwheat

Eriogonum parishii - - - - - - - - - - - Parish's buckwheat

Eriogonum microthecum ssp. corymbosoides -great basin buckwheat

Eriogonum umbellatum ssp. munzii - - - - sulphur flowered buckwheat

Eriogonum wrightii ssp. subscaposum - - - Wright's buckwheat

Polygonum aviculare - - - - - - - - - - - common knotweed

Polygonum ramosissimum - - - - - - - - - yellow-flowered knotweed

Rumex californicus - - - - - - - - - - - willow dock

POLYGONACEAE (continued)

Rumex conglomeratus ? [acc. Thorne] - - - clustered dock

Rumex crispus - - - - - - - - - - - - - - - curly dock

Rumex fueginus - - - - - - - - - - - - - - golden dock

PORTULACACEAE

Calyptridium parryi - - - - - - - - - - - - Parry's pussy-paws

Claytonia perfoliata - - - - - - - - - - - miner's lettuce

Claytonia spathulata - - - - - - - - - - - common montia

Lewisia nevadensis - - - - - - - - - - - - Nevada lewisia

Lewisia rediva var. *minor* - - - - - - - - - bitterroot

Montia fontana ssp. *variabilis* - - - - - water montia

Montiastrum lineare - - - - - - - - - - - - narrow montia

Portulaca oleracea - - - - - - - - - - - - common purslane

PRIMULACEAE

Androsace septentrionalis ssp. *subumbellata* - northern androsace

Dodecatheon [aff. *hendersonii*] - - - - - shooting star

Glaux maritima (rptd in Munz) - - - - - - - sea milkwort

RANUNCULACEAE

Delphinium parishii - - - - - - - - - - - - Parish's larkspur

Myosurus aristatus - - - - - - - - - - - - sedge mouse-tail

Ranunculus aquatilis - - - - - - - - - - - water buttercup

Ranunculus cymbalaria var. *saximontanus* - desert buttercup

Ranunculus californicus var. *austromontanus* - California buttercup

RHAMNACEAE

Ceanothus greggii - - - - - - - - - - - - - desert ceanothus

ROSACEAE

Amelanchier utahensis - - - - - - - - - - - Utah service-berry

Cercocarpus ledifolius - - - - - - - - - - curl-leaf mountain mahogany

Horkelia bolanderi - - - - - - - - - - - - Bolander's horkelia

*Ivesia argyrocoma - - - - - - - - - - - - silver-haired ivesia

Potentilla anserina - - - - - - - - - - - common silverweed

Potentilla biennis - - - - - - - - - - - - biennial cinquefoil

Potentilla gracilis ssp. nuttallii - - - slender cinquefoil

Potentilla pectinisecta - - - - - - - - - sierra cinquefoil

Purshia glandulosa - - - - - - - - - - - - Mojave antelope bush

Rosa woodsii - - - - - - - - - - - - - - - interior rose

RUBIACEAE

Galium parishii - - - - - - - - - - - - - - Parish's bedstraw

SALICACEAE

Salix scouleriana - - - - - - - - - - - - - Scouler willow

SAXIFRAGACEAE

Lithophragma tenellum - - - - - - - - - - smooth woodland star

SCROPHULARIACEAE

Castilleja chromosa - - - - - - - - - - - desert Indian paintbrush

Castilleja chromosa X Castilleja cinerea - hybrid paintbrush

*Castilleja cinerea - - - - - - - - - - - ashy-grey Indian paintbrush

Collinsia parviflora - - - - - - - - - - small-flowered blue-eyed Mary

Cordylanthus nevinii - - - - - - - - - - Nevin's bird's-beak

Limosella acaulis - - - - - - - - - - - - southern mudwort

Limosella aquatica - - - - - - - - - - - northern mudwort

SCROPHULARIACEAE (continued)

Mimulus androsaceus	androsace monkey-flower
Mimulus exiguus	mean monkey-flower
Mimulus guttatus	common monkey-flower
Mimulus floribundus	floriferous monkey-flower
Mimulus pilosus	downy monkey-flower
Mimulus primuloides var. *pilosellus*	primrose monkey-flower
Mimulus suksdorfii	Suksdorf monkey-flower
Penstemon labrosus	San Gabriel penstemon
Penstemon grinellii	Grinell's penstemon
Veronica peregrina	purslane speedwell

SOLANACEAE

Nicotiana attenuata	coyote tobacco
Solanum xantii	purple nightshade

STERCULIACEAE

Fremontodendron californicum	California flannelbush

URTICACEAE

Urtica holosericea	hoary nettle

VIOLACEAE

Viola douglasii	Douglas' violet
Viola purpurea	mountain violet

VISCACEAE

Arceuthobium sp.	pine mistletoe
Phoradendron bolleanum	Bolle's mistletoe

AGAVACEAE

Yucca brevifolia - - - - - - - - - - - - - Joshua tree

Yucca schidigera - - - - - - - - - - - - - Mojave yucca

AMARYLLIDACEAE

Allium campanulatum - - - - - - - - - - - - sierra onion

Allium davisiae - - - - - - - - - - - - - - Davis' onion

Allium fimbriatum var. parryi - - - - - - - fringed onion

CYPERACEAE

Carex athrostachya - - - - - - - - - - - - slender-beaked sedge

Carex nebrascensis - - - - - - - - - - - - Nebraska sedge

Carex praegracilis - - - - - - - - - - - - clustered field sedge

Eleocharis coloradoensis - - - - - - - - - Colorado spike-rush

Eleocharis macrostachya - - - - - - - - - - pale spike-rush

Eleocharis parishii - - - - - - - - - - - - Parish's spike-rush

Eleocharis quinqueflora - - - - - - - - - - five-flower spike-rush

Scirpus acutus - - - - - - - - - - - - - - viscid tule/bulrush

Scirpus validus - - - - - - - - - - - - - - American great bulrush

IRIDACEAE

Iris missouriensis - - - - - - - - - - - - western blue-flag

Sisyrinchium bellum - - - - - - - - - - - - blue-eyed grass

JUNCACEAE

Juncus balticus - - - - - - - - - - - - - - Baltic rush

Juncus bryoides - - - - - - - - - - - - - - moss rush

Juncus bufonius - - - - - - - - - - - - - - toad rush

Juncus effusus - - - - - - - - - - - - - - common rush

JUNCACEAE

Juncus kelloggii - - - - - - - - - - - - - Kellogg's rush

Juncus macrandrus - - - - - - - - - - - - - long-anthered rush

LEMNACEAE

Lemna minor - - - - - - - - - - - - - - - - lesser duckweed

Lemna minima - - - - - - - - - - - - - - - - least duckweed

LILIACEAE

Calochortus invenustus - - - - - - - - - - plain mariposa

Calochortus kennedyi - - - - - - - - - - - Kennedy mariposa

Calochortus invenustus X Calochortus kennedyi hybrids

POACEAE

Agropyron desertorum - - - - - - - - - - - desert wheatgrass

Agropyron pubescens - - - - - - - - - - - - hairy wheatgrass

Bouteloua gracilis - - - - - - - - - - - - blue grama

Bromus mollis - - - - - - - - - - - - - - - soft chess

Bromus orcuttianus - - - - - - - - - - - - Orcutt brome-grass

Bromus tectorum - - - - - - - - - - - - - - downy brome

Deschampsia danthonioides - - - - - - - - - hairgrass

Distichlis spicata - - - - - - - - - - - - salt grass

Elymus glaucus ssp. virescens - - - - - - - western wild rye

Hordeum brachyantherum - - - - - - - - - - meadow barley

Hordeum californicum - - - - - - - - - - - California barley

Hordeum jubatum - - - - - - - - - - - - - - giant squirrel grass

Lolium perenne - - - - - - - - - - - - - - perennial ryegrass

Muhlenbergia asperifolia - - - - - - - - - rough stem muhly

Muhlenbergia californica - - - - - - - - - California muhly

POACEAE (continued)

Oryzopsis hymenoides	Indian rice grass
Poa annua	annual bluegrass
**Poa atropurpurea*	San Bernardino bluegrass
Poa fendleriana	mutton grass
Poa incurva	alpine bluegrass
Poa nevadensis	Nevada bluegrass
Poa pratensis	Kentucky bluegrass
Poa scabrella	malpais bluegrass
Polypogon monspeliensis	rabbit's food grass
Puccinellia nuttalliana	Nutall's alkali grass
Sitanion hystrix	bottle-brush squirrel-tail
Stipa comata	needle and thread grass

S. letterman;;

POTAMOGETONACEAE

Ruppia cirrhosa ?	ditchgrass
Ruppia maritima	ditchgrass

ZANNICHELLIACEAE

Zannichellia palustris	horned pondweed

APPENDIX II. Preliminary Biological Monitoring Plan for Rare Plant Species of the Baldwin Lake Study Area. Following initial field work in Spring 1989, methods discussed herein may be adapted to suit monitoring demands for each species.

PRELIMINARY BIOLOGICAL MONITORING PLAN
NORTH BALDWIN LAKE ECOLOGICAL RESERVE

Prepared By: Kate Barrows
November 1988

INTRODUCTION

Basic information on the occurrence and distribution of rare plant species and habitats within the Baldwin Lake study area is fairly complete. However, little quantitative information on species composition and density of rare plant species is available for the three habitat types addressed by this plan. Derby and Wilson (1979) sampled frequency, density and cover on three pebble plains, not including Baldwin Lake. Quantitative data on rare plant species distribution and abundance in other habitat types (wet meadows, vernal creeks) is unavailable. Approximate counts of the populations of two federally and state-listed plant species have been made on an informal basis in the past. A systematic grid map of one portion of a *Sidalcea pedata* population was completed (Krantz 1988).

Since the time of these studies disturbance and protection efforts have influenced the status of rare plant species. Information on changes in species composition, rare plant densities, and recovery from disturbance is needed for all three habitats. Given these information needs, this Monitoring Plan addresses two basic goals:

1) To establish a baseline monitoring program for rare species of the Baldwin Lake Ecological Reserve and adjacent study area, to assess long term health of rare plant populations.

2) To assess the effects of disturbance on rare plant species and to monitor recovery of disturbed areas.

The monitoring plan will focus on lands managed by the California Department of Fish and Game. Other lands adjacent to the Baldwin Lake Ecological Reserve, managed by The Nature Conservancy and U.S. Forest Service will also be included. The emphasis of the plan is a simple, repeatable monitoring scheme which follows trends in rare plant populations; the program is designed to be carried out with participation of volunteers.

PROGRAM OBJECTIVES

The goal of a rare plant monitoring program is to follow long-term trends in species' populations. There are several basic questions which the proposed monitoring program will attempt to address. These include:

1. What are the natural fluctuations in density and distribution of rare plant species within the study area?

2. Is natural revegetation adequate for recovery of vegetation cover in disturbed habitats? Are there significant differences in species composition between disturbed and undisturbed areas?

3. What are the significant impacts of burros on rare plant habitats? Of human visitors?

To address these questions, the proposed rare plant monitoring program focuses on the following basic objectives:

1. To obtain baseline data on rare plant species distribution and abundance in undisturbed and disturbed areas.
2. To monitor the natural revegetation of disturbed areas.
3. To obtain population counts of listed plant species.

Another objective, which can be addressed in a separate research plan, is to assess the impacts of burros/humans on rare plant species/habitats. An indirect result of the the proposed monitoring program is an evaluation of current protection efforts in terms of the species management goals described in the Operations and Maintenance Schedule.

RARE PLANT SPECIES

The high degree of endemism in the Big Bear Basin results in a list of species that could make a monitoring program an overwhelming task. For this reason, the monitoring scheme will focus on indicator species for each habitat as follows:

Wet Meadows - *Sidalcea pedata, Thelypodium stenopetalum*

Pebble Plains - *Arabis parishii, Arenaria ursina, Castilleja cinerea, Eriogonum kennedyi* ssp. *austromontanum, Linanthus killipii*

Vernal Creeks - *Mimulus exiguus, Mimulus purpureus purpureus, Orthocarpus lasiorhynchus*

MONITORING PROCEDURES

The methods used for monitoring will vary depending on the habitat is question. A primary goal is to obtain a population census of the listed species which occur within the study area. For the pebble plains, quantitative methods to produce a sample estimate can be applied. In the vernal annual habitat, monitoring in the implementation phase can be qualitative in nature until the typical distribution and density of the target species can be assessed.

Wet Meadows

The density and distribution of the two listed species, *Sidalcea pedata* (SIPE) and *Thelypodium stenopetalum* (THST), is such that a complete count of individuals should be possible. For THST, individuals should be counted in several categories: non-flowering rosettes, second year plants in flower/not in flower. For SIPE, individuals can be counted as seedlings, flowering adults, non-flowering adults. In addition to a population census,

permanent plots, with mapped individuals could be established to determine density, number of flowers per individual, survivorship. Permanent plots can be established in a stratified pattern according to plant density; plots should be at least one meter in area (round plots preferable). Alternately, several belt transects (long rectangular plots) could be used.

Data Collected:

1. Absolute count of individuals for SIPE, THST
2. Possible sample plots for density, number of flowers.
3. Areal extent of population for SIPE, THST

Season:

Sampling should be conducted between April 1 and June 30.

Pebble Plains

The recommended method used to monitor trends on the pebble plains will be a Nested Frequency analysis (U.S.F.S. Range Analysis Manual FSH 2209.21 R-4, 1983) with modifications. This frequency method was chosen because it is a simple, repeatable scheme which is based on an objective measure of plant abundance. The primary concern with frequency as a measure of abundance is that data collected is a function of plot size. Nested plots allow selection of the most appropriate quadrat size so that frequency is not consistently under-estimated or over-estimated. Frequency has been shown by a number of authors to be a sensitive measure of vegetation change (Grieg-Smith 1964, Smith et al. 1986, 1987).

Within each of three pebble plains a random point will be selected. From this point a baseline 50 meters long will be laid out along the long access of the plain. Rebar stakes will be placed at each end of the baseline; these stakes will be covered with plastic caps to reduce the hazard to visitors. Because pebble plains are small and relocation of the baseline is not likely to be a problem, the stakes will be driven with only six inches above ground. The position of each baseline will be mapped in reference to roads and other prominent features and the compass directioon of the baseline will be recorded.

Transects will be laid out perpendicular to the baseline at points determined by random numbers between 0 and 50. At each point where a given random number intersects the baseline the transect will be established perpendicular to that baseline. The compass direction of each transect will be recorded. The nested frequency frame is laid along the transect to take a sample. Frequency samples are taken every two meters for a total of 15 samples per transect.

A diagram of the nested frequency frame is shown in Figure 1A. The frequency frame should be laid on the transect tape with the 5 cm plot in the lower left corner, on the meter mark (2 m, 4 m, 6 m etc.). For each frequency frame or sample, the smallest plot size in which a given species occurs is recorded. Plot sizes used in this program are 5 cm^2 25 cm^2, 50 cm^2. For the rare species (ARPA, ARUR, CACI, ERKEA, LIKI), density will

be recorded within the 50 cm^2 plot; for ERKEA, density is recorded according to size (diameter) classes. The number of flowers for ARUR and number of flower clusters for CACI and ERKEA is also recorded. At three points at the top of the frame the substrate (rock, bare ground, vegetation, litter) is recorded in a tally. A sample data sheet is shown in Figure 2A.

For each undisturbed pebble page 1lain, four transects will be sampled for a total of 60 plots (15 per transect). The length and configuration of the transects may vary as long as the number of plots equals 60.

On disturbed sites, which are abandoned roads, the frequency plots can be laid out along a single long transect. The position for placement of the frame is determined by a selection of random numbers. A parallel transect in undisturbed habitat is also sampled.

Data Collected:

1. Frequency for all species within nested plots.
2. Density for ARPA, ARUR, CACI, ERKEA, LIKI within 50 cm^2 plot.
3. Number of flowers/flower clusters for ARUR, CACI, ERKEA.

Season:

Sampling should take place between April 15 and June 30, depending on plant phenology.

Annual Schedule:

Sampling should be done for three consecutive years to establish a baseline of data. Subsequently, sampling may be done every five years.

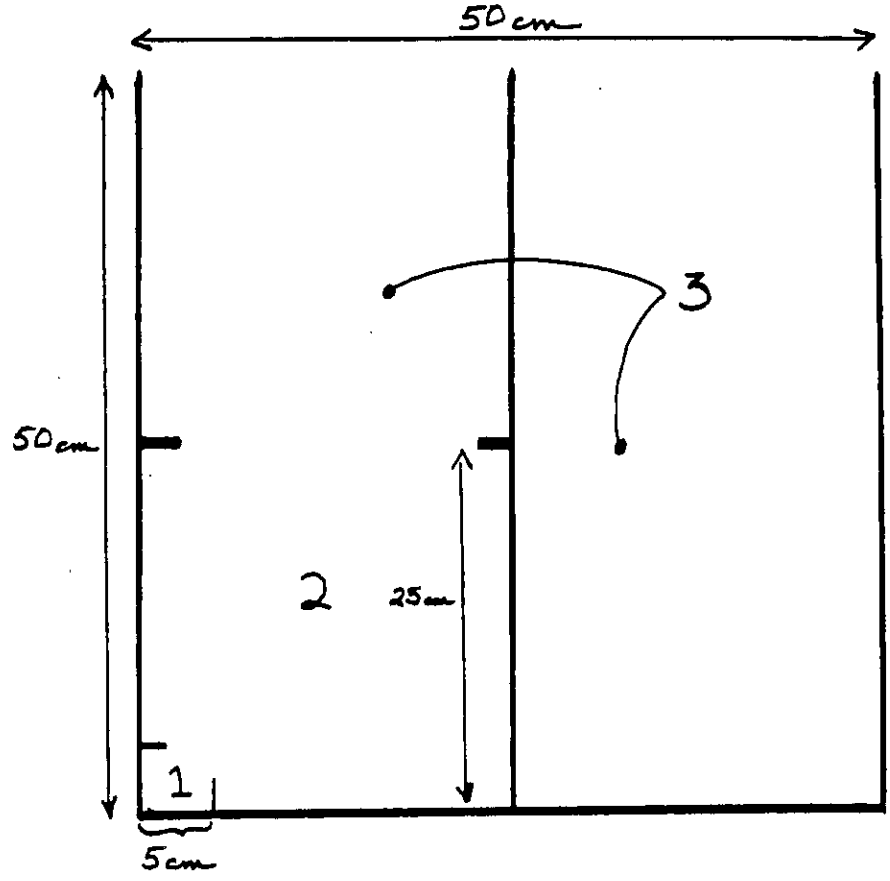

Figure 2. Nested Frequency Sampling frame. Frequency is recorded as the smallest plot in which a given species occurs. Density is recorded in plot 3 (50 cm x 50 cm).

NESTED PLOT DATA

Start time ___
End time ___

SITE: _____ DATE: _____
STUDY NAME: _____ TRANSECT NO.: _____
VEG. TYPE: _____ CONDUCTED BY: _____

Species	Distance along transect (m) →	Point Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Plot Freq. 1	2	3	4	No. Occur	% Comp.
	ANDI																										
	AL																										
	ARPA																										
	ARUR																										
	ASLE																										
	BOGR																										
	BRTE																										
	CACI																										
	CAMO																										
	CERE																										
	COPA																										
	DRDO																										
	ECENM																										
	ERAP																										
	ERCI																										
	ERKEA																										
	IVAG																										
	LIKI																										
	LONE																										
	MIGR																										
	PL																										
	POIN																										
	VIDO																										
	-																										
* Density / No. of Flowers	ARPA																									—	—
	ARUR																										
	CACI																										
	IVAG																										
	LIKI																										
	ERKEA																										

Plot yielding best frequencies (Plot size to be summarized)

Totals

Ground Cover	Veg.	Lit.	Rock	Pave.	Moss	Soil	Total
Dot Tally							
Totals							

Other Species: _____

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APPENDIX III. Proposed plan for renovation of the "Horse house" on California Department of Fish and Game property at Baldwin Lake. Plan was prepared by John Stephenson, preserve manager for The Nature Conservancy.

PROPOSAL: RENOVATING THE "HORSEHOUSE" AT NORTH BALDWIN LAKE

The Nature Conservancy would like to renovate the "Horsehouse" structure at North Baldwin Lake to serve as a storage facility and base of operations for the Big Bear Valley Preserve. We have an experienced carpenter assisting us and he has assured us that most of the existing structure is sound and in good condition. He also informed us that the far west end is not structurally sound and needs to be torn down. Much of the lumber and siding needed for making repairs on the sound structure can be obtained from the section to be torn down.

Here is a list of what we propose to do in the order we plan to do it:

1) Tear down the unstable west end.

- We will work from the top on down to ensure that the structure does not collapse. The roof sheeting will be removed first, then the rafters, then the supports. Since most of this section is already in the form of a roofed, open-air patio, taking it down should not take very long. The useable lumber will be cleaned up and stacked for future use.

2) Patch up the existing siding and install new siding where needed.

- most of the structure already has siding on it, but alot of patching will be needed. We hope that the siding obtained from demolishing the west end will suffice to fill the gaps without siding. However, it is quite possible that some siding will have to be bought.

3) Framing.

- All of the exterior walls are well framed, however some additional framing will be required. An existing sliding glass window on the north side of the building will be framed in for security reasons. An interior wall will be added and two interior doorways will be framed in so that storage rooms can be individually secured. We do not anticipate having to buy any lumber for the framing. The material obtained from demolishing the west end should be more than enough to meet our needs.

4) Install doors.

- Four exterior (solid core) doors and three interior (hollow core) doors need to be installed. One existing exterior door can be reused, however three new ones will have to be bought. All three interior doors will have to be bought.

5) Install windows.

- Five windows need to be installed. The two southside windows already have custom frames and need only to have cut glass placed in them. The three northside windows will require regular sliding windows. All the windows currently have chain link fencing stretched over them. For security reasons, we intend to keep these in place, however they will be trimmed and framed to look more attractive.

6) Roofing.

- Most of the roof is in good shape, but some additional roll roofing will need to be installed. Black mastic will be applied to the joints to make them water proof.

7) Insulation and drywall.

- 3 x 15 inch roll insulation will be placed between the studs and drywall sheeting will be used to form the interior walls. We estimate that approximately 84 4x8 ft. sheets of drywall will be needed to cover the walls.

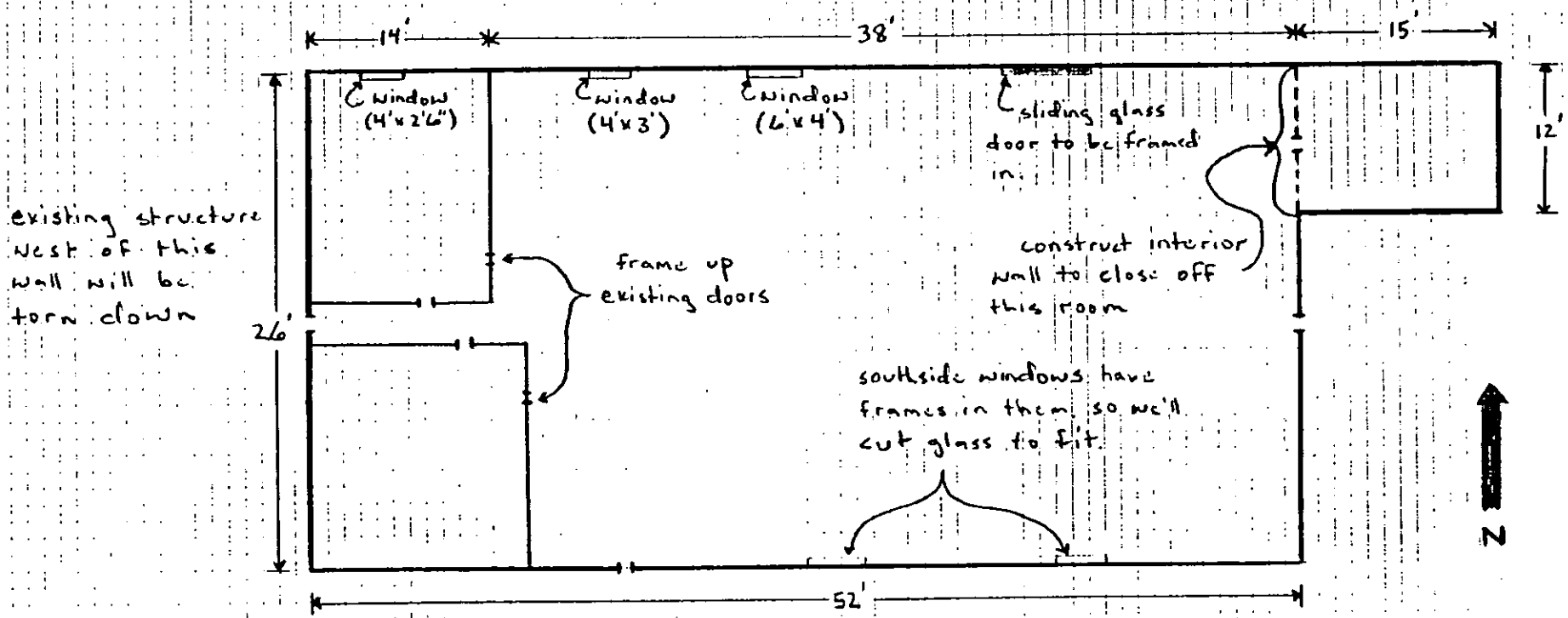
8) Electrical wiring.

- Electrical wiring is already in place, but this wiring will have to be checked and approved by an electrician.

9) Painting.

- The drywall will be painted. The doors and exposed beams will either be painted or varnished.

The renovation work will be done by the preserve caretaker and volunteers. Materials needed for the work will be paid for by the Friends of the Big Bear Valley Preserve and the Nature Conservancy. A skilled carpenter with experience at doing this type of work is assisting us to ensure that the job is done safely and correctly. Everything will be done according to building code standards. A drawing of the floor plan with the proposed renovations is included on the following page.



HORSEHOUSE FLOOR PLAN

APPENDIX IV. Itemization of costs for materials and management actions described in text.

BASIS FOR ESTIMATE OF COSTS FOR MATERIALS AND MANAGEMENT ACTIONS DESCRIBED IN THE PLAN

ITEM	NO. NEEDED	COST/ ITEM	TOTAL COST
1. Post and Sign Boundaries			
Steel T posts (heavyweight)	43	$ 4.62	$ 220.00
Signs - Metal 8" x 10"	50	$ 6.00	300.00
			$ 520.00

Note: Southern boundary is 3694 feet (0.7 miles); eastern boundary is 2639 feet (0.5 miles). Post signs at 150' intervals.

2. Experimental Burro Exclosures			
Redwood 4" x 4" x 8' corner posts	4	$ 7.70	$ 30.80
Barbed wire @ $0.06/ft.	264'	15.84	15.84
Smooth wire @ $0.04/ft.	264'	10.56	10.56
Steel T posts (heavyweight)	16	4.00	64.00
Hardware			10.00
Plus 5% cost overrun and 6% tax			15.00
			150.00

Note: Cost estimate is for one 10 x 10 meter square exclosure.

3. Install Interpretive Kiosk and Sign (near Horse House)

Sign - 4'x 5' or 5' x 6' — $ 750 -1000.00

* Living Desert Reserve (Palm Desert, CA; (619) 346-5694)
  - use aluminum backing with painted wording, hand-painted illustrations. Very attractive.
  - also manufacture clay tiles for trail markers, small signs.
* California State Parks (Bob Garrison)
  - cost for signs may reach $5,000.
* Ann Staley ((916) 325-4293 x 54293)
  - making displays for TNC Cosumnes River Preserve
  - costs $500-1200 depending on wording.

Kiosk — $ 1500.00

* Use redwood for weather resistance
* Possible kiosk design is given on attached figure.
* Can be constructed with volunteer/TNC/USFS labor.

4. Interpretive Brochure

Cost estimate given is for printing cost for 5,000 — $ 2000.00

* Writing/layout/design to be cooperative effort between TNC/CDFG/USFS

16 December 1988

Appendix V. List of agencies/individuals who can provide information relative to various management issues for the Baldwin Lake Ecological Reserve.

Southern California Water/Bear Valley Electric Co.
P.O. Box 1547
Big Bear Lake, CA 92315 (714) 866-4679
- notify re their use of power line roads

Southern California Edison
- notify re their use of power line roads

U.S. Marine Corps
Camp Pendleton, CA
- notify re their use of power line roads

Big Bear City Community Services District
(714) 585-2565
- relative to water issues at Big Bear Lake

Big Bear Valley Historical Society
P.O. Box 513
Big Bear City, CA 92314
- Tom Core was extremely knowledgeable and helpful

Dr. James Malcolm
Department of Biology
P.O. Box 3080
Redlands, CA 92373-0999 (714)793-2121
- expert on Unarmored three-spined stickleback