State of California
The Resources Agency
Department of Fish and Game

STEPHENS KANGAROO RAT SURVEY[1/]
1972-73

by
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ABSTRACT

A survey was conducted over a nine month period beginning July 1972 through October 1973 to determine the current distribution range of the rare Stephens kangaroo rat (Dipodomys stephensi). Trap lines were set in 34 localities in and around the San Jacinto Valley, Riverside County, and northeastern San Diego County, resulting in sixteen areas where D. stephensi is found today. One of these areas is in the habitat locality described by Grinnell (1922) and two are localities described by Lackey (1967). All other habitats described by Grinnell and Lackey have succumbed to destruction by urbanization or cultivation. Data indicate the greatest number of isolated populations of Stephens kangaroo rat to be near the westerly border of its range.

This survey shows that the Stephens kangaroo rat is still present within the range described by Grinnell, and includes an extension into northwestern San Diego County (Lackey, 1967). Its habitat has been reduced to isolated areas where the species is maintaining its numbers.

1/ Supported by Federal Aid in Wildlife Restoration, Project W-54-R," "Special Wildlife Investigations" Job II-5.6 Final Report.

RECOMMENDATIONS

Based on the study herein reported the following recommendations are made

1. Action be immediately initiated to protect those areas critical to Stephens kangaroo rat survival through acquisition, easement or memorandum of understanding with landowners.

2. A study be made of Stephens kangaroo rat habitat requirements to determine causes for population concentration in areas of homogenous habitat.

3. A population study be made to establish an index to be used in future studies.

4. Procedures established in this study be used in future Stephens kangaroo rat surveys.

INTRODUCTION

The Stephens kangaroo rat (Dipodomys stephensi) is endemic to the geographic range referred to as the San Jacinto Valley and vicinity by Grinnell (1922). Range of this rare species is primarily determined by topography that surrounds the area described by Grinnell. In southern California, as in other areas, a change in topography is usually accompanied by zonal changes in vegetation. Such is the case in the San Jacinto Valley and surrounding areas.

San Jacinto Valley and vicinity can be defined as that area of land that is bordered by the Santa Ana mountains to the west; by the San Bernardino mountains and the metropolitan areas of San Bernardino, Riverside, Redlands, and Corona to the north; by the San Jacinto mountains and the Badlands to the east; and, by a series of rugged, chaparral-covered hills to the south.

OBJECTIVES

Objectives of this study were to determine the present distribution of the Stephens kangaroo rat, and the degree to which its habitat has been destroyed by cultivation and urbanization.

INVENTORY

Previous trapping localities recorded by Lackey (1967) and Grinnell (1922) were plotted along with the localities of this survey, and were used in determining the range of the Stephens kangaroo rat shown in Figure 1. Peripheral populations are important in determining the extent of its range within and without the apparent topographic barrier surrounding this range.

Two species, Dipodomys agilis and D. stephensi, are very similar morphologically and can be easily confused without adequate experience in comparative aspects. Because these species occur sympatrically there is a need to be able to distinguish the two in the field. After reviewing Lackey's work (1967) and collecting specimens for comparisons of morphology and color patterns, characteristics were established for identification of the two animals in the field. These are:

1. The pinnae of stephensi are smaller and more or less unicolored.

2. The tail tuft of stephensi contains few white hairs to the tip. Agilis contains many white to the tip of the tail giving an overall lighter appearance.

3. The ventral and dorsal tail stripes of stephensi contain many white hairs with white bases giving a faintly grizzled appearance. The dark tail stripes of agilis contain few such hairs.

4. The lateral tail stripe of stephensi is less than one half the width of the dorsal stripe. Agilis' lateral tail stripe is one half the width or more than the width of the dorsal stripe.

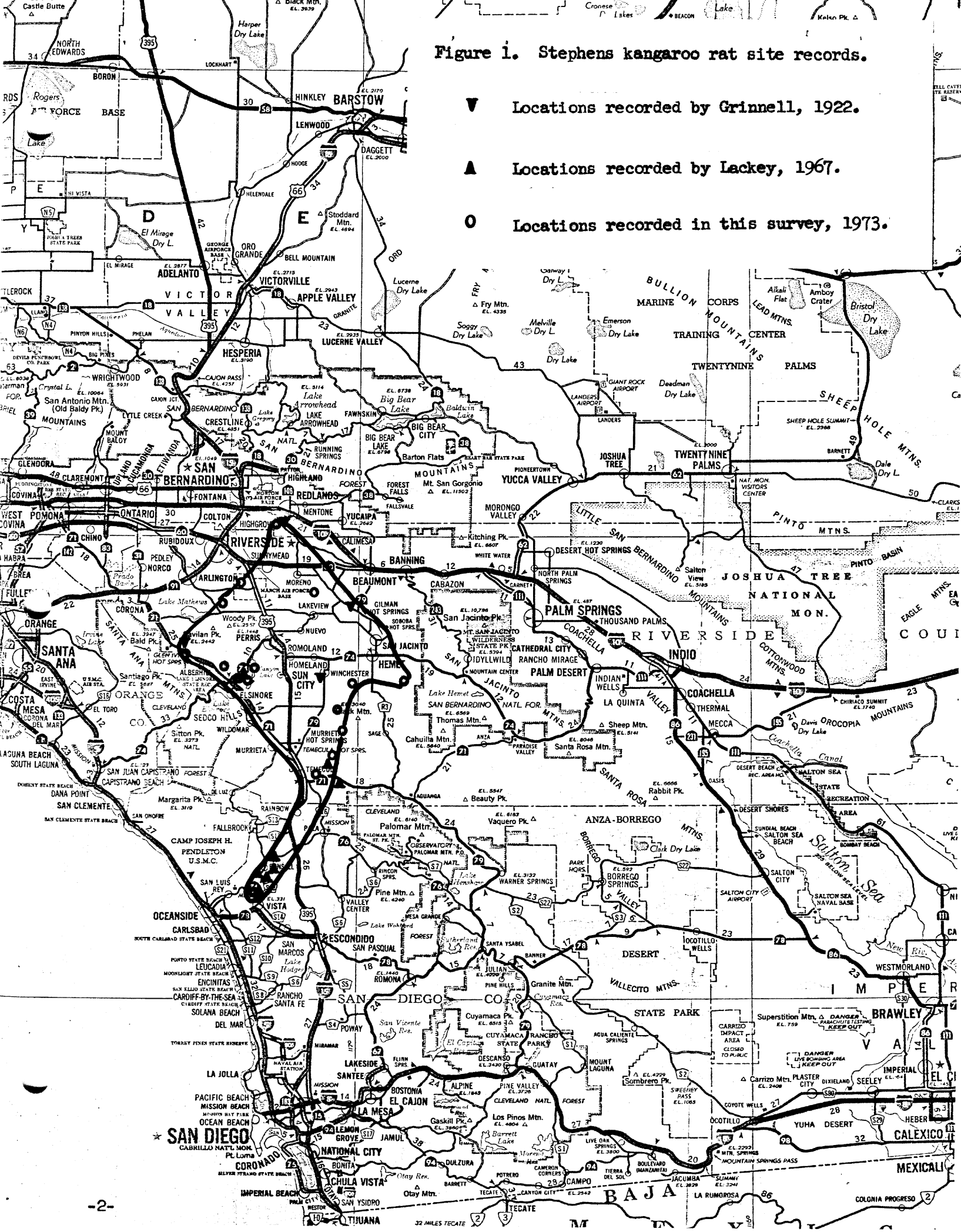

Figure 1. Stephens kangaroo rat site records.

▼ Locations recorded by Grinnell, 1922.

▲ Locations recorded by Lackey, 1967.

O Locations recorded in this survey, 1973.

5. The hind soles of stephensi are dusky while agilis has dark soles.

The first three of these characteristics are the most consistent of the five, but all are used collectively for field identification. Skull measurements show distinct specific differences (Lackey, 1967).

VEGETATION OF STUDY AREA

The general flora of the San Jacinto Valley and vicinity is that of the Coastal Sage Scrub Community described by Munz (1970). There are two primary plant species found in the stephensi habitat type, Eriogonum fasciculatum and Artemisia californica. Coincidentally these species, especially E. fasciculatum, are prime invaders where secondary succession is occurring. This gives an idea of the past status of the habitats where stephensi is found to occur today. Table 1 gives a comparative vegetation analysis for the sixteen trapping localities for stephensi.

MATERIALS AND METHODS

Traps were not set in the standard grid pattern used for population sampling. Due to the nature of this survey, traps were set in such a way to insure the greatest trapping success. A trap line usually consisted of 50 traps with two traps set at each trap site.

Trap locations were chosen when an area fulfilled two criteria: (1) the area had to have vegetation that was sparse and the land had to be low and rolling to level in topography; and, (2) an area that fulfilled the first criterion had to also have some indication of kangaroo rat activity, for example, active burrows and/or fresh diggings.

Traps were set along runways or in front of burrows. Due to the openness of habitat, traps were normally not set under vegetation.

Night driving accompanied the collecting where it was possible to travel overland off the road. If a kangaroo rat was spotted going into a burrow, a trap was set near that burrow. This method proved quite successful.

To reduce possible loss of traps, all trap sites in tall vegetation were marked with flags.

DISCUSSION

As one travels across the San Jacinto Valley and vicinity, he can easily visualize the extent of what must have at one time been Stephens kangaroo rat habitat. Much of this area is low and rolling to flat, just ideal for cultivation. In the last 50 years, much of the prime habitat has been destroyed or altered by cultivation and urbanization, the former having the greater impact on the survival of this species.

All areas where this mammal has been trapped in the survey have been in the past disturbed by farming or other land uses. Knowing this, it might be

TABLE 1

Vegetation Analysis of Trapping Localities

Dominant Vegetation	Trapping Localities															
	Canyon Lake	Arroyo del Toro	Perris Lake	Reche Canyon	Bautista Canyon	Mapes Rd., South	Riverside-Wassen Canyon Drive	March A.F.B. West	Diamond Valley	N. Bachelor Mountain	S. Bachelor Mountain	Long Valley	Pauba Valley	San Luis Rey	Lake Mathews	Temescal Wash
Senecio Douglasii			X													X
Marrubium vulgare			X	X											X	
rysothamnus viscidiflorus			X													
Eriogonum fasciculatum	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Artemisia californica	X		X	X	X	X	X	X	X					X	X	
Salvia mellifera	X		X		X											
S. apiana			X	X											X	
Croton californicus				X												
Haplopappus parishii							X									
Gnaphalium microcephalum							X									
Eriodictyon crassifolium					X											
Lepidospartium squamatum					X											
Rumex hymenosepalus					X											
Lotus scoparius		X					X									
Baccharis viminea																X

assumed that this species is a very robust competitor against "progress," and that it has the ability to rebound or survive a temporary use of its habitat and repopulate an area returning to its original state. However, 34 localities corresponding to habitat types described by Lackey (1967) were trapped, and only 16 of these localities were inhabited.

The presence of this species in 16 localities may be explained in one of two ways, or a combination of both: (1) Temporary disturbance of the habitat did not completely exterminate the species; or, (2) Sufficient peripheral habitat remained in which a portion of the population survived. When the land use ceased there was a reinvasion of this site by the remnant population. The second possibility seems most logical.

Table 1 shows a comparative vegetation analysis dealing with perennials in each of the trapping localities in which D. stephensi was present. As can be inferred from the Table, this species appears to be associated commonly with Eriogonum fasciculatum and Artemisia californica. At the Arroyo del Toro locality A. californica was present within 50 yards of the locality. The Perris Reservoir locality had a great variety of plants because a small stand of natural Coastal Sage Scrub was present within the locality, but none of the species were caught within this stand. Bautista Canyon vegetation varied because of the kind of location. It is a sandy wash in which three of the plants are common inhabitors of washes.

Most of the additional 18 localities trapped which yielded no Stephens kangaroo rat had comparable vegetation types. This indicates that this mammal does not occur in all habitats that appear to be suitable for the species.

Table 2 gives an account of the number caught per locality and trap nights. However, the most important portion of this Table is the acreage of apparent suitable habitat present within each locality. Within each of these areas (excluding Bautista Canyon, March Air Force Base and Diamond Valley) the Stephens kangaroo rats were concentrated within a restricted area in that habitat. The reason is not apparent as yet. Lackey (personal communication, 1972) also noted such concentrations.

Table 2 reveals that where more than one species were present that they existed in essentially the same numbers. This occurred in the Perris Lake, Riche Canyon, and North Bachelor Mountain trapping sites.

This may indicate some degree of interaction between species of kangaroo rat occupying similar habitat areas. Further study into home range and degree of competition might provide an answer.

An extremely important aspect of this survey is identification of immediate threat to each of the 16 trapping localities where there are active populations. All Stephens kangaroo rat's habitat areas are threatened with destruction, some more threatened than others. Bautista Canyon is threatened due to road expansion and increase in recreational use. Reche Canyon has been subdivided, but development has not yet begun. Canyon Lake, Riverside-Wassen Canyon Drive, and Arroyo del Toro have nearby expanding housing developments. Perris Lake will, in the future, become shoreline and recreation land for the proposed Perris Lake. The March Air

TABLE 2

Capture Results of Stephens Kangaroo Rats and Sympatric Kangaroo Rat Species in the San Jacinto Valley and Approximate Habitat Type Present

Locality	Total Trap Nights	Total Kangaroo Rat Captures	D. stephensi	D. agilis	Acreage	
					acres	hectares
Canyon Lake						
East	51	5	5	0	2	0.8
West	25	0	0	0	---	---
Arroyo del Toro	100	7	7	0	20	8.1
Perris Lake	50	9	5	4	1	0.4
Reche Canyon						
Hillside	50	4	2	2	15	6.1
Wash	50	6	3	3		
Bautista Canyon	50	9	2	3	2	0.8
Mapes Road						
West	25	3	3	0	30	12.1
East	25	2	0	2	---	---
Riverside-Wassen Canyon Drive	100	6	6	0	15	6.1
March Air Force Base						
West	50	1	1	0	100	40.5
Diamond Valley	50	1	1	0	2	0.8
N. Bachelor Mountain						
West	50	2	2	0	80	32.4
East	50	5	3	2		
S. Bachelor Mountain	50	5	5	0	30	12.1
Long Valley	50	5	4	1	5	2.0
Pauba Valley	50	12	11	1	5	2.0
San Luis Rey						
North	50	2	2	0	100	40.5
South	50	5	5	0		
Lake Mathews	50	4	4	0	10	4.0
Temescal Wash	50	8	8	0	3	1.2

Force Base and Diamond Valley habitats are not in danger of development, but the kangaroo rat population appears to be small. The Mapes Road, South, and Pauba Valley localities are threatened more by plant succession and accompanying reduction of preferred habitat type than by land use change. The remaining localities can fall to either cultivation or urbanization. Areas surrounding these localities are quickly being utilized for vineyards, orchards, and housing.

Bautista, Reche Canyons, and San Luis Rey represent marginal range locations for the east, north, and south respectively. A loss of these habitats would greatly reduce the D. stephensi range.

Urban development appears to be the primary threat to the Stephens kangaroo rat. Recreation and cultivation represent secondary threats. Today, many of the small agricultural land plots are not being used for crops with the exception of Long Valley and Diamond Valley localities and, therefore, are available for possible colonization by this kangaroo rat.

SUMMARY

Thirty-four localities were trapped in and around San Jacinto Valley and northern San Diego County. Sixteen of these localities have active populations of the Stephens kangaroo rat.

Grinnell (1922) established the distribution range of this species from only four locations within the San Jacinto Valley and vicinity. Lackey (1967) extended the range into the Bonsall and San Luis Rey area of northwestern San Diego County.

Of these historical sites only Reche Canyon from Grinnell's study and the southwest Perris and San Luis Rey sites described by Lackey still harbor active populations.

All trapping localities in this study have been utilized for cultivation with the exceptions of Bautista Canyon, Temescal Wash, and possibly San Luis Rey. Stephens kangaroo rat populations are greater where there are no other species of kangaroo rats present. This may suggest interspecific competition.

There is a strong correlation between the habitat apparently preferred by this species and vegetation within each habitat. Eriogonum fasciculatum and/or Artemisia californica are the common perennials in all the localities.

It can be safely stated that there has since been a vast increase in agriculture in the San Jacinto Valley and vicinity since Grinnell's study in 1922. At this point in time, not much more land may be utilized for cultivation. Most habitat destruction from this time on will most likely be the result of urban or industrial development.

Loss of the Reche Canyon, Bautista Canyon, San Luis Rey, and Perris Lake habitats could result in the reduction of the range within San Jacinto Valley and vicinity to almost one half the projected range. Most populations of this kangaroo rat are concentrated on the western border of this range.

Lackey's (1967) biosystematics of the Heermanni group of kangaroo rats in southern California definitely establishes the Stephens kangaroo rat as a distinct species. If allowed to become extinct, it and the habitat to which it is associated would be lost forever.

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TRAPPING ACCOUNTS

Canyon Lake A-1
Arroyo del Toro A-2
Perris Lake A-3
Reche Canyon A-4
Bautista Canyon A-5
Mapes Road, South A-6
Riverside-Wassen Canyon Drive A-7
March Air Force Base A-8
Diamond Valley A-9
North Bachelor Mountain A-10
South Bachelor Mountain A-11
Calle Azul Road. A-12
Pauba Valley A-13
San Luis Rey A-14
Lake Mathews A-15
Temescal Wash A-16
Trap Localities Lacking Stephens
Kangaroo Rat Population A-17

TRAP LOCALITIES LACKING STEPHENS KANGAROO RAT POPULATION

1. 1.6 km. (1.0 miles) northwest Perris, Riverside County.

2. 3.2 km. (2.0 miles) northwest Perris, Riverside County.

3. 3.2 km. (2.0 miles) north Junction of State Highway 74 and State Highway 71, Riverside County.

4. 1.6 km. (1.0 miles) southwest Bernasconi Pass, Riverside County.

5. 3.2 km. (2.0 miles) northwest San Jacinto, Riverside County.

6. 0.8 km. (0.5 miles) southeast State Highway 60 on Gilman Hot Springs Road, Riverside County.

7. 1.9 km. (1.2 miles) southwest Arnold Heights, Riverside County.

8. 8.1 km. (5.0 miles) southeast Barton Road on Reche Canyon Road, Riverside County.

9. 8.1 km. (5.0 miles) east, 1.6 km. (1.0 miles) north Temecula, Riverside County.

10. 4.0 km. (2.5 miles) west, 7.2 km. (4.5 miles) north Corona, San Bernardino County.

11. 4.0 km. (2.5 miles) west, 4.8 km. (3.0 miles) north Corona, Riverside County.

12. 1.6 km. (1.0 miles) east Interstate 15 on State Highway 138, San Bernardino County.

13. 3.2 km. (2.0 miles) west of Sage, Riverside County.

14. 9.7 km. (6.0 miles) west of Temecula on Mesa de Colorado, Riverside County.

15. 1.6 km. (1.0 miles) East Bonsall, San Diego County.

16. 2.9 km. (1.8 miles) west, 2.7 km. (1.7 miles) South Bonsall, San Diego County.

17. 3.2 km. (2.0 miles) east, 2.4 km. (1.5 miles) south Bonsall, San Diego County.

18. 1.6 km. (1.0 miles) north, 1.3 km. (0.8 miles) east Bonsall, San Diego County.

CANYON LAKE

Location: 8.1 km. (5.0 miles) east of Elsinore, Riverside County. West shore Railroad Canyon Reservoir (Canyon Lake); 1.1 km. (0.7 miles) north of dam along east facing slope, Elevation: 451 m. (1,480 feet) Elsinore Quadrangle.

Description: The amount of suitable Stephens kangaroo rat habitat is approximately 0.8 ha. (2.0 acres). This habitat is bordered by a road and dense vegetation to the north. Southern margin of the habitat is bordered by a small ravine and dense vegetation. Habitat to the east is bordered by the shoreline of the lake; whereas, the western margin is bordered by dense vegetation.

Soil texture is quite different from that which is commonly present surrounding the reservoir. Surrounding soil is rocky and stratified and the texture at the trap locality is firm, neither extremely hard nor sandy. Topography of this locality is the steepest and most rocky of all the localities. The topography slopes abruptly to the east toward the lake.

Vegetation consists of perennials, .3 - .6 m in height. Dominant plant is Eriogonum fasciculatum. Other perennials are: Artemisia californica and Salvia apiana. This locality consists of the densest flora where stephensi has been trapped. Other areas were trapped with similar vegetation and density which lacked stephensi but maintained sizeable populations of agilis.

Stephens kangaroo rats were only found in this clearing as an adjacent trap line was set in an uncleared area to the west.

Land Use Status: This area has been subdivided for housing developments surrounding this privately owned lake. Building on this locality could be initiated at any time.

Degree of Endangerment: Threat to this population is critical. This habitat type may be destroyed at any time. There is no foreseeable chance of preserving this locality with the increase of housing and domestic pets.

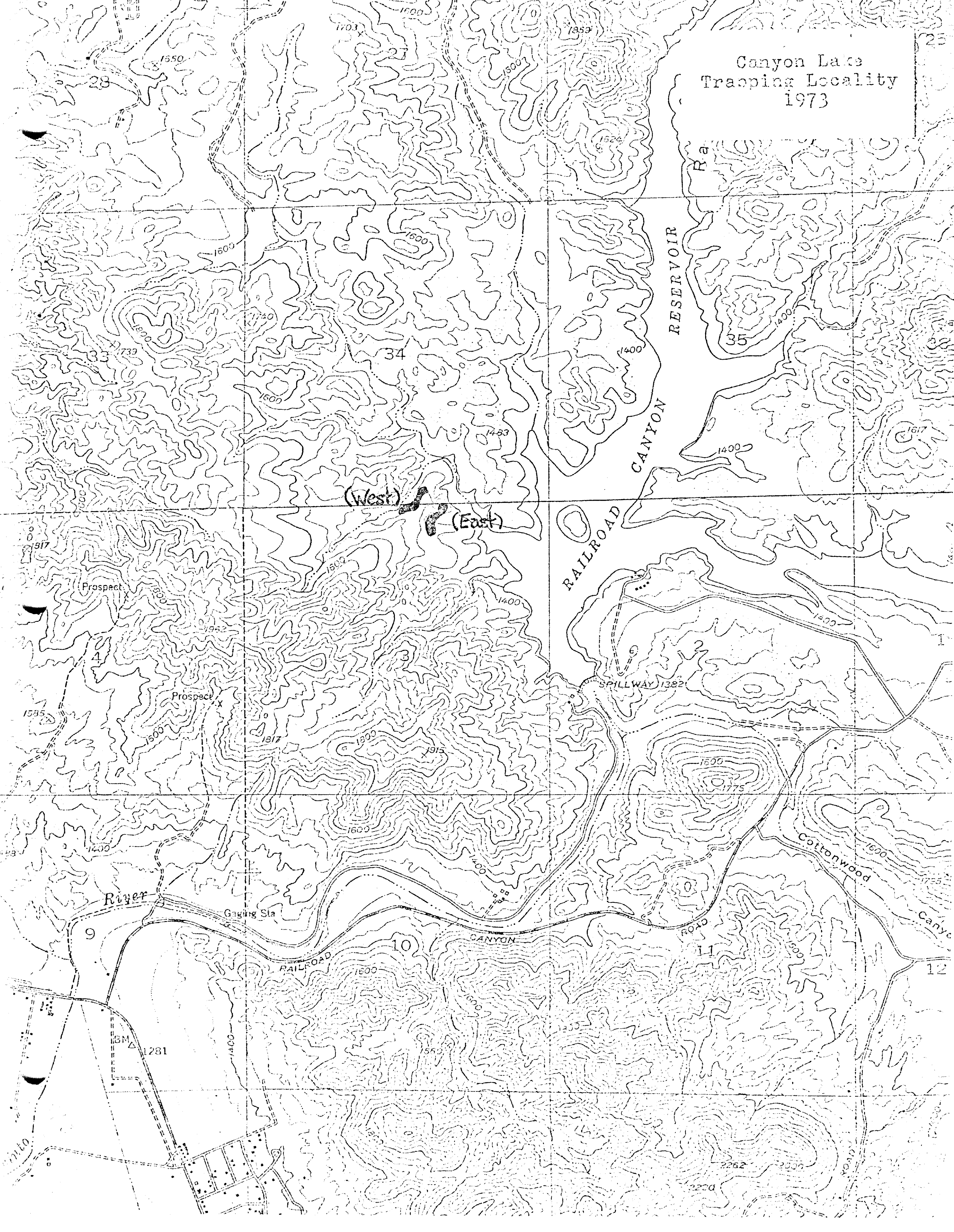
Transects:

East Transect: Traps were set around or near active burrows. Traps were set around perennials where possible.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
July 7/72	25	3	0	1
Mar 2/73	26	2	0	0

West Transect: Traps were set around perennials because there were very few burrows that appeared to be large enough for a kangaroo rat. This habitat is a west facing slope with dense vegetation.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
July 7/72	25	0	0	7


Canyon Lake
Trapping Locality
1973
(West)
(East)
CANYON RESERVOIR
RAILROAD CANYON
SPILLWAY 1382
Prospect
Prospect
River
Gaging Sta
RAILROAD
CANYON
ROAD
Cottonwood
Canyo
BM 1281
ROAD
28
27
33
34
35
4
3
2
9
10
11
12
1600
1400
1400
1400
1400
1600
1703
1859
1550
1624
1740
1739
1483
1617
1817
1915
1775
1917
1585
1962
1735
2262
2200
2000

ARROYO DEL TORO

Location: 1.9 km. (1.2 miles) northeast State Highway 71 on Bull Canyon Road, Riverside County. Elevation: 451 m. (1,480 feet) Elsinore Quadrangle.

Description: This locality is an alluvial of the Arroyo del Toro with approximately 8.1 ha. (20 acres) of suitable habitat. This habitat is bordered by a creekbed and swift rising hills with dense vegetation to the west. Northern margin of the habitat is bordered by a small knoll with dense vegetation. Vegetation appears to restrict northerly extension of D. stephensi in this area. To the east the habitat is bordered by a swift rising hill covered with vegetation density equivalent to the Canyon Lake locality, but only D. agilis was present. Southern portion is bordered by housing, a eucalyptus grove and dense vegetation.

Soil texture is neither sandy nor extremely hard, but firm. Topography gently slopes toward the southwest.

Flora of the habitat consists of two perennials: Eriogonum fasciculatum and Lotus scoparius (dominant). Vegetation is very open thus providing very little cover.

Stephensi was concentrated approximately in the center of its habitat.

Land Use Status: Land has been used in the past for cultivation and is currently inactive. Plant succession occurring in this area is considered unstable.

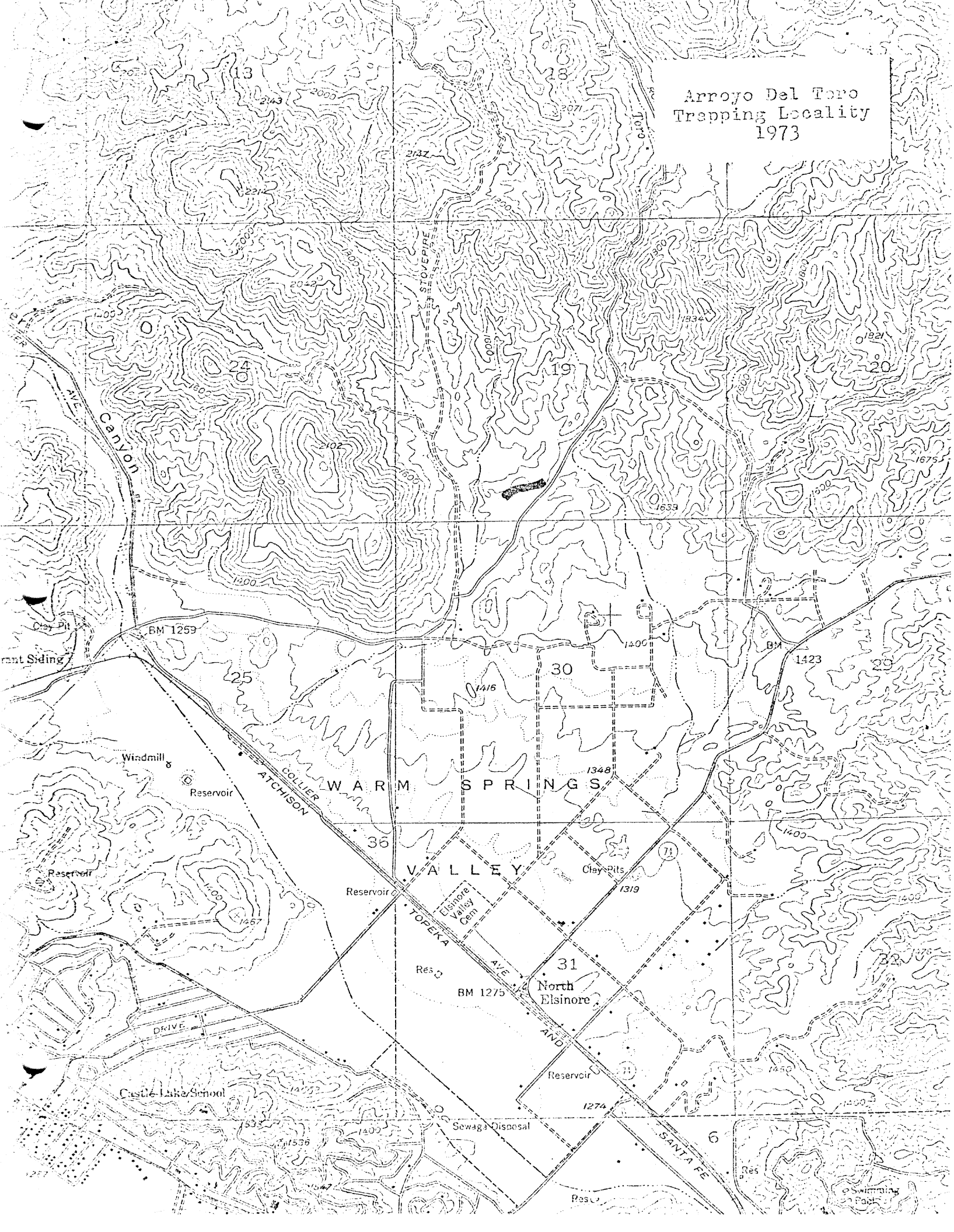
Degree of Endangerment: Threat to this population is borderline. There are houses being built within a 0.8 km. (0.5 mile) radius. This land may become subdivided in the future. There is little danger of the land again being used for agriculture.

If plant succession is allowed to continue, the Stephens kangaroo rat may become exterminated by the loss of apparent preferred habitat.

Transect: There were many runways that were being used by stephensi. Traps were set along these runways and next to active burrows.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
July 25/72	100	7	0	2

Traps were set the previous night east of the habitat. Result was the capture of 3 D. agilis. This is of interest because superficially the vegetation density appears to distinctly separate the two species.


Arroyo Del Toro
Trapping Locality
1973
Canyon
STOVEPIPE
Clay Pit
BM 1259
Windmill
Reservoir
ATCHISON
COLLIER
WARM SPRINGS
VALLEY
Clay Pits
Elsinore Valley Cem
TOPEKA
AVE
North Elsinore
BM 1275
DRIVE
Castle Lake School
Sewage Disposal
SANTA FE
AND
Swimming Pool
BM 1423

PERRIS LAKE

Location: 5.2 km. (3.2 miles) south southeast of Moreno, Riverside County. Northern shoreline of future Perris Reservoir. Elevation: 533 m. (1,750 feet) Sunnymead Quadrangle.

Description: Amount of suitable habitat is questionable. The area has been cultivated within the last few years. Stephen's kangaroo rats were trapped in an uncultivated area bordering a cultivated field. In the next few years this entire area will be under water.

Mt. Russell with steep topography and dense vegetation borders the habitat to the north. To the south and west, this habitat is bordered by recent cultivation and the eastern margin is bordered by dense vegetation and steep topography.

The soil where firm consists mostly of soil washed down from the hillsides to the north. Topography slopes gently to the south.

Vegetation of this area varies. There is a small area to the east of the habitat with natural Coastal Sage Scrub Community plants. Stephens kangaroo rats were trapped along a small wash with few perennials of Artemisia californica, Eriogonum fasciculatum, and Marrubium vulgare.

Active burrows were found only in about a one acre plot. Other areas were checked, but there was no indication of activity. It is, therefore, assumed this mammal is more or less restricted to this small area due to the farming activity or some other unknown factor at this time.

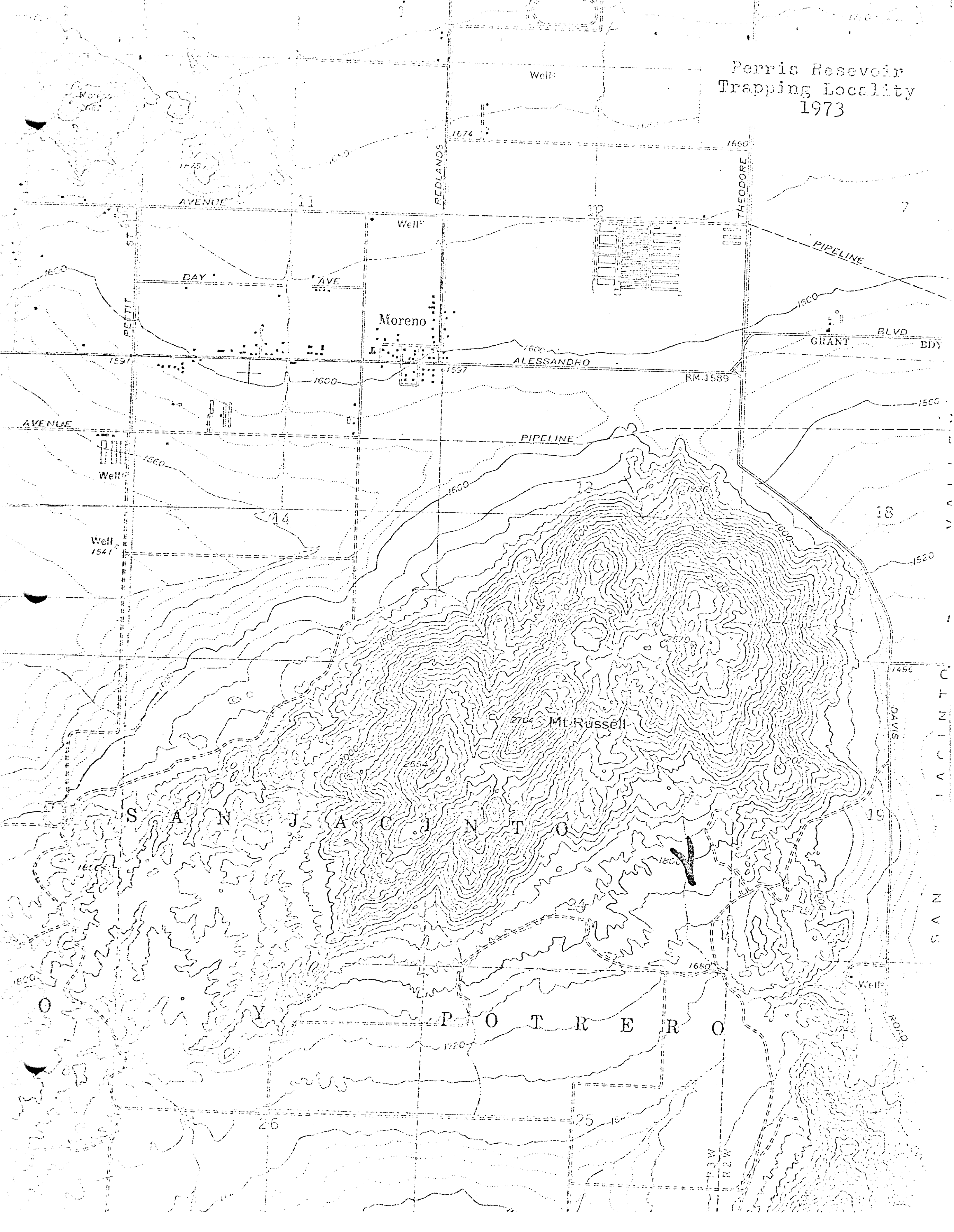
Land Use Status: This habitat has been cleared in the past, probably for agriculture and today is basically unpopulated except for the small section at the northeastern section of the field. Future of this area is to become shoreline for the Perris Reservoir.

Degree of Endangerment: Threat to this population is critical, as the habitat will probably be completely destroyed by development of the area.

Transect: Traps were set along a small wash where active burrows were present. Traps were set next to the burrows.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 2/72	50	5	4	2

An interesting note: D. stephensi and D. agilis were captured in the trap line: specifically, in two traps set together. Upon release, D. agilis went into a burrow next to the trap site and D. stephensi went some 30 yards away to a burrow further in the open. Remaining D. agilis trapped were not more than 50 yards from an area with dense vegetation. Trapping of these two species in the same trap line is not too alarming (Grinnell, 1922).



Perris Resevoir
Trapping Locality
1973

RECHE CANYON

Location: 4.7 km. (2.9 miles) southeast of Barton Road on Reche Canyon Road, 2.1 km. (1.3 miles) west on Road entering Riverside Park Research Institute, Riverside County. Elevation: 402 m. (1,320 feet) San Bernardino, South Quadrangle.

Description: This canyon represents the northern extent of Stephen's kangaroo rat range. Grinnell (1922) successfully trapped in this approximate area. Amount of suitable habitat in this area is approximately 2-4 ha. (5-10 acres).

This location is surrounded on all sides by hills. The eastern hillside has a small plateau that does not contain active burrows. Habitat is made up of a sloping hillside and a wash.

Soil on the hillside is firm, but not extremely hard. Soil texture in the wash is basically top soil from the hillsides, with little sand mixed in. Topography of the hillside slopes abruptly to the east; whereas, the wash slopes slightly northward.

Vegetation of this area consists of two primary types. The hillside is very barren with Artemisia californica and Eriogonum fasciculatum. The wash is composed primarily of the perennial Marrubium vulgare with some new growth Croton californica. This vegetation is also open.

Stephensi is concentrated toward the north northwest end of the habitat type. Active burrows were found only in this area.

Land Use Status: The hillside has been cleared in the past. This is noticeable due to a dense vegetative border along the steeper hillside. The wash has also been cleared. Development is now inactive. There is little if any urbanization, although the area is a "Research Park." Future of this area is speculative.

Degree of Endangerment: Threat to this popuation is borderline. Preservation of the habitat will depend on future developments and actions taken to preserve Reche Canyon.

Transects:

Hillside Transect: Traps were set where active burrows were present. No runways or fresh diggings were noticeable, possibly because of the firmness of the soil.

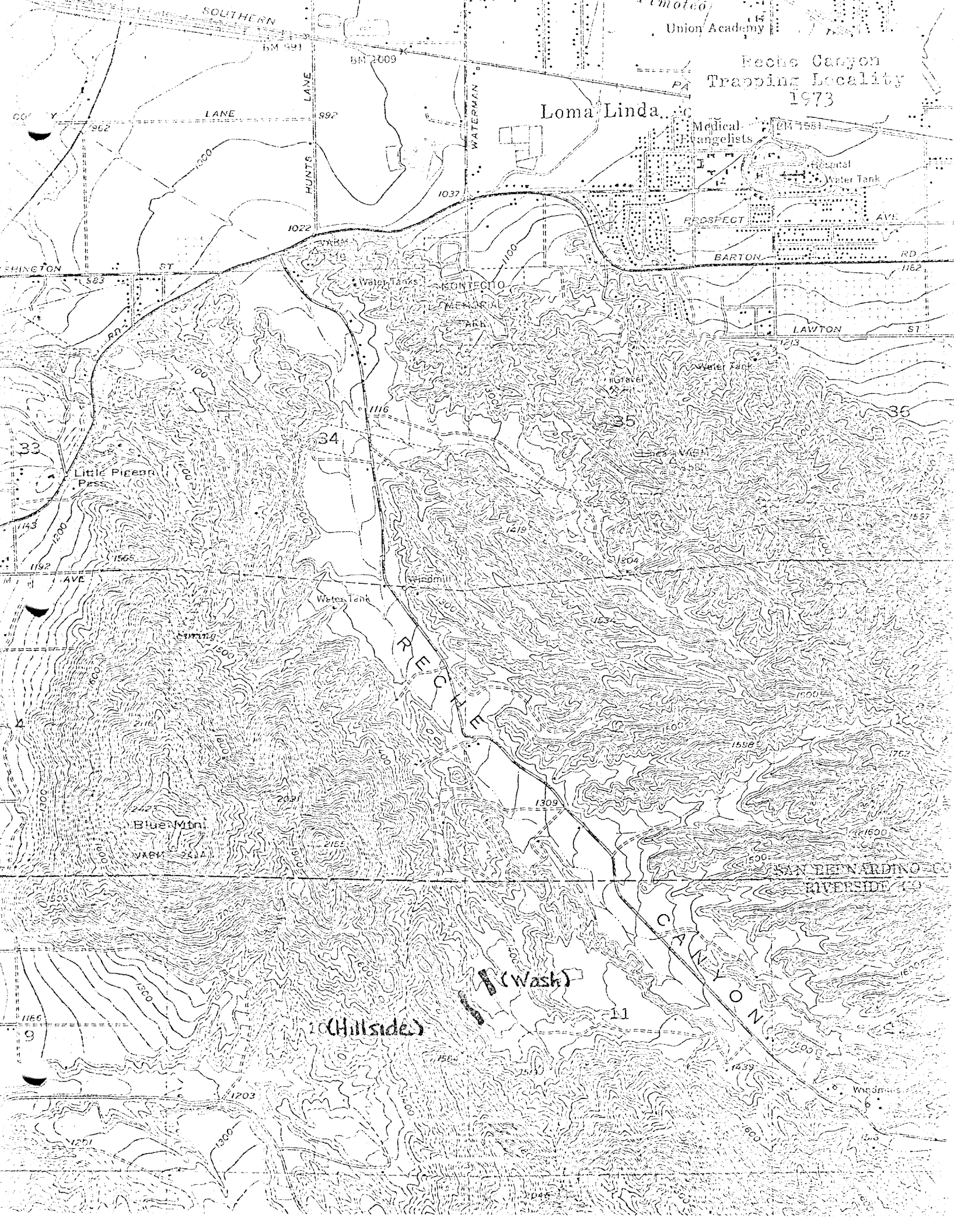
Trap line extended about a quarter mile running north to south following the contour of the hillside.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 14/72	50	2	2	0

Identity of this species was difficult due to the variation in the color of the pinnae and lateral tail stripe.

Wash Transect: A trap line was set where active burrows and/or where fresh diggings were present.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 21/72	50	3	3	0


Union Academy
Reche Canyon
Trapping Locality
1973
Loma Linda
Medical
Evangelists
Hospital
Water Tank
PROSPECT
AVE
BARTON
RD
LAWTON
ST
LANE
HUNTS
WATERMAN
SOUTHERN
Water Tanks
MONTECITO
MEMORIAL
Gravel
Windmill
Water Tank
Little Pigeon
Pass
Blue Mtn.
RECHE
CANYON
(Wash)
(Hillside)
SAN BERNARDINO
RIVERSIDE
33
34
35
36
9
10
11

BAUTISTA CANYON

Location: 6.4 km. (4.0 miles) southeast Vallevista, Riverside County, immediately southeast of Bautista Dam or Levee. Elevation: 610 m. (2,000 feet) Hemet Quadrangle.

Description: This locality is unlike the typical habitat type. The site is a wash and is distinctly sandy. The soil is not firm, but easily gives way to pressure. Amount of habitat in the immediate area would scarcely exceed 0.8 ha. (2 acres).

Habitat is bordered by a levee to the west. The southern margin is bordered by a dirt road and dense vegetation and by a semi-riparian condition to the east and north. Topography slopes gently to the northwest.

Vegetation type is characterized by Lepidospartium squamatum as the most conspicuous plant along with Eriodictyon crassifolium, Salvia mellifera, Artemisia californica, Eriogonum fasciculatum, and Rumex hymenosepalus which is a phanaerophyte. At the time of trapping there was no sign of Rumex.

Land Use Status: The area has remained basically natural. and is untouched except for its use as target range for riflemen and motorbikes.

A highway route through Bautista Canyon to Anza-Borrego desert is under consideration. A conservation group is currently petitioning the state for reconsideration.

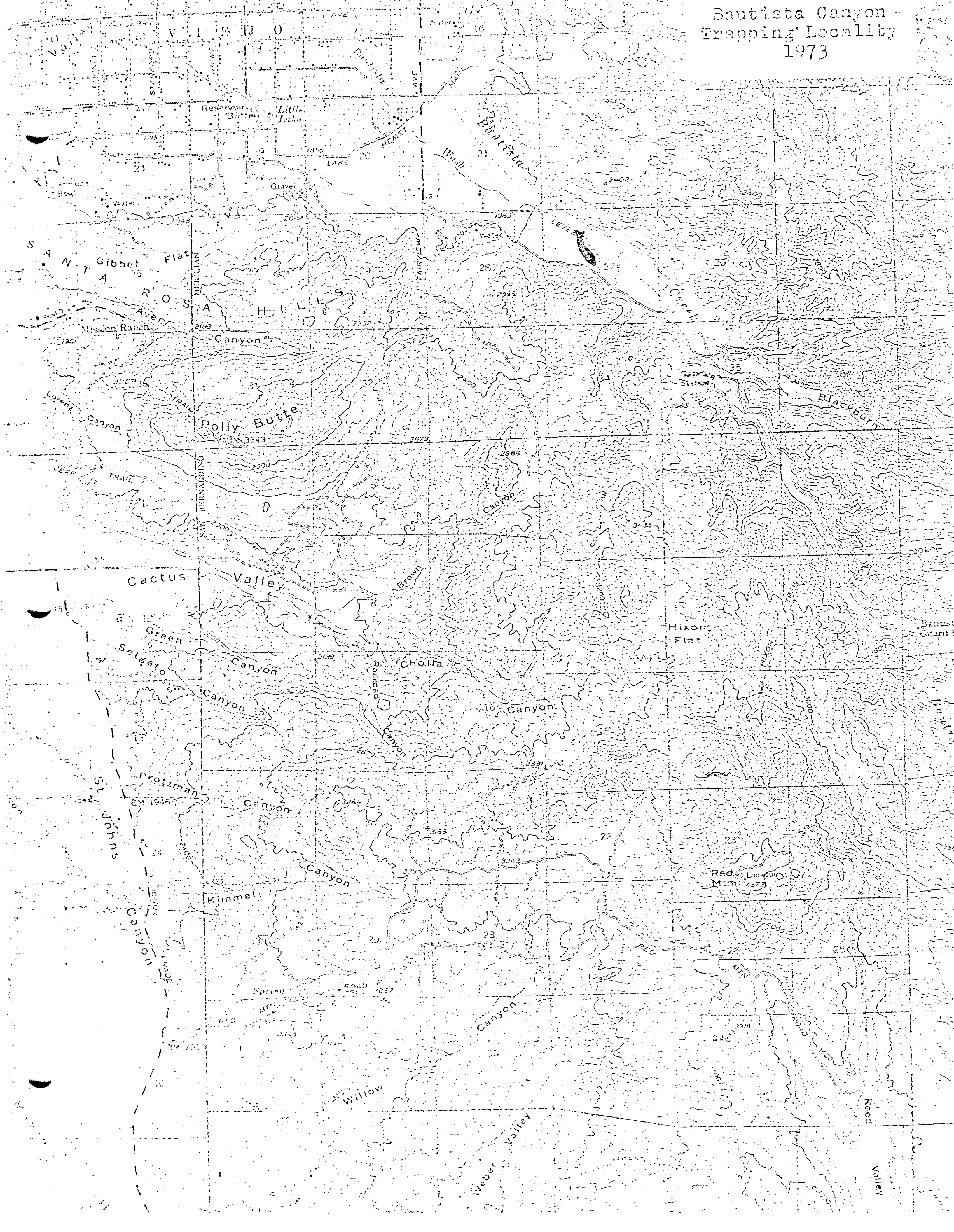
Degree of Endangerment: Threat of this population is borderline. Presence of motorbikes and riflemen may or may not present a threat. Building of a highway through this area will undoubtedly destroy much of the natural habitat and, in essence, affect the entire biogeography of the canyon. This area has been spoken of as a "desert island" by Grinnell and Swarth (1913), and Atsatt (1913) due to the presence of desert fauna and flora.

Transect: Traps were set near active burrows or near fresh diggings. There was a great deal of fresh digging in the sandy soil.

Date	Number Traps Set	Kangaroo Rat Species			
		D. stephensi	D. a. agilis	D. a. cabezonae	D. merriami
Sep. 7/72	50	2	1	2	4

This area deserves special attention due to the diversity of kangaroo rat species present in one small area, and should be looked at more closely.

Bautista Canyon
Trapping Locality
1973


Reservoir Butte
Little Lake
HEMET
LAKE
Bautista
Wash
Gravel
Water
LEVEE
Creek
SANTA ROSA HILLS
Gibbel Flat
Avery Canyon
Mission Ranch
Polly Butte
3343
Lopez Canyon
JEEP TRAIL
Blackburn
Canyon
Cactus Valley
Brown
Hixon Flat
Green Canyon
Salgato Canyon
Cholla
Railroad Canyon
Canyon
Protzman Canyon
St. Johns Canyon
Kimmel Canyon
Red Mtn
Lookout
Spring
ROAD
Canyon
Willow
Weber Valley
Reed Valley

MAPES ROAD, SOUTH

Location: 5.6 km. (3.5 miles) south southwest Perris, Riverside County. Elevation: 433 m. (1,420 feet) Elsinore-Romoland Quadrangle.

Description: Amount of suitable Stephens kangaroo rat habitat present may exceed 20.2 ha. (50 acres). However, plant succession is rapidly occurring, increasing the cover density of the habitat.

There were two transects set in this area. Both habitats were surrounded by dense vegetation to the east, west, and south, and bordered by a field recently cultivated to the north.

Soil is firm, neither extremely hard nor sandy, except for small wash areas. Topography of the two areas differed slightly, but were basically low and rolling slopes.

Two species of perennials that accounted for the vegetative cover were: Eriogonum fasciculatum and Artemisia californica.

Although the amount of habitat was extensive, the Stephens kangaroo rat population was concentrated in pockets within the area that appeared homogeneous. This deduction is due to the presence of active burrows in certain places only.

Land Use Status: This area was used for agriculture in the past and currently is grazed by sheep. Future use of the area is unknown.

Degree of Endangerment: Threat to this population is borderline. This is primarily due to the plant succession taking place; E. fasciculatum is rapidly taking over the areas. This may be due to the stiffer competition of Eriogonum with other plant species or preferential grazing by sheep.

Transects:

West Transect: This area follows a small wash toward the San Jacinto River to the south and is fairly open with perennials being .3 - .6 m in height. Traps were set around active burrows.

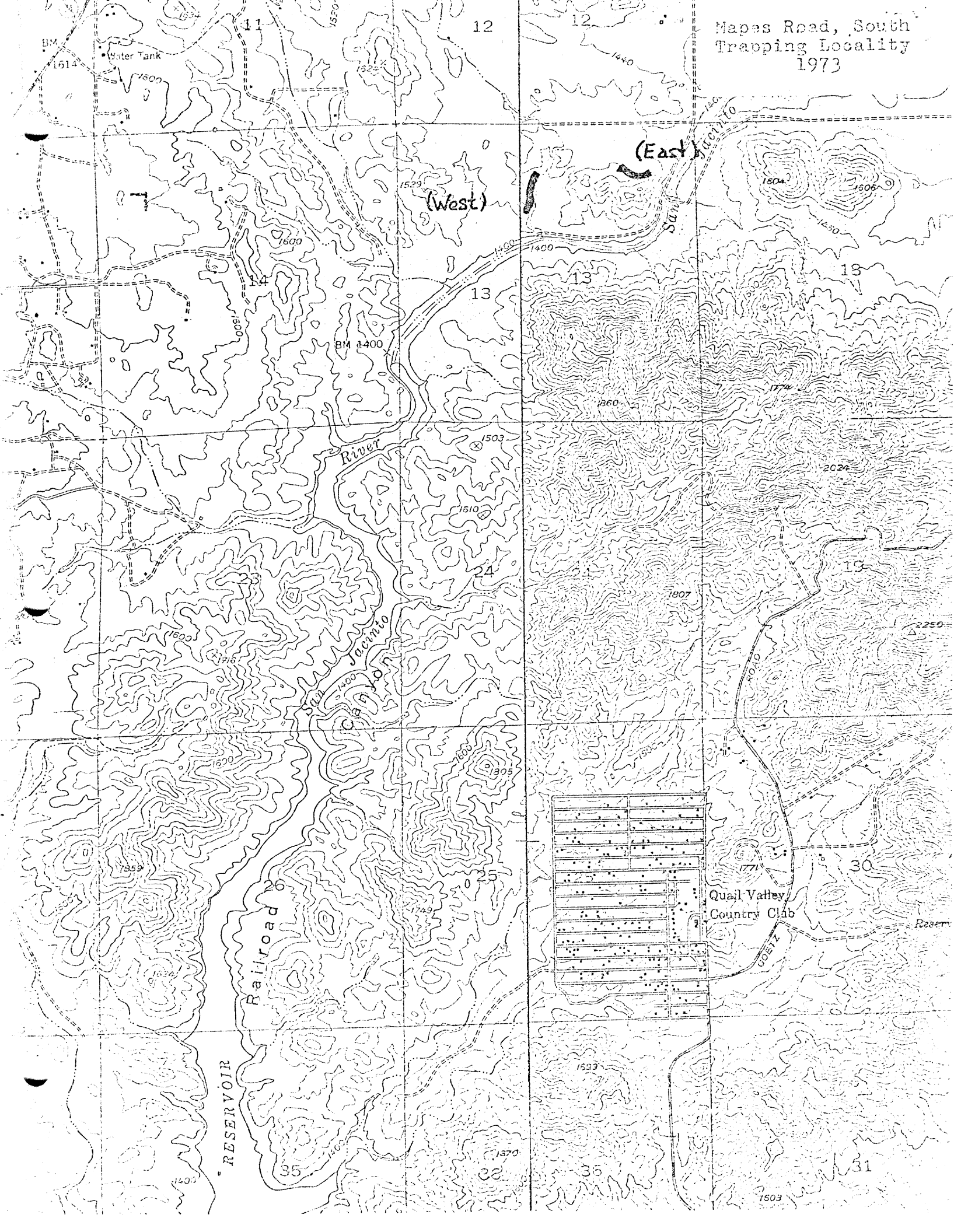
Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Oct. 6/72	25	3	0	2

East Transect: Habitat is relatively level with E. fasciculatum being much denser and taller (.6-1.0 m). This transect area is unquestionably in a further stage of succession than the western transect. Many kangaroo rats were seen active in this

area at night. Traps were set near burrows that were active or burrows where kangaroo rats were seen to enter while night driving.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Oct. 6/72	25	0	2	0

There may be some implication toward vegetation density preference on the part of D. stephensi or competitive exclusion of this species from this specific trap site by D. agilis.


Mapes Road, South
Trapping Locality
1973
(East)
(West)
Water Tank
BM 1614
BM 1400
San Jacinto River
San Jacinto Canyon
Railroad
RESERVOIR
Quail Valley
Country Club
ROAD
11
12
13
14
15
18
23
24
25
26
30
31
35
36

RIVERSIDE-WASSEN CANYON DRIVE

Location: 4.8 km. (3.0 miles) northeast State Highway 71 on Highway 74; specifically, the corner of Riverside Avenue and Wassen Canyon Drive, Riverside County. Elevation: 488 m. (1,600 feet) Elsinore Quadrangle.

Description: Suitable habitat approximates 4.0-6.1 ha. (10-15 acres). An area south of this habitat appears also to be homogeneous to the locality. This area was inaccessible for trapping. It is owned or leased by the Rawhide Motorcross Park. If this area is populated by the Stephens kangaroo rat it would increase this habitat area to approximately 40 ha. (100 acres).

Besides being bordered on the south by a motorbike park, the habitat is bordered on the north by small hills and dense vegetation and on the western and eastern portions by dense vegetation and housing.

Soil texture is firm, neither sandy nor extremely hard. Topography slopes slightly to the south.

Vegetation is dense in areas with clumps of Haplopappus Parishii and Artemisia californica. Dominant perennial is Gnaphalium microcephalum with the accompanying species of Eriogonum fasciculatum and Lotus scoparius.

The kangaroo rat population is concentrated in a small alluvial fan at the southern margin of the habitat. The reason for this is unknown at present.

Land Use Status: Land has been cleared in the past and was probably used for agriculture. It is privately owned and presently inactive. There are a few mobile homes going up to the west. Future of this area is speculative.

Degree of Endangerment: Threat to this population is borderline. However, building of houses in the area of kangaroo rat concentration could completely exterminate the species from this particular area.

More investigation should be done on the apparent suitable habitat to the south. If there is a population of stephensi in the Rawhide Motorcross Park, steps should be taken to determine the impact motorbikes have on the habitat and the Stephens kangaroo rat. The Riverside-Wassen Canyon Drive area represents one of the largest areas of homogeneous habitat identified in this study.

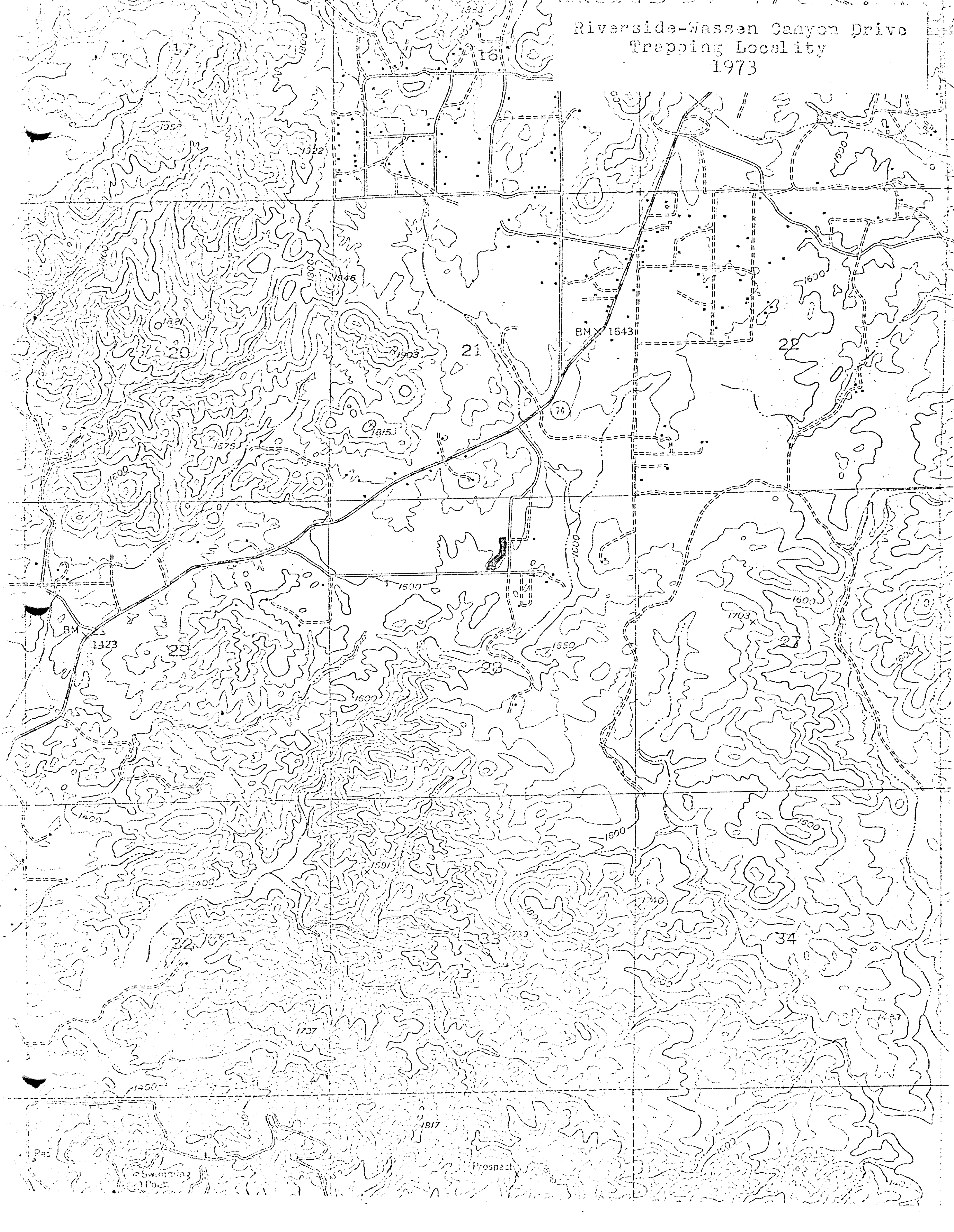
Transect: A trap line was set running north to south. There were many burrows that appeared active in this area. Traps were set near active burrows and around perennials where possible.

A-7 (Cont.)

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Oct. 13/72	100	6	0	1

Stephens kangaroo rats captured at this location resembled most closely the description given by Grinnell (1922) and Lackey (1967).

Riverside-Wassen Canyon Drive
Trapping Locality
1973



MARCH AIR FORCE BASE, WEST

Location: March Air Force Base, western section, 1.0 km. (0.6 miles) southwest Arnold Heights, Riverside County. Elevation: 503 m. (1,650 feet) Riverside, East Quadrangle.

Description: Amount of suitable habitat present may exceed one hundred hectares. Habitat is bordered on the east by the town of Arnold Heights and on the west, north, and south by gradual vegetation change.

Soil texture is firm, and topography is relatively low and rolling with presence of a few small knolls.

Vegetation is dense in some areas, but mostly open. Eriogonum fasciculatum and Artemisia californica are the dominant perennials.

The Stephens kangaroo rats in this locality cannot be considered concentrated because there was only one animal captured.

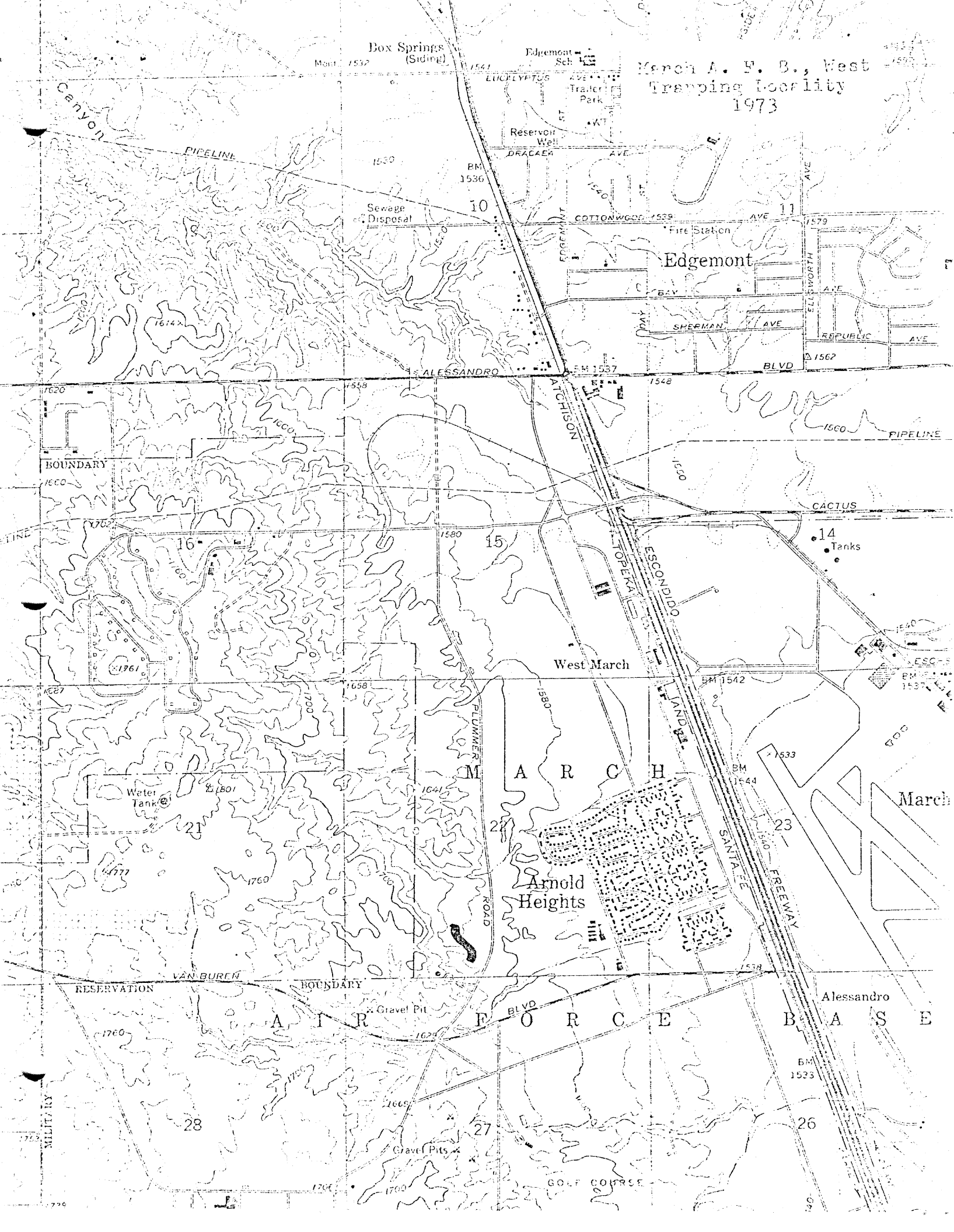
Land Use Status: This area has been farmed or, at least, altered in the past. At present land is inactive and does not appear as if it will be utilized in the near future.

Degree of Endangerment: Threat to this population is critical in view of the extremely low capture rate. The population is very small. There were very few burrows that showed any activity whatsoever. An area of approximately a quarter square mile checked indicated little activity.

Transect: A trap line was set where there was positive indication of active burrows that would accommodate a kangaroo rat. The trap line was distributed over a wide range.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Jan. 26/73	50	1	0	3

This area is close to 4.8 km. (3.0 miles) southwest of the recorded locality in Alessandro Valley by Grinnell (1922).


March A. F. B., West
Training Locality
1973
Box Springs
(Siding)
Edgemont Sch.
Trailer Park
Reservoir
Well
Canyon
PIPELINE
Sewage
Disposal
BM
1536
10
11
Fire Station
Edgemont
EDGEMONT
AVE
ELLSWORTH
SHERMAN
REPUBLIC
BLVD
ALESSANDRO
BM 1537
ATCHISON
TOPEKA
SANTA FE
BOUNDARY
CACTUS
14
Tanks
16
15
ESCONDIDO
West March
BM 1542
FREEWAY
Water
Tank
21
22
23
M A R C H
Arnold
Heights
March
FLUMERA
ROAD
VAN BUREN
BOUNDARY
RESERVATION
Gravel Pit
A I R F O R C E B A S E
Alessandro
BM
1523
28
27
26
Gravel Pits
GOLF COURSE
MILITARY

DIAMOND VALLEY

Location: 7.2 km. (4.5 miles) southwest Hemet; specifically, 1.6 km. (1.0 miles) west, 0.8 km. (0.5 miles) north of junction of Newport Road and State Street, Riverside County. Elevation: 497 m. (1,630 feet) Hemet Quadrangle.

Description: Amount of habitat present is very limited, possibly 0.8 ha. (2 acres). Kangaroo rats at this locality were trapped in semi-open vegetation on a hillside surrounded by cultivated fields. This locality is roughly in the middle of Diamond Valley southwest of Hemet. There are several small hills within the valley that are not cultivated.

Soil in this area is very hard-packed. Topography slopes in all directions.

Dominant plant is Eriogonum fasciculatum with some Artemisia californica. As stated the vegetation is semi-open.

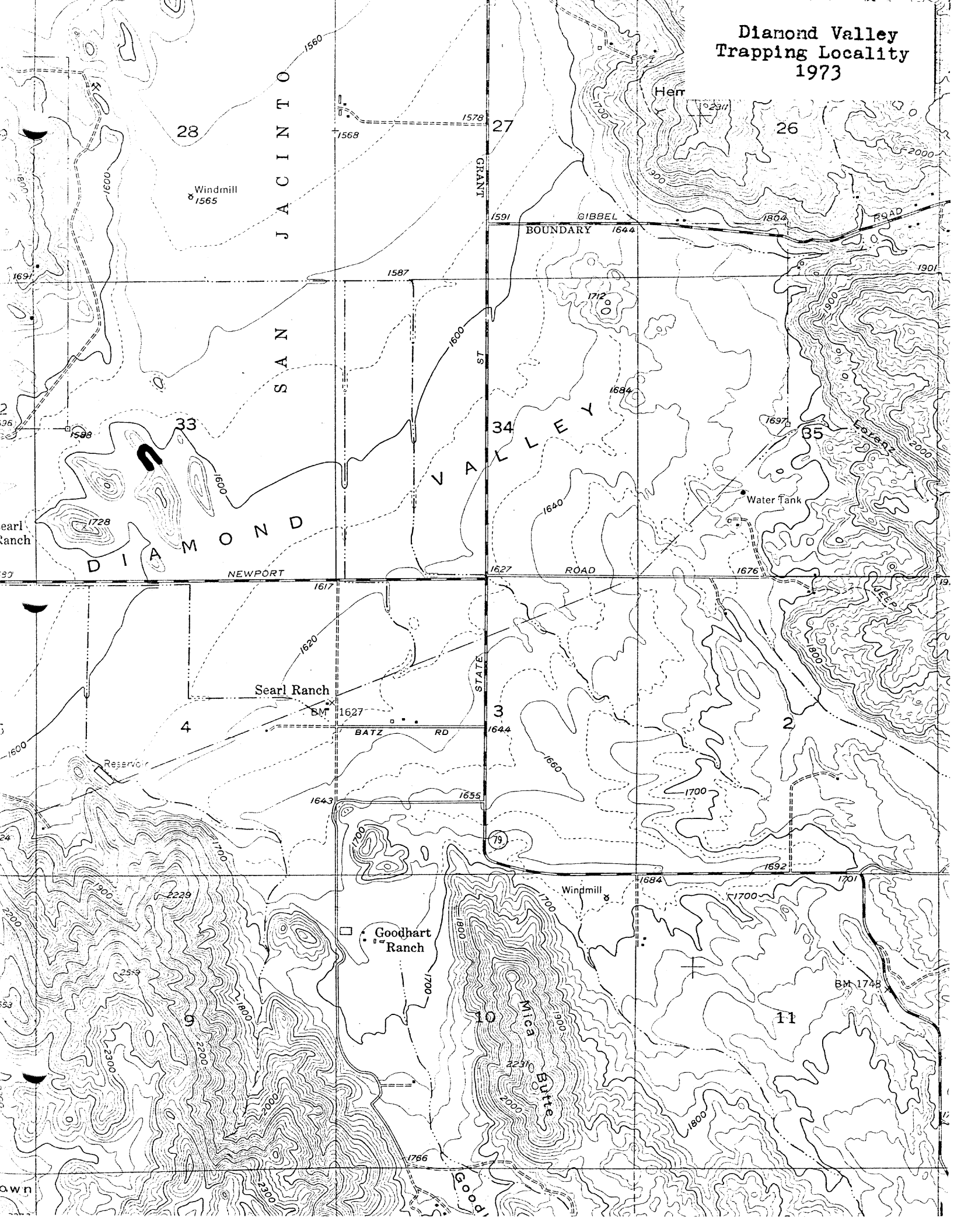
There were few active burrows present and no signs of concentration of burrows or runways.

Land Use Status: Past and land use is agriculture. It will probably remain so in the future. The few small hills in the area will probably succumb to some other form of land use.

Degree of Endangerment: Threat to this population is critical. The habitat is small and the kangaroo rat population is low as indicated by the absence of active burrows and low capture results.

Transect: A trip line was set in semi-open vegetation bordering recently used fields. Most kangaroo rat activity found was on the south facing slopes where vegetation was less dense.

Date	Number Traps Set	Kangaroo Rat Species		Other Rodents
		stephensi	agilis	
July 14/73	50	1	0	2


Diamond Valley
Trapping Locality
1973
SAN JACINTO
DIAMOND VALLEY
GRANT ST
STATE
BOUNDARY
GIBBEL ROAD
NEWPORT ROAD
BATZ RD
JEEP
Windmill
1565
Water Tank
Searl Ranch
BM 1627
Reservoir
Goodhart Ranch
Windmill
Mica Butte
2231
BM 1748
Lorena
26
27
28
33
34
35
4
3
2
9
10
11
1560
1600
1620
1640
1660
1700
1800
1900
2000
2200
2300
1578
1568
1591
1644
1587
1712
1684
1697
1627
1676
1617
1644
1643
1655
1692
1701
1766

NORTH BACHELOR MOUNTAIN

Location: Vail Ranch is 16.1 km. (10 miles) southwest of Hemet; specifically, 1.6 km. (1.0 miles) north of Bachelor Mountain, Riverside County. Elevation: 457 m. (1,500 feet) Bachelor Mountain Quadrangle.

Description: Amount of suitable habitat present may exceed 32 ha. (80 acres). Much of this area has not been used for the last 16 years. The Stephen's kangaroo habitat is bordered on the west, east, and south by small hills with dense vegetation and cultivation, and on the south by Bachelor Mountain with steep topography and dense vegetation.

Soil texture is hard in places, with the topography low to gently rolling.

Vegetation is composed of Eriogonum fasciculatum with some annual composites. Plant density is quite open when annual herbs are excluded.

Kangaroo rat populations are concentrated into pockets within a relatively large area of apparent suitable habitat.

Land Use Status: Once utilized for crops early in the valley's history, this land currently is not being farmed. It will probably not be farmed or developed in the near future unless the owner decides to sell or lease the land (personel communication with the owner).

Degree of Endangerment: Threat to this population is borderline. There is no immediate danger to the Stephen's kangaroo rat at this locality. However, there is no way of telling what plans developers, leasors, etc. will have in the future due to the development of Skinner Lake and Rancho California to the south.

Transects:

West Transect: Traps were set 2.4 km. (1.5 miles) northwest of Bachelor Mountain along a small wash. Active burrows were concentrated along the borders of the wash. There were many runways in the area which is approximately 6.0 ha. (15 acres). The kangaroo rat population was concentrated within about a 1/2 ha. plot that paralleled the wash.

Date	Number Traps Set	Kangaroo Rat Species		Other Rodents
		stephensi	agilis	
July 21/73	50	2	2	0

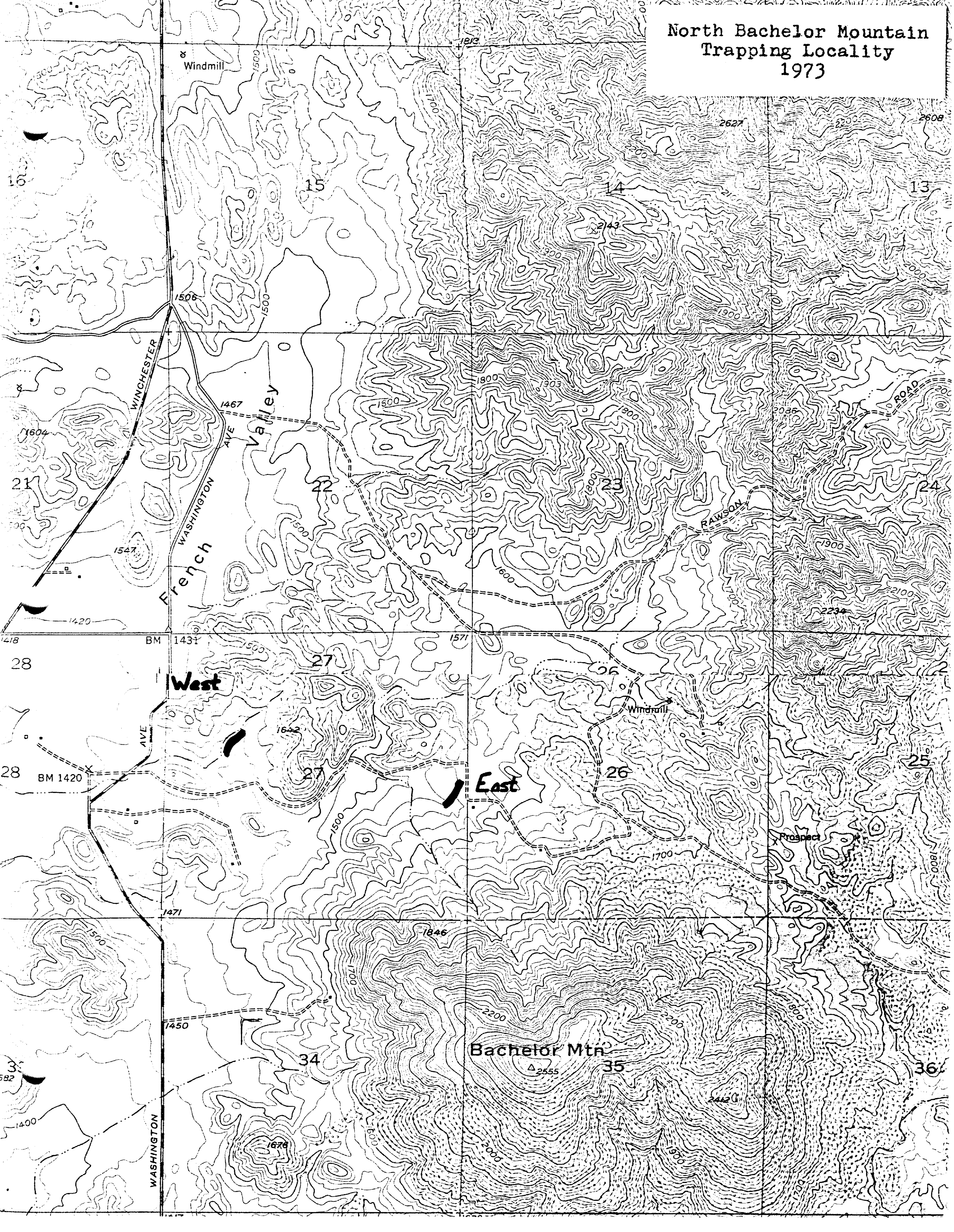
Stephensi was not as distinct in external morphology as in other locations.

East Transect: Traps were set 1.6 km. (1.0 miles) north Bachelor Mountain where active burrows were present. There was indication of much activity from the runways, fresh diggings, and trails along a dirt road. Amount of apparent suitable habitat here is large; it may exceed 28.3 ha. (70 acres).

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
July 22/73	50	3	2	1

Soil was not as hard as the West Transect.

North Bachelor Mountain Trapping Locality 1973



SOUTH BACHELOR MOUNTAIN

Location: 4.5 km. (2.8 miles) south southeast Bachelor Mountain; specifically 0.8 km. (0.5) miles west of Warren Road on Borel Road, Riverside County. Elevation: 488 m. (1,600 feet) Bachelor Mountain Quadrangle.

Description: Amount of habitat present is approximately 12.1 ha. (30 acres) with other intermittent areas to the east, west, and north possibly inhabited by the Stephens kangaroo rat. These areas were not checked for signs of activity. The habitat is bordered on the south by cultivation, on the north by dense vegetation.

Soil texture is firm with the topography rolling and sloping southward.

Flora of the area is Eriogonum fasciculatum w th large areas of Eremocarpus setigerus.

The Stephens kangaroo rat population appears to be concentrated along a dirt road with some burrows in the center of the road.

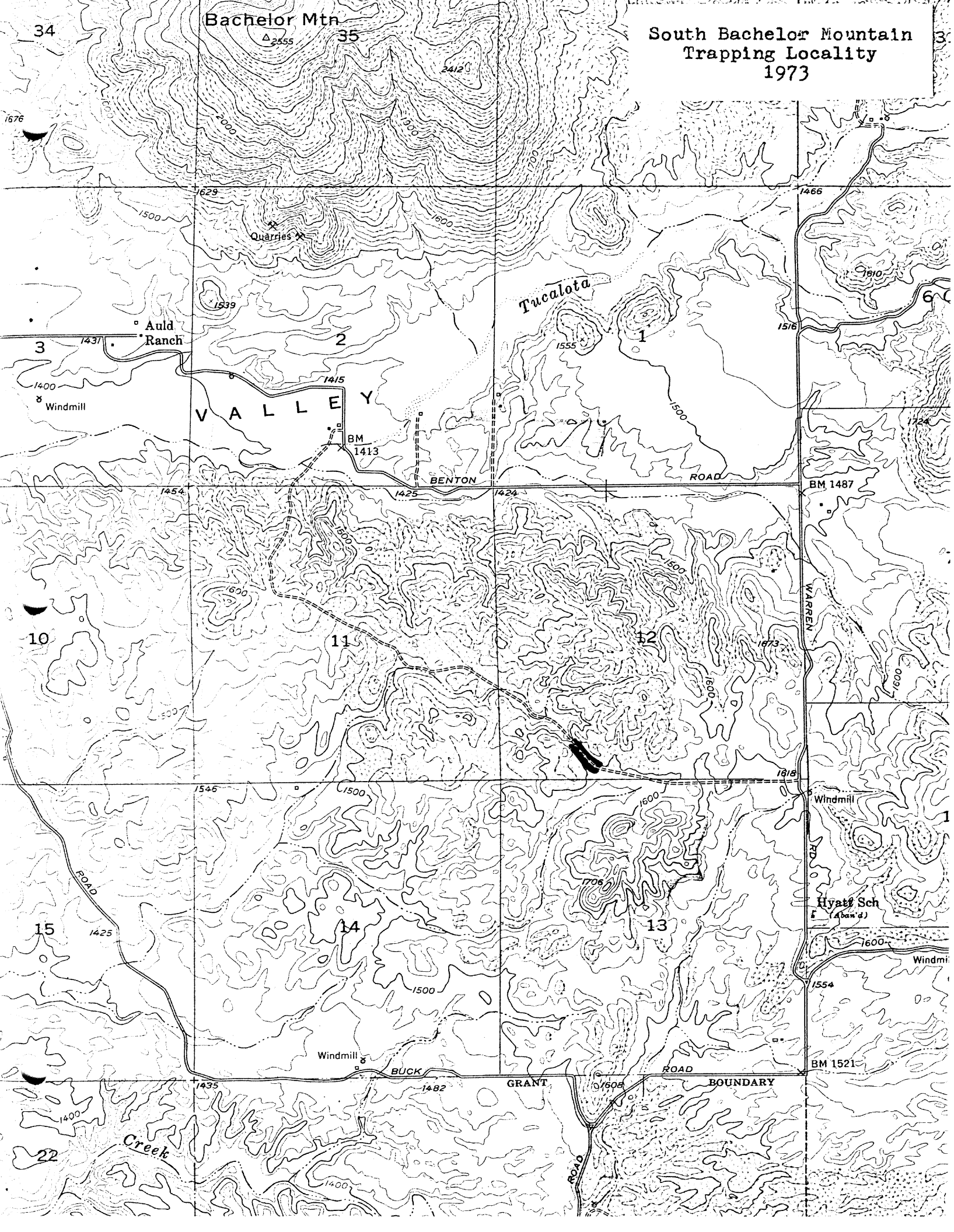
Land Use Status: Land has been used in the past for cultivation. Today it is not being used. Future use is undetermined. Within a few hundred yards from Borel Road is the boundary of the Metropolitan Water District's Skinner Lake.

Degree of Endangerment: Threat to this population is borderline. There appears to be no immediate danger of the destruction of this habitat. However, with the development of Skinner Lake and Rancho California it is difficult to make any projections as to the future status of the area.

Transect: Traps were set along a dirt road used by the Metropolitan Water District in the construction of a boundary fence for Skinner Lake.

Stephensi appeared to use the road as a major pathway of activity. Burrows were found in the road and along the road's edge.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
July 30/73	50	5	0	3


South Bachelor Mountain
Trapping Locality
1973
Bachelor Mtn
△2555
Quarries
Auld
Ranch
Windmill
VALLEY
Tucalota
BM
1413
BENTON
ROAD
BM 1487
WARREN
Windmill
RD.
Hyatt Sch
(Aban'd)
Windmill
BUCK
ROAD
GRANT
BOUNDARY
BM 1521
ROAD
Creek
34
35
3
2
1
6
10
11
12
13
14
15
22

LONG VALLEY

Location: 9.7 km. (6.0 miles) northeast of Temecula; specifically, 8.4 km. (5.2 miles) east of Rancho California Plaza, 2.3 km. (1.4 miles) north on Calle Azul Road, Riverside County. Elevation: 366 m. (1,200 feet) Bachelor Mountain Quadrangle.

Description: Amount of suitable habitat is approximately 2.0 ha. (5 acres). The area to the south and west is being converted into grape vineyards and some land to the north is being farmed to other crops. Land to the east is composed of hills with dense vegetation.

Soil texture is firm and topography to the southwest is gently rolling.

Flora of the area is dominantly Eriogonum fasciculatum. Erodium forms the ground covering in the open places. Volunteer wheat is also present.

The Stephens kangaroo rat is concentrated on a 1/4 acre plot at the end of Calle Azul Road. Much activity along the road was revealed by night driving.

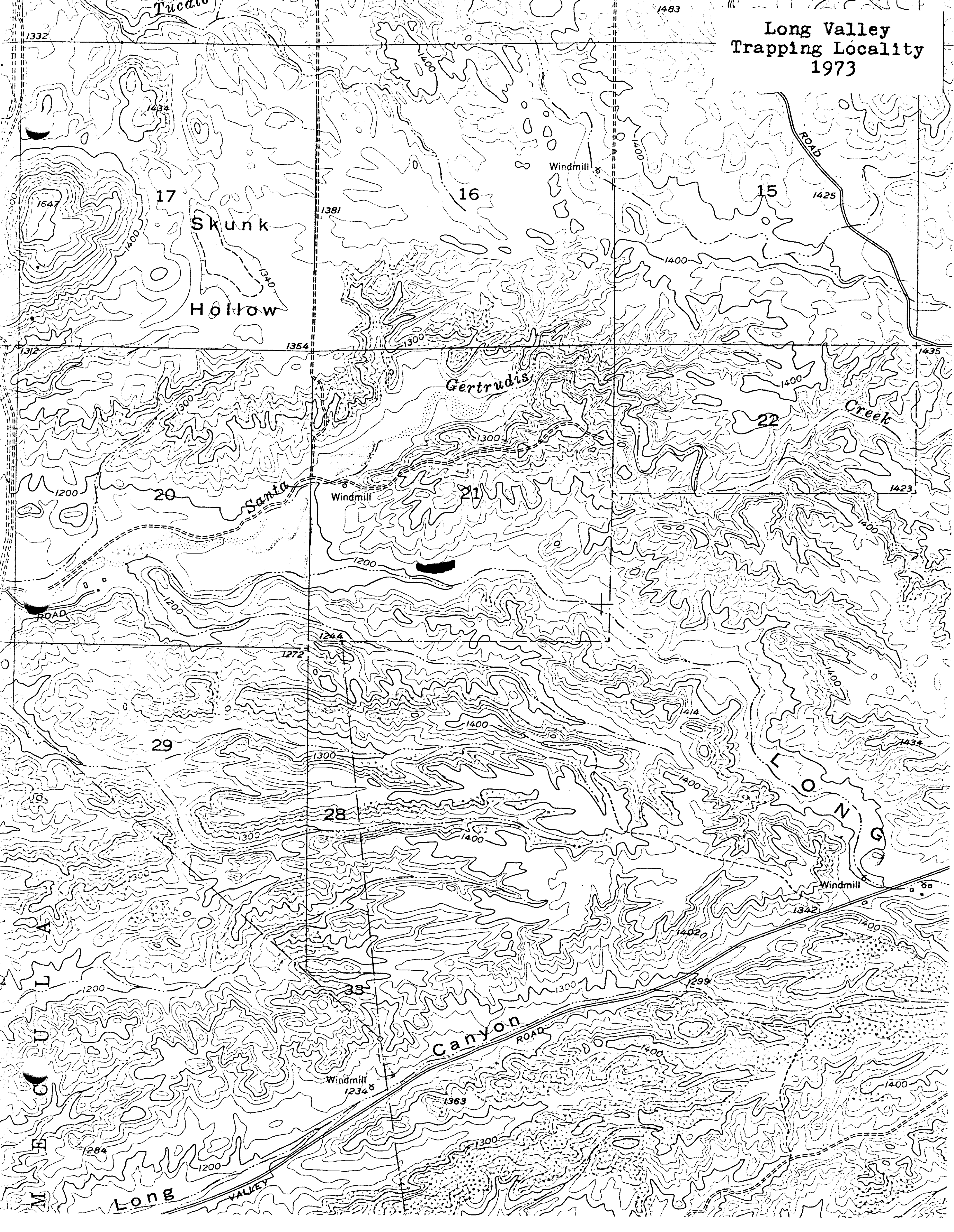
Land Use Status: The area was grown to wheat in the past but now is not farmed. Future land use is most likely to be vineyards or orange groves.

Degree of Endangerment: Status of this population is critical. With the tremendous development of Rancho California it won't be long for this habitat to disappear. There are grape vineyards within a quarter mile from this locality.

Transect: Traps were set near active burrows and along major runways. There was high concentration of activity within this small area of approximately a quarter acre.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
July 31/73	50	4	1	0

Long Valley
Trapping Locality
1973



PAUBA VALLEY

Location: 4.2 km. (2.6 miles) east of Temecula; specifically 3.7 km. (2.3 miles) east, 1.6 km. (1.0 miles) north junction Highway 395 and Highway 71, Riverside County. Elevation: 366 m. (1,200 feet) Bachelor Mountain-Pechanga Quadrangles.

Description: Amount of habitat is difficult to assess. Much of the area has been used to grow wheat. Other areas are covered with dense vegetation. The particular locality inhabited by the Stephen's kangaroo rat may exceed 2.0 ha. (5 acres). The habitat is bordered on all sides by dense vegetation on hills and recent wheat plantings in the small valleys.

Soil texture is firm and topography is rolling hills.

Flora is composed of Eriogonum fasciculatum and some annual composite species. Density of the vegetation is intermixed with open areas near the base of small hills.

Kangaroo rat population in this locality is the densest found in this survey. It was concentrated on a 0.2 to 0.5 hechare area bordering Margarita Road.

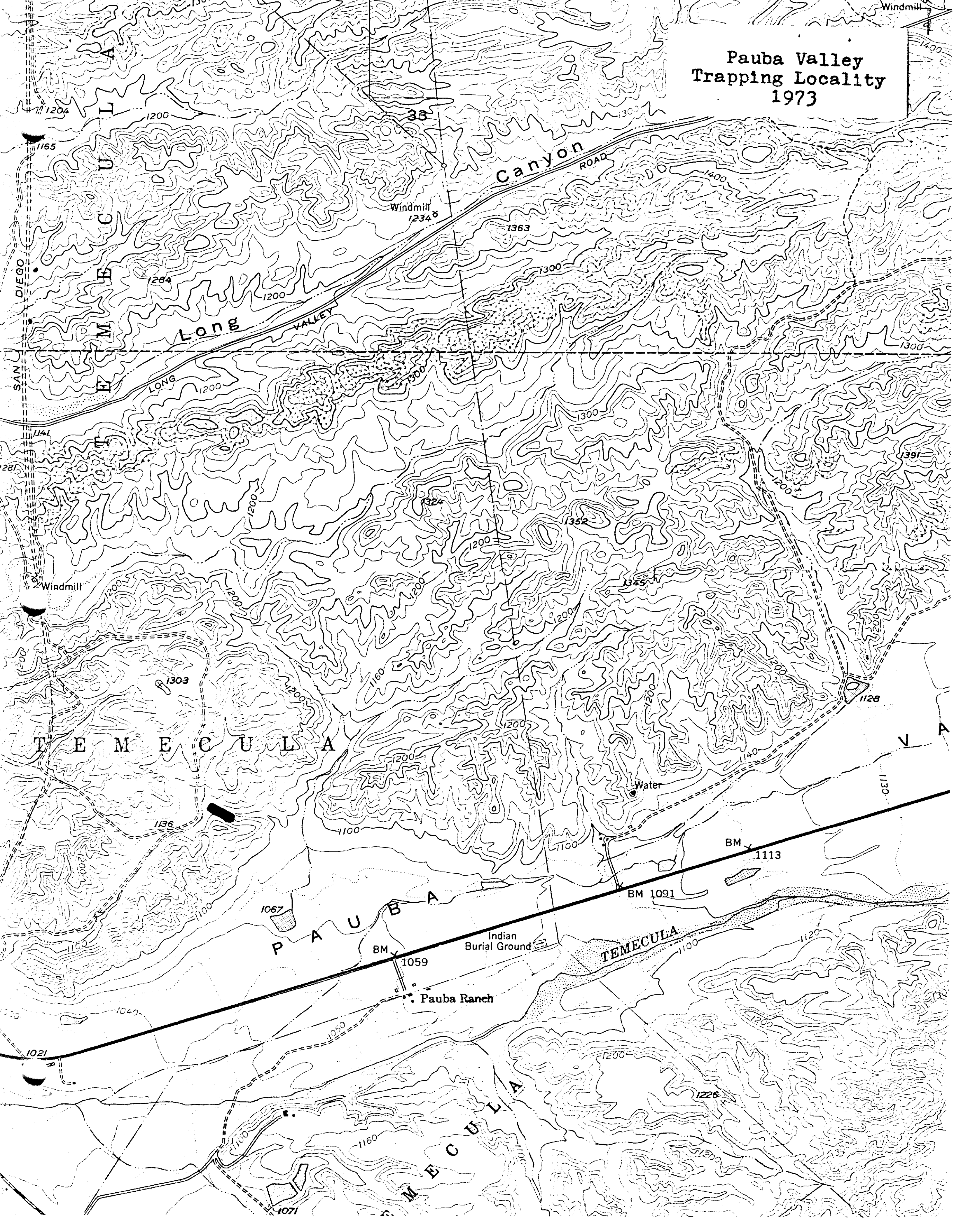
Land Use Status: The area has been farmed in the past and is currently inactive. Its future is undetermined. There is no present trend in developing in this immediate area.

Degree of Endangerment: Status of this population is borderline. Although there appears to be no immediate threat of development in this locality, the area may fall to plant succession causing eventual loss of preferred habitat.

Transect: Traps were set at burrows that indicated recent activity. The species was concentrated along an old dirt road. This population represented the greatest number of Stephens kangaroo rats captured in this survey.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 6/73	50	11	1	0

There were 5 immature stephensi captured at this locality.



Pauba Valley
Trapping Locality
1973

SAN LUIS REY

Location: 3.2 km. (2.0 miles) east, 1.0 km. (0.6 miles) south Mission San Luis Rey, San Diego County. Elevation: 104 m. (340 feet) San Luis Rey Quadrangle.

Description: Amount of suitable habitat may exceed 40.5 ha. (100 acres). This locality is the only remaining one in San Diego County of those described by Lackey in 1967. It is bordered on the west and south by housing developments and on the north and east by cultivation.

Soil texture is firm and topography is gentle rolling hills.

Flora is composed primarily of Artemisia californica with some Eriogonum fasciculatum. Although the habitat seems to be quite large and extensive, the kangaroo rat population is concentrated within certain areas. Three separate populations were found within the habitat type.

Land Use Status: Past use of the land is uncertain. There is no evidence it has been farmed. Its current use is for cattle grazing. Future of this locality is questionable; developers are trying to subdivide the area for housing.

Degree of Endangerment: Status of this population is critical. The owner intends on maintaining the area as a natural habitat; however, he is in his eighties. He is receiving much pressure from developers who are trying to put the area into housing, etc. Loss of this habitat would conclude any comparative studies with Stephens kangaroo rat populations to the northeast and would reduce its distribution.

Transects:

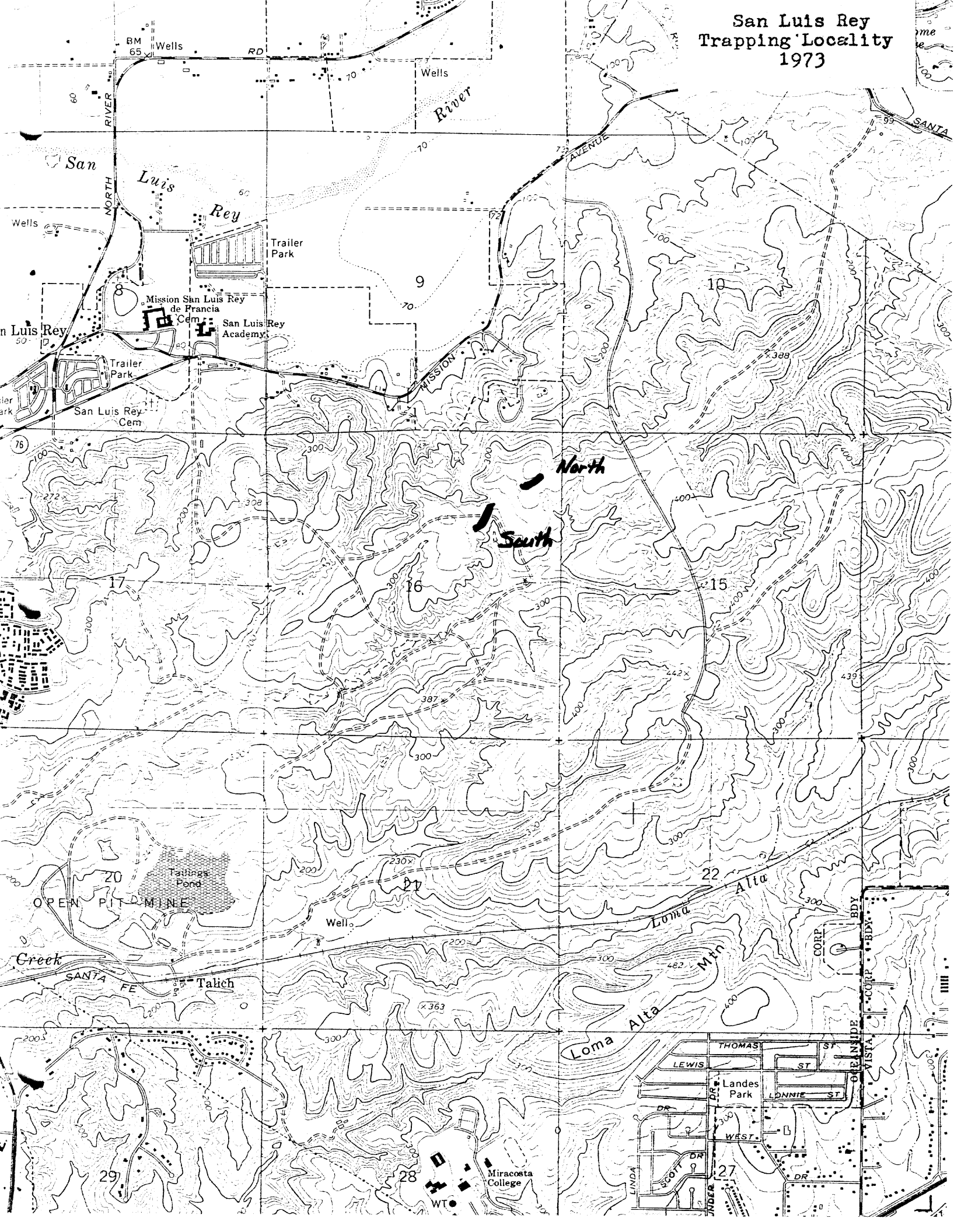
North: Traps were set near active burrows at one area within suitable habitat. Vegetation was rather dense with composite annuals.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 9/73	50	2	0	0

South: Traps were set as in the North Transect. The vegetation was open with few annuals present.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 10/73	50	5	0	2

Three of these kangaroo rats were immature.


San Luis Rey
Trapping Locality
1973
North
South
BM 65
Wells
RD
River
NORTH
San Luis Rey
Trailer Park
Mission San Luis Rey de Francia
San Luis Rey Academy
Cem
MISSION
AVENUE
SANTA
Tailings Pond
OPEN PIT MINE
Well
Creek
SANTA FE
Talich
Loma Alta
Loma Alta Mtn
Miracosta College
Landes Park
THOMAS
LEWIS
LONNIE
WEST
VISTA
OCEANSIDE
CORP BDY

LAKE MATHEWS

Location: 15.3 km. (9.5 miles) northwest Perris; specifically, 1.9 km. (1.2 miles) northwest Cajalco Ranger Station, Riverside County. Elevation: 445 m. (1,460 feet) Steele Mountain Quadrangle.

Description: Amount of suitable Stephens kangaroo rat habitat present is approximately 4.0 ha. (10 acres). It is bordered by cultivation on the south, east, and north and by dense vegetation on the west.

Soil is firm, neither extremely hard nor sandy. The topography is low and rolling.

Vegetation of the area is open with few perennials. Those present are Salvia apiana, Artemisia californica, and Marrubium vulgare. There are some California juniper to the west of the habitat.

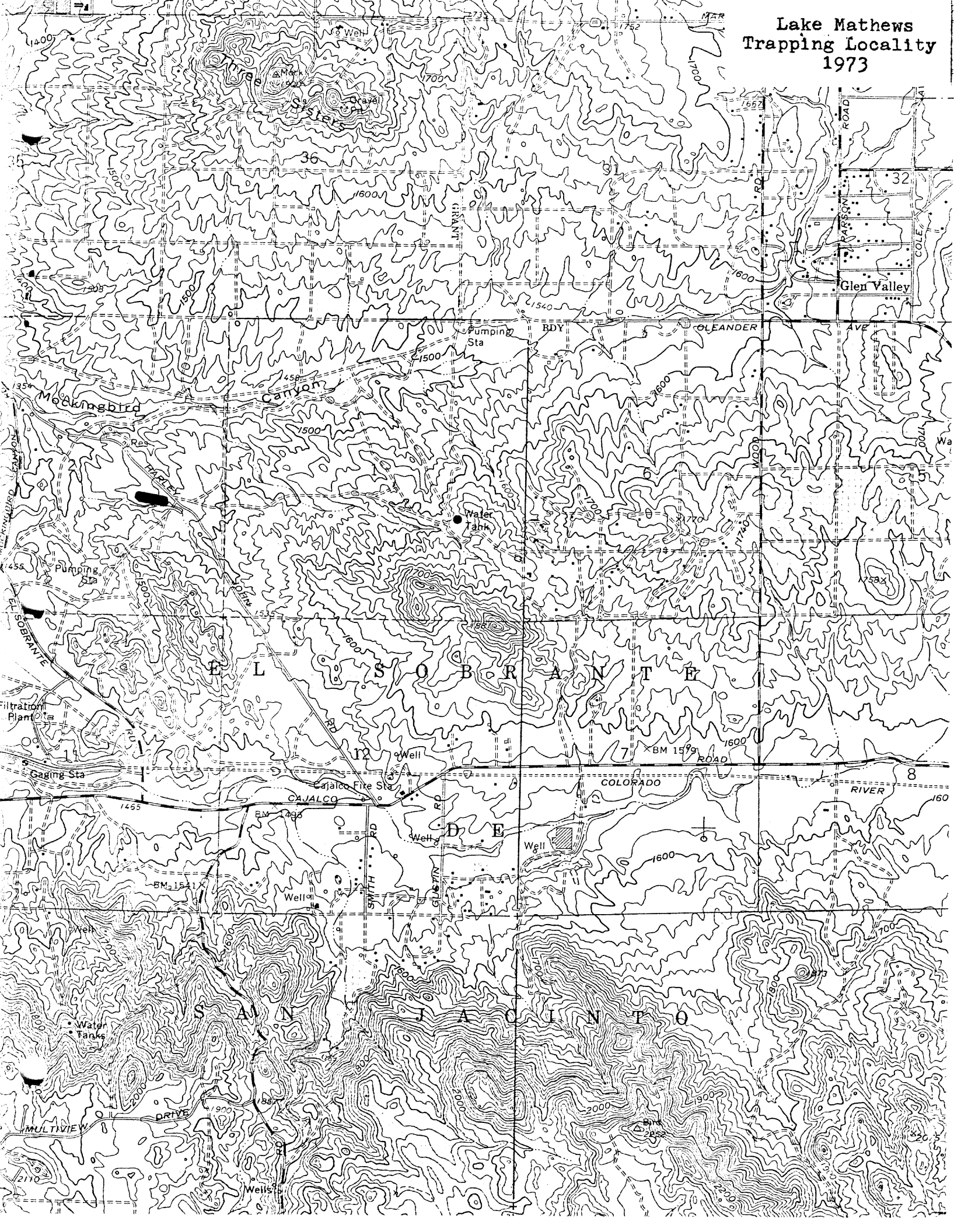
The kangaroo rat population was concentrated near the center of the habitat along a dirt road.

Land Use Status: In the past the land was farmed; however, at present the land is not in use. There is no immediate knowledge of future development.

Degree of Endangerment: Status of this population is borderline. New citrus groves have been developed nearby and this habitat could easily succumb to development.

Transect: Traps were set along a dirt road. Active burrows were concentrated around this road. There was no indication of activity in places other than the dirt road.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 15/73	50	4	0	0


Lake Mathews
Trapping Locality
1973
Three Sisters
Gravel Pit
Well
GRANT
ROAD
PARSON
COLE
Glen Valley
OLEANDER
AVE
Pumping Sta
RDY
Mockingbird
Canyon
Res
MARKHAM
CANYON
WOOD
Water Tank
Pumping Sta
EL SOBRANTE
EL SOBRANTE
Filtration Plant
Gaging Sta
Cajalco Fire Sta
CAJALCO
ROAD
COLORADO
RIVER
BM 1599
BM 1498
BM 1541
SMITH
GLENN
Water Tanks
MULTIVIEW
DRIVE
SAN JACINTO
Bird
Wells

TEMESCAL WASH

Location: 16.4 km. (10.2 miles) northwest of Elsinore; specifically, 2.6 km. (1.6 miles) southeast Temescal Ranger Station, Riverside County. Elevation: 329 m. (1,080 feet) Lake Mathews Quadrangle.

Description: Amount of habitat present is small scarcely exceeding 1.2 ha. (3 acres). Stephens kangaroo rat habitat is bordered on the west by a steep incline to railroad tracks and a citrus grove, on the east and north by Highway 71 and riparrian growth, and on the south by dense vegetation. This habitat is not far from Grinnell's 1922 locality recorded.

Soil texture is sandy, characteristic of washes and topography is relatively level.

Flora consists of Eriogonum fasciculatum, Baccharis viminea, and Senecio Douglasii.

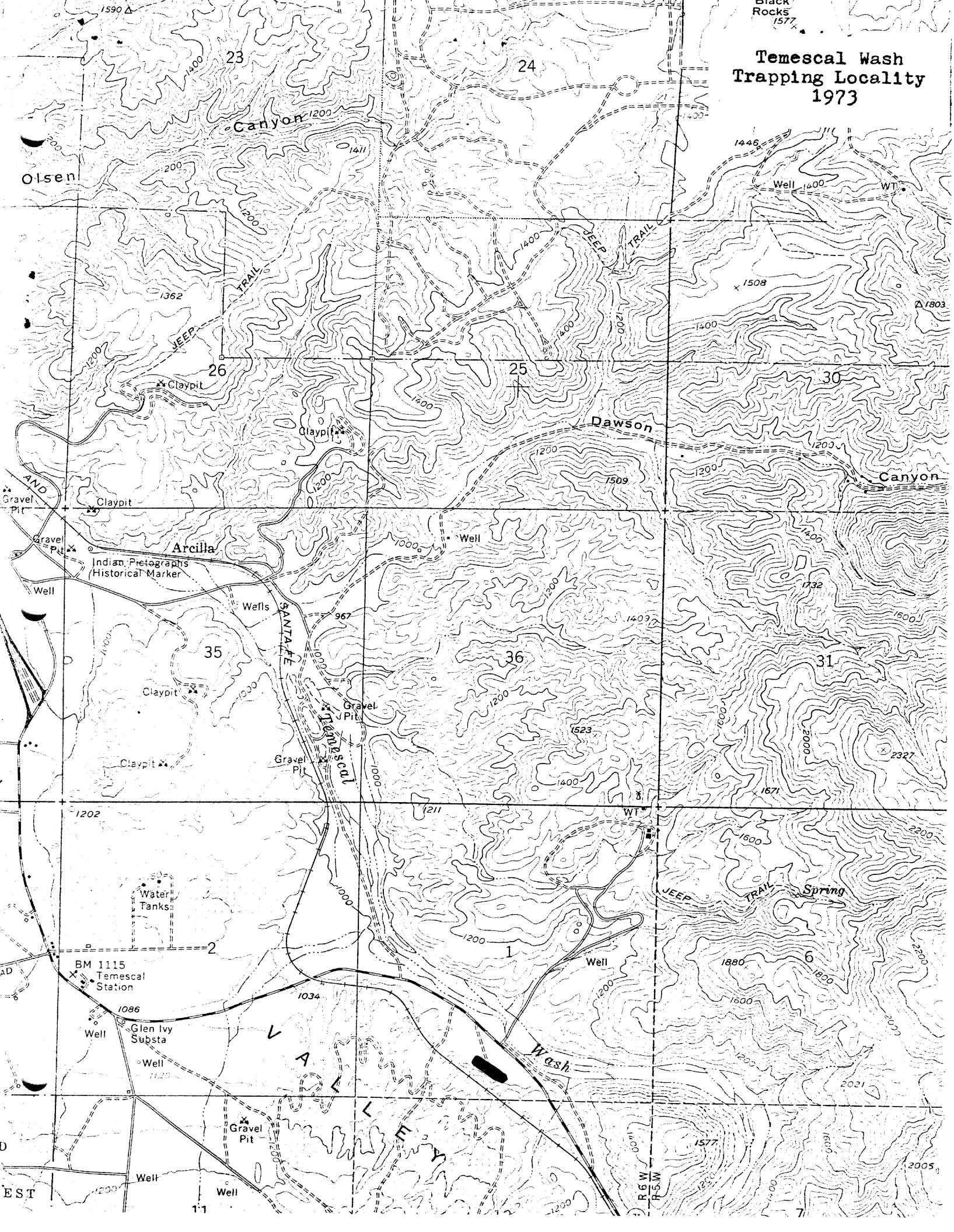
The Stephens kangaroo rat population was concentrated near the middle of the habitat with the burrows closely together.

Land Use Status: This area appears to have remained undisturbed and stable for some period of time although occasional grazing was has occurred. Future land use of this small area is questionable.

Degree of Endangerment: Status of this population is non-threatened.

Transect: Traps were set in front of active burrows and along some runways.

Date	Number Traps Set	Kangaroo Rat Species stephensi	agilis	Other Rodents
Aug. 16/73	50	8	0	2


Temescal Wash
Trapping Locality
1973
Black Rocks
Olsen
Canyon
Dawson
Canyon
Arcilla
Indian Pictographs
Historical Marker
Claypit
Gravel Pit
Well
Wells
SANTA FE
Temescal
Wash
JEEP TRAIL
Spring
Water Tanks
BM 1115
Temescal Station
Glen Ivy Substa
VALLEY
Wash
R.6 W.
R.5 W.
23
24
25
26
30
31
35
36
1
2
6
7