Labinger, Z. and J. Greaves, "Results of 1998 Avian Surveys and Least Bell's Vireo Monitoring: Restoration Phase of the ARCO/Four Corners January 17, 1994 Oil Spill on the Santa Clara River, California" (March 1, 1999; 1999A)

cc Paul Frame
Dan Guthrie
John Gray

1998

RESULTS OF 1998 AVIAN SURVEYS AND LEAST BELL'S VIREO MONITORING: RESTORATION PHASE OF THE ARCO/FOUR CORNERS JANUARY 17, 1994 OIL SPILL ON THE SANTA CLARA RIVER, CALIFORNIA

DRAFT
1 March 1999

Prepared for:

United States Fish and Wildlife Service
Environmental Contaminant Division
2493 Portola Road, Suite B
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Prepared by:

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March 16, 1999

U.S. Fish and Wildlife Service
2493 Portola Road, Suite B
Ventura, CA 93003

ATTN: Denise Steurer

RE: 1998 Draft report of avian surveys and least Bell's vireo monitoring: restoration phase of the Arco/Four Corners January 17, 1994 Oil spill on the Santa Clara River, California.

Dear Denise,

Enclosed please find 2 copies of the 1998 draft report of avian surveys and least Bell's vireo monitoring: restoration phase of the Arco/Four Corners January 17, 1994 Oil spill on the Santa Clara River, California.

Jim and I look forward to hearing from you or the trustees concerning comments and questions about this report. As in past years, your office should supply a copy of this report to three land owners that granted us permission to survey on their property: Newhall Land and Farming Corporation, Lloyd Butler, and Hedrick Farm. Jim Greaves will email their addresses if you need.

I look forward to hearing from you concerning this upcoming field season.

Sincerely,

Zev Labinger

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Summary

This report presents results from the fifth year of avian surveys conducted in 1998, required by USFWS after the January 17, 1994 ARCO/Four Corners oil spill on the Santa Clara River, in Los Angeles County, California. In addition to the areas immediately affected by inundation of oil, two unaffected reference sites downstream have been included to allow for comparison of bird population parameters between the affected and unaffected areas to assess any injuries to birds from the oil spill. This year, five additional areas were surveyed for endangered species. Methods used to conduct the assessment included point counts, tape playback surveys, general surveys, and endangered species monitoring - which included least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo.

Point count data in 1998 indicated that species richness was significantly lower in the affected area compared to the reference sites. In contrast to previous years, mean relative abundance was not significantly different between areas. Similarly, no differences in mean relative abundance were found between areas for the two most common water-related species (killdeer and spotted sandpiper). Species richness was significantly greater at Reference Site I compared to all other areas. Within the affected area, the diversity of sensitive riparian obligate species was significantly higher at two locations (Point 8, and Section 4).

Two yellow-billed cuckoos and four southwestern willow flycatchers were found during our surveys. Least Bell's vireos were present both in the affected area and reference sites - with 6 and 51 pairs, respectively, a substantial increase from 1996 (increase mostly within Reference Site I). At two other areas surveyed, 13 additional pairs were found. Compared to 1997, this year's productivity was significantly lower, except for at Reference Site I (where it was only slightly lower:3.4 versus 3.6). Thirteen fledglings from the affected area, 120 fledglings from the reference sites, and 19 fledglings from three other areas were banded.

1.0 Introduction

On 17 January 1994, an earthquake caused the rupture of an ARCO/Four Corners oil pipeline in Santa Clarita, California. The oil spilled into the Santa Clara River at McBean Parkway and spread approximately 17 miles to the Piru Creek confluence. In response to the spill, the California Department of Fish and Game (CDFG) and the US Fish and Wildlife Service (USFWS) on behalf of state and federal trust resources began conducting a cooperative preassessment to determine potential natural resource injuries. In an effort to assess impacts to these resources, namely wildlife and associated habitat, the CDFG and USFWS initiated studies within the spill area on macroinvertebrates, teleost fishes, herpetofauna, and avifauna. This document reports the results from the fifth year of field studies conducted in the spring and summer of 1998.

The natural resource trustees, U.S. Fish and Wildlife Service and California Department of Fish and Game reached a $7.1 million dollar settlement in 1997 with Arco-Four Corners Pipeline for natural resource injury from this spill. The settlement money is to be used for restoration of natural resources lost in the oil spill. In order to conduct effective restoration planning, the trustees have determined that additional monitoring of avian species is warranted. Given this shift in the project's purpose, we made specific changes to the methodology and analysis of the results, and added a Discussion section (Labinger and Greaves 1997).

1.1 The Affected Area

The Santa Clara River is one of the largest undammed rivers in Southern California, stretching east-west for approximately 140 kilometers (Figure 1). The affected area is midway within the watershed and supports a variety of sensitive riparian habitats ranging in succession from emergent wetland freshwater marsh to mature willow and cottonwood forest and more disturbed areas of giant reed (*Arundo donax*), tamarisk (*tamarix sp.*) and mulefat (*Baccharis salicifolia*) scrub. Several large freshwater marsh habitats are present which contain emergent bulrush (*Juncus sp.*), cattail (*Typhus sp.*), and young willow (*Salix sp.*) and cottonwood (*Populus sp.*) trees. In addition, much of this stretch of the river is contiguous with native upland habitats such as coastal sage scrub and oak woodland.

The abundance and distribution of birds appears to be directly related to the quality and quantity of available habitat. Since western riparian ecosystems are among the most productive habitats for birds in North America and among the rarest (Krueper 1992), it is not surprising that many parts of the river supports a rich diversity of birds, including a number of endangered, threatened, and sensitive species. Some of this section of the river is included within US Fish and Wildlife Service Critical Habitat designation for the state and federally endangered least Bell's vireo (*Vireo bellii pusillus*).

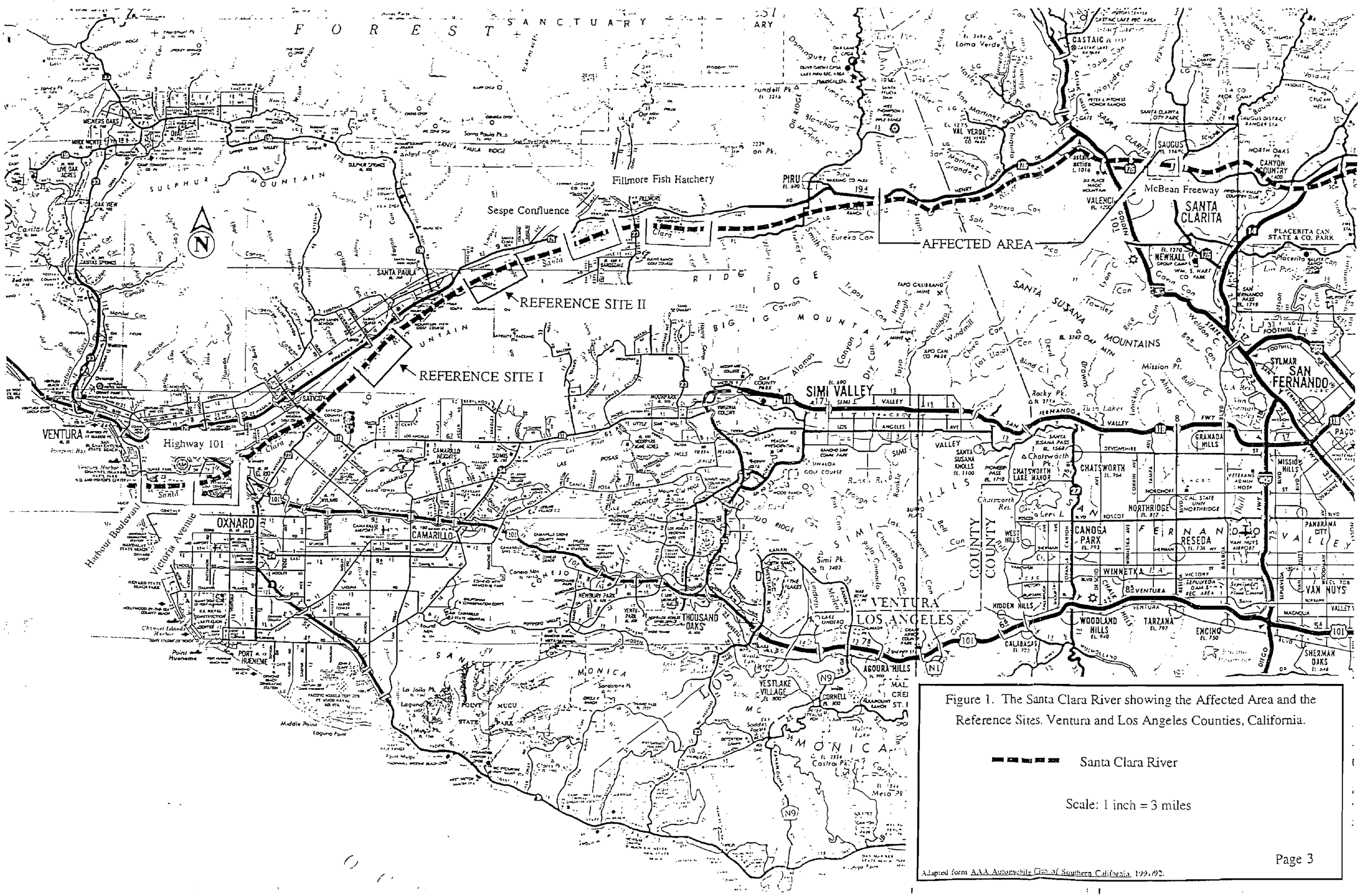


Figure 1. The Santa Clara River showing the Affected Area and the Reference Sites. Ventura and Los Angeles Counties, California.

Santa Clara River

Scale: 1 inch = 3 miles

Adapted form AAA Automobile Club of Southern California, 1991-92.

2.0 Methods

In 1994, two reference sites were chosen as control areas for comparison to the spill area (affected area). The reference sites are located downstream of the spill area near Santa Paula approximately 20 and 25 miles, respectively (Figure 1). Each site is 4.5 km long and combined (9 km) they are exactly half the size of the affected area. Reference sites were chosen according to several criteria: 1) vegetation composition was similar to that found within major portions of the affected area; 2) both sites supported least Bell's vireos, allowing for species specific comparisons; 3) they were in close proximity geographically; and, 4) they were topographically similar to the affected area (i.e. east-to-west river flow within the same river valley). Sites were not chosen up river from the spill area due to the absence of comparable habitat. Although the reference sites were located downstream of the spill, the sites should have been uncontaminated since the oil was contained by several earthen dams 20 miles upstream, and most of the oil was cleaned from the river before heavy rains could wash it past the affected area (T. Abajian, USFWS, pers. com.). The location of all counting points is presented in Figures 2, 3, 4, and 5.

The overall study design in 1998 was similar to the previous four years (Labinger et al. 1994). In general the study was composed of two parts: 1) impacts to the avian community, and 2) impacts to endangered species, including monitoring of known least Bell's vireo sub-populations (Labinger et al. 1994). Project design emphasized comparisons between points within the affected area, and between the affected area and reference sites (non-affected areas). This approach allowed us to test the hypothesis that bird population parameters vary with respect to degree of habitat damage. Testing the validity of such a hypothesis forms the basis of many damage assessments (USDI 1994).

Methods employed in the study included point counts, tape playback surveys for three endangered species (western yellow-billed cuckoo *Coccyzus americanus occidentalis*, southwestern willow flycatcher *Empidonax traillii extimus*, and least Bell's vireo), general bird surveys, and least Bell's vireo population monitoring. In an effort to better understand factors affecting vireo nesting success, specifically from cowbirds, the 1998 monitoring began earlier than in previous years (late April) and was more intensive. Specifically, monitoring efforts were increased significantly along Reference Site I (Santa Paula to Saticoy). Since no cowbirds were being trapped along the river in 1998, we attempted to locate as many vireo nests in this area as possible in order to assess potential impacts to the vireos from cowbirds. This segment presented an ideal opportunity to examine cowbird interactions because more than half the river's population of vireos was found within this section.

This year we further increased our survey area to better understand the distribution of endangered species and subsequent restoration planning. Five additional areas were chosen based on their high quality riparian habitat and prior history of supporting breeding least

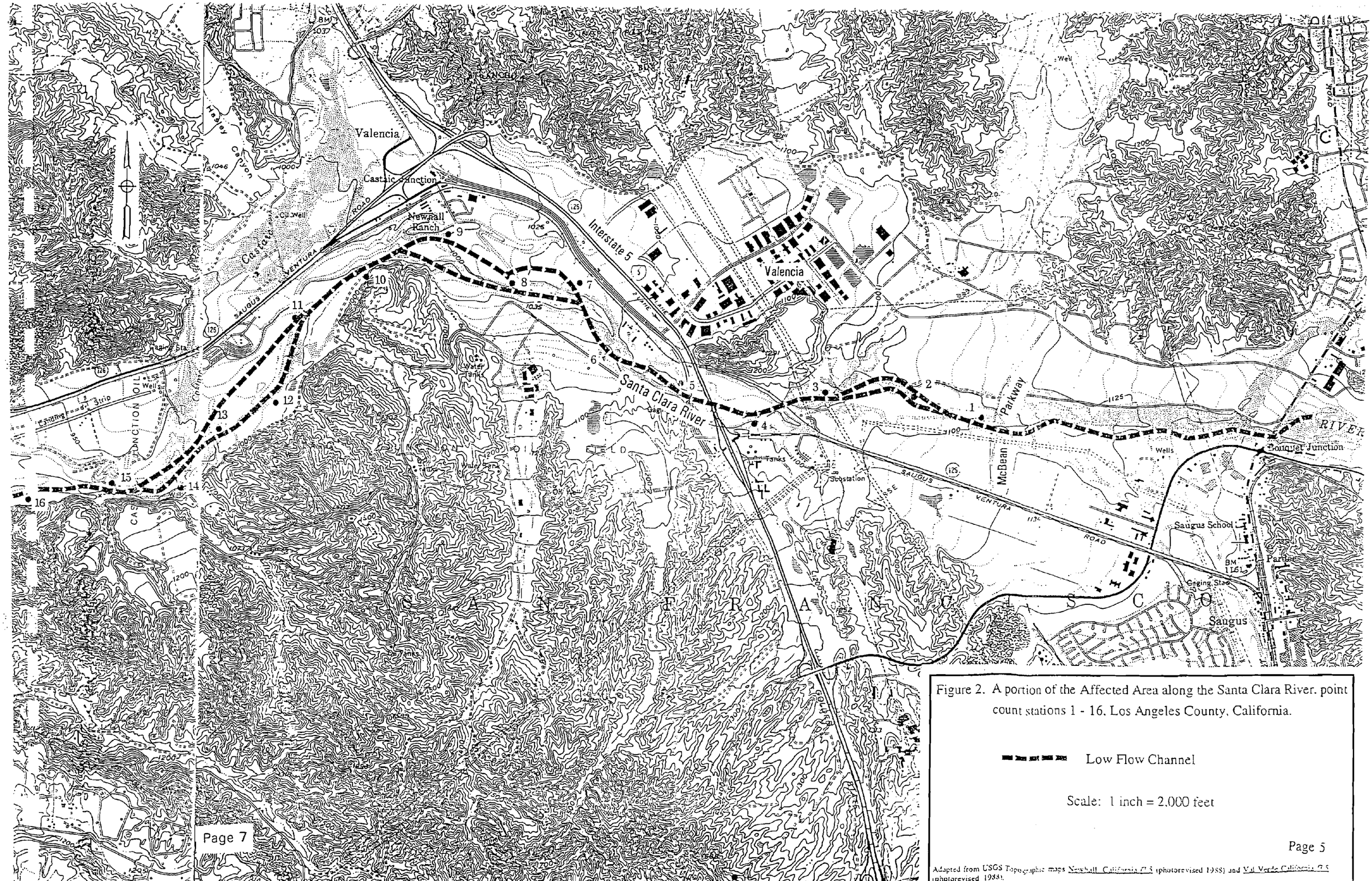


Figure 2. A portion of the Affected Area along the Santa Clara River. point count stations 1 - 16. Los Angeles County, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic maps Newhall, California 7.5 (photorevised 1988) and Val Verde California 7.5 (photorevised 1988).

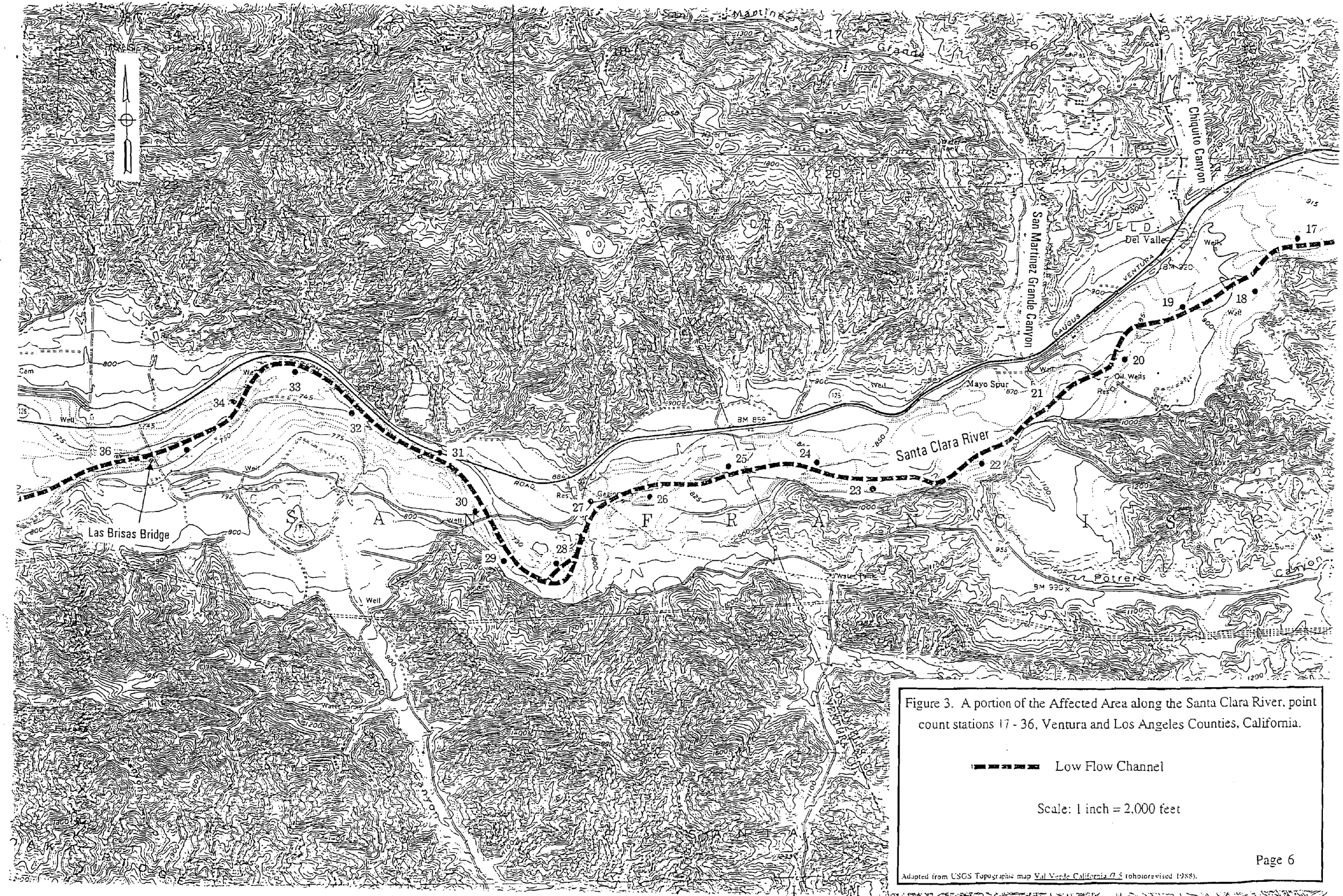


Figure 3. A portion of the Affected Area along the Santa Clara River, point count stations 17 - 36, Ventura and Los Angeles Counties, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic map Val Verde California 7.5 (photorevised 1988).

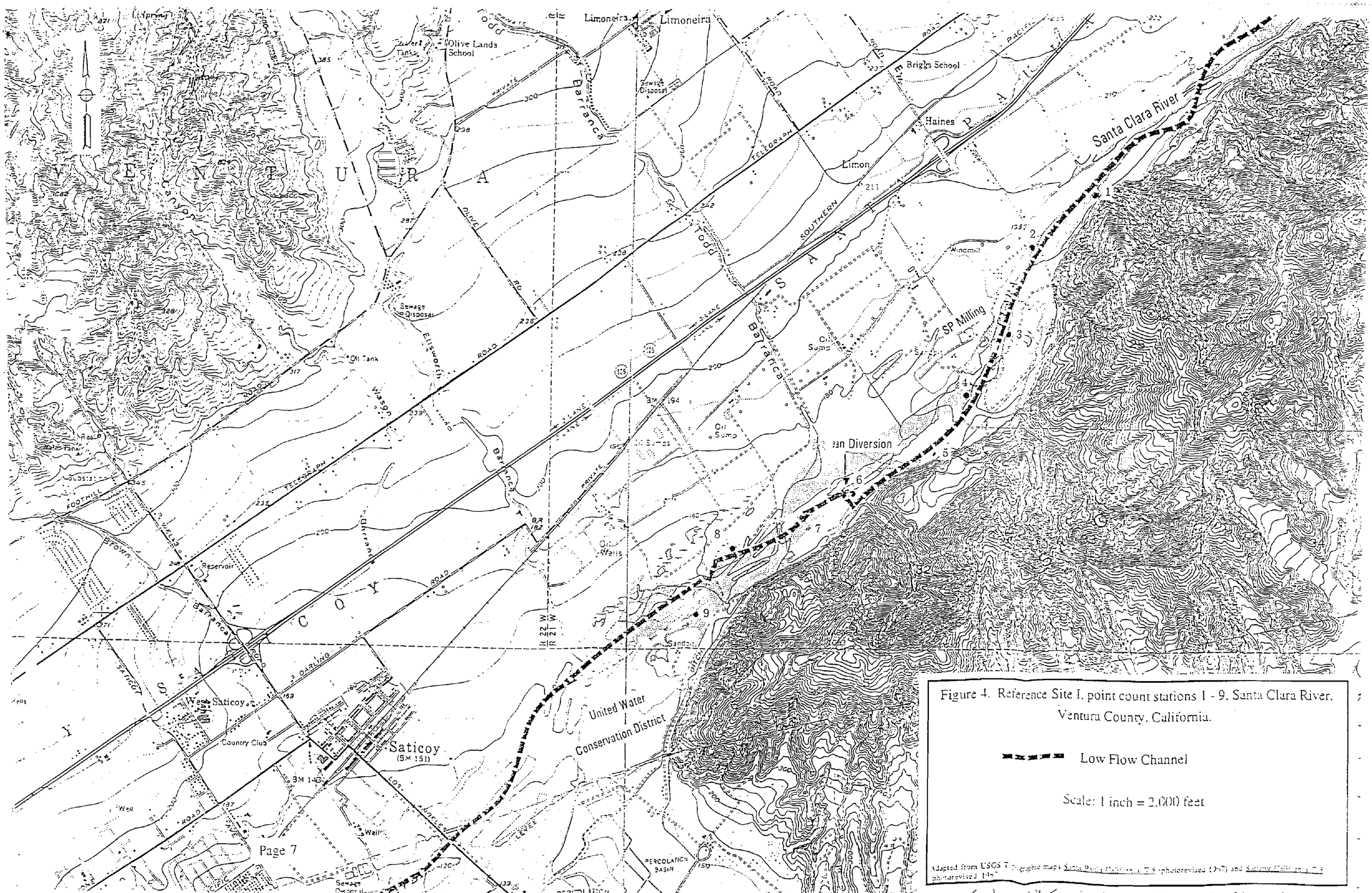


Figure 4. Reference Site I, point count stations 1 - 9, Santa Clara River, Ventura County, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic maps Santa Paula, Calif., 7.5' photorevised 1967 and Saticoy, Calif., 7.5' photorevised 1967

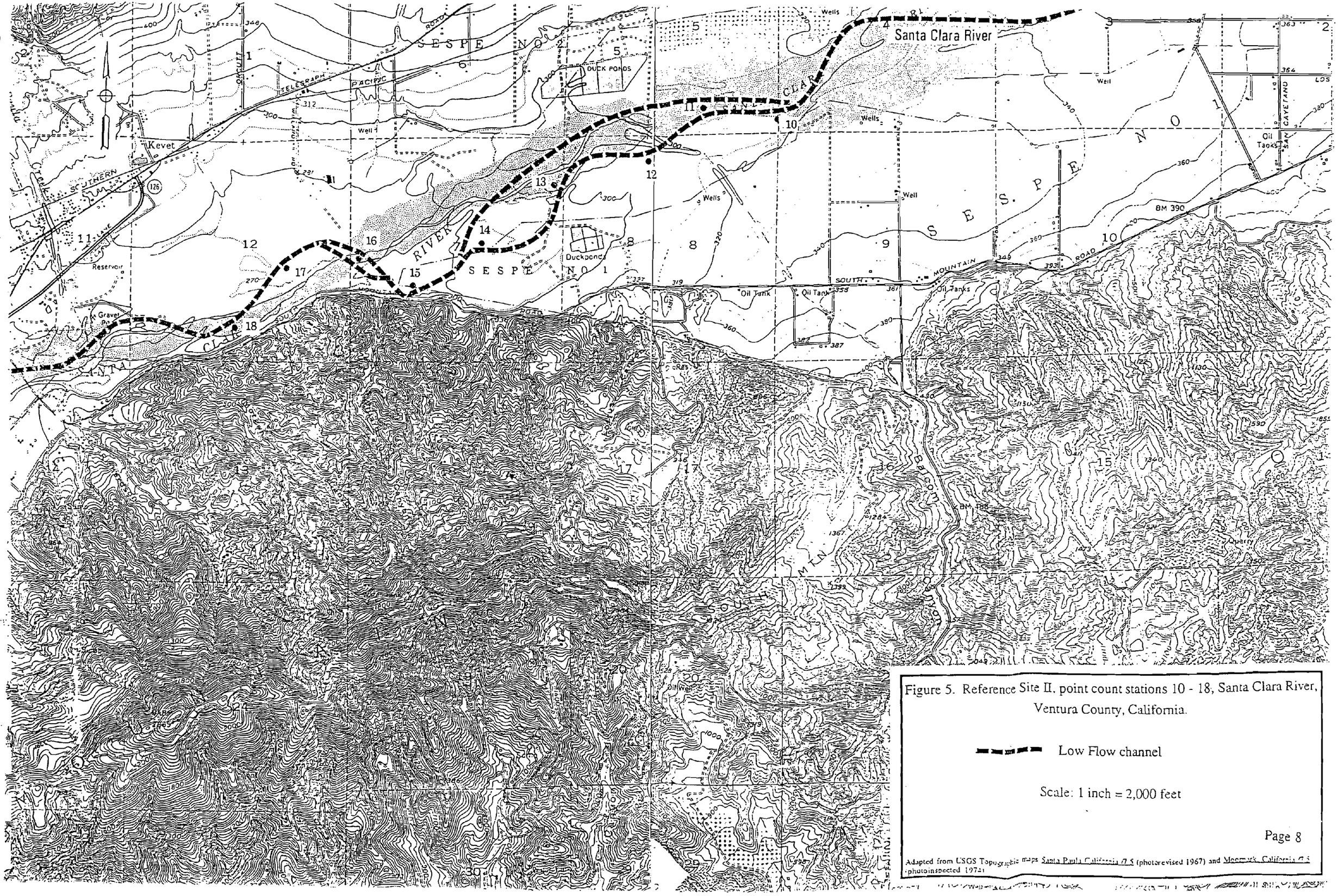


Figure 5. Reference Site II, point count stations 10 - 18, Santa Clara River, Ventura County, California.

Low Flow channel

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic maps Santa Paula California 7.5 (photorevised 1967) and Moorpark, California 7.5 (photoinspected 1973)

Bell's vireos (SEB 1993). The locations of these additional areas are: 1) Along the Harbour Boulevard area (first year surveyed); 2) between Highway 101 and Victoria Avenue; 3) at the confluence of Sespe Creek and the Santa Clara River; 4) the California Fish and Game Fish Hatchery area east of Fillmore; and, 5) McBean Freeway upstream one mile (Figure 1). Methods employed in these surveys included tape playback for the three endangered species, general surveys, and least Bell's vireo monitoring.

The study included an assessment of habitat parameters at count points. Habitat data was collected at each of the 54 points used for counting birds. Percent coverage of each habitat parameter was estimated visually within a 100 meter radius around each point. Parameters included: standing water; open ground; ruderal; forb; emergent wetland; shrubs - willow sp. < 2m high, cottonwood sp. < 2m high, mulefat, giant reed, tamarisk, miscellaneous sp.; and trees - willow sp., Fremont cottonwood (*Populus fremontii*), black cottonwood (*Populus trichocarpa*).

2.1 Quality Control

All field work was conducted by Z. Labinger, J. Greaves, and D. Kisner. Both of the authors (Labinger and Greaves) are biologists that have 20 years of professional experience in field ornithology, including experience with the methods employed here. D. Kisner has 5 years of intensive field work experience, including experience with the methods employed here. He worked in conjunction with one of the authors but did not participate in the vireo nest monitoring.

Specific training procedures were conducted prior to data collection and are outlined in Labinger et al. (1994). Field data were inspected daily for accuracy and completeness.

2.2 Statistical Analysis

All pertinent data were entered into IBM-compatible computers by Z. Labinger. After all data were entered, hard copies were printed and compared with original data sheets by reading data aloud to a second biologist.

Statistical analysis concentrated mostly on point count data. We calculated mean relative abundance for each species from combined data of the two observers. Relative abundance and species richness (number of species) were determined for each point. Relative abundance data deviated slightly from a normal distribution; whereas, species richness followed a normal distribution. To be conservative, we used the nonparametric Mann-Whitney U method to test the relationships between points within the affected area, and between the affected area and reference sites (Ryan et al. 1985). In this report we have not statistically analyzed the results in relation to data from previous years; however, comparisons are

discussed in the Discussion section.

The estimated percent cover of the habitat parameters were compared between points within the affected area and between the affected area and reference sites. Some parameters were combined such as shrub and tree cover and used as one statistical parameter. Multiple regression analysis was employed to examine possible correlations between habitat parameters and avian point count data (relative abundance and species richness).

The scope of this study did not include exhaustive literature search of historical data for the study area. Most of this information is in private documents since all the affected area is private property. Much of the information that is available can not be used for statistical comparisons due to differences in data collection methodology.

3.0 Results

3.1 General Surveys

All species detected during general surveys and point counts are listed in Table I. A total of 105 species were detected throughout the study area. Of these, 24 species (representing approximately 25% of the total) were detected only during the general surveys.

General productivity data were not collected in a consistent manner and with comparable effort, and therefore are difficult to analyze statistically. We did collect direct breeding evidence for 43 species. Among these is a new breeding species for the study area: Wilson's Warbler (this species is slowly increasing its range southward within southern California). Highly detectable species such as the waterbirds may yield more reliable data. Juveniles were observed for each of the following waterbird species: green heron, black-crowned night heron, mallard and killdeer. Fewer nests of the ground nesting species (killdeer and spotted sandpiper) were found compared to previous years. This was the first year that spotted sandpiper juveniles were not observed despite at least one known nest and an extra observer compared to previous years. This may be the result of low food availability or a delayed breeding cycle due to late rains and flooding. The data do not indicate any significant differences in the number of juveniles of other species between the affected area and reference sites.

3.2 Point Counts

The mean relative abundance for each species is presented by study area section and reference site in Table I. Species richness and total mean relative abundance is presented in Table II. Mean relative abundance of all species combined was slightly greater at the affected area, but not significantly different from the reference sites. However, closer examination of

APPENDIX A. Mean relative abundance of bird species detected during 1998 surveys along the affected area and reference sites (mean in bold, standard error in normal font; species detected not during a point count are noted with " * ").

SPECIES		AFFECTED AREA (SECTIONS)								REFERENCE SITES			
		1		2		3		4		I		II	
Pied-billed Grebe	*Podilymbus podiceps*									*		*	
Double-crested Cormorant	*Phalacrocorax auritus*									*			
Great Blue Heron	*Ardea herodias*	**0.00**	0.00	**0.22**	0.25	**0.00**	0.00	**0.00**	0.00	**0.39**	0.46	**0.11**	0.31
Great Egret	*Casmerodius albus*	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.06**	0.16	**0.06**	0.16
Snowy Egret	*Egretta thula*	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.17**	0.24	**0.06**	0.16
Cattle Egret	*Bubulcus ibis*											*	
Green Heron	*Butorides virescens*	**0.00**	0.00	**0.11**	0.31	**0.11**	0.21	**0.00**	0.00	**0.22**	0.34	**0.06**	0.16
Black-crowned Night-Heron	*Nycticorax nycticorax*	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.06**	0.16	**0.00**	0.00
Mallard	*Anas platyrhynchos*	**0.06**	0.16	**0.00**	0.00	**0.11**	0.21	**0.00**	0.00	**0.22**	0.34	**0.00**	0.00
Gadwall	*Anas strepera*	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.11**	0.31	**0.00**	0.00
Cinnamon Teal	*Anas cyanoptera*											*	
Turkey Vulture	*Cathartes aura*	**0.00**	0.00	**0.06**	0.16	**0.06**	0.16	**0.06**	0.16	**0.00**	0.00	**0.11**	0.31
White-tailed Kite	*Elanus leucurus*	**0.22**	0.25	**0.17**	0.24	**0.00**	0.00	**0.00**	0.00	**0.06**	0.16	**0.00**	0.00
Cooper's Hawk	*Accipter cooperii*	**0.17**	0.24	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Red-shouldered Hawk	*Buteo lineatus*	**0.33**	0.33	**0.28**	0.34	**0.00**	0.00	**0.22**	0.63	**0.11**	0.21	**0.22**	0.48
Red-tailed Hawk	*Buteo jamaicensis*	**0.22**	0.25	**0.56**	0.72	**0.22**	0.34	**0.11**	0.21	**0.44**	0.55	**0.17**	0.24
American Kestrel	*Falco sparverius*	**0.06**	0.16	**0.28**	0.48	**0.06**	0.16	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
California Quail	*Callipepla californica*	**1.00**	0.94	**1.00**	0.85	**0.17**	0.33	**0.28**	0.63	**0.89**	0.39	**0.44**	0.76
Killdeer	*Charadrius vociferus*	**0.44**	0.37	**1.00**	0.82	**1.44**	1.01	**0.72**	0.85	**1.17**	1.29	**1.39**	1.26
Greater Yellowlegs	*Tringa melanoleuca*									*		*	
Spotted Sandpiper	*Actitis macularia*	**0.06**	0.16	**0.11**	0.31	**0.28**	0.48	**0.00**	0.00	**0.44**	0.55	**0.17**	0.33
Least Sandpiper	*Calidris minutilla*									*			
Bonaparte's Gull	*Larus philadelphia*									*			
Heermann's Gull	*Larus heermanni*									*			
Western Gull	*Larus occidentalis*	**0.00**	0.00	**18.11**	51.23	**1.17**	1.51	**0.06**	0.16	**0.22**	0.48	**0.11**	0.21
Gull species		**0.00**	0.00	**0.00**	0.00	**0.06**	0.16	**0.00**	0.00	**0.06**	0.16	**0.00**	0.00
Common Ground-dove	*Columbina passerina*							*		*			
Rock Dove	*Columba livia*	**3.78**	9.35	**1.39**	3.11	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Spotted Dove	*Streptopelia chinensis*											*	
Mourning Dove	*Zenaida macroura*	**0.50**	0.47	**0.22**	0.34	**0.39**	0.52	**0.50**	0.58	**0.89**	0.57	**0.33**	0.33
Greater Roadrunner	*Geococcyx californianus*					*							
Common Barn-Owl	*Tyto alba*	*		*									
Great Horned Owl	*Bubo virginianus*											*	
Lesser Nighthawk	*Chordeiles acutipennis*									*			
White-throated Swift	*Aeronautes saxatalis*	**0.06**	0.16	**0.67**	1.27	**0.06**	0.16	**0.00**	0.00	**0.00**	0.00	**0.11**	0.21

		AFFECTED AREA (SECTIONS)								REFERENCE SITES			
SPECIES		1		2		3		4		I		II	
Anna's Hummingbird	*Calypte anna*	0.06	0.16	0.06	0.16	0.28	0.34	0.00	0.00	0.06	0.16	0.22	0.42
Black-chinned Hummingbir	*Archilochus alexandri*												
Costa's Hummingbird	*Calyptae costae*	0.00	0.00	0.06	0.16	0.39	0.46	0.00	0.00	0.00	0.00	0.06	0.16
Allen's Hummingbird	*Selasphorus sasin*	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.00	0.00	0.00	0.00
Hummingbird sp		0.28	0.63	0.11	0.21	0.11	0.21	0.00	0.00	0.06	0.16	0.06	0.16
Nuttall's Woodpecker	*Picoides nuttallii*	0.72	0.53	0.67	0.58	0.33	0.33	0.56	0.28	0.06	0.16	0.00	0.00
Downy Woodpecker	*Picoides pubescens*	0.11	0.21	0.17	0.24	0.22	0.25	0.00	0.00	0.39	0.39	0.00	0.00
Hairy Woodpecker	*Picoides villosus*	0.28	0.34	0.11	0.31	0.00	0.00	0.00	0.00	0.11	0.31	0.00	0.00
Northern Flicker	*Colaptes auratus*	0.17	0.33	0.50	0.47	0.00	0.00	0.11	0.31	0.17	0.24	0.28	0.42
Pacific-slope Flycatcher	*Empidonax difficilis*	0.00	0.00	0.00	0.00	0.06	0.16	0.06	0.16	0.11	0.21	0.17	0.33
Black Phoebe	*Sayornis nigricans*	0.39	0.46	0.39	0.39	0.67	0.47	1.17	0.47	0.89	0.74	0.61	0.46
Say's Phoebe	*Sayornis saya*												
Ash-throated Flycatcher	*Mylarchus cinerascens*	1.06	0.44	1.17	0.71	0.94	0.55	0.89	0.61	0.56	0.60	0.50	0.41
Cassin's Kingbird	*Tyrannus vociferans*	0.06	0.16	0.11	0.21	0.00	0.00	0.00	0.00	0.17	0.33	0.00	0.00
Western Kingbird	*Tyrannus verticalis*	0.06	0.16	0.00	0.00	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Kingbird sp.		0.00	0.00	0.00	0.00	0.06	0.16	0.06	0.16	0.00	0.00	0.00	0.00
Horned Lark	*Eremophila alpestris*												
Tree Swallow	*Tachycineta bicolor*	0.00	0.00	0.28	0.34	0.22	0.34	0.00	0.00	0.72	1.55	2.28	3.22
Violet-green Swallow	*Tachycineta thalassina*	0.00	0.00	0.22	0.42	0.17	0.33	0.00	0.00	0.00	0.00	0.17	0.33
Northern Rough-winged Sw	*Stelgidopteryx serripennis*	0.83	0.94	0.50	0.53	0.44	0.37	0.11	0.31	0.56	0.44	2.17	2.43
Cliff Swallow	*Hirundo pyrrhonota*	0.94	1.23	19.78	34.62	2.00	3.39	17.11	33.84	16.33	15.62	7.39	17.75
Barn Swallow	*Hirundo rustica*	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.17	0.33	0.17	0.33
Swallow sp.		0.00	0.00	0.50	0.71	0.00	0.00	0.06	0.16	0.00	0.00	0.11	0.21
Scrub Jay	*Aphelocoma coerulescens*	1.61	0.77	1.28	0.85	0.78	0.53	0.56	0.68	0.28	0.63	0.56	0.64
American Crow	*Corvus brachyrhynchos*	6.89	15.71	0.83	0.67	6.06	16.08	1.61	1.45	0.00	0.00	0.33	0.53
Common Raven	*Corvus corax*	3.50	4.81	1.67	1.25	1.67	2.01	0.22	0.48	0.89	1.02	0.39	0.57
Plain Titmouse	*Parus inornatus*	0.94	0.72	0.67	0.71	1.00	0.67	0.61	0.57	0.00	0.00	0.11	0.31
Common Bushtit	*Psaltriparus minimus*	0.67	0.85	0.94	1.36	0.61	1.10	1.00	1.47	1.06	2.33	0.22	0.48
White-breasted Nuthatch	*Sitta carolinensis*	0.06	0.16	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bewick's Wren	*Thryomanes bewickii*	1.83	1.00	1.06	0.72	1.44	0.72	1.00	0.47	1.33	0.47	0.83	0.67
House Wren	*Troglodytes aedon*	0.17	0.33	0.22	0.34	0.00	0.00	0.11	0.21	0.00	0.00	0.00	0.00
Western Bluebird	*Sialia mexicana*	0.06	0.16	0.06	0.16	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Swainson's Thrush	*Catharus ustulatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.06	0.16
American Robin	*Turdus migratorius*	0.00	0.00	0.00	0.00	0.06	0.16	0.22	0.25	0.00	0.00	0.22	0.25
Wrentit	*Chamaea fasciata*	0.06	0.16	0.78	0.71	0.78	0.58	1.44	0.76	0.50	0.47	0.61	0.57
Northern Mockingbird	*Mimus polyglottos*	0.06	0.16	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
California Thrasher	*Toxostoma redivivum*	0.28	0.34	0.11	0.21	0.44	0.60	0.44	0.50	0.17	0.33	0.28	0.34
Phainopepla	*Phainopepla nitens*	0.00	0.00	0.28	0.34	0.06	0.16	0.56	0.60	0.00	0.00	0.00	0.00
European Starling	*Sturnus vulgaris*	0.28	0.63	0.00	0.00	0.06	0.16	0.06	0.16	0.11	0.31	0.06	0.16

SPECIES		AFFECTED AREA (SECTIONS)								REFERENCE SITES			
		1		2		3		4		I		II	
Bell's Vireo	*Vireo bellii*	0.17	0.47	0.00	0.00	0.00	0.00	0.28	0.48	1.83	1.41	0.67	0.97
Hutton's Vireo	*Vireo huttoni*												
Warbling Vireo	*Vireo gilvus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.16
Solitary Vireo	*Vireo solitarius*												
Nashville Warbler	*Vermivora ruficapilla*												
Townsend's Warbler	*Dendroica townsendi*												
Black-throated Gray Warble	*Dendroica nigrescens*												
Orange-crowned Warbler	*Vermivora celata*	0.06	0.16	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.25
Yellow Warbler	*Dendroica petechia*	0.11	0.21	0.06	0.16	0.28	0.34	0.83	0.91	1.94	0.76	1.17	0.58
Common Yellowthroat	*Geothlypis trichas*	0.39	0.74	0.28	0.42	0.72	0.67	1.22	0.58	1.22	0.79	1.50	0.88
Wilson's Warbler	*Wilsonia pusilla*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.21	0.00	0.00
Yellow-breasted Chat	*Icteria virens*	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.42	1.00	0.33	0.89	0.84
Western Tanager	*Piranga ludoviciana*												
Northern Cardinal	*Cardinalis cardinalis*												
Black-headed Grosbeak	*Pheucticus melanocephalus*	0.56	0.55	0.89	0.52	1.67	0.62	1.06	0.60	1.61	0.61	0.89	0.57
Blue Grosbeak	*Guiraca caerulea*	0.39	0.52	0.28	0.34	0.22	0.34	0.44	0.64	0.39	0.31	0.17	0.24
Lazuli Bunting	*Passerina amoena*	0.06	0.16	0.00	0.00	0.00	0.00	0.22	0.34	0.22	0.34	0.33	0.47
Indigo Bunting	*Passerina cyanea*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.31
Spotted Towhee	*Pipilo erithrophthalmus*	0.78	0.58	0.33	0.47	1.17	0.78	0.44	0.68	1.11	0.39	1.00	0.47
California Towhee	*Pipilo crissalis*	0.61	0.77	0.78	0.53	0.94	0.68	1.00	0.78	0.78	0.71	0.28	0.42
Rufous-crowned Sparrow	*Aimophila ruficeps*	0.00	0.00	0.11	0.21	0.06	0.16	0.11	0.21	0.00	0.00	0.00	0.00
Chipping Sparrow	*Spizella passerina*												
Lark Sparrow	*Chondestes grammacus*	0.00	0.00	0.00	0.00	0.22	0.63	0.00	0.00	0.00	0.00	0.00	0.00
Song Sparrow	*Melospiza melodia*	1.83	1.05	1.22	0.85	1.61	0.97	2.67	1.29	1.56	0.55	2.56	0.83
Sparrow sp.		0.00	0.00	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Red-winged Blackbird	*Agelaius phoeniceus*	0.11	0.21	0.17	0.47	0.22	0.42	0.00	0.00	0.17	0.47	2.89	7.00
Brewer's Blackbird	*Euphagus cyanocephalus*	0.00	0.00	2.22	6.29	0.11	0.31	0.00	0.00	0.17	0.33	0.44	0.68
Brown-headed Cowbird	*Molothrus ater*	0.89	0.84	0.39	0.66	0.06	0.16	0.50	0.62	0.94	0.55	0.06	0.16
Hooded Oriole	*Icterus cucullatus*	0.00	0.00	0.00	0.00	0.11	0.31	0.00	0.00	0.00	0.00	0.00	0.00
Bullock's Oriole	*Icterus bullocki*	0.28	0.34	0.11	0.21	0.17	0.33	0.33	0.62	0.28	0.63	0.11	0.21
Purple Finch	*Carpodacus purpureus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.16
House Finch	*Carpodacus mexicanus*	1.28	1.34	1.50	1.08	0.61	0.52	1.33	0.71	2.33	3.02	0.72	0.63
Lesser Goldfinch	*Carduelis psaltria*	1.11	1.26	0.28	0.34	1.00	0.47	2.44	1.14	2.61	1.68	0.50	0.71
Lawrence's Goldfinch	*Carduelis lawrencei*	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.31	0.00	0.00
American Goldfinch	*Carduelis tristis*	0.06	0.16	0.00	0.00	0.06	0.16	0.33	0.53	0.39	0.39	0.67	0.75
Goldfinch sp.		0.00	0.00	0.00	0.00	0.06	0.16	0.00	0.00	0.00	0.00	0.00	0.00
House Sparrow	*Passer domesticus*												

TABLE II. Comparison of mean species richness and relative mean abundance of points per section within study area (Standard Deviation in parenthesis).

	AFFECTED AREA (SECTION)					REFERENCE SITE				
	1	2	3	4	Total	I	II	Total	P[1]	
Relative Abundance	36.94(20.15)	65.50(56.39)	32.33(17.78)	43.50(35.96)	44.57(36.79)	49.00(18.79)	36.44(25.22)	42.72(22.52)	0.317	ns
Richness	22.22(3.49)	24.22(3.11)	23.56(5.41)	21.33(3.81)	22.83(4.04)	27.44(3.13)	23.67(3.43)	25.56(3.73)	0.012	*
Total Richness	53	55	52	44	70	55	56	66		

1. Mann-Whitney Test of Affected area versus Reference site: ns -- not significant, * -- significant.

TABLE III. Mean relative abundance of the three most common species and water-related species in the study area (Standard Deviation in Parenthesis).

	AFFECTED AREA (SECTION)					REFERENCE SITE				
	1	2	3	4	Total	I	II	Total	P[1]	
Abundant Species										
Common Yellowthroat	0.39(0.78)	0.28(0.44)	0.72(0.71)	1.22(0.62)	0.65(0.72)	1.22(0.83)	1.50(0.93)	1.36(0.87)	0.005	*
Song Sparrow	1.83(1.12)	1.22(0.91)	1.61(1.02)	2.67(1.37)	1.83(1.20)	1.56(0.58)	2.56(0.88)	2.06(0.89)	0.404	ns
House Finch	1.28(1.42)	1.50(1.15)	0.61(0.55)	1.33(0.75)	1.18(1.04)	2.33(3.20)	0.72(0.67)	1.53(2.39)	0.898	ns
Water-related Species										
Killdeer	0.44(0.39)	1.00(0.87)	1.44(1.07)	0.72(0.91)	0.90(0.89)	1.17(1.37)	1.39(1.34)	1.28(1.32)	0.374	ns
Spotted Sandpiper	0.06(0.17)	0.11(0.33)	0.28(0.51)	0.00(0.00)	0.11(0.32)	0.44(0.58)	0.17(0.35)	0.31(0.49)	0.229	ns
Fisheaters[2]	0.00(0.00)	0.33(0.35)	0.11(0.22)	0.00(0.00)	0.11(0.24)	0.89(0.82)	0.28(0.36)	0.58(0.69)	0.014	*

1. Mann-Whitney Test of Affected Area versus Reference site: ns -- not significant, * -- significant.
2. Fisheaters = Great Egret, Snowy Egret, Great-blue Heron, Black-crowned Night-heron, Green Heron.

the data reveals an exceptionally large mean relative abundance for section 2 in the affected area (65.50). This large number is partially the result of a large flock of western gulls (250-300) that were using a portion of the river bottom near point 18. However, differences are still not significant after removing these individuals from the analysis.

In contrast, mean species richness per point was significantly greater at the reference sites than at the affected area. This difference appears to be mainly the result of Reference Site I where 27 species were detected. However, differences between sections and reference sites become minimal when examining the total species richness. This point illustrates the importance of scale and resolution when analyzing such data. No trends were found between points within the affected area in relative abundance or species richness. In other words, these parameters did not increase or decrease in relation to distance from the initial spill area.

Relative abundance of the three most abundant species is presented in Table III. As with most census methods, point counts tend to be more accurate for abundant species (Verner 1985). Therefore, three of the most abundant species were analyzed separately (common yellowthroat, song sparrow, and house finch). Only the common yellowthroat showed a significant difference where mean relative abundance was lower at the affected area compared with the reference sites.

The relative abundance of water-related species was also examined separately (Table III). All of these species spend a majority of their time foraging and/or nesting on the ground near water, and therefore, were more likely to be directly affected by the oil spill. The relative abundance of the two most common water-related species, spotted sandpiper and killdeer, did not vary significantly between the affected area and reference sites. The relative abundance of the less common waterbirds (all fish-eaters: great egret, great-blue heron, snowy egret, green heron, and black-crowned night-heron) were pooled for analysis to increase the sample size. Relative abundance of these species combined was significantly lower in the affected area than in the reference sites ($P=0.014$). The relationship between mean relative abundance of these three water-related species and points along the affected area and reference sites is graphed in Figure 6.

We examined the distribution of sensitive riparian obligate species to determine areas of high diversity. Figure 7 shows two graphs: A) the total number of species (richness), and B) the number of sensitive riparian obligate species plotted for all count points in the study area. Total species richness is fairly evenly distributed over most points. In previous years, Reference Site I supported a significantly greater number of species. This year, however, Reference Site I had a similar number of species to other sections but each point within the site supported a consistently large number of species. In contrast, sensitive riparian obligate species show much more variation in number. Areas of high diversity of these species include the Magic Mountain area (point 8), Salt Creek down to Las Brisas (points 27 - 36),

Figure 6. The relationship between mean relative abundance and count points along the affected area and reference sites for several water-related species (Santa Clara River, California).

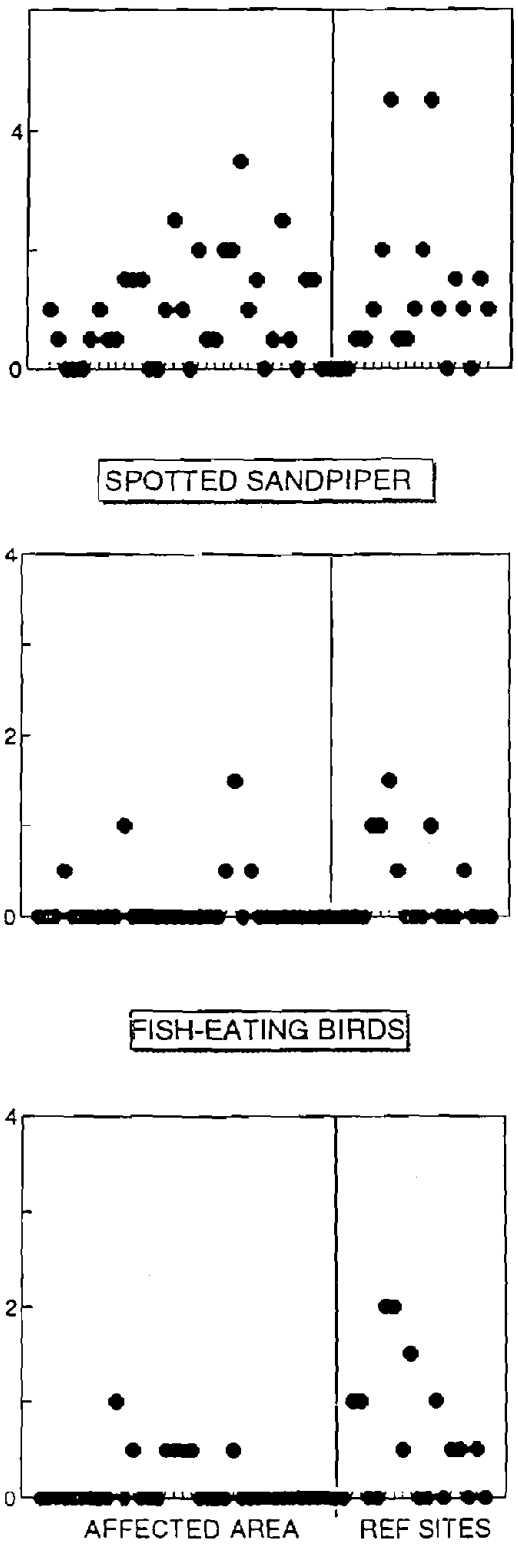
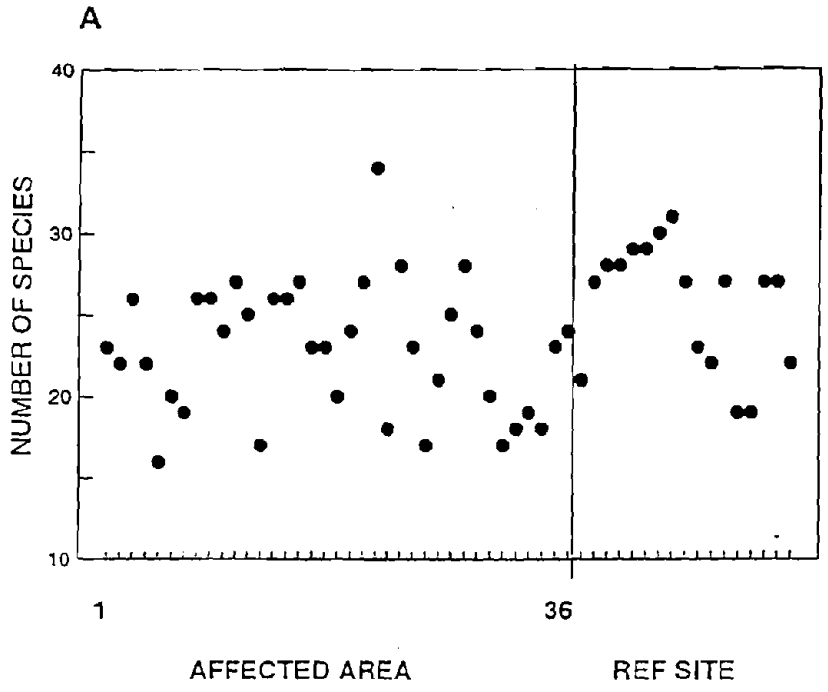
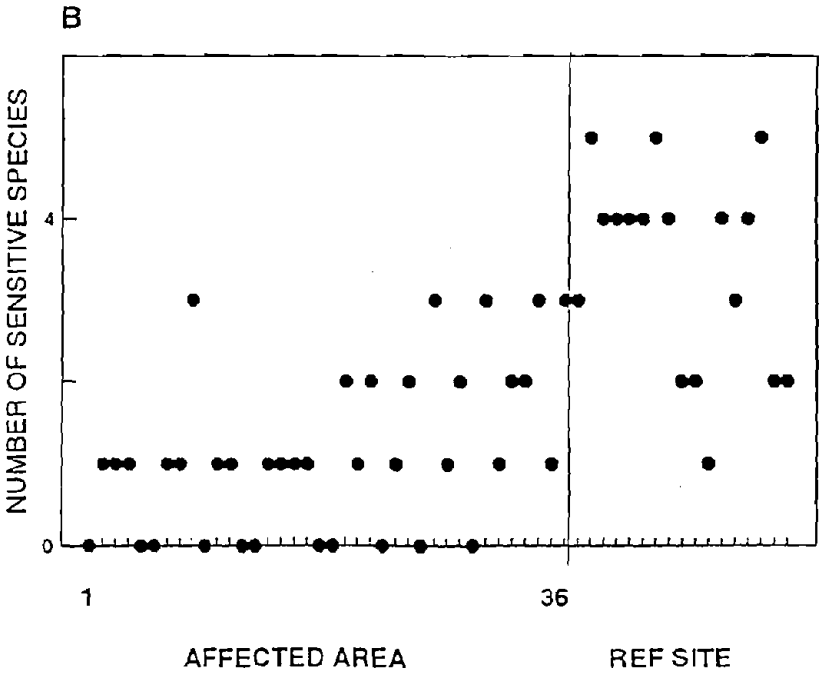


Figure 7. The relationship between points along the affected area and reference sites and: A. the total number of species detected per point; and B. the total number of sensitive riparian obligate species per point (Allen's hummingbird, least Bell's vireo, warbling vireo, Swainson's thrush, blue grosbeak, yellow-breasted chat, and yellow warbler).





and reference sites I and II. These areas are discussed in more detail within the context of Sensitive Species Accounts and the least Bell's vireo habitat use and distribution.

3.3 Habitat Relationships

The results of estimated percent cover of habitat parameters for each point is presented in Table IV. We used multiple regression analysis to examine each of the habitat parameters (and combinations) in relation to mean relative abundance and species richness. Mean relative abundance did not correlate significantly with any of the habitat parameters. However, species richness was significantly negatively related to the number of habitat parameters present at a point, and the total tree coverage (Figure 8). The combined regression equation is: Species Richness = 27.6 - 0.519 Habitat Parameters - 0.0748 Total Tree, r-squared = 12.9 %, P = 0.029.

3.4 Endangered Species Surveys

This is the second year that all three endangered species were detected within the study area. The locations of all individuals of the three endangered species are presented in Figures 9 - 14. Observations and monitoring accounts are as follows.

3.4.1 Yellow-billed Cuckoo

At least two yellow-billed cuckoos were heard approximately 500m upstream of the affected area (McBean Freeway) on 14 July (Figure 9). The birds repeated their congeneric (both sexes) vocalization several times seemingly not in response to a taped playback. These birds were not observed. No cuckoos were found on two subsequent searches of this area and were presumed to have migrated through the area.

3.4.2 Southwestern Willow Flycatcher

Figure 11 shows the location of a territorial southwestern willow flycatcher within Reference Site I. One individual was first observed singing here on 1 June. The bird was monitored during four subsequent visits (5, 13 and 20 June, and 16 July). Activity was always focused within a one acre area, and included singing, calling and territorial response to taped playback song and human presence. No other bird or actually nesting was observed. The habitat was appropriate for breeding, consisting of a mature old growth willow stand with a lush understory of mugwort, blackberry and poison oak, and some standing water nearby.

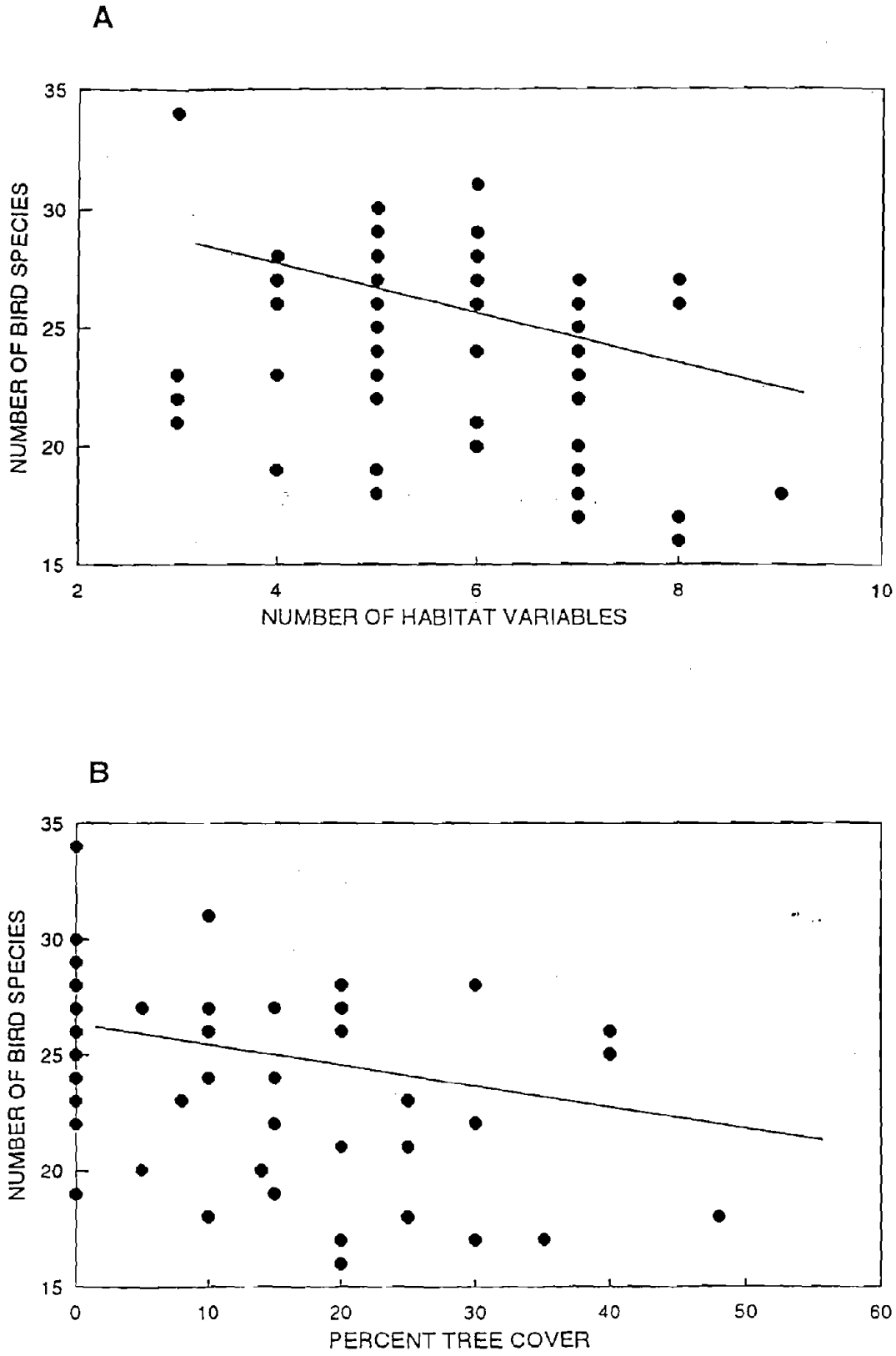
Two willow flycatchers were observed downstream of Reference Site I at the edge of the Los Olivas Golf Course on 9 June (Figure 14). Both birds were singing and foraging, although no

Table IV. Habitat parameters at each of the 54 points used to count birds. Numbers are estimates of percent cover in a 100 meter diameter around each point.

						SHRUB COVER						TREE COVER	
POINT NUMBER	Water	Open Ground	Ruderal	Forbe	Emergent Wetland	Mulefat	Salix sp.	Tamarisk	Arundo	Cottonwood sp.	Miscellaneous sp.	Salix sp.	Cottonwood sp.
Affected Area													
1	0	43	0	20	0	5	0	0	1	0	6	15	10
2	0	20	0	0	0	10	25	0	25	3	2	15	0
3	10	35	0	10	2	2	0	0	1	0	0	35	5
4	5	20	0	5	0	0	35	0	5	0	0	25	5
5	5	50	0	5	0	5	10	0	5	0	0	5	15
6	20	25	35	5	0	0	0	0	1	0	0	10	4
7	3	5	50	20	10	0	10	0	2	0	0	0	0
8	0	10	0	80	0	0	5	0	5	0	0	0	0
9	10	25	17	20	3	0	15	0	0	10	0	0	0
10	0	45	0	13	0	0	0	0	2	0	25	0	15
11	50	5	0	0	0	2	20	0	3	20	0	0	0
12	0	65	0	10	0	0	15	0	5	5	0	0	0
13	0	40	0	25	0	2	5	0	2	0	6	0	20
14	0	40	0	20	0	0	10	0	0	5	15	0	10
15	0	45	0	27	0	0	5	0	3	0	0	0	20
16	15	45	0	28	0	3	0	0	0	2	2	0	5
17	10	45	0	45	0	0	0	0	0	0	0	0	0
18	0	35	0	20	0	15	25	5	0	0	0	0	0
19	0	45	0	5	0	15	25	0	5	0	0	5	0
20	5	40	0	20	0	5	15	0	5	0	0	0	10
21	5	45	0	10	0	3	20	2	0	5	0	10	0
22	40	55	0	5	0	0	0	0	0	0	0	0	0
23	0	25	0	15	2	10	10	3	10	0	0	10	15
24	0	83	0	5	1	0	10	0	1	0	0	0	0
25	0	50	0	15	0	2	5	0	3	0	0	20	5
26	40	5	0	10	0	10	3	2	0	0	0	15	15
27	0	50	0	0	0	10	10	5	0	0	0	20	5
28	5	35	0	5	0	0	5	0	10	0	0	35	5
29	5	45	0	0	0	5	15	0	0	0	0	20	10
30	25	30	0	4	0	0	20	0	1	20	0	0	0

POINT NUMBER	Water	Open Ground	Ruderal	Forbe	Emergent Wetland	SHRUB COVER: Mulefat	Salix sp.	Tamarisk	Arundo	Cottonwood sp.	Miscellaneous sp.	TREE COVER: Salix sp.	Fremont Cottonwood
31	45	10	30	0	2	0	3	0	5	0	0	5	0
32	15	25	0	15	0	5	0	0	5	0	0	25	10
33	55	5	0	0	5	0	20	0	5	0	0	5	5
34	30	15	0	0	0	0	5	0	35	0	0	0	15
35	45	5	0	0	2	0	0	0	0	0	0	45	3
36	40	50	0	0	0	0	0	0	2	0	0	3	5
Reference Sites													
R1	5	80	0	5	0	0	5	0	5	0	0	0	0
R2	60	0	0	0	0	0	0	0	20	0	0	20	0
R3	50	10	0	0	0	5	20	0	0	0	0	15	0
R4	50	9	0	0	0	0	40	0	1	0	0	0	0
R5	50	5	0	20	0	0	5	0	0	0	0	20	0
R6	65	20	0	0	5	0	5	0	5	0	0	0	0
R7	0	40	0	35	0	5	3	0	10	0	7	0	0
R8	5	85	0	3	0	0	5	0	2	0	0	0	0
R9	0	40	0	5	0	5	5	0	35	0	0	10	0
R10	10	25	0	25	0	5	5	0	5	5	0	20	0
R11	5	50	0	40	0	0	0	0	5	0	0	0	0
R12	0	95	0	0	0	0	3	0	2	0	0	0	0
R13	0	20	0	20	0	0	15	0	40	0	0	5	0
R14	0	80	0	15	0	0	2	0	3	0	0	0	0
R15	10	55	0	15	0	0	5	0	15	0	0	0	0
R16	0	30	0	33	0	2	20	0	5	0	0	10	0
R17	40	40	0	18	0	0	0	0	2	0	0	0	0
R18	5	85	0	3	0	0	5	0	2	0	0	0	0

Figure 8. The relationship between the total number of species (richness) per point and: A. the total number of habitat variables recorded; and B. the total percent tree cover.



nesting activity was observed. These individuals were not found on two subsequent surveys of the area. As this particular area is also a dry, shrubby location, we presumed that the flycatchers were migrants and did not breed in this location. Finally, a fourth singing individual was observed at Reference Site II, near point 12, but was not detected on subsequent surveys (Figure 12).

3.4.3 Least Bell's Vireo

Least Bell's vireos were found at three locations within the affected area (Magic Mountain, Salt Creek, and Las Brisas; Figures 9 and 10), at the two reference sites (Figures 11 and 12), and at two locations outside the original study area: Fillmore Fish Hatchery (Figure 13), and in area between Highway 101 and Harbour Boulevard (Figure 14). General population and productivity parameters for all vireo sites are presented in Table V. Vegetation used for nest support is presented in Table VI. Productivity per successful pair was relatively high at the reference sites and other areas; where as, productivity was significantly lower at affected area. However, productivity per pair (including non-successful pairs) was relatively low, especially at the Magic Mountain area of the affected area and at Reference Site II.

Affected Area. In 1998, we again found evidence of only one pair of least Bell's vireos at the Salt Creek location. At least three pairs of successful vireos (possibly 5 pairs present) were found between Las Brisas Bridge upstream to point 32. Two pairs were found again in the Magic Mountain area: one in the same territory which was unsuccessful; and the other, in a new territory approximately 500m downstream which was successful. Four of the 15 adults found in the affected area were banded as nestlings in 1994 (1), 1995 (2), and an uncertain year.

Both vireo pairs were parasitized at the Magic Mountain Area within Section 1 of the affected area. This resulted in only two fledglings from one of the nests.

Reference Sites. A total of 57 males were found at the two reference sites: 43 at reference site I and 14 (same as in 1997) at reference site II. Of 51 females at the reference sites, at least 40 were at reference site I and 11 at reference site II. Productivity at reference site I was significantly higher than at either reference site II and slightly higher than at the affected area. In 1998, a total of 12 nests were parasitized, a significant increase over the past years where we found only three nests parasitized, all in 1994. Parasitism occurred throughout the study area except locally at Salt Creek and Las Brisas areas. In contrast to previous years, mean relative abundance data from the point counts indicate that cowbirds increased significantly within Reference Site I, which in 1998 had numbers similar to those of Sections 1 and 4 within the affected area (Figure 15).

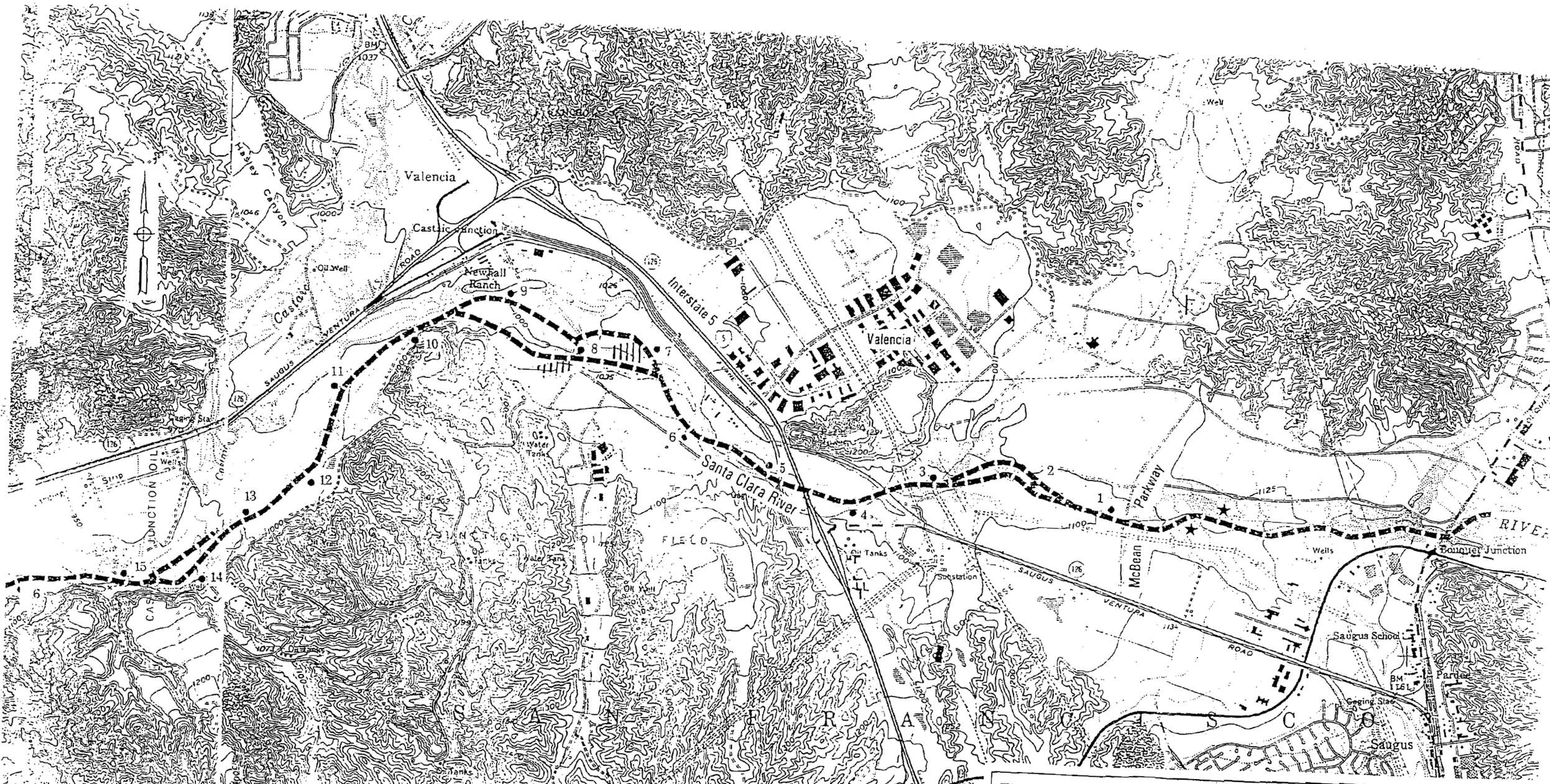


Figure 9. Threatened and Endangered species detected along the Affected Area (points 1 - 16) and upstream of McBean Freeway, Santa Clara River, Los Angeles County, California.

Least Bell's Vireo Breeding Area

★ Yellow-billed Cuckoo

Low-flow Channel

1 inch:2000 feet

Source: Adapted from USGS topographic map Val Verde California, 7.5 (photorevised 1988).

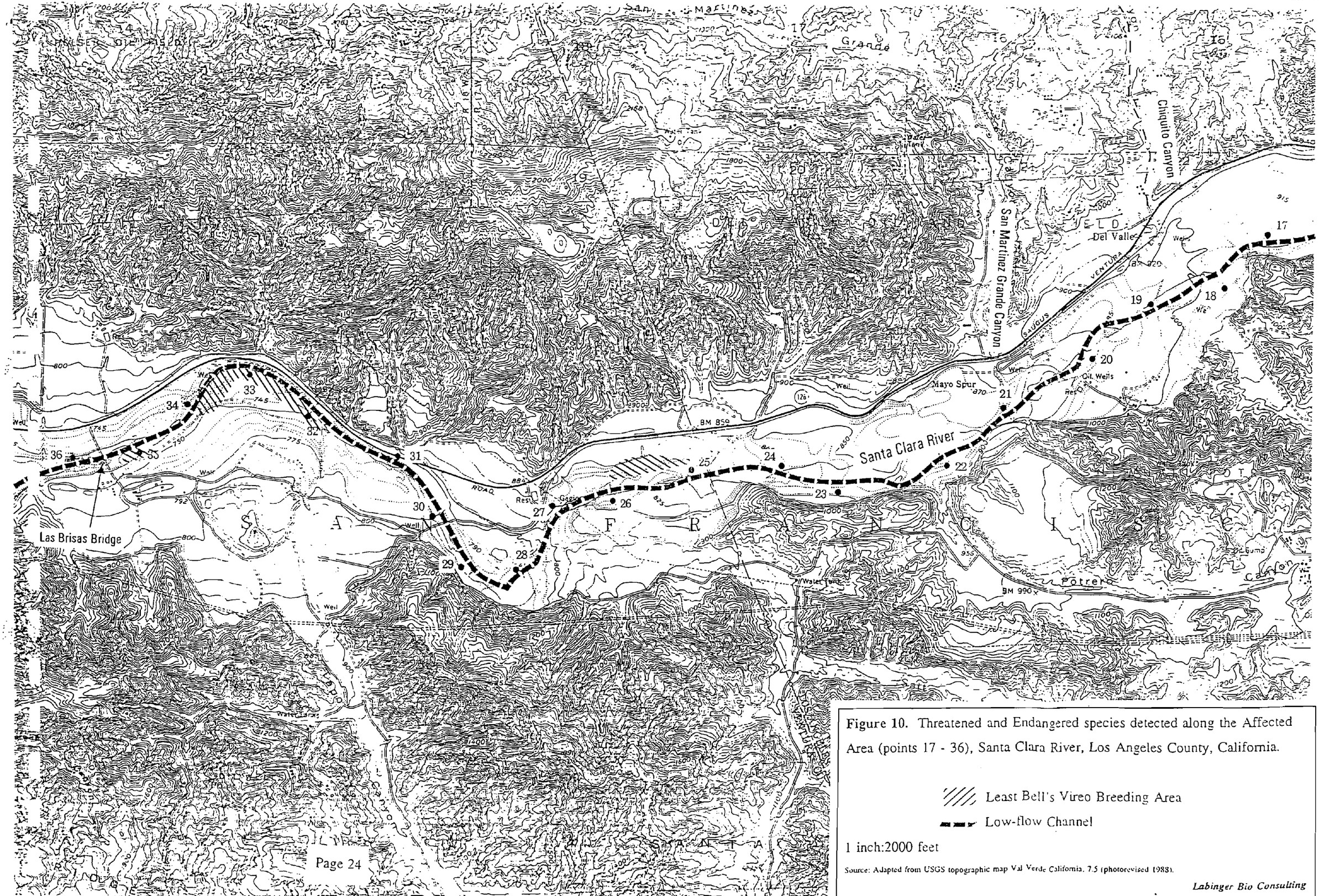


Figure 10. Threatened and Endangered species detected along the Affected Area (points 17 - 36), Santa Clara River, Los Angeles County, California.

Least Bell's Vireo Breeding Area

Low-flow Channel

1 inch:2000 feet

Source: Adapted from USGS topographic map Val Verde California, 7.5 (photorevised 1988).

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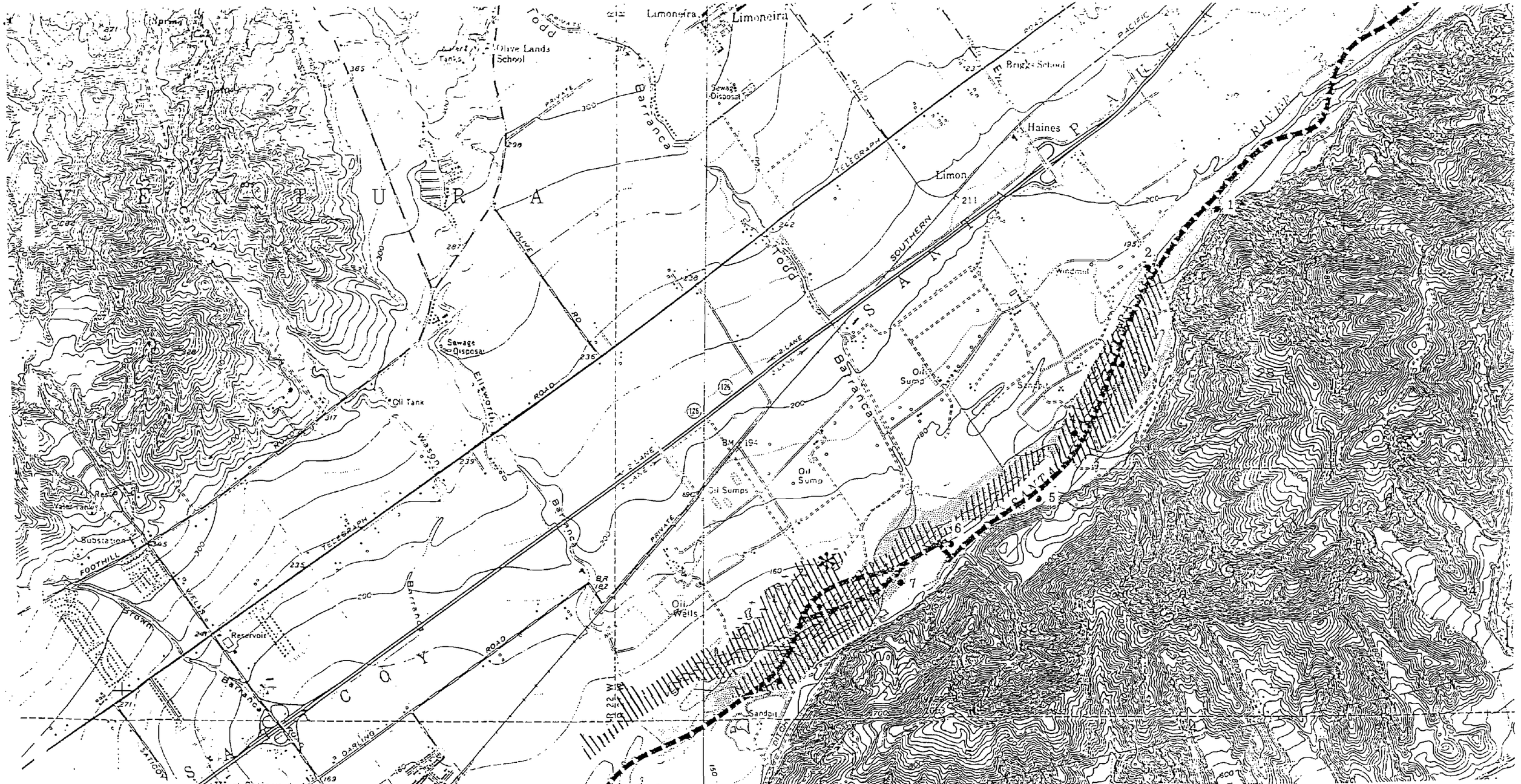


Figure 11. Threatened and Endangered species detected along Reference Site I. Santa Clara River. Ventura County, California.

Least Bell's Vireo Breeding Area

Willow Flycatcher

Low-flow Channel

1 inch:2000 feet

Source: Adapted from USGS topographic map Val Verde California, 7.5 (photorevised 1988).

Labinger Bio Consulting

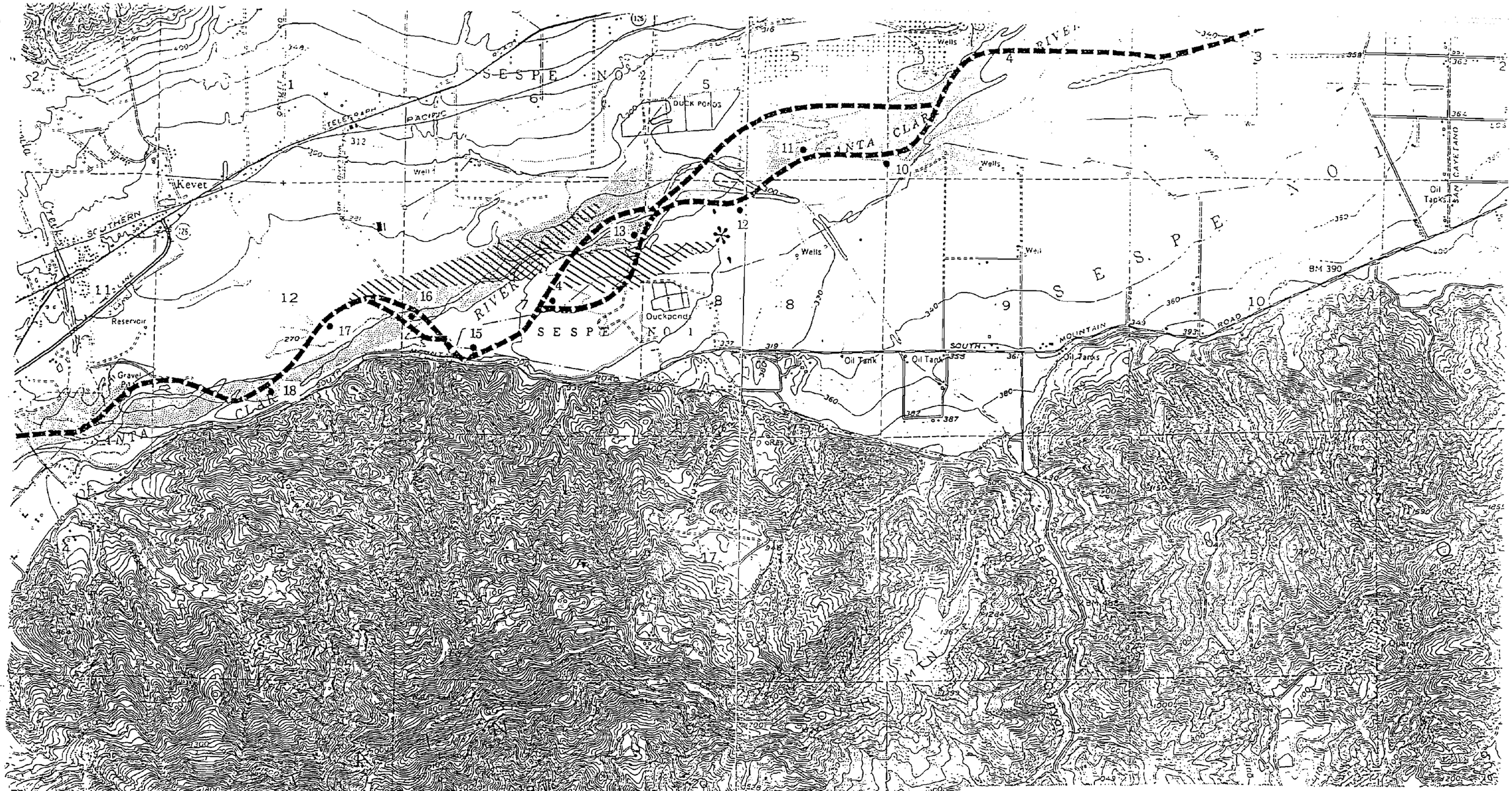


Figure 12. Threatened and Endangered species detected along Reference Site II, Santa Clara River, Ventura County, California.

Least Bell's Vireo Breeding Area

Low-flow Channel

1 inch:2000 feet

Source: Adapted from USGS topographic map Val Verde California. 7.5 (photorevised 1988).

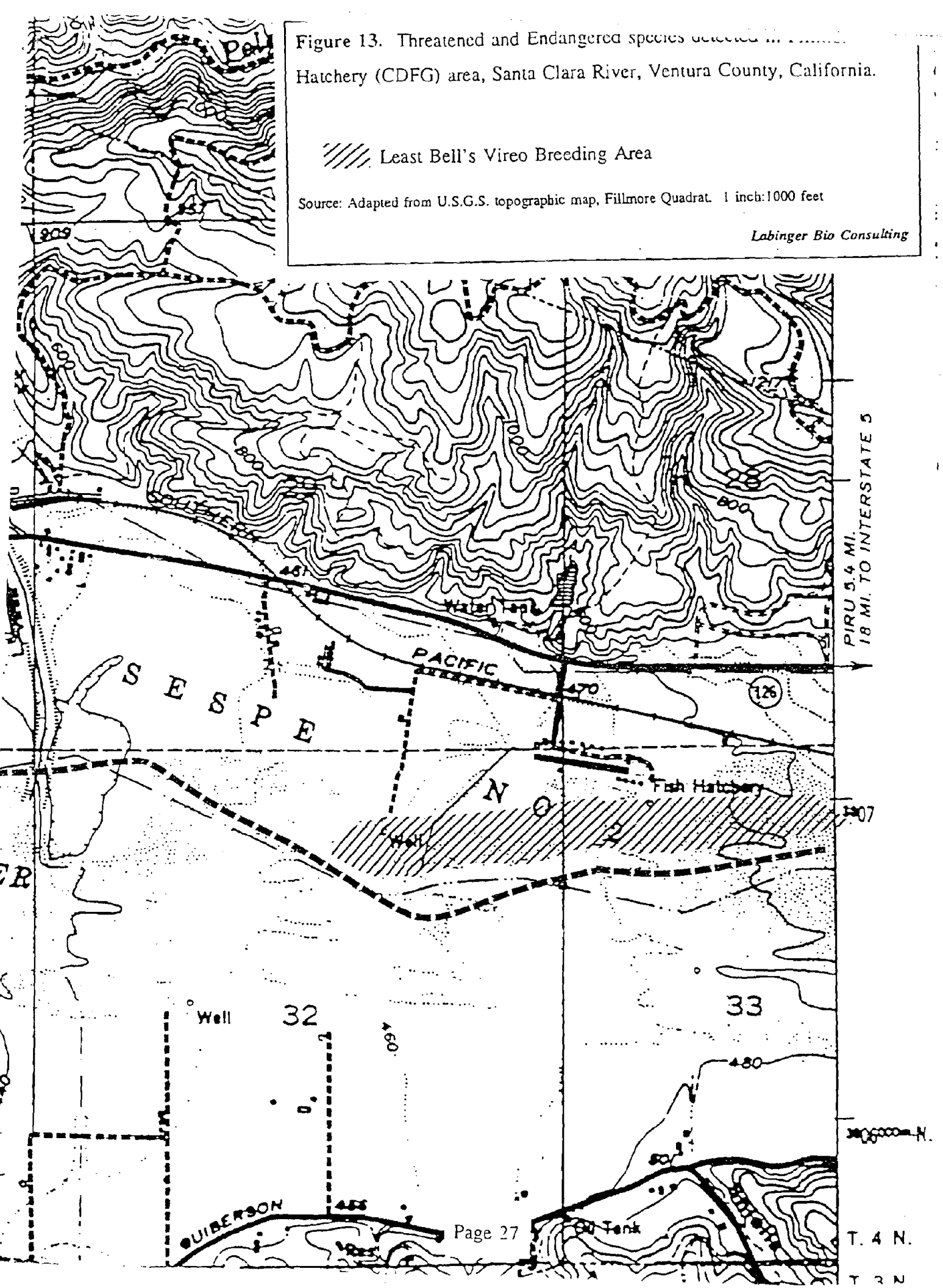
Labinger Bio Consulting

Figure 13. Threatened and Endangered species detected in [illegible] Hatchery (CDFG) area, Santa Clara River, Ventura County, California.

Least Bell's Vireo Breeding Area

Source: Adapted from U.S.G.S. topographic map, Fillmore Quadrat. 1 inch:1000 feet

Labinger Bio Consulting



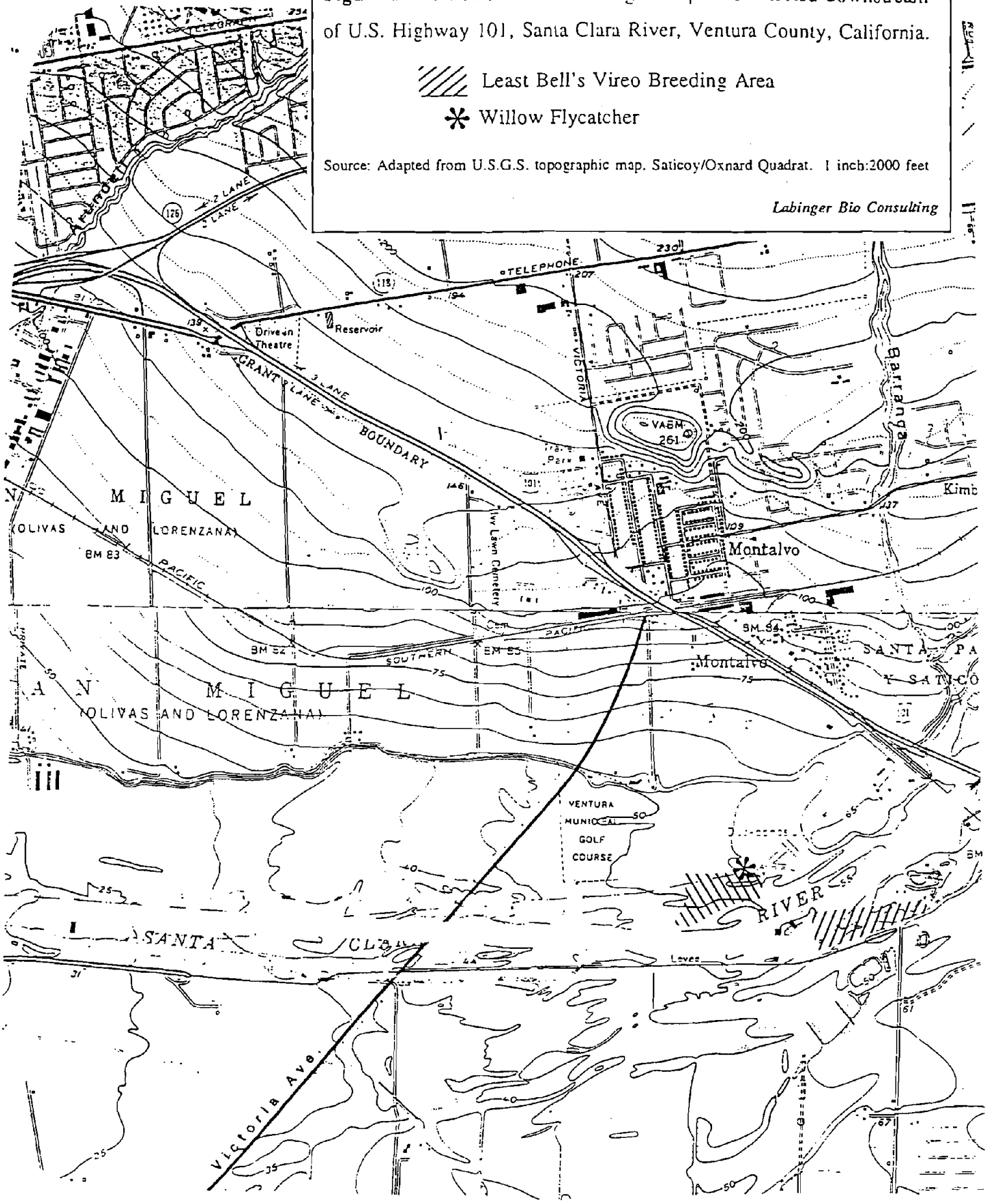


Figure 14. Threatened and Endangered species detected downstream of U.S. Highway 101, Santa Clara River, Ventura County, California.

Least Bell's Vireo Breeding Area

Willow Flycatcher

Source: Adapted from U.S.G.S. topographic map. Saticoy/Oxnard Quadrat. 1 inch:2000 feet

Labinger Bio Consulting

TABLE V. Least Bell's Vireo territories, adults, juveniles and nests in Affected, Reference and three additional areas at the Santa Clara River, Los Angeles and Ventura Counties, California, during 1998.

	Affected Area			Reference Sites			
Attribute[1]	Magic Mtn.	Salt Creek	Las Brisas	I	II	Other[2]	Total
Territories	2	2	5	43	14	18	84
Males	2	2	5	43	14	18	84
Females	2	1	3+	40	11	13	70+
Pairs Observed	2	1	3+	40	11	13+	70+
Successful Pairs	1	1	3	32	4	8	49
Vireo Young Observed	2+	3	10+	136+	12	30+	193+
Nesting attempts	4+	2	5+	75+	20	16	122+
Probable additional nests	1+	0	1+	13+	3	7+	25+
Nests successful	1	1	4	45+	5	10	66
Unknown outcome	0	1	1+	0	3	1	5+
Nests parasitized	2	0	0	3	3	6	12
Cowbirds raised	0	0	0	0	0	1	1
Productivity							
A. (young/all pairs)	1+	3	2.5	3.4	1	2.3	2.8
B. ("/successful pairs)	2+	3	2.5	4.2	3	3.8	4.5

[1] Includes fledglings observed in area where nests were not found, but presumed.

[2] Other areas: 1) Between Fillmore Fish Hatchery an Fillmore; 2) Highway 101 downstream to Victoria Street; and 3) Harbour Boulevard area.

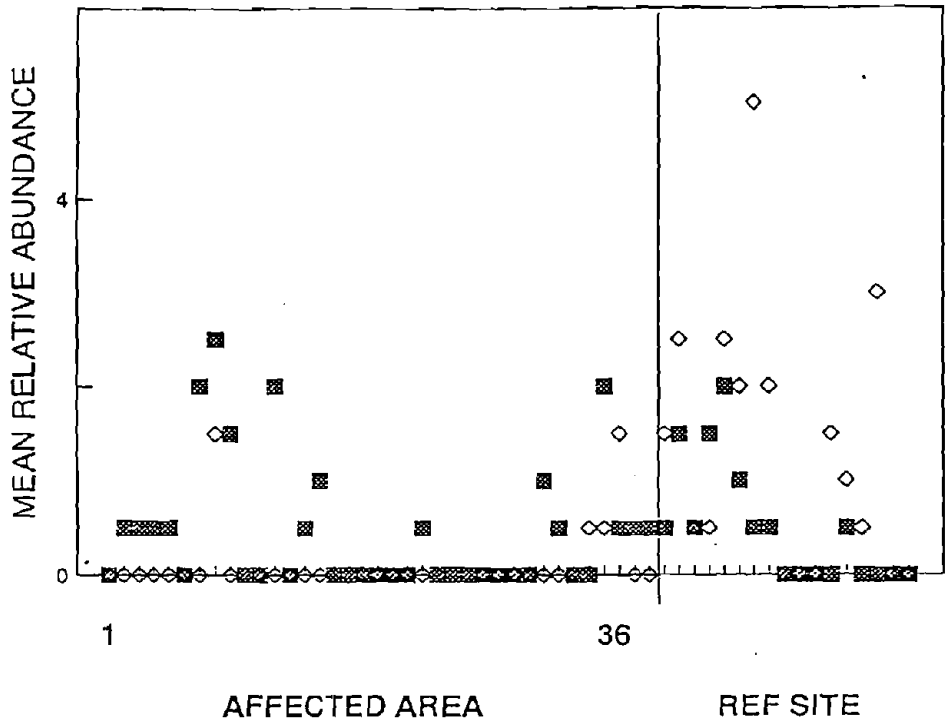
Table VI. Plant species used by least Bell's vireos for nest host[1] on the Santa Clara River in Ventura and Los Angeles counties, California, during 1998.

Nest hosts	1994	1995	1996	1997	1998	Totals
Alnus rhombifolia	0	0	0	0	2	2
Artemisia californica	0	0	0	2	0	2
Artemisia douglasiana	1	0	2	0	1	4
Artemisia tridentata	0	0	0	1	0	1
Atriplex lentiformis	1	1	1	0	0	3
Arundo donax	2	1	0	3	8	14
Baccharis salicifolia	10	4	13	28	20	75
Brassica geniculata	0	1	0	0	0	1
Conyza canadensis	1	0	0	0	0	1
Populus fremontii	0	0	0	2	1	3
Populus trichocarpa	0	1	0	0	2	3
Prunus sp.	0	1	0	0	1	2
Rhus integrifolia	0	0	1	0	0	1
Tamarisk sp.	0	0	0	0	1	1
Toxicodendron diversilobum	0	1	1	0	5	7
Salix spp. (4 willow species)[2]	21	14	25	40	62	162
Sambucus mexicana	0	0	0	0	1	1
Total	36	24	43	76	104	283

1 Does not Include where another plant species provided all or most of the actual nest concealment; for example, giant reed provided such cover for an additional 15 nests, 6 of which were wholly concealed by giant reed; thus, 14 of 23 nests were successful that had giant reed as host or major cover.

2 Includes arroyo, narrowleaf, red, and yellow willows (*Salix lasiolepis, S. exigua, S. laevigata, and S. lasiandra*, respectively).

Figure 24. The relative abundance of brown-headed cowbirds (black squares) and least Bell's vireos (diamonds) detected per point along the affected area and reference sites in 1998, Santa Clara River, California.



Banding Results Greaves banded 168 nestlings, of which 152 were successfully fledged: 13 from the affected area, 120 from the reference sites, and 19 from the other sites. All such fledglings were banded with a US Fish and Wildlife numbered aluminum band on one leg and a drainage band (colored plastic) on the other leg. One male vireo, banded as a nestling on the San Luis Rey River, San Diego County, in 1993 (Kus, 1993) was again present at reference site I in the same territory used in 1995, 1996 and 1997. This territory is in the vicinity of another territory held by two vireos (from 1991-94) that were banded as nestlings in San Diego County (SEB 1993). A three year old female, banded as a nestling on the San Luis Rey River in 1995, also returned for its second known year near the location in Reference Site II where it was found in 1997 (Kus, pers. com.).

3.5 Sensitive Species Accounts

Great Blue Heron (*Ardea herodias*)

Great blue herons are listed on the California Natural Diversity Data Base as a species that warrants monitoring. Along the central and south coast, breeding sites of this species are increasingly uncommon (Garrett and Dunn 1981, Lehman 1994). They require marsh, riparian and grassland for foraging and mature, tall trees for nesting.

Great blue herons were found in low numbers throughout the study area. This species is most common on the lower Santa Clara River within the reference sites. One active nest was observed at the Sespe Creek confluence. At least six juveniles were also observed: three in Reference Site I, two at Reference Site II, and one within Section 4 of the affected area.

Great Egret (*Casmerodius albus*)

Great egrets are listed on the California Natural Diversity Data Base as a species that warrants monitoring. Breeding sites are increasingly uncommon throughout much of southern California (Garrett and Dunn 1981). Great egrets require marsh, riparian, grassland or agricultural fields for foraging and mature, tall trees for nesting.

Only 2-3 individuals were found within the study area, and limited to the reference sites. No nesting or juveniles were observed.

White-tailed Kite (*Elanus leucurus*)

White-tailed kites are a California Species of Special Concern. Although breeding populations fluctuate greatly, declines continue to be recorded throughout California (Lehman 1994). Kites forage over open habitats such as marsh, grassland and savannah, and nest in trees in riparian and oak woodland. Their diet is composed primarily of small mammals.

As in 1997, at least four pairs of white-tailed kites were found within the study area in 1998 and in similar locations. Each reference site had a pair, and within the affected area, one pair was observed within sections 1 and 2, and a second pair was observed in Section 4. At least 4 kites fledged from a nest north of Magic Mountain (affected area), six juveniles were observed near point 17, at least 1 juvenile was observed at each of the reference sites.

Cooper's Hawk (*Accipiter cooperi*)

The Cooper's hawk is a California Species of Special Concern. In southern California birds are mostly resident, however populations are augmented in winter with northern birds. Cooper's Hawks are uncommon breeders in Southern California but fairly evenly distributed where appropriate habitat exists (Garrett and Dunn 1981, Lehman 1994). Nests throughout most of California from March through July. During the breeding season they require woodlands (preferably live oak and riparian) adjacent to semi-open habitat where they feed primarily on small birds.

Cooper's hawks were observed at all sections of the affected area, reference sites and along area downstream of Highway 101. One nest was found outside of the study area, just downstream of Victoria Bridge, although juvenile birds were observed at Section 1 and at Reference Site I. During the first two years of this study, Cooper's hawks were also documented breeding (nests located) within sections 1, 2, and 3.

Horned Lark (*Eremophila alpestris)*

Horned Larks are a California Species of Special Concern. They are resident throughout California in areas of large open grassland and agricultural fields. Although large flocks can be seen during the winter, breeding appears to be more uncommon (Garrett and Dunn 1981).

Horned larks were observed along Section 1, Reference Site I, above McBean Freeway, and downstream of Highway 101. All birds are using ruderal fields adjacent to the river bottom. In addition, breeding evidence was noted this year: two adults were seen carrying food at the north side, lower portion of Reference Site I.

Loggerhead Shrike (*Lanius ludovicianus*)

The Loggerhead Shrike is a California Species of Special Concern. They are resident along the central and south coast, where numbers increase in the winter. Further inland, shrikes are locally common in open areas of grassland and scrub and are uncommon breeders along the mountains and coastal plain (Garrett and Dunn 1981, Lehman 1994).

A family group of five shrikes were observed on 2 July along the upland lower portion of Reference Site I, southside (near United Water Conservation District). A shrike nest was

found in this area in 1994. This is one of the only areas this species has been found within the river bottom, despite known populations along the adjacent mountain ranges (Labinger, unpublished data).

Yellow Warbler (*Dendroica petechia*)

The yellow warbler is a California Species of Special Concern. This neotropical migrant is fairly common locally where mature riparian woodland exists. Numbers have been decreasing steadily throughout California, especially in southern California (Garrett and Dunn 1981). Nests in the upper canopy of riparian trees, commonly willow species.

Yellow warblers are found throughout the study area, but are significantly more common at reference site I where relative abundance this year is 4 to 6 times greater than in other sections (Table I). Very low populations exist along the upper portions of the study area (Sections 2 and 3) where only 4-5 pairs were present. This is unexpected given the extent of seemingly suitable habitat along these portions of the affected area. Yellow warblers appear to be highly susceptible to cowbird parasitism which may partly explain their low numbers within the affected area. As in past years, we observed one instance of yellow warblers feeding cowbird fledglings.

Yellow-breasted Chat (*Icteria virens*)

The yellow-breasted chat is a California Species of Special Concern. This neotropical migrant is locally common to rare in riparian woodland of southern California. Numbers have been decreasing steadily throughout California, especially in southern California (Garrett and Dunn 1981). Nests in low, thick riparian vegetation.

Yellow-breasted chats are patchily distributed over available habitat within the study area. They are much more common at the reference sites where relative abundances are 5 to 10 times greater than in the affected area (Table I). Only 1-2 pairs were present along sections 1, 2 and 3 within the affected area, despite the presence of seemingly suitable habitat along those areas (at least six males are present along Section 4). They too may be adversely affected by cowbirds; a pair was observed feeding a fledgling cowbird at reference site I in 1996.

4.0 Discussion

4.1 General Bird Community

We found significant differences in several bird population parameters both between the affected area and reference sites, and within the affected area. Species richness (i.e. number

of species) was significantly greater in the reference sites, especially reference site I, but showed little difference between sections within the affected area. However, limiting the analysis to sensitive species of riparian obligates, we found that both relative abundance and species diversity was significantly higher along portions of sections 1 and 4 (in addition to reference sites). Although many factors can affect overall bird distribution, these results probably reflect significant differences in habitat quantity and quality which are specific to riparian obligate species.

This is the third year in a row that no trends were found between points within the affected area in relative abundance or species richness. In 1994, species richness and the relative abundance of several species, including waterbirds, were positively correlated with distance from oil spill origin. This may indicate that significant oil related impacts are now minimal. In addition, this is the second year that no significant differences were found between the affected area and reference sites in the relative abundance of the two most common water-related species, killdeer and spotted sandpiper. Killdeer numbers appeared to increase significantly from 1997, however, spotted sandpipers were in similar low numbers. Last year we explained that their low numbers were probably due to vegetative growth from low flood events. However, several major floods occurred in 1997/98, again scouring much of the river bottom. Killdeer, being a common species are probably able to respond faster to such changes (immigration from surrounding areas); whereas, the more uncommon spotted sandpiper would have much lower local recruitment.

Flooding of the river bottom and subsequent scouring removed much of the lower shrub layer and emergent wetland vegetation (see below). Common yellowthroat and song sparrow may have been impacted by loss of this particular habitat in that their numbers were significantly lower in 1998 compared to 1996 and 1997. Two wetland species were absent from our surveys this year: virginia rail and belted kingfisher. The former may have also been adversely impacted by flooding and scouring. However, kingfishers should not have been directly impacted. Belted kingfishers have been uncommon throughout this study period with a maximum of 2 pairs known per season.

The results of the habitat parameters' analysis were similar to last year. The only factors significantly correlated with bird species richness were: 1) the total number of habitat parameters found at a point (habitat diversity); and 2) total tree cover. However, both of these correlations were negative. In other words, the number of bird species decreased with increased habitat diversity and tree cover. This result is contrary to expected. One problem with this analysis is that habitat parameters were estimated within 100 meter circles; whereas, birds were detected up to 350 meters from count points. One way to correct for this would be to limit the analysis to birds detected within 100 meters, but sample sizes might be too small for statistical analysis. A better solution would be to increase the amount of habitat sampling around points.

The vegetation analysis did show a significant decrease in tree cover compared to 1997. As these data were collected from sites along the river's edge, much of this tree loss is probably the result of deep scouring during flooding. In several areas, relatively large sections of mature cottonwood/willow forest was lost. In addition, several areas within the affected area were bulldozed (points 6 - 9, 31 - 32, and at reference points 11 - 13 and 14 -15. This caused several problems: 1) loss of trees and other riparian vegetation; 2) increased probability of flood damage due to faster river flow; 3) creation of large debris dikes (6-8m tall and running 1-2 kilometer stretches) within the river bottom that effectively isolating the remaining riparian vegetation from the lowflow channel. Much of the remaining vegetation bordering the outside of these dikes eventually dies, and Arundo thickets become dominant.

4.2 Endangered Species

Western yellow-billed cuckoo

The yellow-billed cuckoo is an insectivorous neotropical migrant. It occurs throughout North America and is divided into eastern (*C. a. americanus*) and western subspecies. Western yellow-billed cuckoos arrive late in the season at the end of June through the beginning of July and stay until late August and September (Laymon & Halterman 1987). In general, this species requires broad woodlands of even-aged growth, preferring older growth cottonwood or other canopied riparian woods for breeding sites (Gaines and Laymon 1984). Highly specific foods occurring in cyclic infestations (such as hairy caterpillars and tree frogs) are also important determinants in cuckoo distribution and productivity (Laymon & Halterman 1987).

The western yellow-billed cuckoo is listed state endangered and has no federal endangered status. Historically cuckoos were widespread in the state, but have declined to only three small populations (Gaines & Laymon 1984). Although detailed historical data are lacking from the South Coast region, cuckoo breeding has been documented along the Santa Clara River (Willet 1933). More recently, a cuckoo was observed between 23 June and 4 July 1979, on the Santa Clara River within the area affected by the oil spill (Webster in Garret & Dunn 1981). A dead cuckoo was found in the parking lot at Magic Mountain (adjacent to this years individual) on 3-5 July 1981 (specimen at CSU Northridge, California; Laymon pers. com.). Finally, in July 1992, a cuckoo was heard within the affected area in section 3 (Holmgren M. pers. com.).

Last year, the first cuckoo was detected during the four-year study. The location of that cuckoo at the Magic Mountain area was one of the areas most impacted this year by flood control efforts. Before 1998, this was one of the broadest stretches of riparian woodland along the river, including many older growth Fremont cottonwoods. Presumably to protect the rapidly eroding northeast bank, a large swath of forest (approximately 50m wide and 500m long) was bulldozed and tall dikes built up along its sides (see discussion of dike

impact above). Although its difficult to say whether these activities were the main cause of cuckoos being absent this year, such habitat loss is a critical problem for this species. Cuckoo distribution and possible breeding within the study area has not been adequately assessed due to limited late season surveys. As this species has a later arrival and breeding chronology than least Bell's vireos, more intensive surveys and monitoring of appropriate habitat are required in later in the season (July and August).

Southwestern willow flycatcher

The willow flycatcher is a small, insectivorous neotropical migratory species ranging broadly from the east coast through most of the lower 48 states and parts of Canada. Willow flycatchers breed in a variety of wet habitats, particularly swamps and riparian thickets, especially willow (Garrett & Dunn 1981). Formerly widespread in the southwest and sporadically distributed in California, the species has declined in recent decades.

There are three recognized subspecies of willow flycatcher in California (all are State Endangered), of which the southwestern race (recently listed as Federally Endangered) is the most likely to occur in coastal southern California (Schlorff 1990). A few small populations persist in coastal southern California, including one on the Santa Ynez River, Santa Barbara County (Unitt et al. in prep), and one on the Santa Margarita River in San Diego County (Buck, pers. com.). On the Santa Clara River, no breeding birds have been documented in recent years within the area affected by the spill. However, Webster (in Garrett & Dunn 1981) encountered several singing males, between June and July 1979, assumed to be breeding, within the study area.

We have observed several, apparently non-breeding individuals during this study: 1994 - a singing, territorial bird at reference site II (Labinger et al. 1994); and 1995 - two non-singing individuals along section 3 of the affected area (Labinger et al. 1995). The Habitat in which the territorial bird was found in 1997 appears to support excellent conditions for breeding: willow woodland, interspersed with ponds of standing water, and open and shaded areas of emergent wetland. In 1998, of the three birds observed, one appeared to be territorial within appropriate breeding habitat. Unfortunately it was located in an area that was difficult to visit and was subsequently not monitored sufficiently to assess breeding status. Despite these annual occurrences, no locations appear to be used consistently unlike their high degree of territory tenacity found in other regions (Holmgren and Collins (eds) 1995, Tibbits et al. 1994, Whitfield 1990).

Least Bell's vireo

The least Bell's vireo is a small insectivorous neotropical migrant which nests in the low vegetation associated with thickets of willow and mulefat in riparian woodlands. The least Bell's vireo is one of the four subspecies recognized in North America (Brown 1993). Formerly widespread in California, the species underwent a dramatic decline in abundance and range during the first half of the 20th century (Grinnell and Miller 1944; Gaines 1977). It was designated an endangered species by the California Fish and Game Commission in 1980 (CDFG 1986) and was listed as endangered by the Federal government in 1986 (FWS 1986).

The species arrives in late March through April and departs from late August through September. Nesting usually begins several days after pair formation. Nests are typically placed in the fork of a shrub, small tree or in weeds, suspended within a meter of the ground in dense scrub vegetation found in or adjacent to the river bottom (Gray and Greaves 1984).

Although the historic breeding range of least Bell's vireos extended throughout the lowland valleys of California, USA, and northern Baja, Mexico (Wilbur 1979 and 1980), the present breeding range is limited to about 50 locations from Santa Barbara County south to San Diego County, where the majority of the U.S. population is found (Franzreb 1989). They have been observed within the affected area over the past decade (Independent Environmental Consultants 1993; Labinger et al. 1994) and breeding was documented by Holmgren (1992). Several other small sub-populations exist on the lower stretch of the Santa Clara River outside the spill area (Labinger et al. 1994). Annual surveys were conducted from 1991 through 1994 as part of a cowbird trapping program for the lower river in Ventura County (SEB 1991, 1992, 1993). Data on least Bell's vireo nesting and productivity on the Santa Clara River has been compiled annually since 1991.

Annual changes in least Bell's vireo populations within our study area vary between locations (Table VII). In general, total pairs within the affected area and reference site II have remained relatively stable, but with increasing distribution from central locations (e.g. spreading down river from Salt Creek, and down river and south river from Timber Canyon, respectively). In contrast, at reference site I, vireos increased steadily by 20 - 30 percent each year since 1991, with an almost 40 percent increase from 1996 to 1997. Least Bell's vireo populations elsewhere appear to be increasing more rapidly compared to the Santa Clara River, from approximately 300 pairs (1974-1985, Franzreb 1989) to over 1,000 pairs in 1997 (FWS 1998). This increase is being attributed in part to removal of cowbirds from habitats near major breeding populations and improved protection of riparian woodlands along major rivers of southern California (FWS 1998). These important issues, cowbird control and habitat protection, require more attention on the Santa Clara River. Cowbird impacts are discussed below in Section 4.3.1

Table VII. Least Bell's vireo productivity on the Santa Clara River, Ventura and Los Angeles counties, California, during 1994-1998.

	1994[1]	1995	1996	1997	1998
Affected Area					
Males	9	2	7	10	9
Pairs	5	2	6	6	6
Young produced	3	9	12	19	15
Young per pair	0.6	4.5	2.0	3.2	2.5
Cows present	yes	yes[2]	yes	yes	yes
Cowbird control	no	no	yes	yes	no
Reference Site I					
Males	14	15	25	40	43
Pairs	13	14	26	34	40
Young produced	33	60	77	123	136
Young per pair	2.5	4.3	2.9	3.6	3.4
Cows present	no	no	no	no	yes
Cowbird control	yes	yes	yes	yes	no
Reference Site II					
Males	9	8	8	14	14
Pairs	7	8	8	10	11
Young produced	17	19	9	32	12
Young per pair	2.4	2.4	1.1	3.2	1.1
Cows present	yes	yes	yes	yes	yes
Cowbird control	yes	yes	yes	yes	no
Other Areas[3]					
Males	---	---	--	14	18
Pairs	---	---	--	10	13
Young produced	---	---	--	12	30
Young per pair	---	---	--	1.2	2.3
Cows present	no	no	no	no	yes
Cowbird control	yes	yes	yes	yes	no
Grand total pairs	25	24	40	60	70
Grand total young[4]	53	88	98	186	193
Grand total young per pair	2.1	3.7	2.5	3.1	2.8

1 Cowbird trapping in 2 Reference sites and Fillmore, 1994-97; no cowbird trapping in 1998.

2 Cattle were removed from Salt Creek area, and they raised young successfully in 3 of 3 nests. Cattle present in Salt Creek area during other years, 1994, and 1996-98.

3 Other areas are Fillmore Fish Hatchery, Sespe Creek confluence, and down stream of US-101 to near the river mouth.

4 Total young is a minimum because survey effort varied from year to year.

Several adults that were banded as nestlings on the San Luis Rey River, San Diego County returned again this year. Over the past four years we have documented the dispersal of vireos within the Santa Clara River watershed including individuals moving between the reference sites and the affected area, and between watersheds to the north and the south. Data obtained from these recaptured birds provide important information about site tenacity and dispersal. Combining the data from several different banding studies, we have suggested that enough gene flow occurs between populations to consider least Bell's vireos a panmictic species (Greaves and Labinger 1997).

It is difficult to account for the sub-population size and density differences between locations within the study area. Differences in productivity between locations may have more to do with habitat quality than habitat availability. For example, vireos were successful at the Salt Creek sight only in 1995 when cattle had been removed. The habitat was not trampled and few cowbirds were observed (Labinger et al. 1996). In the Magic Mountain area, flood control projects bulldozed a swath between the two existing territories (see yellow-billed cuckoo discussion above). Other possible factors are discussed below.

4.3 Factors Affecting Bird Populations

The decline of many riparian obligate species in the western United States is believed to be the result of habitat loss and degradation from agriculture, pesticides and herbicides, livestock grazing, water diversion projects and continued urbanization of riparian corridors. In addition, brood parasitism by brown-headed cowbirds (a bird which lays its eggs in other species' nests to be raised by the hosts) appears to be suppressing productivity of host species such as least Bell's vireos and southwestern willow flycatchers, and may hinder the re-colonization of former breeding areas (Greaves and Labinger, 1997; Whitfield 1990). Cowbird impacts are discussed in the following section.

4.3.1 Brown-headed Cowbird Impacts

During this and previous studies, we have observed cowbird parasitism on a wide range of host species, but most commonly on common yellowthroat, yellow warbler, yellow-breasted chat, and song sparrow. Our data, and thus, understanding of cowbird and host interaction is based primarily on least Bell's vireos which were monitored intensively because of their endangered status and susceptibility.

In 1998, more least Bell's vireo nests were affected by cowbirds than in the last 6 years combined. This is equal to the total number of nests found in 1991, all of which were parasitized or adversely impacted by cowbirds (Greaves, unpubl. data). The combined effects of cowbird parasitism and clutch or brood destruction in 1998 impacted approximately 25 percent of all nests found (n=110). Brood destruction appeared to include at least 6 vireo

nestlings tossed from their nests (including 2 sets of nestlings from one pair), and clutch destruction involved the removal of one or more eggs from at least 8 nests (including from at least 2 nests from one pair). In addition, many more juvenile cowbirds were seen, especially at a younger age (including nestlings), and in greater numbers in areas from which they had been nearly absent in previous years. Much of these impacts occurred within Reference Site I where cowbird trapping had been conducted for several years, when only one or two juvenile cowbirds were observed per season.

Increased cowbird impacts in 1998, after several years of low impacts and cowbird trapping, illustrates the necessity of a continual trapping program (at least until the population approaches carrying capacity). Successful trapping programs have assisted with the recovery of the Camp Pendelton population that had fewer than 100 pairs in 1984, and rose to almost 500 pairs in 1996 (FWS 1998). An annual cowbird control program along the lower reaches of Santa Clara River was conducted by California Department of Fish and Game between 1991 and 1997 (SEB 1993, FWS 1998). A limited Caltrans trapping program (2 traps in the Castaic Junction area) was conducted in 1996 and 1997 (Haglund and Baskin 1996, pers. com.). By the end of the 1997 breeding season, the Santa Clara River vireo population was at a point on its recovery growth curve which resembled that of the Camp Pendelton and Prodo Basin early growth rates (30 - 35 %). On the Santa Clara River, 1997 was the fifth year of cowbird control, and the third year in a row that the vireo population increase 25 percent annually. From 1997 to 1998, the population increased only 15 percent. This decrease corresponds with a decrease in the number of traps used in 1997 from 12 to 8.

At a time when the population requires management action to recover, putting cowbird control in abeyance for even one year can have significant adverse impacts on an otherwise rapidly growing vireo population. In fact, the *FWS Draft Recovery Plan for the Least Bell's Vireo* (1998) states specifically the importance of a continual cowbird control program.

5.0 Acknowledgements

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