

State of California  
The Resources Agency  
Department of Fish and Game  
Wildlife Management Division

A SURVEY OF THE BELDING'S SAVANNAH SPARROW  
(*Passerculus sandwichensis beldingi*)  
IN CALIFORNIA, 1991

by

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U.S. Fish and Wildlife Service  
Southern California Field Station  
Carlsbad Office

November 1991

FINAL REPORT TO  
Department of Fish and Game  
1416 Ninth Street  
Sacramento, CA 95814

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Survey partially supported by California Endangered  
Species Tax Check-off Account, FY 1990-91

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Brooks Harper, Office Supervisor  
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ABSTRACT

Thirty-four marshes were surveyed during the period of 5 March-28 June 1991 for the territorial Belding's Savannah sparrow (Passerculus sandwichensis beldingi), which is currently a state-endangered and federal category two candidate subspecies. ("Category two" species lack sufficient information to support a federal listing proposal as endangered or threatened). Populations were found in 27 of those marshes from Goleta Slough south to Tijuana Marsh on the Mexican border of southern California. The total for the state was at least 1,844 pairs. Populations varied from 1 to 303 pairs. This statewide estimate is 18.9% less than the 2,274 pairs reported in 1986 (Zembal et al. 1987) ; however, the largest population at Mugu Lagoon was not completely counted in 1991. If the population at Mugu is assumed to be unchanged from 1986 then the statewide estimate is 9.8% less than in 1986.

Major needs for this subspecies still include acquiring and restoring upper marsh habitat, providing tidal flushing, protecting marshes from disturbance and degradation, and researching demography, possible intermarsh movement, and the influence of exotic predatory species.

Contract Final Report (FGU429) to California Department of Fish and Game  
Supported by California Endangered Species Income Tax Check-off

## INTRODUCTION

The Belding's Savannah sparrow (Passerculus sandwichensis beldingi) has been a California state-listed endangered subspecies since 1974 and a category two candidate for classification as an endangered or threatened species under the federal Endangered Species Act (ESA). This race is one of the four described forms of the widespread Savannah sparrow (AOU 1983) that inhabit a wide variety of grassland, tundra, mountain meadow, and marsh habitats throughout North and Central America. The other races are P. s. princeps (Ipswich sparrow; restricted to Nova Scotia Canada and environs), P. s. sandwichensis (= nevadensis ?; throughout Central and North America), and P. s. rostratus (Baja California, and Mexico, and to southern and central California in winter). Belding's is darker in plumage than the other races and is restricted to saltmarsh habitats. Also, the subspecies is geographically isolated year-round to the southern portion of the California coast from Goleta Slough in Santa Barbara County south to the border and beyond into Mexico to El Rosario in Baja California (Grinnell and Miller 1944, Van Rossem 1947, AOU 1983).

In addition to the previously cited studies, available written works on Belding's include a life history study (Massey 1979), theses on the effects of habitat type and human disturbance (White 1986) and vegetative characteristics in relation to Belding's densities (Johnson 1987), a study of geographic variation in song (Bradley 1977), a study of vegetation requirements (USFWS 1986), localized surveys (Zemba et al. 1984, 1986, 1989; Kus 1990), and a brief population and banding study (Corey and Massey 1990).

Belding's can be difficult to count accurately. Their breeding territories are small and high concentrations of individuals may occur relatively close to one another making censusing difficult. Males affirm their territoriality by singing, perching, chasing, and actual physical sparring with other Belding's. Surveys are best restricted to morning hours when the peak of these territorial manifestations occur. The optimal time of

year to survey is from March to May when territoriality is most intense and there is also the absence of the other Savannah sparrow races. Belding's nests are well camouflaged, difficult to locate within the salt marsh vegetation, and are susceptible to abandonment by the adults if disturbed (Massey 1979). Although actual breeding territories of this rare passerine are located in the upper littoral zone dominated by pickleweed (Salicornia virginia), foraging occurs throughout the marsh and even along the shoreline (Bradley 1973, Massey 1977, Massey 1979, Zembal et al. 1987, and this study); foraging individuals are often seen along the beach. In the winter, individuals are relatively secretive and inconspicuous (Massey 1979) and form flocks. Two other races, nevadensis and rostratus, are also found in southern California marshes during this time.

Three previous estimates of the Belding's population in California have been made (Bradley 1973, Massey 1977, and Zembal et al. 1987). Bradley (1973) estimated a total of 1,059 pairs but did not include several marshes in his census. Massey (1977) visited all of the known sites and estimated about 1,610 pairs. A total of 2,274 pairs was counted in 1986 (Zembal et al. 1987). The purpose of this survey was to provide a status update for Belding's five years after the last count and to examine the southern California marshes for problems and opportunities for this endangered bird.

#### METHODS

Territorial Belding's were surveyed at 34 different sites in California (Figure 1). Approximately 30% more time was spent engaged in surveys as compared to 1986 (Table 1). Counts were usually conducted in the early morning to a maximum of three hours after sunrise. This time frame was exceeded only when overcast conditions appeared to be responsible for a prolonged period of morning activity. Surveys were conducted during the period 5 March-28 June 1991 with the majority of the fieldwork completed in March and April. There were four principal observers involved in the

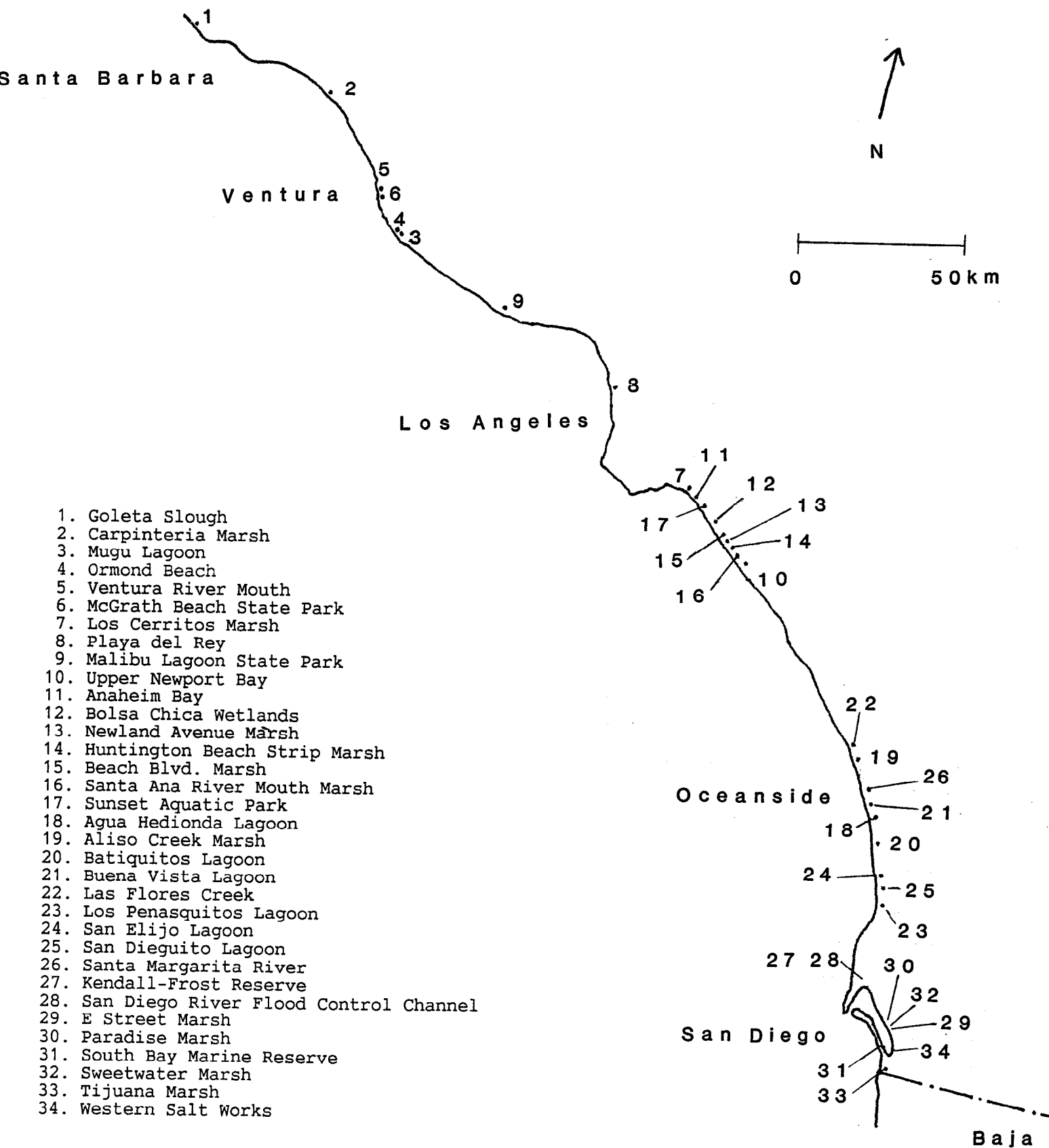


Table 1. Observer effort involved in the Belding's savannah sparrow census, 1991.

LOCATION	DATE	TIME <sup>1</sup> SPAN	TOTAL NUMBER <sup>2</sup> OF OBSERVERS	OBSERVER <sup>2</sup> HOURS
<u>Santa Barbara County</u>				
Goleta Slough	4/19	0645-1000	3	10
Carpinteria Marsh	4/16	0730-1000	2	2.5
<u>Ventura County</u>				
Mugu Lagoon	3/27-/28	0630-1000	7	21
Ormond Beach	4/19	0655-0740	2	1.5
Ventura River Mouth	4/19	0905-0930	2	1
McGrath Beach State Park	4/19	0812-0830	2	0.5
<u>Los Angeles County</u>				
Los Cerritos Marsh	3/9	0655-0820	1	1.5
Playa del Rey	5/12	0650-0900	1	2
Malibu Lagoon State Park	3/31	0730-0840	1	1
<u>Orange County</u>				
Upper Newport Bay	3/8-/21	0545-0830	1	11
Anaheim Bay	3/5-4/9	0600-1020	5	21
Bolsa Chica Wetlands	3/29-4/26	0645-1015	3	15
Newland Avenue Marsh	3/19-/22	0815-0902	1	1
H.B. Strip Marsh	3/23-/29	0655-1010	1	3.5
Beach Blvd. Marsh	3/19-/22	0650-0815	1	3
Santa Ana River Mouth Marsh	3/23	0850-1000	1	1
Sunset Aquatic Park	4/9		1	0.5
<u>San Diego County</u>				
Agua Hedionda Lagoon	4/25	0700-0930	1	2.5
Aliso Creek Marsh	4/7	0850-0930	1	1
Batiquitos Lagoon	4/5	0715-1100	3	11
Buena Vista Lagoon	6/14	0640-0750	1	1
Las Flores Creek	4/7	0730-0830	1	1
Los Penasquitos Lagoon	6/17	0635-0920	3	8
San Elijo Lagoon	3/15	0745-1100	7	23
San Dieguito Lagoon	3/14,4/8	0625-0823	4	10
Santa Margarita River	3/6-4/3	0650-0955	4	13
(Mission Bay)				
Kendall-Frost Reserve	3/22	0700-0930	1	2.5
<sup>3</sup> S.D.R. Flood Control Channel	3/12	0635-0930	2	6
(San Diego Bay)				
E Street Marsh	3/18	0700-1000	2	6 <sup>4</sup>
Paradise Marsh	3/18	0700-1000	2	6 <sup>4</sup>
South Bay Marine Reserve	6/28	0705-0920	2	4
Sweetwater Marsh	3/18	0700-1000	2	6 <sup>4</sup>
Tijuana Marsh	4/18	0620-0905	6	15
Western Salt Works	6/28	0930-1030	3	3
TOTAL OBSERVER HOURS - - - - -				204

<sup>1</sup>The time span gives the earliest starting and latest finishing times of censusing for all visits <sup>2</sup>The number of observers is the total number of different individuals who participated in counting at that marsh; the observer hours is the total amount of time spent by all observers <sup>3</sup>San Diego River <sup>4</sup>Six hours was the total time spent surveying E St., Paradise, and Sweetwater marshes.

censusing: Robert James, Doreen Stadtlander, Jane Tutton, and Richard Zembal. Several others participated in individual counts: Donna Brewer, Cat Brown, Kris Burnell, Mike Couffer, Art Davenport, Karil Dennis, Wayne Ferrin, C. Gronholt, Mark Holmgren, Scott Johnston, Martin Kenney, John Konecny, Robert Patton, Mark Pavelka, Ron Ryno, Terri Stewart, and Christine Thompson.

All territorial individuals were counted at each marsh. Territoriality was manifested through their singing, scolding, extended perching together of presumed mates, nest building, feeding young, and aerial chasing (Zembal et al. 1987). Survey methods are more completely described in Zembal et al. (1987).

#### THE STATE CENSUS AND DISCUSSION

At least 1,844 pairs of Belding's Savannah sparrows were identified in 27 marshes (Table 2). This is a 18.9% reduction from the 1986 census (Zembal et al. 1987); however, the largest population in 1986 of 446 pairs at Mugu Lagoon was not completely surveyed in the latest effort. The partial survey suggested that the 1991 population is similar. If the population at Mugu is assumed to be the same as 1986, then the present survey is 9.8% less than in 1986. The population at Buena Vista Lagoon was extirpated, but an individual was detected at McGrath Beach, retaining the number of populations. Nine Belding's populations increased, two remained the same, but 13 declined (Table 3). Substantial (greater than 40%) population increases were noted at four marshes: Goleta, San Elijo, South Bay, and Tijuana, but declines of at least equal magnitude were observed at six of the marshes: Playa Del Rey, Anaheim Bay, Huntington Beach, Agua Hedionda, San Diego River, and Western Salt Company Dikes. Inundation of habitat due to the unseasonably late March rains may be partly responsible for these observed declines at Bolsa Chica Wetlands and other locations. This occurred within a short time span and at the known onset of the nest-building phase (Massey 1979). Additionally, the Western Salt Company Dikes were surveyed late in the breeding season when breeding



Table 2. Breeding pairs of Belding's savannah sparrows in California in 1991 by location, compared to three previous censuses.

	<sup>1</sup> 1973	<sup>2</sup> 1977	<sup>3</sup> 1986	1991
<u>Santa Barbara County</u>				
Carpinteria Marsh	100	34	74	52
Goleta Slough	50	28	50	81
<u>Ventura County</u>				
McGrath Beach State Park	-	12	0	1
Mugu Lagoon	175	250	446	239 <sup>5</sup>
Ormond Beach	-	17	20	15
<u>Los Angeles County</u>				
Los Cerritos Marsh	-	5	2	9
Playa del Rey	25	37	32	5
<u>Orange County</u>				
Upper Newport Bay	130	83	245	199
Anaheim Bay	125	267	244	138
Bolsa Chica Wetlands	40	186	163	110
Newland Avenue Marsh	-	-	24	32 <sup>4</sup>
Huntington Beach Strip Marsh	-	34	47	19
Santa Ana River Mouth Marsh	-	-	0	0
Sunset Aquatic Park	-	6	0	0
<u>San Diego County</u>				
Agua Hedionda Lagoon	37	16	45	13
Aliso Creek Marsh	-	-	5	5
Batiquitos Lagoon	0	20	47	50
Buena Vista Lagoon	0	5	1	0
Los Penasquitos Lagoon	160	52	156	108
San Elijo Lagoon	17	30	31	47
San Dieguito Lagoon	0	9	39	39
Santa Margarita River Estuary	125	106	107	120
<u>(Mission Bay)</u>				
Beacon (FAA) Island	-	4	0	-
Kendall-Frost Reserve	-	45	13	9
S.D. River Flood Control Channel	-	70	28	9
<u>(San Diego Bay)</u>				
E Street Marsh	-	18	8	15
Paradise Marsh	-	16	19	14
South Bay Marine Reserve	-	25	15	42
Sweetwater Marsh	-	40	118	141
Tijuana Marsh	100	95	225	303
Western Salt Company Dikes	-	100	70	29
TOTAL	1,084	1,610	2,274	1,844+

<sup>1</sup>Bradley (1973), <sup>2</sup>Massey (1977), <sup>3</sup>Zemba et al. (1987), <sup>4</sup>includes marshlands adjacent to Beach Blvd not counted in 1986, <sup>5</sup>incompletely surveyed, '-' = not censused

Table 3. Population percentage changes of Belding's Savannah sparrows between the 1986 and 1991 surveys. Mugu Lagoon, Newland Avenue, and Tijuana Estuary are not listed since the surveys were not completely done in both years. The percentage changes should be interpreted carefully. For example, the 350% increase at Los Cerritos resulted from an increase of 2 to only 9 territories. NOTE: McGrath Beach went from zero to one bird, a percentage increase of infinity.

1. Los Cerritos	350%
2. South Bay Marine Reserve	180
3. E Street Marsh	88
4. Goleta Slough	62
5. San Elijo	52
6. Sweetwater Marsh	16
7. Santa Margarita	12
8. Batiquitos Lagoon	6
9. San Dieguito Lagoon	0
10. Aliso Creek	0
11. Upper Newport	-19
12. Ormond Beach	-25
13. Paradise Marsh	-26
14. Kendall Frost	-30
15. Carpinteria Marsh	-30
16. Los Penasquitos	-31
17. Bolsa Chica	-33
18. Anaheim Bay	-43
19. Western Salt Company	-59
20. Huntington Beach	-60
21. San Diego River	-68
22. Agua Hedionda	-71
23. Playa Del Rev	-84

Forster's terns (Sterna forsteri) occupied part of the habitat.

Only eight marshes have populations of 100 pairs or larger, as in 1986. An additional 50 pairs were detected at Tijuana Marsh since the 1986 census; however, coverage was more complete in the latest survey. Eleven sites had fewer than 50 individuals (25 territories). This compares with nine in 1986 (Zemba et al. 1987). Franklin and Soule (1981) presented mathematical models showing that in order for genetic material not to be lost in every generation, an effective population size of 50 individuals is necessary in isolated populations and 500 may be necessary for evolutionary processes to continue. Assuming no intermarsh travel by Belding's, Mugu Lagoon may currently have the only population large enough (446 territories in 1986) for much of a chance of long-term survival. Populations at many locations appear to be showing erosion, although weather, observer variation, and unknown aspects of

Belding's behavior (particularly intermarsh movements) are all unquantified regulating factors.

Although Belding's are concentrated in some locations with muted tides, the most productive habitat has regular, consistent tidal influence. Habitat which usually is not submerged for long in many marshes was flooded by spring rains in 1991, rendering vast acreages uninhabitable to Belding's. This problem is ongoing and particularly devastating in marshes with inconsistent tidal influence such as Los Penasquitos, Batiquitos, and San Elijo lagoons. The essential long-term goal is to return constant tidal influence to such areas. Because upper marsh habitat was the easiest for people to fill and put to other purposes, much of it disappeared from southern California many years ago. Today, most marsh edges include many acres of saline soils that could support some Belding's habitat but now support weeds instead. Habitat restoration should begin for this State-endangered bird with a pilot project. Some of the most pervasive problems for Belding's across its range include trash, trespass, lack of tidal inundation, and low habitat base.

Several study questions and further recovery efforts should be pursued to benefit Belding's including: (1) the question of possible movements between populations, (2) habitat enhancement efforts, (3) possible productivity limitations to Belding's due to predation by exotic organisms, (4) the question of the correct taxonomic status of the Santa Ynez River population of Savannah sparrows, and (5) a possible federal listing as a threatened or endangered species. The number of populations, sizes, and distances from each other need to be factored into a demographic model for Belding's since it is not known how many populations of what size are needed to best assure the existence of Belding's in the future. The less interchange that occurs between Belding's of different marshes, the greater the number of populations that should be maintained to best insure continued existence. Anecdotal evidence (observations of higher numbers of wintering birds) suggest that some Belding's move to Playa Del Rey (Corey and Massey 1990). The larger Belding's populations of Mugu Lagoon or Anaheim Bay may be important centers of

dispersal in the maintenance of Playa Del Rey and/or some of the other smaller populations. Dispersal, in part, may be an explanation for maintenance of a small population such as Los Cerritos (since 1977) and the recurrence of Belding's at McGrath Beach. A large-scale banding effort would need to be undertaken to try to answer how commonly, over what distances, and under what ecological conditions, interchange between marshes may occur.

Habitat improvement methodology for Belding's is well documented but rarely done. Firstly, the restoration and maintenance of tidal circulation at proper elevations results in a more diverse marsh flora and fauna as well as improves Belding's habitat. This has been shown at Mugu Lagoon and Tijuana Marsh. Though expensive, land acquisition and protection may be the best option for gaining Belding's habitat to increase population sizes. Since 1986, Sweetwater, Paradise, and E Street Marshes have been added to the National Wildlife Refuge system. Bolsa Chica would greatly benefit from protection and enhancement. Restoration projects could have major benefits at all of the inhabited wetlands. Further acquisition and creation of Belding's habitat should be an integral part of the Service's potential Coastal Refuge System.

The Belding's dependence on thick vegetative stands dominated by pickleweed is well documented (Zembal 1986). Massey (1979) observed that both sexes eat the growing succulent tips of pickleweed. Females are known to use dried Salicornia twigs in building their nests. Also, males use the branches of the plants as song perches. A better understanding of the autecology of Salicornia for large scale revegetation could be gained by the California Department of Fish & Game (CDFG) sponsoring smaller trial demonstrations in an area such as Buena Vista Lagoon. Knowledge gained by revegetation experimentation would be useful for habitat restoration and creation. Although mixed success has been achieved growing Salicornia from cuttings, creating habitat for natural seedling establishment may be easier and more successful, especially if the elevation and hydrology are correct for the plant (J. Zedler, pers. comm.). Covin and Zedler (1988) showed that the

application of urea (a nitrogenous fertilizer) increased Salicornia growth (as well as Spartina growth when it is not in the presence of pickleweed). A combination of these efforts should be considered.

Less expensive measures to enhance habitat would include human trespass limitation by increasing fencing and sign posting as well as increasing public awareness of the value of the habitat. These measures may allow public support for the more expensive measures outlined above.

Possible limitations to Belding's populations due to predation by introduced red foxes (Vulpes fulva), domestic cats and dogs, and other exotic predators, should be investigated for the magnitude of contribution to population limitation. Established breeding populations of red fox have expanded throughout the coastal southern California counties (Richard Golightly pers. comm.). There is mounting biological evidence that the red fox has a detrimental effect on various avian species. Populations of the California least tern (Sterna antillarum browni) and light-footed clapper rail (Rallus longirostris levipes) were observed to fluctuate in response to changes in red fox density at Seal Beach National Wildlife Refuge (USFWS 1990). In 1990, at least 60 (and possibly as many as 99) of 137 Western snowy plover (Charadrius alexandrinus nivosus) nests were documented as lost due to red fox predation at Monterey Bay, California (Anonymous 1990). The plover population has declined at that location since the fox appeared in 1985. Preliminary findings indicate that red foxes consume a variety of food items, including passerine birds (Richard Golightly pers. comm.). Therefore, control measures on behalf of Belding's are probably warranted, in conjunction with any necessary public education efforts.

Although the classical works on Belding's distribution (Grinnell and Miller 1944, Van Rossem 1947, AOU 1983) do not recognize the potentially large Santa Ynez River Marsh population as the Belding's form due to its presumed geographic isolation, proposed research utilizing comparative molecular and behavioral techniques may indicate that it warrants state-endangered protection as beldingi (Kris Burnell, pers. comm.).

The habitat enhancement and research measures outlined above are badly needed. Coupled with careful monitoring, this might insure the continued survival of the Belding's Savannah sparrow.

The data presented in this report show a rangewide population decline in the overall number of Belding's between 1986 and 1991, as well as declines of several populations. With ESA protection, upper marsh habitat dominated by Salicornia throughout the range of Belding's would have better protection. Presently, existing habitat is threatened by proposed developments and other degradations. This protection may be crucial, considering recent proposals to weaken the Clean Water Act and thereby the protection of wetlands.

## THE MARSHES

### Santa Barbara County

#### Goleta Slough - 81 territories.

Most of the birds, as in 1986, were found in the more tidally-influenced area near Fowler Street. Despite the population increase, there has been an apparent total death of Salicornia in several large wetland basins: west and east of Los Carneros, and slightly northwest of the Central Stores Building, all possibly due to tidal flow problems. The major problem here is the lack of tidal access and resulting dramatic fluctuation in water salinity. This should be corrected to improve habitat. Expansion of the adjacent Santa Barbara Airport into upper marsh habitat is being proposed.

#### Carpinteria Marsh - 52 territories.

Most of the birds were, as in 1986, found in the smaller wetland area between Apple Road and Santa Monica Creek. This coincides with tidal dampening there due to constricted tidal access. Most of these birds are banded as part of an ongoing study by Kris Burnell, a doctoral student at U.C. Santa Barbara. Potentially habitat-altering flood control projects are planned upstream. Predation may be a major problem here also. Feral cat tracks are very abundant, there is a large local population of raccoons, and at least occasional visits by red fox.

### Ventura County

#### Mugu Lagoon - 239+ territories.

Due to an incomplete survey, the total is only 53.6% of the 1986 count. The total of 91 territories in the East and Central Arms is 88% of the 1986 sum of 103; these areas were completely surveyed during both years. Since the areas between L and M Avenues and inland from the West Arm were not surveyed at all and the area upcoast from M Avenue was only partly viewed, only 148 territories were located in the West Arm in 1991 compared to 343 in 1986. The total of 113 territories between the West Arm and the coast was comparable to the 101 located in 1986, however. Given these observations of similar-appearing totals for completely surveyed areas, it seems that if the survey in 1991 was done completely, a figure comparable to 1986 would have been attained. Increased sedimentation from Calleguas Creek was noted from the March 1991 storms. The Soil Conservation Service predicted in 1983 (in Onuf 1987) that, "the only wetlands that will exist by the year 2030 will be a thin finger extending into the eastern arm and narrow corridors passing through what now is the central basin to the western arm..." If it continues as predicted, it could result in a muted tidal regime, closure of the ocean inlet, and associated losses of habitat and habitat quality for Belding's and other flora and fauna. Sedimentation must be controlled and increased tidal circulation should be provided to the isolated sections of the marsh to improve habitat quality.

#### Ormond Beach - 15 territories.

This area is upcoast and contiguous with the Mugu Lagoon habitat. The birds were found in the remaining thick Salicornia area on Ormond Beach. Approximately two acres of former pickleweed habitat was recently disced. At least part of the area is proposed for a marina and housing development.

#### McGrath Beach State Park - 1 territory.

A single posted bird was observed. Belding's at this location were reported extirpated in 1986 (Zemba et al. 1987). Neither Belding's nor suitable habitat were observed in 1986 as the marsh was apparently taken over by freshwater marsh plants. As long as the marsh remains closed to tidal influence, it is unlikely that Belding's will recolonize this area.

Ventura River Mouth - 1 territory.

Some pickleweed was observed in the sumps adjacent to the railroad tracks where an individual Belding's was observed. The zone is a heavily-used public accessway to the State Beach and estuary.

Los Angeles County

Los Cerritos Marsh - 9 territories.

In this remnant marsh, tidal influence creating a functional habitat of different littoral zones is evident in about 25-30 acres of the area. Belding's are clustered in the higher elevation area of a few acres in the center of the tidally influenced area. The saltmarsh and saltpan areas are mostly fenced off, but fishermen gain access to the adjacent Los Cerritos Flood Control Channel to the north and can get into the marsh via a gap in the fence along Studebaker Road. Oil recovery operations occur adjacent to Belding's habitat. A red fox was observed running through the tidally influenced area during our survey. A small Belding's colony has remained here since at least 1977. Given the extremely small population and its expected increased probability of extinction, it seems likely that the nearby large Anaheim Bay population (138 territories in 1991) functions as a center of dispersal. This appears to be a nice little saltmarsh, with good restoration potential awaiting tidal influence. Restoration of approximately 70 additional acres is planned by the Kaufman & Broad Co. in conjunction with a proposed housing development; the oil leases will then be terminated. The return of tidal influence to additional acreage with an upper littoral zone vegetated with Salicornia as well as improved fencing to reduce human trespass would be expected to increase the present Belding's habitat and population.

Plava Del Rey - 5 territories.

All of the territories were found in the non-tidally influenced area adjacent to the channelized Ballona Creek, inland from the channel. Some of the pickleweed is desiccating. There has been a large decline in population size at this site. The highest population total of 37 pairs was observed in 1977 (Corey and Massey 1990). Since then, 29 pairs were noted in 1987; and in 1990, only 12 pairs were observed. Subsequent to 1987, the population on the north side of the creek has been extirpated; this area is now invaded by upland plants and is proposed for development. The current nesting area has highway noise buffered by the berm near Culver Blvd. A channel between this area and the apartments probably also helps to reduce human disturbance. Additional habitat is available surrounding the nesting area but is affected by freshwater influence as indicated by the presence of upland plants growing between the pickleweed. Vehicle tracks (including "donuts"), bike, and foot traffic were noted in the saltpan north of Culver Blvd. South of Culver, the area may be affected by traffic noise, as indicated by the lack of Belding's there in appropriate-looking habitat. Other potential problems include jet noise from the north runway of Los Angeles International Airport. (Belding's cannot be heard vocalizing during aircraft takeoffs). Also, red fox is present. These foxes were regularly seen in the breeding area (Corey and Massey 1990); a den was also found in the locality. The researchers recommend reintroduction of tidal flow and the closing of culverts during high tides to prevent flooding of the habitat. This would also reduce freshwater influence. Censuses for Belding's should be continued in conjunction with restoration efforts recommended by Corey and Massey (1990).

Malibu Lagoon State Park - 0 territories.

There are a total of two acres of pickleweed, which appears to be tidally influenced. However, there is a large amount of human disturbance in the area as well as apparent freshwater influence to the vegetation; the latter may be leaching out salts and allowing for upland plants to invade. The pickleweed was mixed with saltgrass (Distichlis spicata), iceplant, and oxalis. Residences are adjacent along the ocean side and water sprinkler heads are in the adjacent uplands of the Park. Unfortunately, the path through the marsh



is a heavily trafficked access route to the adjacent state beach. Though the path is marked with wire, some footprints were seen in the mud along one channel. A feral cat was also observed. Song sparrows (Melospiza melodia) were heard throughout the area. A new walkway to the beach could be constructed around the marsh to reduce human disturbance, and watering adjacent to the Salicornia should be discontinued to reduce the leaching problem; this would improve colonization potential for Belding's.

#### Orange County

##### Upper Newport Bay - 199 territories.

The largest concentration of Belding's was again at the upper end of the bay where the biggest contiguous expanse of pickleweed is located. As with most southern California marshes, the upper marsh in most of the bay is not very expansive. Replacing roadside weeds with Salicornia plantings would help remedy this in many areas of the bay. The largest noted problems for Belding's here were people trespass in the marsh and feral cats. People, bikes, dogs, and horses regularly trample through the best Belding's habitat in the bay. Regular patrol, assigned only to Upper Newport Bay (UNB), would stop this. People are still releasing animals into UNB, unaware of the problems this causes. Furthermore, red foxes are now accessing the bay and coyote visitation is down. A predator monitoring and control program should commence.

##### Anaheim Bay - 138 territories.

Belding's were concentrated between Bolsa Avenue and the railroad tracks as in former years but in fewer numbers. They are also still concentrated east of Case Road and its former extension and in the 1980 restoration area along the channels. Upper marsh is scarce on the refuge and could be restored in many areas to accommodate many more Belding's.

##### Sunset Aquatic Park - 0 territories.

No suitable habitat is present in this remnant marshland contiguous with Anaheim Bay. The small patches of marsh that are left are too small with too little Salicornia. If the old tern nesting site is ever renovated, the edge should be tapered to support marsh habitat and Belding's.

##### Bolsa Chica Wetlands - 92 territories.

Most Belding's were observed in the area receiving a muted tidal influence adjacent to Pacific Coast Highway (Inner Bolsa Bay, South Bolsa Slough, and "Cell" 1). Most of the other pickleweed is in a degraded state; it either receives only seepage flows of water, is sparse, or is flooded. Freeman Creek (flowing between Cells 44 and 17 and parallel to Pacific Coast Highway) flooded over much Salicornia. Other cells had higher water levels due to the unusual heavy March rains. Some of these cells had upland plants such as mustard (Brassica sp.), bromus grasses (Bromus spp.), and tumbleweed (Salsola iberica), indicating the presence of fresh water. Continued oil recovery operations contribute lost wildlife values in the form of petroleum and noise pollution along with fill materials in the wetland. A painter was observed dumping a substance appearing to be paint into the wetland. Human trespass off of the public "Loop Trail," and illegal dogs and bicycles on the trail, most evident on weekends, could be reduced by an improved law enforcement effort by CDFG wardens as well as the posting of more clearly worded signs that spell out all of the activities incompatible with a State Ecological Reserve. In addition, there is proposed development in the upper marsh and on the adjacent bluffs that would, in part, eliminate actual and potential Belding's habitat.

##### Newland Avenue Marsh - 32 territories.

This includes the area adjacent to Beach Blvd to the north of the flood control channel not counted in the 1986 census and the area south of the flood control channel to Newland Avenue that was censused previously (Zemba et al.

1987). All of this habitat is non-tidally influenced. This privately owned land was noted in 1986 as recovering from "weed control" in 1982. Twenty-four territories were counted in the 1986 census; only 13 were noted in the same area in 1991. Much of the pickleweed on both sides of the flood control channel is turning light brown. Water present is apparently due to seepage and recent rainfall. A small cattail (Typha sp.) wetland of ca. 1 acre has developed in the marsh just adjacent to the lawn of the apartment complex on Beach Blvd. Territorial Belding's are located on islands in the brackish wetlands.

To better manage for Belding's, the marsh needs to have a higher elevation area, restoration of tidal influence, removal of exotic plants such as giant reed (Arundo donax) and Myoporum, and control of human and pet trespass by proper fencing. The fence between the apartment complex on Beach Blvd and the wetlands has a four inch gap in places, allowing for easy access for pets and other animals into the habitat. Vehicle tracks were also observed on the Beach Blvd side.

#### Huntinton Beach Strip Marsh - 19 territories.

Fewer than half of the birds present in 1986 (47 territories) were observed. Like the Newland Avenue Marsh, much of the pickleweed on both sides of the flood control channel is turning light brown. Water present is apparently due to seepage and recent rainfall. Drought conditions since 1986 may have accounted for a reduction of habitat productivity. No territories were noted downcoast from Brookhurst Avenue, where the habitat is disturbed due to construction activities on the Santa Ana River Flood Control Project. Despite similar looking habitat to marshlands harboring the highest Belding's density in the marsh, the area upcoast near the steam generating plant had only one pair. Renewal of tidal influence is badly needed to the entire strip; the newly opened (in 1991) Talbert Channel restored only a small area.

#### Santa Ana River Mouth Marsh - 0 territories.

Massey (1977) noted Belding's here in the spring of 1973, but they have apparently not been present since that time despite the presence of some appropriate-looking habitat. Much of the habitat is very high and dominated by Salicornia subterminalis with intermixed upland weeds. Heavy equipment tracks and trespassers evident throughout the area suggest that a large amount of human disturbance occurs, partly in association with a marsh restoration project by the U.S. Army Corps of Engineers underway. Control of human and pet entry would be helpful also at this location. Hopefully, Belding's will reoccupy this site upon the project's completion.

### San Diego County

#### Aliso Creek Marsh - 5 territories.

This site is a mosaic of salt marsh vegetation dominated by Salicornia and saltgrass. It is bordered by an ephemeral lagoon to the northwest and sandy beach to the west. The western sandy beach is occupied by the federally endangered California least tern. As part of a management strategy for the terns, the eastern portion of this area is fenced by communication wire and on the north, south and west sides by mesh fencing. This encompasses not only the tern site but includes Belding's habitat. "No trespassing" signs are posted. Since 1988, the least tern fencing has been retained throughout the year restricting access to the Salicornia and it appears the vegetation has recovered somewhat since 1986. Despite these efforts, military vehicles were observed invading Belding's habitat inside the communication wire on May 9, 1991. The number of breeding pairs detected remained the same since the 1986 survey. We recommend the erection of a more substantial fence around Belding's habitat to prevent further habitat destruction and mechanical scarification of bare compacted soil to facilitate the regeneration of pickleweed cover.

#### Santa Margarita River Estuary - 120 territories.

The number of breeding pairs was up slightly from the 1986 Belding's Savannah

sparrow survey (USFWS, 1986) in which 107 pairs were reported. As in 1986, the highest concentrations were located west of Interstate 5 in a wide band of Salicornia bordered to the north by the main river channel and to the south by a dredged channel. Seventy-two percent of the territories detected were located in this area. Eighteen territories were reported along the north edge of the main river channel and 10 territories at the southern portion of the saltpan. The western strip of Salicornia which lies to the south of the river mouth and is bordered by sand dunes to the west contained 6 territories. A concern for this area is the amount of dried and brown pickleweed present. The mouth of the Santa Margarita River has been closed the majority of time during the period between 1987-1991. This restriction of tidal influence may be affecting the condition of the salt marsh habitat. The mouth of the river did open during March rains and at this time remains open. Restoration of constant tidal influence and additional salt marsh vegetation is highly recommended.

Buena Vista Lagoon - 0 territories.

The habitat which exists at this site appears too sparse and fragmented to support breeding Belding's Savannah sparrows. In 1986, a small patch of pickleweed was reported in the northeast corner of the inner lagoon where one pair was detected. The lagoon perimeter is inundated with trash and is heavily disturbed by foot traffic. In order for Belding's to successfully utilize this lagoon, restoration of higher marsh vegetation would be necessary along with restricting foot and vehicle traffic. The islands located in the inner lagoon would be exceptional candidates for Salicornia revegetation since they are isolated from human disturbance. We recommend that the Department pursue a revegetation and protection program.

Agua Hedionda Lagoon - 13 territories.

Suitable habitat for Belding's exists at the eastern corner of the inner lagoon. The number of territories detected is much lower than the 1986 survey in which 45 pairs were manifest. The low count for this survey is attributed to the high waters and channelization which made access to the survey area difficult. Human foot traffic through the marsh and especially along the perimeter of the lagoon has disturbed the vegetation. Bike tracks and canine tracks were visible. Extreme water level fluctuations coupled with human disturbance is preventing this area from reaching its full potential for Belding's productivity. Securing the marsh to prevent human intrusion is highly recommended.

Batiquitos Lagoon - 50 territories.

The lagoon had been inundated for a year and had just started drying for 3-4 weeks prior to this survey. The Belding's population was concentrated north of San Marcos Creek in the eastern portion of the inland lagoon. Much of the Salicornia at the southeastern edge was inundated and only 3 individuals were observed. Many areas of the lagoon show evidence of human disturbance. Transient camps, trash and canine tracks were present. Restoration of a full tidal prism and prevention of human trespass are highly recommended.

San Eliio Lagoon - 47 territories.

The northern edge of the lagoon was heavily inundated and much of the Belding's habitat which previously existed was under water. Much of the remaining habitat was located along the western edge of the lagoon where 60% of the sightings were made. There were 12 territories located between Pacific Coast Highway and the railroad tracks and 16 territories east of the tracks adjacent to the foot trail. Nineteen territories were detected east of Interstate 5 along with a flock of approximately 22 non-territorial birds. Their presence may be a result of the high water levels and recent inundation of habitat. Lack of tidal influence continues to remain a problem along with human disturbance. As in the past, we continue to recommend the restoration of full tidal influence and prevent human trespass.

San Dieguito Lagoon - 39 territories.

As in 1986, the largest concentrations (11 territories) of Belding's were located at the south end of the south channel on the largest island in a mixture of Salicornia virginica and Salicornia subterminalis. Ten territories were detected in the southeastern portion of the lagoon, north of Grand Avenue and three pairs were found in a small patch of Salicornia adjacent to Jimmy Durante Blvd. Several other sightings were scattered northwest of the foot trail. The lack of constant tidal influence and continuation of human trespass are also problematic here.

Los Penasquitos Lagoon - 108 territories.

The number of Belding's detected is down slightly from the 1986 report of 156 pairs. This may be due to the fact that this area was surveyed very late in the season and birds may not have been as territorial. A flock of 7 birds was located at the far eastern end of the marsh. Belding's were evenly distributed throughout the habitat except for the area east of the railroad tracks in the north corner which was heavily inundated. The mouth of the lagoon was closed at the time of this survey. A continuing problem is the lack of tidal influence for this lagoon. Long periods of drying and inundation have adversely effected the salt marsh vegetation. The amount of human disturbance appeared to be minimal. A few areas along the railroad easement contained trash. Restoration of constant tidal influence is recommended.

Kendall-Frost Reserve - 9 territories.

All the sightings reported were located in a small area of Salicornia along the inland edge of the marsh adjacent to Pacific Beach Drive. This is the only area which harbors pickleweed. The rest of the marsh is dominated by cordgrass (Spartina foliosa). A domestic cat and numerous cat tracks were observed on the mud flats. There are ongoing problems with human trespass from Campland and the invasion of mangrove (Avicennia sp.). There is little area available in this marsh for upper marsh vegetation. The few acres of land now dominated by iceplant and other upland weeds should be added to the Reserve. These areas should be graded and planted with Salicornia. This could result in several times the habitat which is presently available to Belding's.

San Diego River Flood Control Channel - 9 territories.

The north side of the river is virtually devoid of Belding's habitat. The Salicornia which does exist is low, sparse and patchy. Only one territory was detected on this side of the channel. A small amount of habitat was found along the southeastern portion of the river where 8 territories were located. The habitat along the channel undergoes drastic swings in vegetational dominance from year to year. The lower areas were well invaded by cordgrass this year and the dominant higher marsh plant was Jaunea carnosa. Freshwater vegetation, particularly, Typha, seems to encroach and recede, depending upon the rainfall. Because of the dynamic hydrology of this area, it could be difficult to manage for a larger expanse of Beldings' habitat.

Sweetwater Marsh - 141 territories.

Territories were dense along the main stretch of habitat south of the Sweetwater River. The habitat is dominated by Salicornia and cut with several large channels. A minimal amount of trash was present. Sweetwater Marsh, along with Paradise, E Street, F Street and Venner Avenue Marshes, now comprise part of the Sweetwater Marsh National Wildlife Refuge and has been managed by the USFWS since 1988. Access to the Sweetwater area has been restricted and portions have been cleared of trash and debris. Continued control of people, pets, and trash should result in higher security and productivity for Beldings then what was possible in the past. Prior to management by the USFWS, the area known as Vener Avenue Pond was subject to heavy human disturbance. Restricted access has allowed the vegetation to return. It is now dominated by Salicornia and occupied by 30 pairs of

Belding's Savannah sparrows. This is a good example of the results of minimizing trampling and disturbance brought on through management. Four territories were detected at the F St. Marsh. The overall increase in Beldings' at Sweetwater is largely attributed to the increased management at these sites.

Paradise Marsh - 14 territories.

The number of breeding birds was slightly lower than the count of 19 pairs reported in 1986. Belding's were concentrated in an area along the eastern edge of the main channel. A flock of 7 Belding's was also detected along the eastern edge of the marsh but no individuals displayed signs of territoriality. A considerable amount of disturbance caused by foot traffic and garbage dumping are especially evident along the perimeter of the marsh. An area just below the railroad tracks showed evidence of actual digging occurring on this site. A connector marsh between Paradise and the Sweetwater was re-vegetated with Salicornia but has not been successful enough to date to provide additional viable habitat. Revegetation efforts should be continued.

E Street Marsh - 15 territories.

Almost twice as many pairs were detected during this survey than that of the 1986 census. The habitat is mostly uniform and the Belding's were evenly distributed throughout the area with a slightly higher concentration towards the western edge. The increase in the number of Belding's may be a product of restricted foot and vehicle traffic which has allowed the pickleweed to flourish and diminished the direct disturbances to Beldings' that were once a major problem.

Western Salt Company Dikes - 29 territories.

The only suitable Belding's habitat is a narrow strip of Salicornia which exists along the outermost dike and perimeter road. All the territories detected were located adjacent to evaporation pond cells #12 and #14. Four small flocks of Belding's were also observed in this area along with individuals foraging. This area was surveyed very late in the breeding season which could explain the low numbers of territorial individuals compared to the 70 pairs present during the 1986 Belding's survey. However, there is concern that a real and significant loss of habitat could be responsible for lower detections as well. It is clear that Beldings' were much more abundant in 1977 and 1986, and that the existing strip of habitat is now patchy and thinner. Areas of suitable looking Salicornia are unoccupied. Investigations for potential contaminant problems, alleviation of any existing problem, and securing areas for habitat restoration in this part of the bay are absolutely essential.

South Bay Marine Reserve - 42 territories.

More than twice as many Belding's were present during this survey as compared to 1986. Belding's were concentrated in the northwest section of the marsh where the habitat is dominated by Salicornia virginica and Salicornia subterminalis. Some foot traffic and trash were noted within the habitat. There remains a high restoration potential along the adjacent shoreline which should be taken advantage of.

Tijuana Marsh - 303 territories.

A large expanse of Salicornia marsh is located at the mouth of the Tijuana River. Of the total 303 territories, 68% were located south of the river. The habitat located north of the main river channel is mostly uniform and Belding's were evenly distributed throughout the area. Compared with the 1986 census, coverage of the south side of the river was more complete, accounting in part for the increased number of territories detected. One of the most evident problems is human disturbance. Numerous foot paths are worn throughout the area and much of the disturbance occurs where people do not stay on marked trails but apparently wander into the habitat. A significant amount of trash is also present along with dog tracks. Known water quality

problems in the Tijuana River must be dealt with. River mouth closure still presents itself as a potential future problem which should be avoided by improving the marsh hydrology, giving ample consideration for Belding's habitat. Local efforts for increased Belding's productivity could include improved local drainage in areas that sometimes flood and pond for weeks when late winter and spring rains occur.

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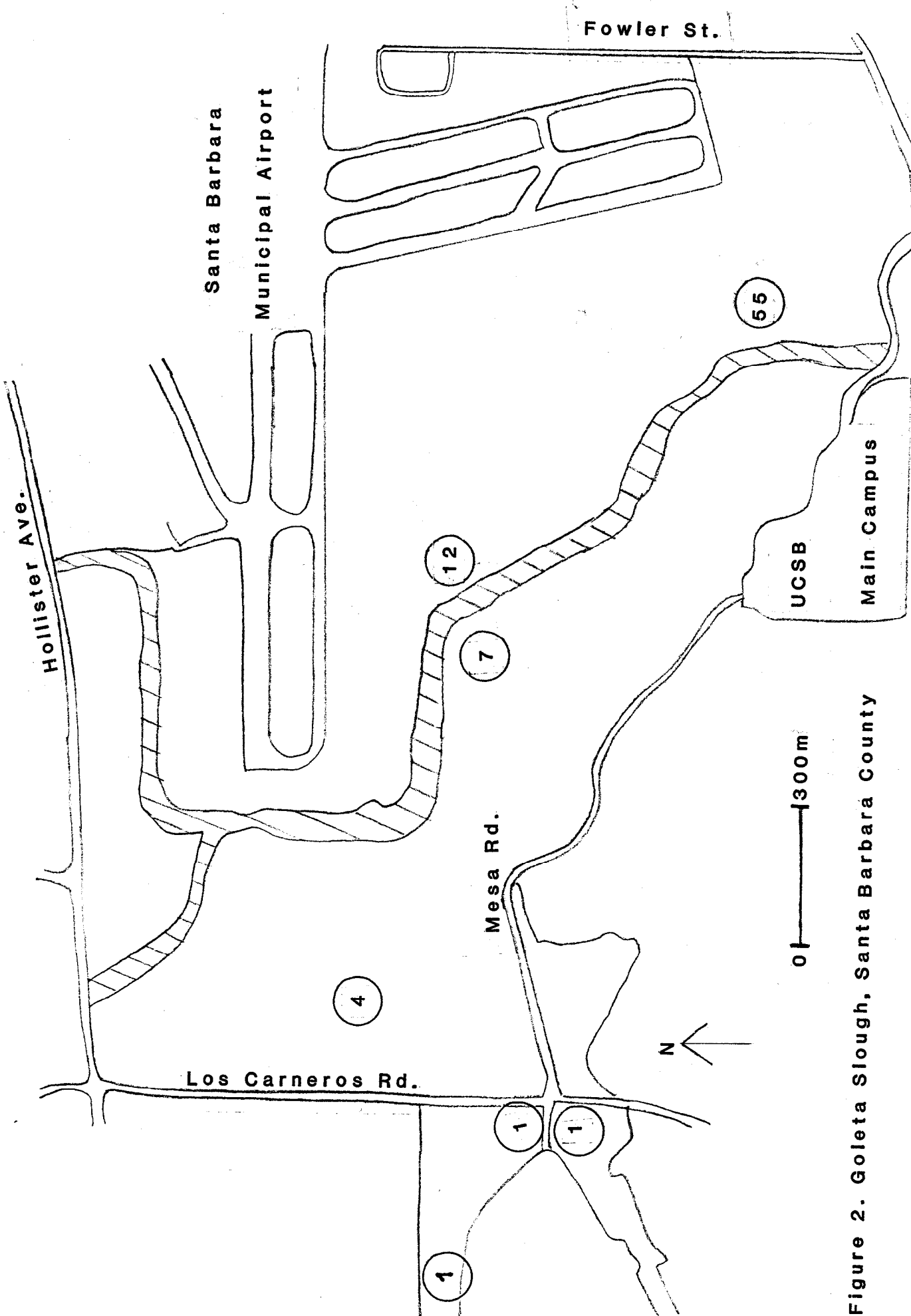


Figure 2. Goleta Slough, Santa Barbara County



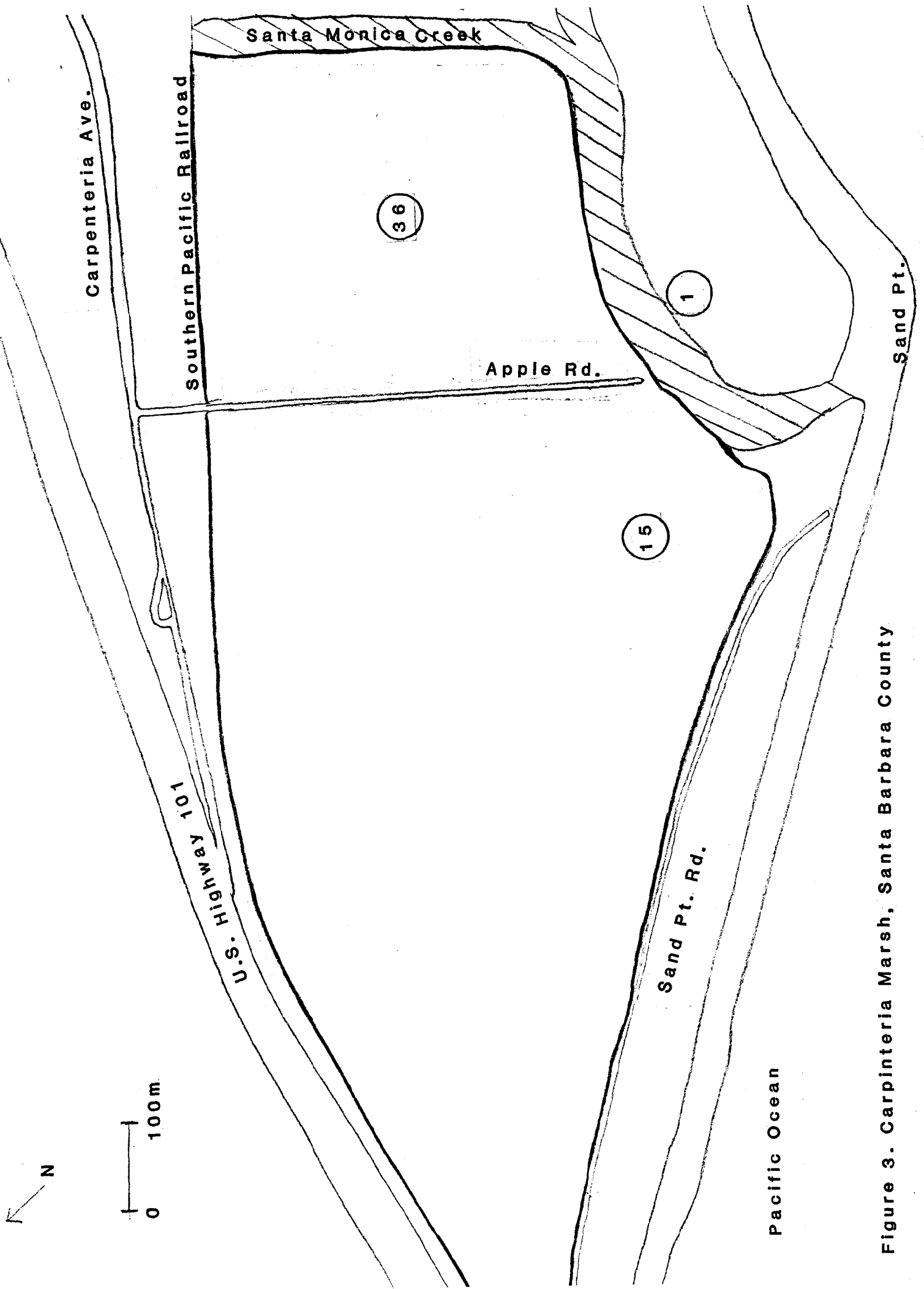


Figure 3. Carpinteria Marsh, Santa Barbara County

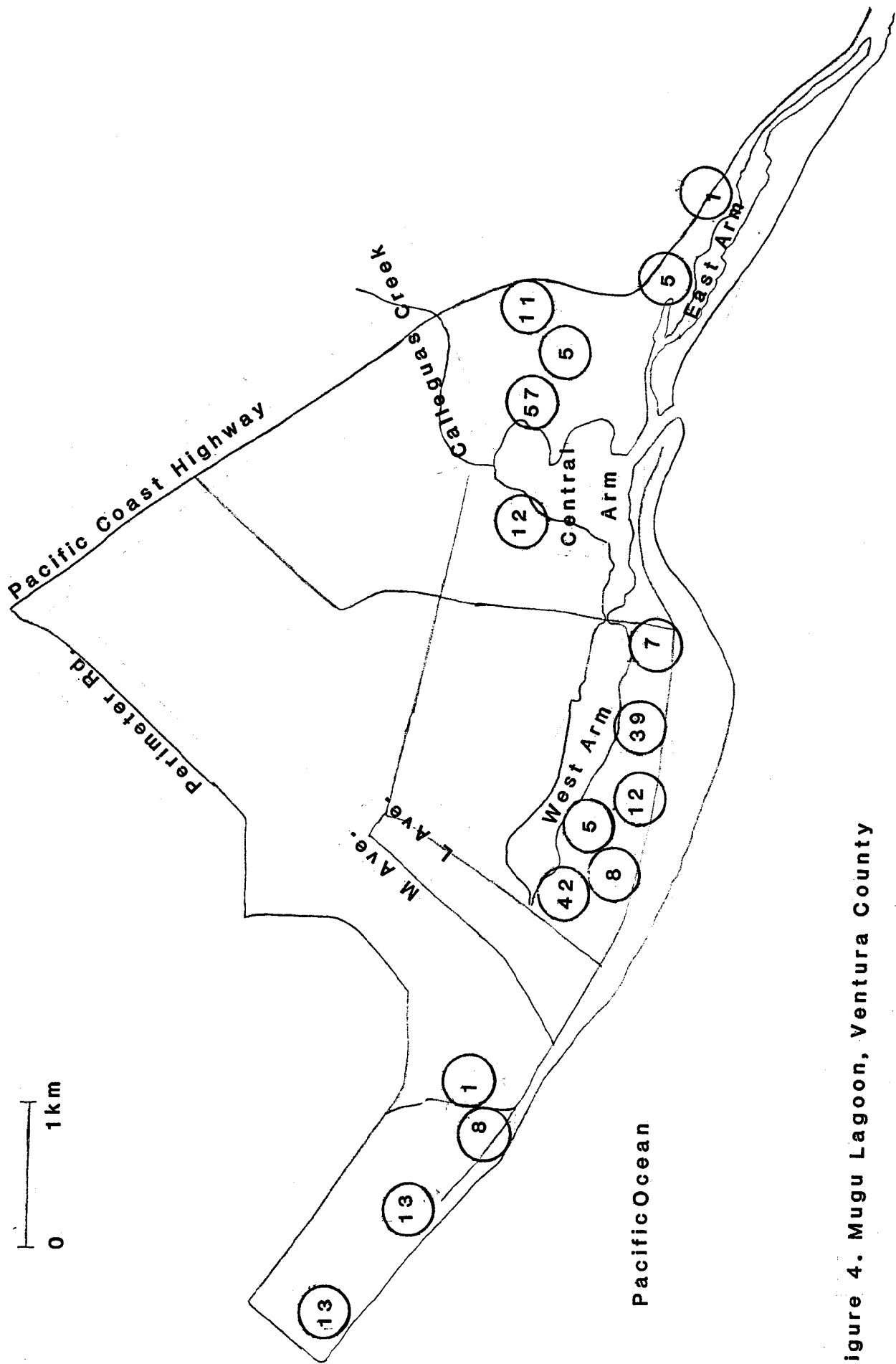


Figure 4. Mugu Lagoon, Ventura County

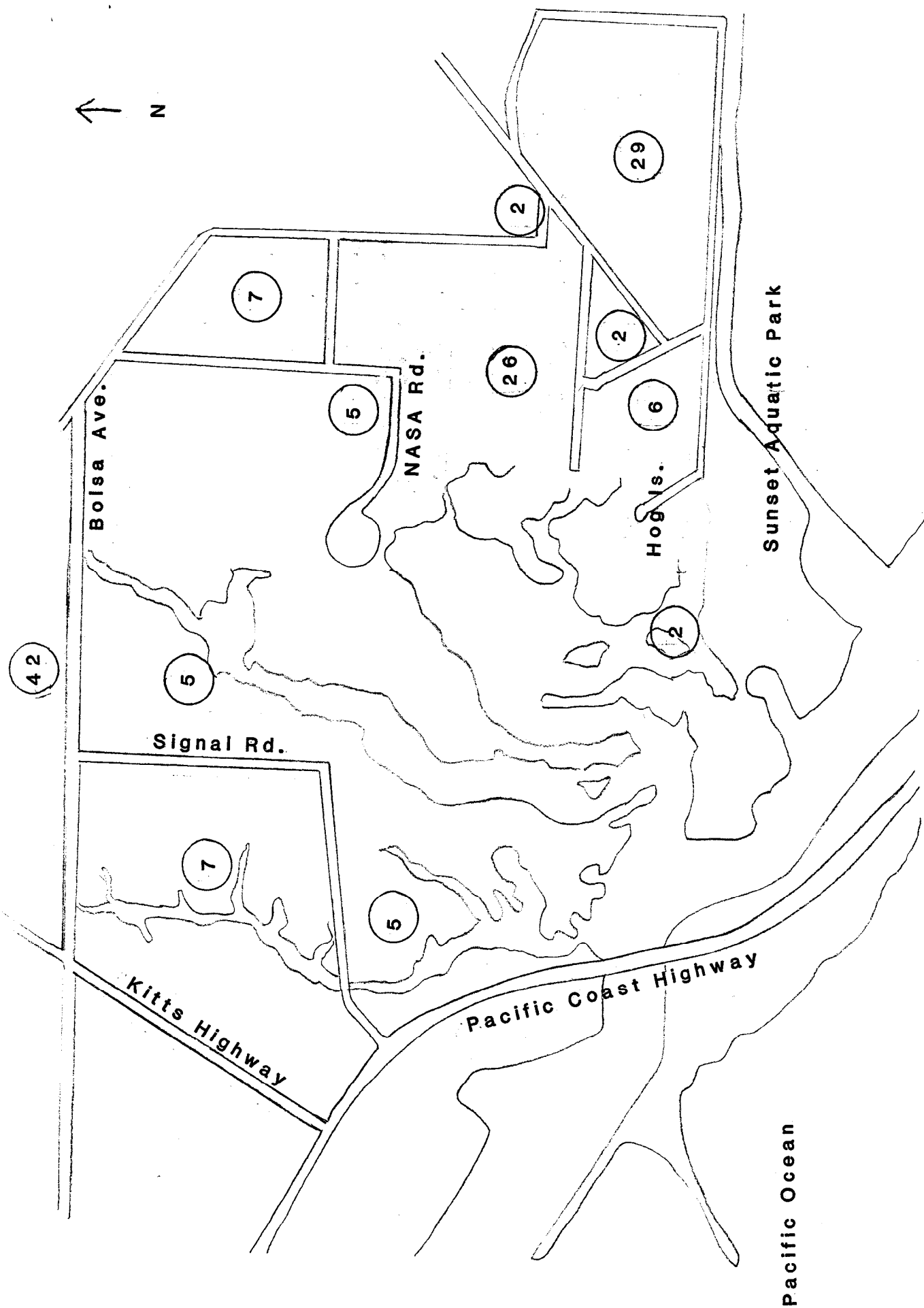


Figure 5. Anaheim Bay and Sunset Aquatic Park, Orange County

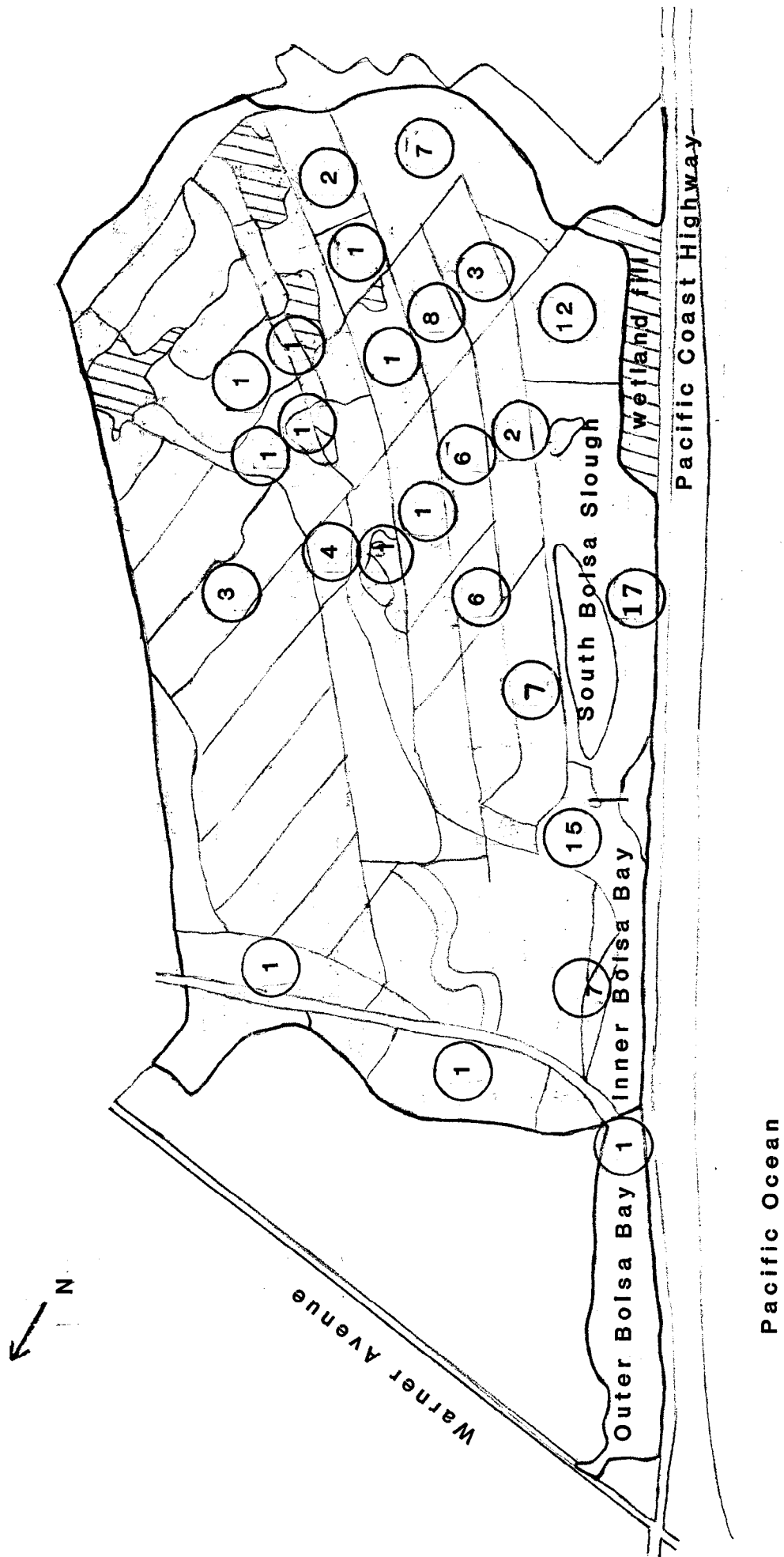


Figure 6. Bolsa Chica Wetlands, Orange County

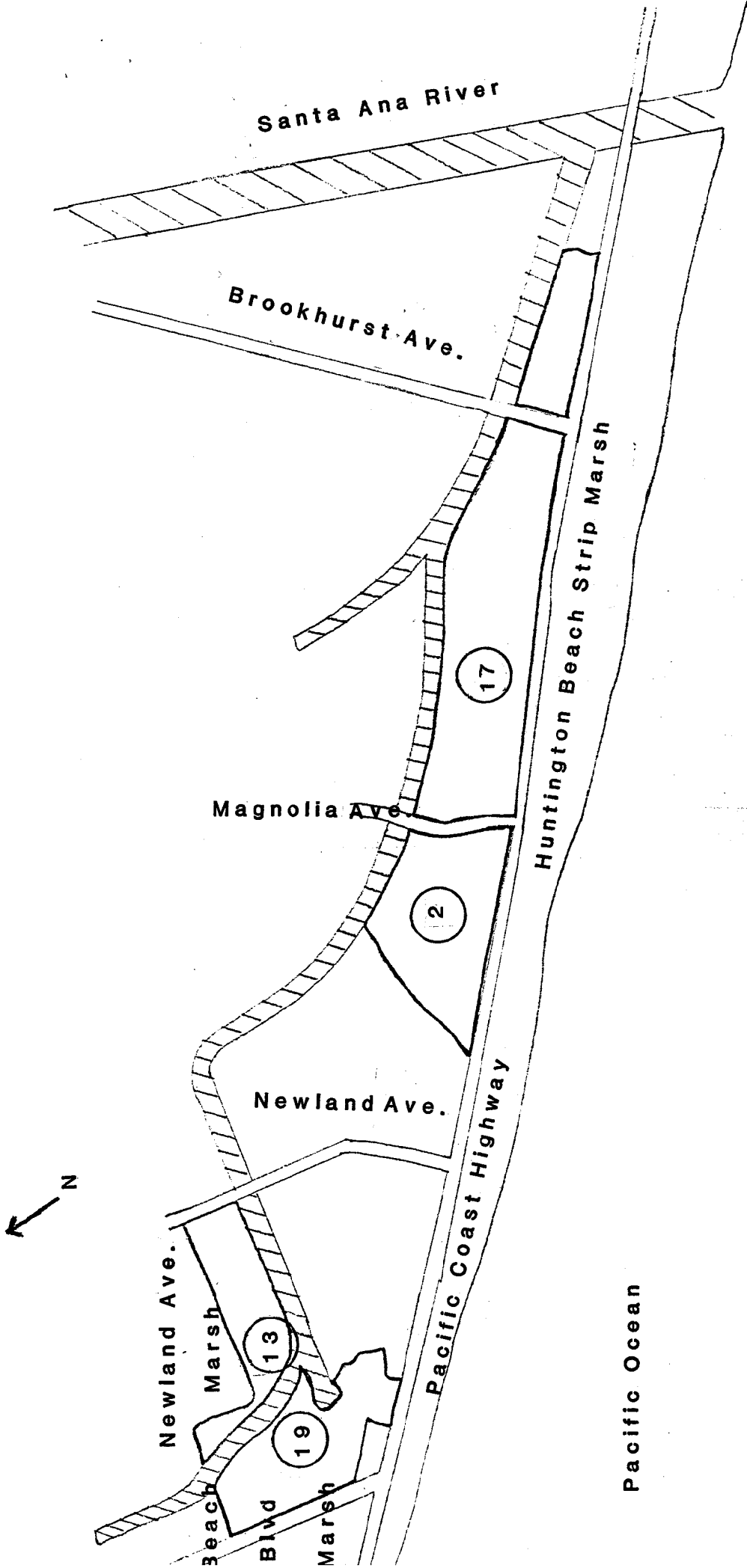


Figure 7. Beach Blvd., Newland Ave., and Huntington Beach Strip Marshes, Orange County

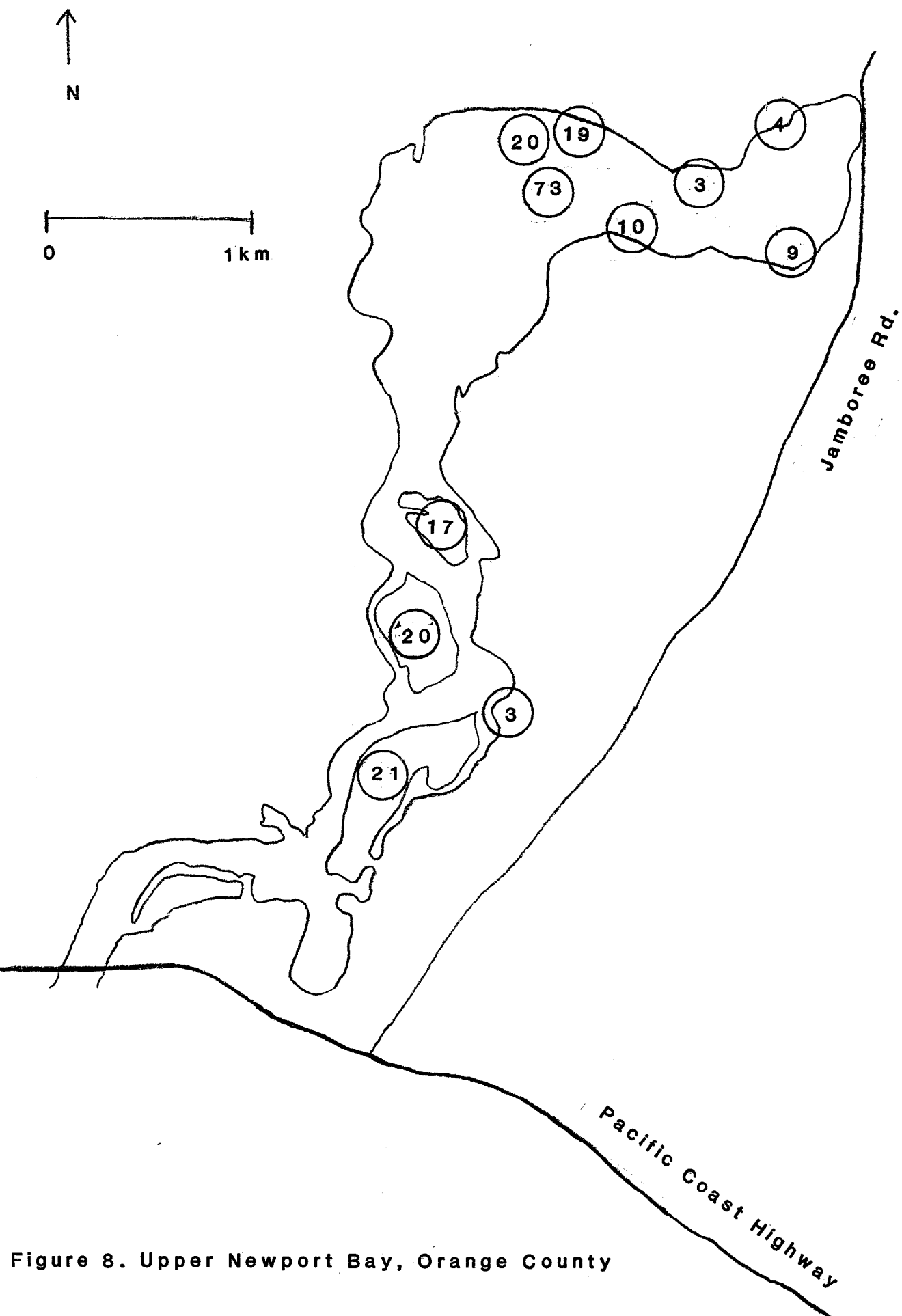


Figure 8. Upper Newport Bay, Orange County

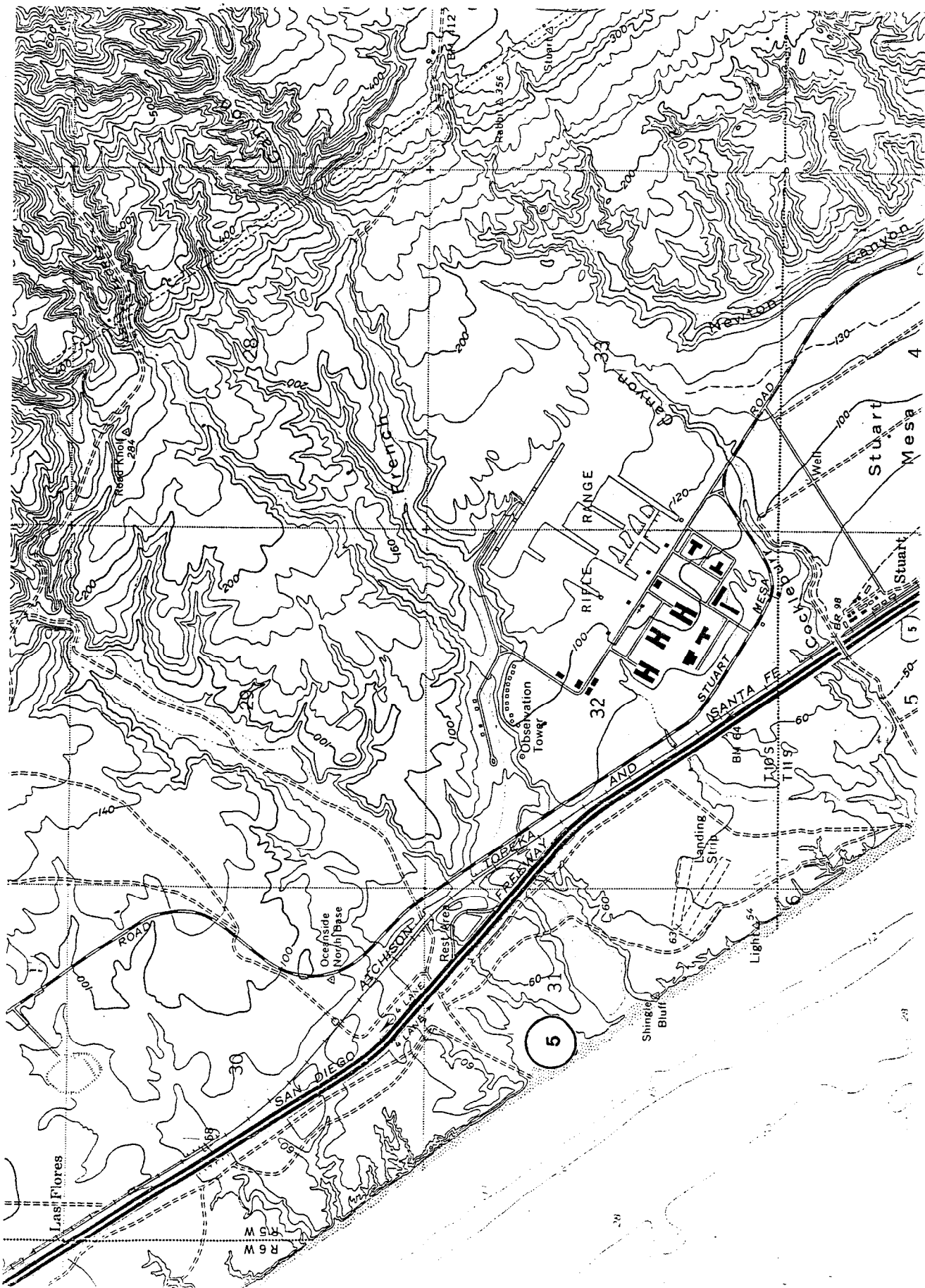


Figure 9. Aliso Creek, San Diego County.

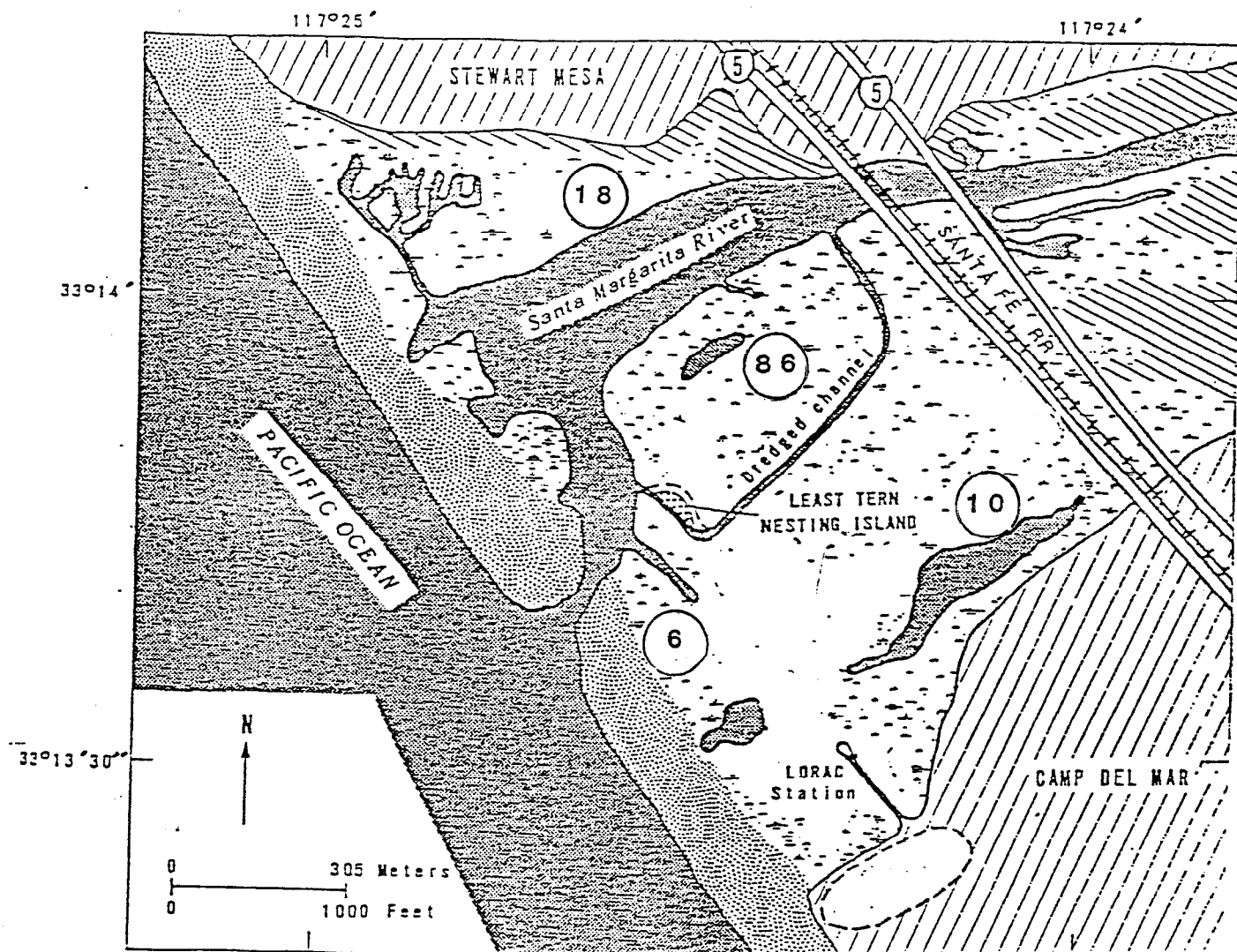


Figure 10. Santa Margarita River Estuary, San Diego County.



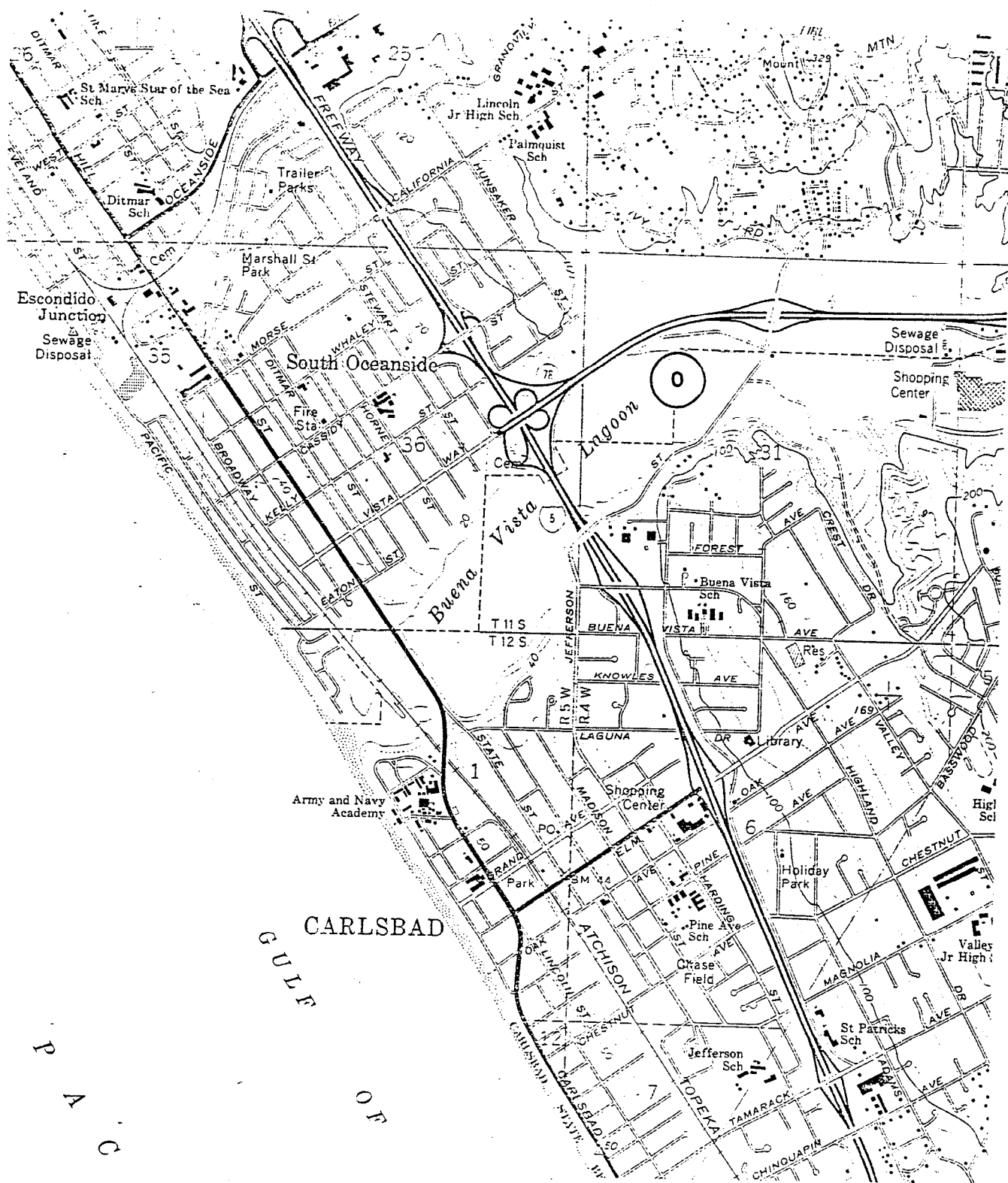


Figure 11. Buena Vista Lagoon, San Diego County.

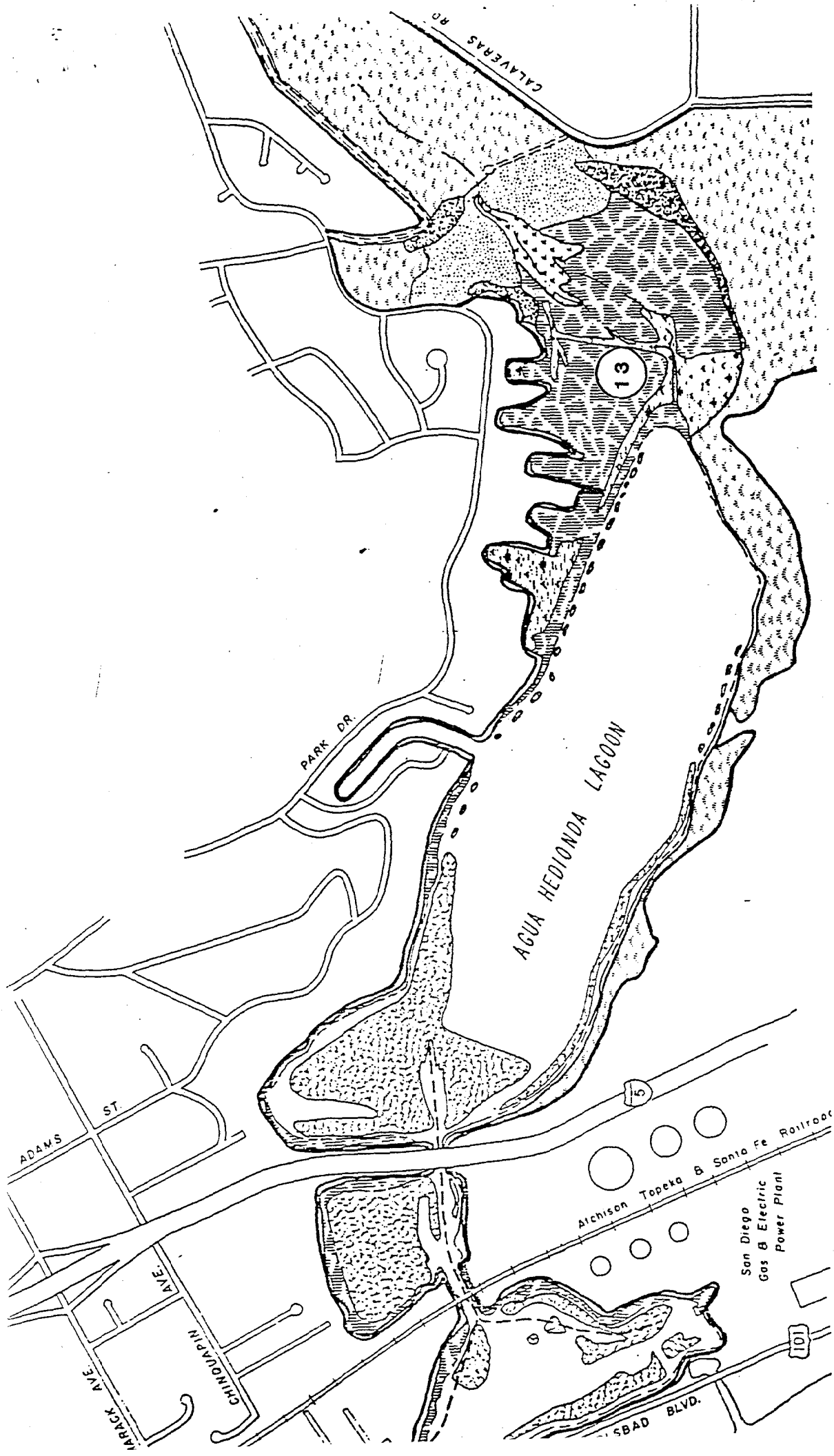


Figure 12. Agua Hedionda, San Diego County.

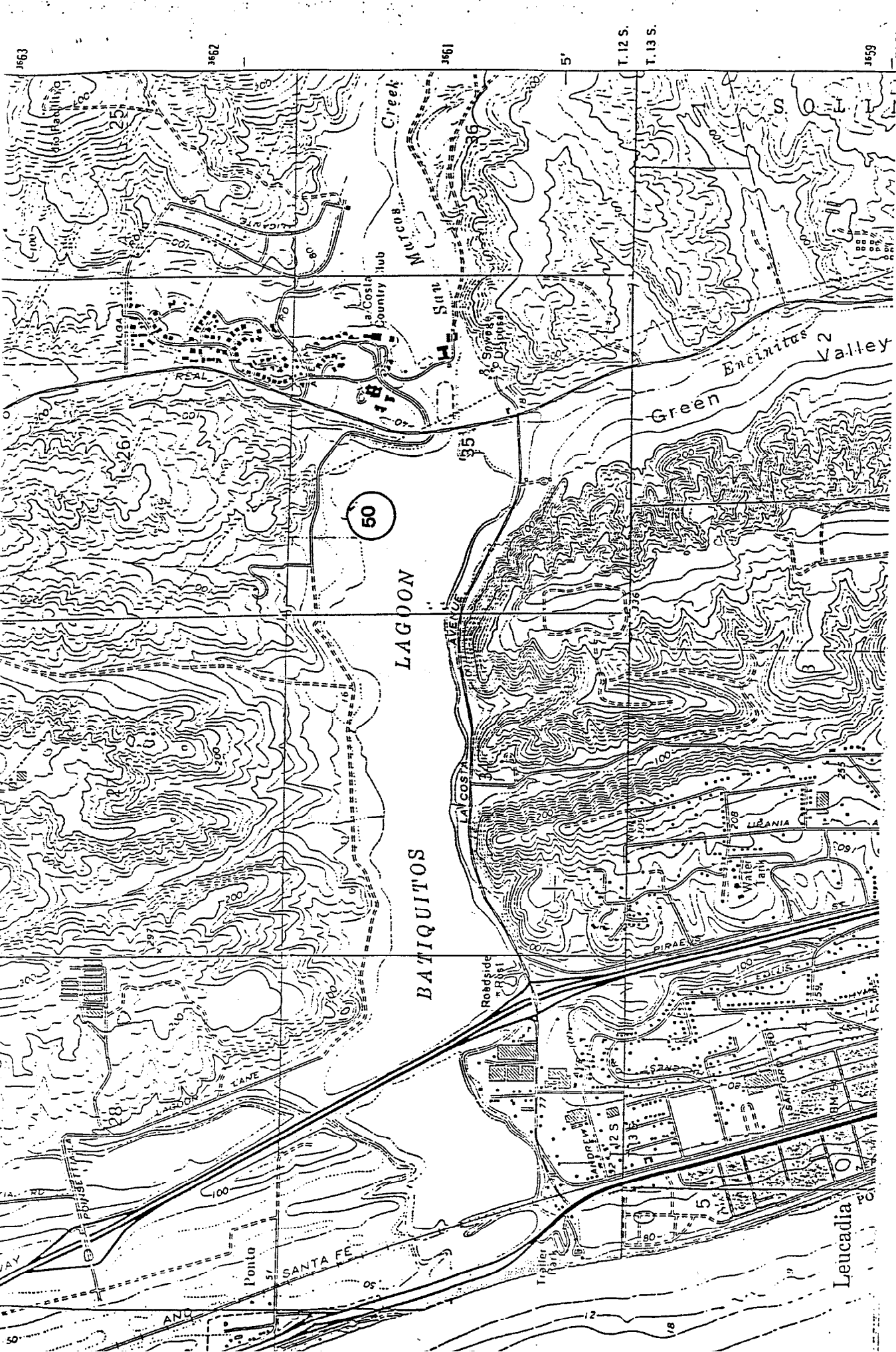


Figure 13. Batiquitos Lagoon, San Diego County.

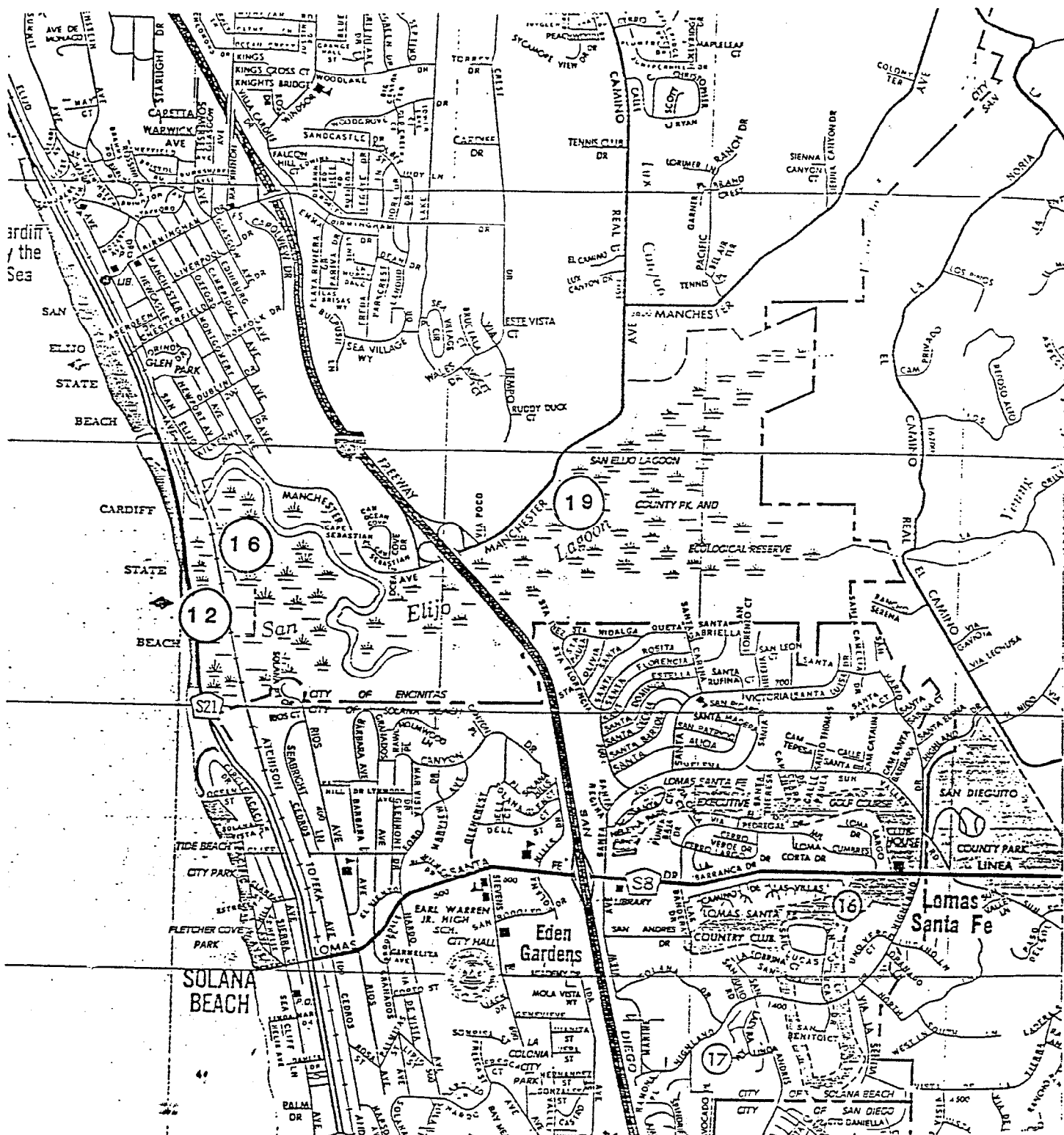


Figure 14. San Elijo Lagoon, San Diego County.

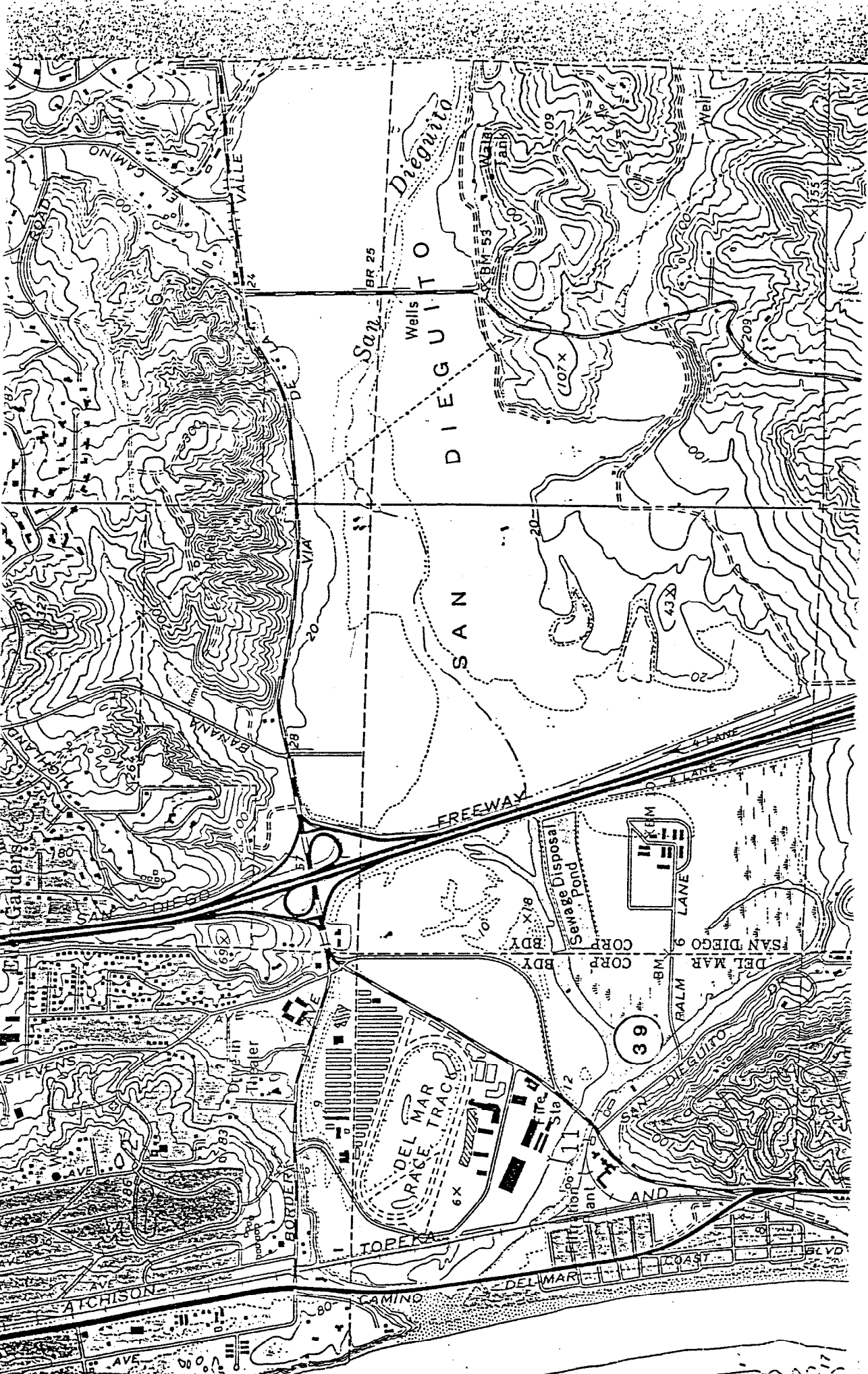


Figure 15. San Dieguito Lagoon, San Diego County.

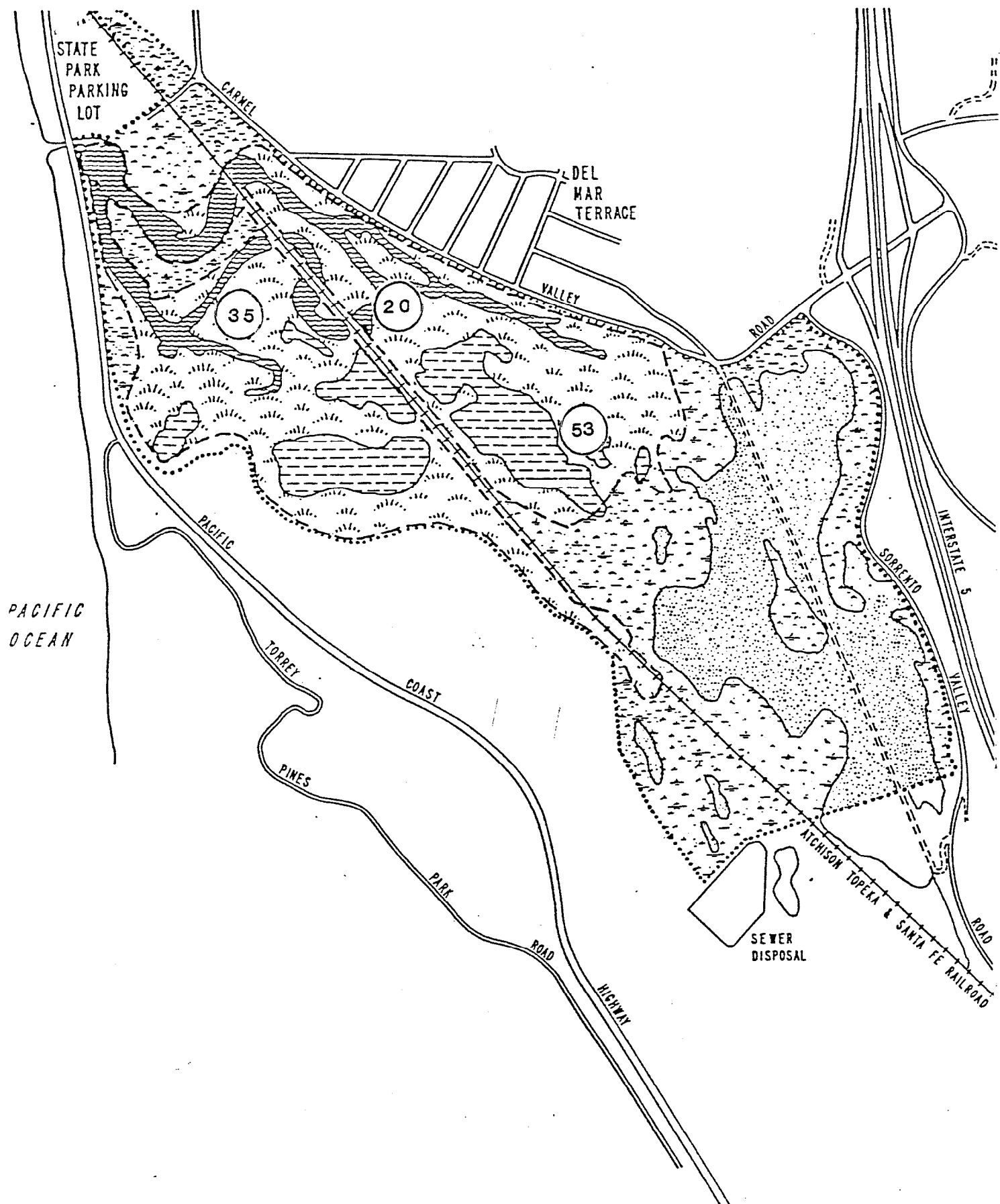


Figure 16. Los Penasquitos Lagoon, San Diego County.

# KENDAIL - FROST

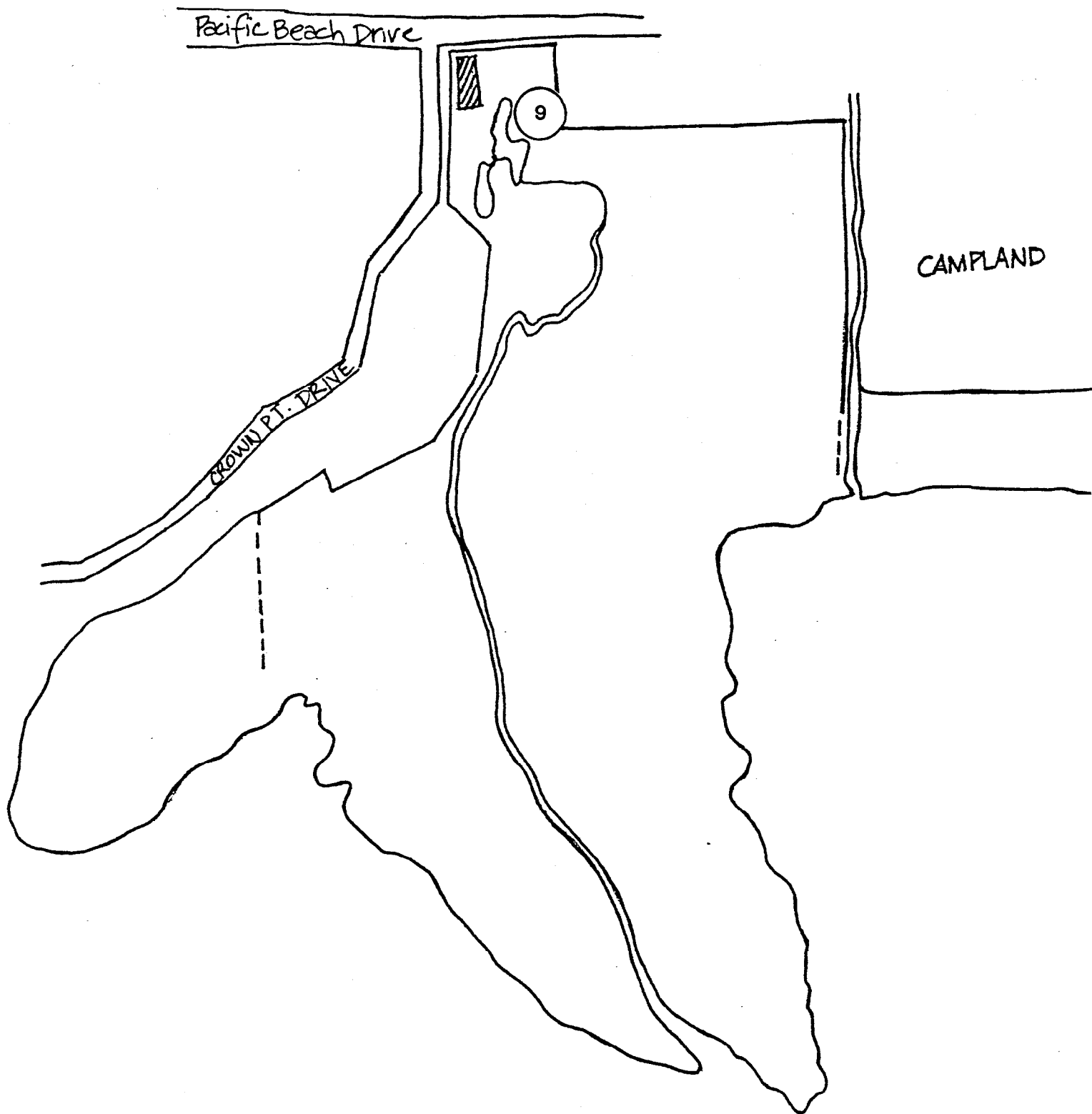


Figure 17. Kendall-Frost Reserve, San Diego County.





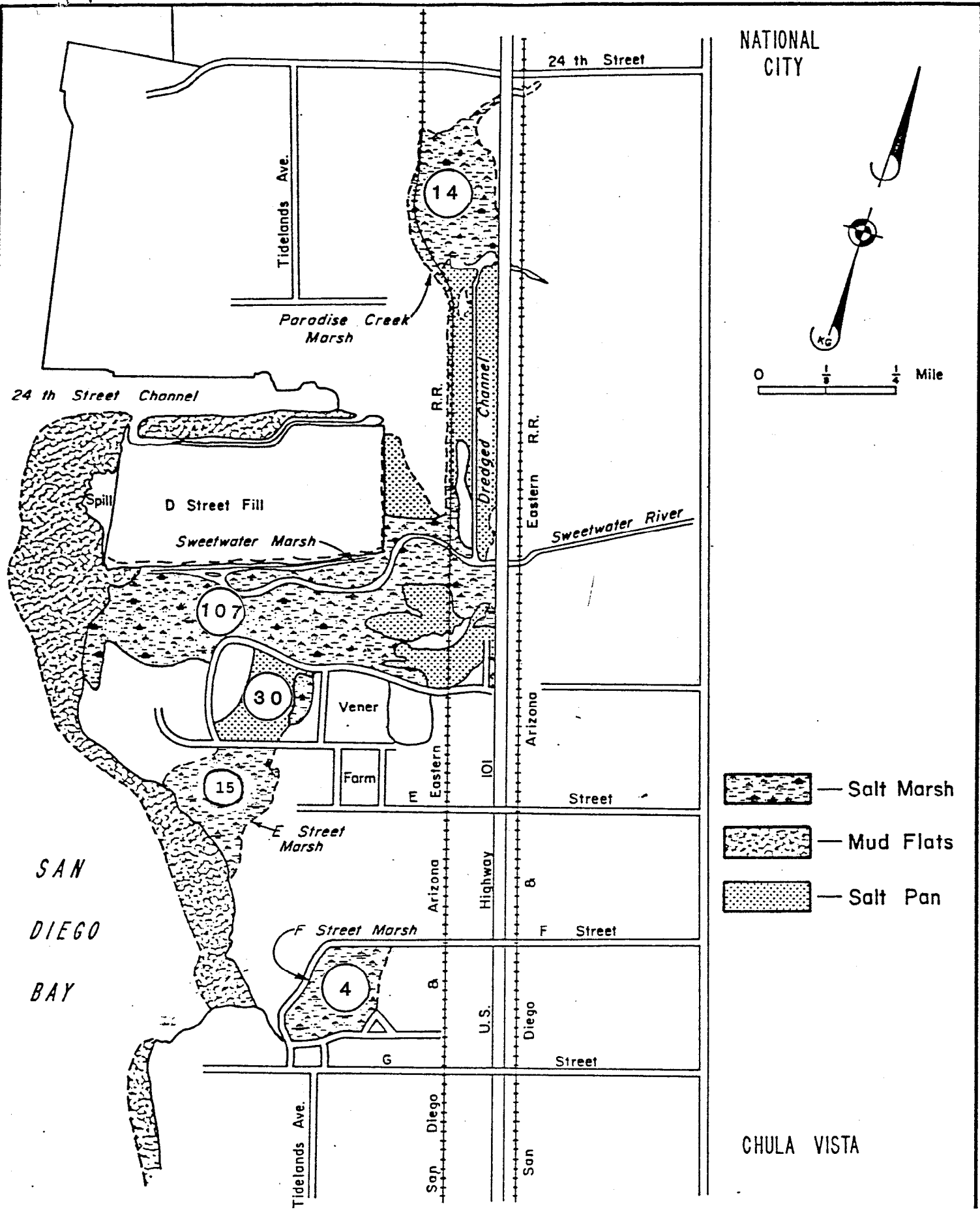


Figure 19. Sweetwater Marsh, Paradise Marsh, and E St. Marsh, San Diego County.





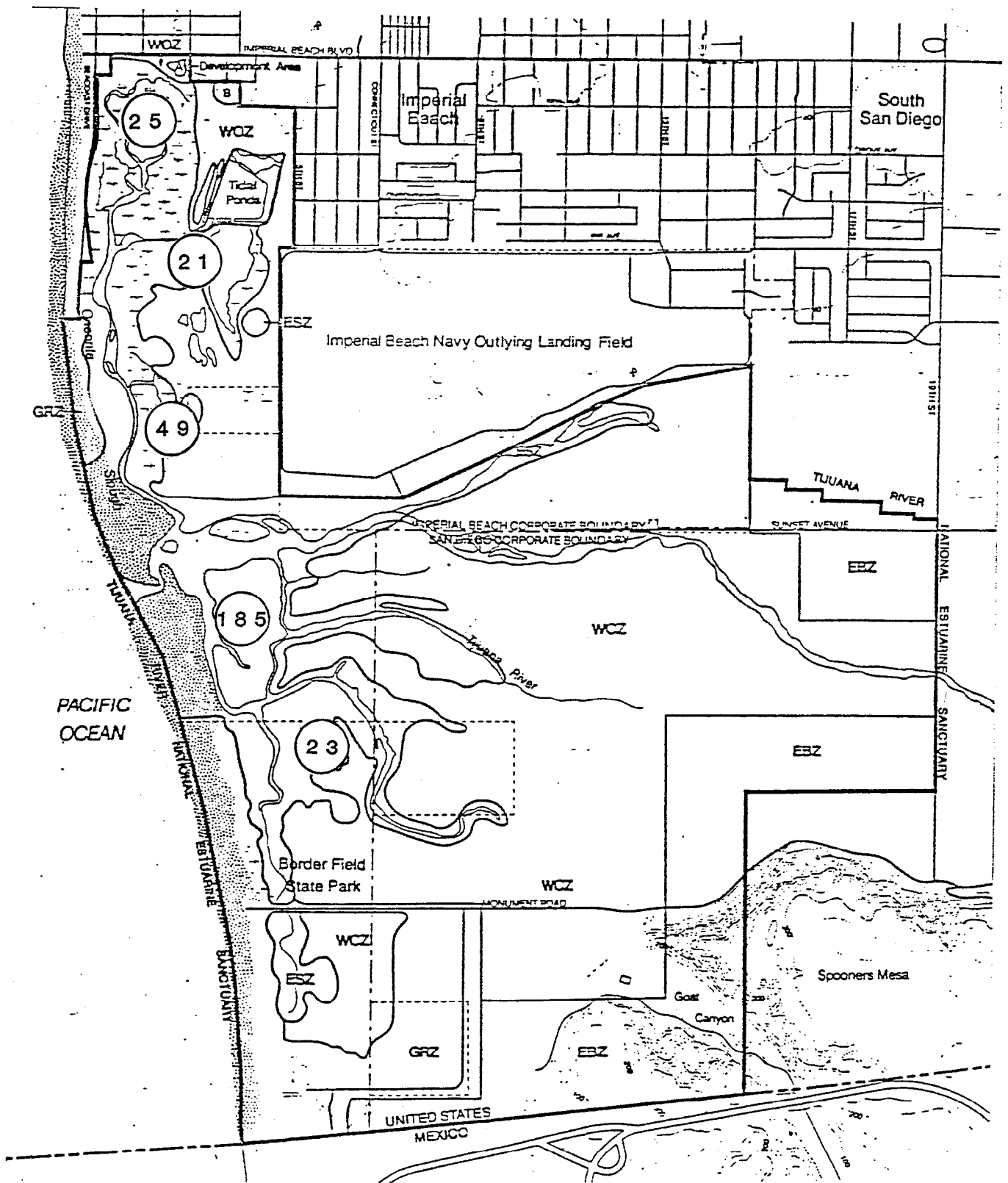


Figure 22. Tijuana Marsh, San Diego County.